

LACANDÓN – FOREST FOR LIFE REDD+ PROJECT



Document Prepared By South Pole Carbon SAS

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1 TABLE OF CONTENTS

1	General.....	9
1.1	Summary Description of the Project (G1).....	9
1.2	Project Location (G1)	11
1.3	Conditions Prior to Project Initiation (G1, G2, G5, CL1, CM1 & B1)	16
1.3.1	Project Physical Parameters:	17
1.3.2	Current land use.....	25
1.3.3	Deforestation system.....	28
1.3.4	Identification and description of the deforestation agents.....	29
1.3.5	Without-Project Community Scenario.....	30
1.3.6	Description of current biodiversity within the project zone	33
1.3.7	Types and condition of vegetation within the project zone.	44
1.3.8	Without-project Biodiversity Scenario.....	46
1.3.9	Current carbon stocks within the project zone.....	47
1.3.10	Customary and legal property rights.....	48
1.3.11	Description of the First instance	58
1.4	Project Proponent (G1 & G4)	61
1.5	Other Entities Involved in the Project (G4)	63
1.6	Project Start Date (G1).....	66
1.7	Project Crediting Period (G1)	66
2	Design	66
2.1	Sectoral Scope and Project Type	66
2.2	Description of the Project Activity (G1 & G5).....	66
2.3	Management of Risks to Project Benefits (G1)	70
2.4	Measures to Maintain High Conservation Values.....	72
2.4.1	High Conservation Values 5 and 6.	72
2.4.2	High Conservation Values 1.....	73
2.5	Project Financing (G1 & G4)	73
2.6	Employment Opportunities and Worker Relations (G3).....	75
2.7	Stakeholder (G1 & G3).....	76
2.7.1	Identification of Stakeholders	76
2.7.2	Stakeholder Engagement	77
3	Legal Status	87
3.1	Compliance with Laws, Statues, Property Rights and Other Regulatory Frameworks (G3 & G5) 87	
3.2	Evidence of Right of Use (G5).....	89
3.3	Emissions Trading Programs and Other Binding Limits (G5)	90
3.4	Participation under Other GHG Programs (G5).....	90
3.5	Other Forms of Environmental Credit (G5).....	90
3.6	Projects Rejected by Other GHG Programs (G5).....	90
3.7	Respect for Rights and No Involuntary Relocation (G5).....	90
3.8	Illegal Activities and Project Benefits (G5).....	91
4	Application of Methodology	91
4.1	Title and Reference of Methodology.....	92
4.2	Applicability of Methodology	92
4.3	Methodology Deviations	95
4.4	Project Boundary (CL1 & CL2).....	102

4.4.1	Additional Information Relevant to the Project.....	107
4.5	Commercially Sensitive Information	109
4.6	Baseline Scenario (G2)	110
4.7	Additionality (G2)	112
5	Quantification of GHG Emission Reductions and Removals (Climate).....	119
5.1	Project Scale and Estimated GHG Emission Reductions or Removals (CL2)	119
5.2	Leakage Management Areas (CL3)	120
5.3	Baseline Emissions (CL1)	121
5.3.1	Projection of the quantity of future deforestation	127
5.3.2	Projection of the location of future deforestation	136
5.3.3	Calculation of baseline activity data per forest class	137
5.3.4	Calculation of baseline activity data per post-deforestation forest class.....	140
5.3.5	Estimation of baseline carbon stock change	141
5.3.6	Calculation of carbon stock change factors	144
5.3.7	Calculation of baseline carbon stock changes.....	147
5.3.8	Baseline non-CO ₂ emissions from forest fires	156
5.4	Project Emissions (CL2).....	157
5.4.1	Ex ante estimation of actual carbon stock changes and non-CO ₂ emissions in the project area	157
5.5	Leakage (CL3)	162
5.6	Summary of GHG Emission Reductions and Removals (CL2).....	169
5.6.1	Significance assessment.....	169
5.6.2	Calculation of ex-ante estimation of total net GHG emissions reductions	169
5.6.3	Calculation of ex ante Verified Carbon Units (VCUs)	174
5.7	Climate Change Adaptation Benefits (GL1)	176
6	Community	179
6.1	Net Positive Community Impacts (CM1 & CM2).....	179
6.2	Negative Offsite Stakeholder impacts (CM3)	183
6.3	Exceptional Community Benefits (GL2).....	183
7	Biodiversity	187
7.1	Net Positive Biodiversity Impacts (B2).....	187
7.2	Negative Offsite Biodiversity Impacts (B3)	192
7.3	Exceptional Biodiversity Benefits (GL3)	192
8	Monitoring.....	195
8.1	Description of the Monitoring Plan.....	195
8.1.1	Description of the Monitoring Plan (CL4, CM4 & B4)	195
8.1.2	Organization and responsibilities of the parties involved	196
8.1.3	General instructions on data collection.....	196
8.1.4	Data archiving	197
8.1.5	Quality control and Quality Assurance procedures (QA/QC).....	197
	VCS Monitoring & CCBS Section CL4 Climate Impact Monitoring	198
	CCBS Section CM4 Community Impact Monitoring	203
	CCBS Section B4 Biodiversity Impact Monitoring	213
8.2	Data and Parameters Available at Validation (CL4)	216
8.3	Data and Parameters Monitored (CL4, CM4 & B4)	232
	APPENDIX I. List of vegetal species of National Park Sierra del Lacandón	251
	APPENDIX II. List of bird species of National Park Sierra del Lacandón	261
	APPENDIX III. List of reptile species of National Park Sierra del Lacandón	268

APPENDIX IV. List of amphibian species of National Park Sierra del Lacandón.....	271
APPENDIX V. List of fish species of National Park Sierra del Lacandón.....	272
APPENDIX VI. List of mammals species of national park sierra del lacandón.....	273

2 LIST OF TABLES

Table 1. Geodetic central coordinates	15
Table 2. Types of soils in the SLNP	22
Table 3. Watershed and subwatershed in the SLNP	24
Table 4. Description of the variables of the deforestation system in the SLNP.....	28
Table 5. Types of ecosystems by INAB	34
Table 6. Average carbon content considered for each forest class present in the project zone. Values obtained from the sub-national baseline	48
Table 7. Communities within SLNP.....	50
Table 8. Implementation schedule	69
Table 9. Management of Risk	70
Table 10. Local consultation workshops performed	84
Table 11. Project boundaries	103
Table 12 Simplified Land cover change matrix 2000-2010 / Forest to non forest classes	125
Table 13. Description of the Stratum in the reference region	127
Table 14. Deforestation rates within each Stratum in 2000–2007, 2007-2010 and 2000-2010.....	127
Table 15. Projection of deforestation in Stratum 2	129
Table 16. Projection of deforestation in Stratum 3	130
Table 17. Projected annual deforestation within the reference region in the baseline	133
Table 18. Projected annual deforestation within the project area in the baseline.....	134
Table 19. Projected annual deforestation within the leakage area in the baseline.....	135
Table 20. Projected annual areas deforested per forest classes within the project area	138
Table 21. Projected annual areas deforested per forest classes within the leakage belt	139
Table 24. Forest class in the project area and leakage belt.....	141
Table 25. Inventory information by source and data date	141
Table 26. Statistical results of average carbon stocks in the aboveground biomass pool per hectare grouped according to forest type.....	142
Table 27. Average carbon stocks in the below ground biomass pool grouped according to forest class	142
Table 28. The long – term 20 year average of carbon stocks average in post-deforestation classes	143
Table 29. Carbon stock change factors for areas subjected to unplanned deforestation	145
Table 30. Carbon stock change factors for areas subjected to planned degradation only	146
Table 31. Carbon stock change factors for zones of post-deforestation	147
Table 32. Total net carbon stock change in the aboveground biomass of the initial forest classes in the project area	148
Table 33. Total net carbon stock change in the belowground biomass of the initial forest classes in the project area	149
Table 34. Total carbon stock change from illegal harvested wood products from the initial forest classes in the project area	150
Table 35. Total net carbon stock change in the project area including illegal Harvested Wood Products (Cwp included)	151

Table 36. Total carbon stock change from legal harvesting from all initial forest classes in the project area	152
Table 37. Total net carbon stock change (legal+illegal Cwp included) of the initial forest classes in the project area	153
Table 38. Total carbon stock change in the aboveground biomass of the initial forest classes in the leakage belt.....	154
Table 39. Total net carbon stock change in the belowground biomass of the initial forest classes in the leakage belt.....	155
Table 40. Total net carbon stock change (illegal Cwp included) in the project area.....	156
Table 41. Ex ante projections for areas subjected to illegal and legal forest degradation in the project scenario	157
Table 42. Ex ante estimated actual carbon stock decrease due to planned logging in the project area .	158
Table 43. Total ex ante carbon stock decrease due to planned activities in the project area	159
Table 44. Ex ante estimated carbon stock change in the project area under the project scenario.....	160
Table 45. Ex ante estimated leakage due to displacement.....	165
Table 46. Total estimate of ex-ante leakage	166
Table 47. Ex ante net anthropogenic GHG emission reductions attributable to AUD project activity	171
Table 48. Summary of ex-ante net GHG emission reductions	173
Table 49. Ex – ante net anthropogenic GHG emission reductions, buffer credits and VCUs.....	175
Table 50. Expected impacts.....	180
Table 51. Expected impacts.....	188
Table 52. Species used in project activity	190
Table 53. List of Vulnerable, Endangered or Critically Endangered species present in SLNP.....	193
Table 54. Direct effects monitored - Social impact.....	204
Table 55. Indirect effects monitored - Social impact	210
Table 56. Monitoring for employees or direct beneficiaries hired by the project.....	211
Table 57. Monitoring of High Conservation Value 5.....	212
Table 58. Monitoring of High Conservation Value 6.....	212
Table 59. Effects monitored - Biodiversity impact	213

3 LIST OF FIGURES

Figure 1. Guatemala Sub-nationals regions.....	11
Figure 2. Municipalities in the Reference Region.....	12
Figure 3. Zoning of Mayan Biosphere Reserve – Location of the National Park Sierra de Lacandón.....	14
Figure 4. First instance project area.....	15
Figure 5. Precipitation of the project zone.....	18
Figure 6. Temperature of the project zone	19
Figure 7. Evapotranspiration of the project zone.....	19
Figure 8. Geology of the project zone	21
Figure 9. Types of soils of the project zone.....	23
Figure 10. Slope of the project zone	23
Figure 11. Hydrology of the project zone	25
Figure 12. Land use changes and fire. Source: Estado de la Reserva de la Biosfera Maya.....	26
Figure 13. Land use and land cover of the project zone – year 2000	27

Figure 14. Land use and land cover of the project zone – year 2010	27
Figure 15. HCV1 – Concentrations of biological diversity / endangered species	39
Figure 16. 1. Iguana (Iguana iguana). 2. Howler monkey. 3. Heliconia 4. Usumacinta River. 5. Totolaca (Aramus guarauna) 6. Lacandona Lagoon.....	40
Figure 17. HCV5 - Sites and resources fundamental for satisfying the basic necessities of local communities.....	41
Figure 18. 1. Fungus. 2. Malerio seeds (Aspidosperma megalocarpum) 3. Family Unit Management Plan. 4. Forest nursery (Pimienta dioica). 5. Community gathering Ramon seeds 6. Natural fiber (Pita Floja) 7. Students establishing family gardens.....	42
Figure 19. HCV6 - Archaeological significance for the project area	43
Figure 20. 1-7 Archaeological remains – Piedras Negras Archaeological Park	44
Figure 21. Types of forest in the project zone	45
Figure 22. Communities and private properties within Sierra del Lacandón National Park.....	57
Figure 23. Part of the comic informative delivered to communities	78
Figure 24. Community workshops for identify project activities.....	79
Figure 25. Invitation to final consultation.....	80
Figure 26. Community workshops in Unión Maya Itzá.....	81
Figure 27. Community workshops in La Lucha	82
Figure 28. Community workshops in La Técnica Agropecuaria	83
Figure 29. Map of Forest Vs. Non Forest in the subnational region of the north lowlands of Guatemala. .	93
Figure 30. Forest cover map of the project zone – year 2000.....	94
Figure 31. Forest cover map of the project zone – year 2012.....	94
Figure 32. Geographic grouped project area	106
Figure 33. Project boundary – First Instance	106
Figure 34. Geographic areas for new project activity instances	107
Figure 35. Deforestation of the project zone. Year 2000 - 2012.....	111
Figure 36. Leakage management areas	121
Figure 37. Land use and Land cover map of the reference region in 2010.....	123
Figure 38. Changes in forest/non forest between 2000-2007-2010	124
Figure 38. Land use and Land cover change 2000-2010.....	125
Figure 39. Strata of the VCS reference region.....	128
Figure 40. Cover change map 1986 – 2009 for Stratum 1	131
Figure 41. Graphical representation of annual time-step data of forest cover loss 2000 - 2010	132
Figure 42. A visual representation of the deforestation under the risk model over the project lifetime in 5-year time lapse.....	137
Figure 43. Leakage area of Lacandón REDD+ Project	164
Figure 44. Change in annual temperature by 2050.....	176
Figure 45. Change in annual precipitation by 2050.....	177

COVER PAGE

i. Project name	Lacandón - Forest for Life REDD+ Project
ii. Project location	La Libertad and Las Cruces Municipalities, North West of Petén Department, Guatemala
iii. Project Proponent	Primary Project Proponent Fundación Defensores de la Naturaleza 4a. Avenida 23-01 Zona 14 Phone (+502) 2310-2929 / 5323-2765 Javier Marquez Email: jmarquez@defensores.org.gt Unión Maya Itzá Cooperative REDD+ representative: Juan Carlos Pérez Phone: (+502) 4185-7328 La Lucha Cooperative REDD+ representative: Angel Velarde Phone: (+502) 4908-6978 La Técnica Agropecuaria Cooperative REDD+ representative: Haroldo Ramirez Phone: (+502) 5336-0807
iv. Auditor	AENOR Jose Luis Fuentes Perez jfuentes@aenor.es Phone: +34 914326000
v. Project lifetime	Project start date: February 1st 2012 Project lifetime: 30 years GHG accounting period: February 1st 2012 - January 31st 2042
vi. Project implementation period covered by the PIR	February 1st 2012 – August 24th, 2014
vii. CCB History	Full validation and First verification
viii. Edition of CCB Standard Being Used	Third Edition
ix. Summary of Climate, Community and Biodiversity Benefits Generated	The Sierra del Lacandón National Park is one of the seven nucleuses of the Mayan Biosphere Reserve. The <u>climate objectives</u> is covered through the implementation of activities to reduce deforestation and forest degradation by decreasing illegal timber extraction and assuring legality of land use right through forest sustainable management. These activities will help reduce GHG emissions and will increase carbon stocks over time. The <u>community objectives</u> takes into account the strengthening of local governance; supporting the development of sustainable economic and livelihoods alternatives through training and technical workshops; enhancing local administrative capacity, leadership capacity and environmental awareness through training activities. The project activities are based on community dialog, education and training.

	The <u>biodiversity objectives</u> will focus on identifying, prioritizing and executing actions for the adequate management of the environmental and cultural resources and achieve their most effective and efficient conservation. It is expected that the populations of endemic and endangered species will increase, native species will be planted restoring the ecosystem for fauna and flora communities. By reducing deforestation the environmental function of the diverse ecosystems will be maintained, the cultural tangible heritage will be preserved and greenhouse gas emissions through deforestation and degradation processes will be prevented.
x. Gold Level Criteria Being Used and Summary of Gold Level Benefits Generated:	<u>Climate benefits:</u> The project comprises a range of activities beneficial to climate change adaptation: • Diversification of employment and income beyond agriculture, such as identification of new NTFP. • Improvement of agricultural practices with the aim of granting higher productivities and slowing the amount of hectares deforested per household/year. Monitoring of these climate adaptation impacts will go in line with other monitoring activities. Indicators concerning agricultural productivity and employment opportunities such as through commercialization of alternative NTFP will also be used to monitor climate adaptation impacts. <u>Community benefits:</u> Through the project activities such as adjustment of land uses and land use rights, sustainable farming and livestock familiar management systems, and diversification and use of communal forestry resources; the communities will increase their incomes and will improve their quality of life. Besides, women participation would increase in REDD+ project activities. <u>Biodiversity benefits:</u> Three conservation targets were chosen: The near threatened Jaguar (<i>Panthera onca</i>), the largest feline in Latin America and part of the Guatemalan culture for years; the endangered Tapir (<i>Tapirus bairdii</i>), largest land mammal in the Neotropics and the only living representative of perissodactyla order, is a species considered nationally endangered and throughout its range, and vulnerable Pecari (<i>Tayassu pecari</i>), is threatened due to strong illegal hunting. By protecting areas of intact forest the habitat of many species is conserved. Furthermore, the project activities reforests with native species also in IUCN Red list like <i>Swietenia macrophylla</i> and <i>Cedrela odorata</i>.
xi. Date of Completion of this Version and Version Number:	7 June 2016 Version 3.1
xii. Expected verification schedule	February 2016

1 GENERAL

1.1 Summary Description of the Project (G1)

This project is developed under the requirements of Agriculture, Forestry and Other Land Use (AFOLU) projects. Specifically, the project category is “Avoided Unplanned Deforestation & Degradation” (AUDD) for Reducing Emissions from Deforestation and Degradation (REDD).

G1.3 Guatemala is among the 19th megadiverse countries in the world, with 33.7% of forest cover land. Its native forest contribute significantly to the livelihood of local populations. About a third of the national territory has been declared a protected area. The multicultural richness of the country, together with traditional and ancestral knowledge of the inhabitants, constitutes a potential for climate change projects.

The project zone is included in the Key Biodiversity Area (KBA) Selva Maya Corridor, which contains the second most extensive tract of continuous tropical rainforest in the Americas after the Amazon Forest, where Selva Lacandóna and Sierra del Lacandón (Mexico/Guatemala) are one of the four keys biodiversity areas¹. The Sierra del Lacandón National Park (SLNP) is one of the seven nucleuses of the Mayan Biosphere Reserve (MBR) which represents almost 20% of the surface of Guatemala and about 60% of the surface inside the Guatemala System of Natural Protected Areas (SIGAP as per Sistema Guatemalteco de Áreas Protegidas). Within the borders of the SLNP there are at least 29 archaeological sites from the Mayan Civilization, including the monumental city of Piedras Negras².

The SLNP is the second largest National Park in Guatemala. It has been characterized, along with the Mirador-Rio Azul National Park, as the region of greatest plant diversity within the MBR. The rugged terrain and rainfall, higher than the rest of the reserve, give it unique characteristics. It has outstanding archaeological remains of the classical and pre-classical Maya civilization³.

The Lacandón – Forest for Life (Bosques para la Vida) REDD+ Project (hereinafter Lacandón REDD+ Project) focuses on reduce deforestation that is being exerte by different agents on the forest region by improving living condition of the communities located within the National Park and surrounding areas. Through implementation of project activities, the environmental function of the diverse ecosystems will be maintained, the cultural tangible heritage will be preserved and greenhouse gas emissions from deforestation and degradation processes will be prevented.

¹ Critical Ecosystem Partnership Fund. 2010. Assessing Five Years of CEPF Investment in the Mesoamerica Biodiversity Hotspot. A Special Report. Available at http://www.cepf.net/Documents/Final_NMesoamerica_Assessment_Jan2010.pdf

² Fundación Defensores de la Naturaleza; CONAP. 2015 Plan Maestro 2011-2015. Parque Nacional Sierra del Lacandón. Unpublished.

³ ParksWatch. 2003. Perfil de Parque – Guatemala. Parque Nacional Sierra del Lacandón. Available at http://www.parkswatch.org/parkprofiles/pdf/slnp_spa.pdf

According to the Guatemalan Law, the Guatemalan National Council for Protected Areas (CONAP, as per Consejo Nacional de Áreas Protegidas) is the Governmental body responsible for the management of the area⁴. CONAP awarded in 1999 the co-management of the SLNP with the Non-Governmental Organisation (NGO) Fundación Defensores de la Naturaleza (FDN).

The patterns of deforestation and their associated agents and drivers in the area have been identified and understood. The important factors are the increase of human population linked to the expansion of agropecuarian activities and forest fires due to slash and burn forest method, illegal logging, lack of public institutions presence in the field, illegal settlements and extraction of natural resources (hunting and non-timber forest products as the xate palm - *Chamaedorea sp.*). The project will analyse, design and implement measures that will result in lower deforestation rates while includes the deforestation agents in activities that enhance the integrated maintenance of the natural resources and the archeological sites. The project activities will pay special attention to the specific social and cultural issues and will incorporate these characteristics in the management plans considering at the same time, the specific biodiversity and climate characteristics of the region.

G1.2 The project's community objectives takes into account the strengthening of local governance; supporting the development of sustainable economic and livelihoods alternatives through training and technical workshops; enhancing local administrative capacity, leadership capacity and environmental awareness through training activities. The project activities are based on community dialog, education and training.

The climate objectives will be covered through the implementation of activities to reduce deforestation and forest degradation by decreasing illegal timber extraction and assuring legality of land use right through forest sustainable management. These activities will help reduce GHG emissions and will increase carbon stocks over time.

Although deeper understanding of the biodiversity occurring in the project region is still needed, the presence of species classified as endangered by the International Union for Conservation of Nature (IUCN) has been well documented. Examples are Jaguar – *Panthera onca* (Near threatened), Tapir – *Tapirus bairdii* (Endangered) and Pecari - *Tayassu pecari* (Vulnerable) for fauna; and Cedro – *Cedrela odorata* (Vulnerable) and Caoba – *Swietenia macrophylla* (Vulnerable) for flora. The project's biodiversity objectives focusing on preserving endangered species and their habitats as compared to baseline scenario conditions through communal forestry resources management, forest protection and biodiversity programs.

Given the high natural and cultural values present in the region, it is of utmost importance to identify the environmental and economic context that surrounds the processes of deforestation currently occurring in the area. The agents and drivers of deforestation have been identified through literature review and workshops conducted with representatives of institutions.

The project activities will focus on identifying, prioritizing and executing actions for the adequate management of the environmental and cultural resources and achieve their most effective and efficient conservation, while benefiting the sustainable development of the region.

⁴ Congreso de la República. 1989. Ley de Áreas Protegidas. Available at <http://www.acnur.org/t3/fileadmin/Documentos/BDL/2008/6696.pdf?view=1>

1.2 Project Location (G1)

G1.3 Reference region

Guatemala has divided the country into five specific regions with similar physical, social and economic characteristics. Regions with different dynamics of deforestation, landscape, ecosystems, economic and socio-cultural conditions. The reference region for this project corresponds to the Sub-national region “Tierras Bajas del Norte” (Northern Lowlands), which covers the entire department of Peten and partially the departments of Huehuetenango, Quiché, Alta Verapaz and Izabal. Northern Lowlands present the largest extensions of remaining forest in Guatemala, and also present the highest level of deforestation.

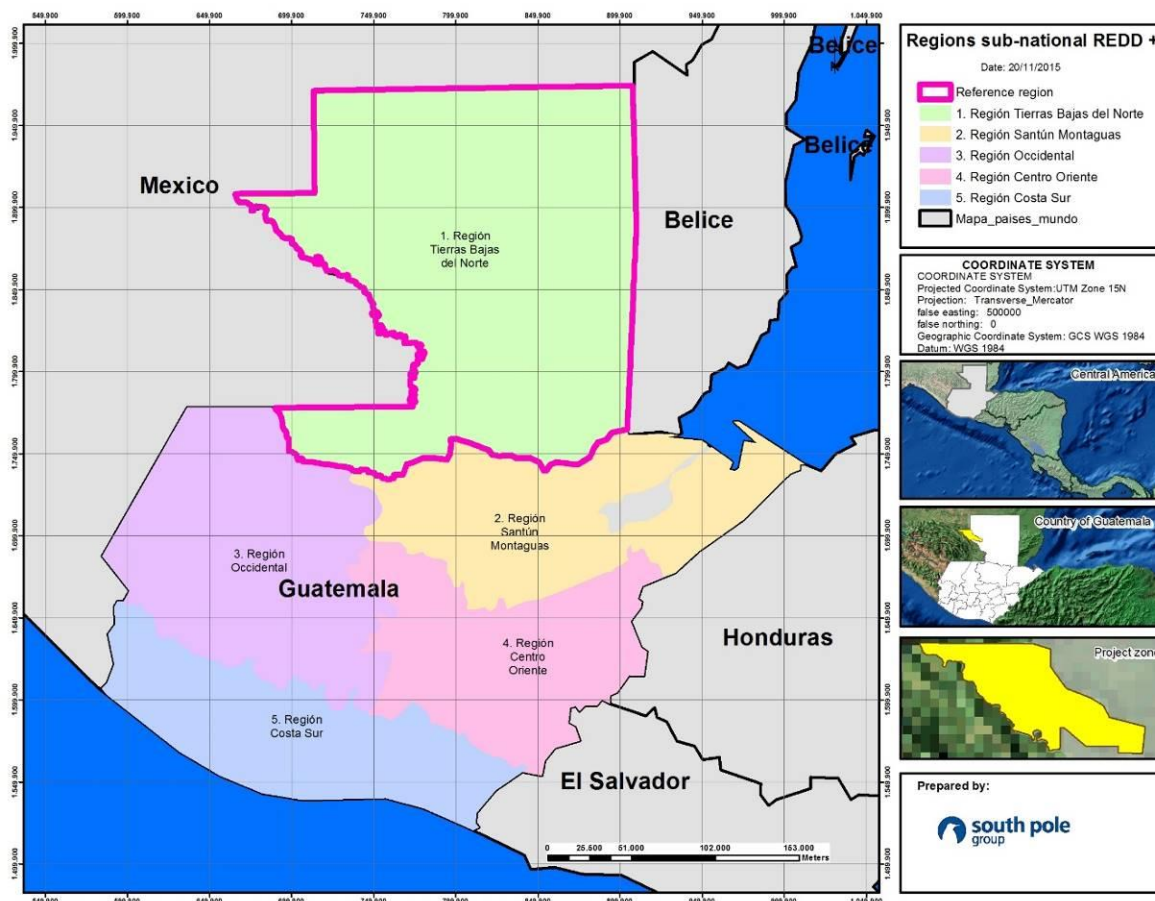


Figure 1. Guatemala Sub-nationals regions.

The region has the highest proportion of forest in the country (57% of the total) and the highest deforestation from 1990 to 2000 (43% of the total). The dynamics of deforestation are influenced by the altitude and topographical characteristics.

Municipalities in the reference region
Date: 20/11/2015

Legend:

- Banillas
- Cahabón
- Chahal
- Chajul
- Chisec
- Cobán
- Dolores
- Flores
- Fray Bartolomé de las Casas
- La Libertad
- Livingston
- Melchor de Mencos
- Nebaj
- Playa Grande-Ixcán
- Poptún
- San Andrés
- San Benito
- San Francisco
- San José
- San Luis
- Santa Ana
- Sayaxché

COORDINATE SYSTEM
Projected Coordinate System: UTM Zone 15N
Projection: Transverse_Mercator
false easting: 500000
false northing: 0
Geographic Coordinate System: GCS WGS 1984
Datum: WGS 1984

Central America

Country of Guatemala

Project zone

Prepared by: south pole group

Landscape configuration of the Reference Region (RR) adequately represents the conditions of Lacandón REDD+ project area, with the exception of the average annual precipitation. As the VM0015 methodology only requires compliance with 3 of 4 environmental criteria it has been found that the project area and the reference region are sufficiently similar according to the criteria of the methodology.

⁶ Critical Ecosystem Partnership Fund. 2010. Assessing Five Years of CEPF Investment in the Mesoamerica Biodiversity Hotspot. A Special Report. Available at: http://www.cepf.net/Documents/Final_NMesoamerica_Assessment_Jan2010.pdf

Project Zone

The Lacandón REDD+ Project is located in the North West of Petén Department in Guatemala. The project zone is the total area of the SLNP, where La Lucha cooperative is located, plus the areas of the cooperatives Unión Maya Itzá and La Técnica Agropecuaria, which are located partially and totally outside the National Park area. The total project zone is 206 268.71 ha.

About half of its boundaries are international border with the Mexican states of Chiapas and Tabasco. The northeast borders is the multiple use zone of the MBR, the north limits with the state of Tabasco (Mexico), for the west is the Usumacinta River natural border with the state of Chiapas (Mexico), and south and east boundaries are the buffer zone of the MBR, within the municipalities of La Libertad and Las Cruces.

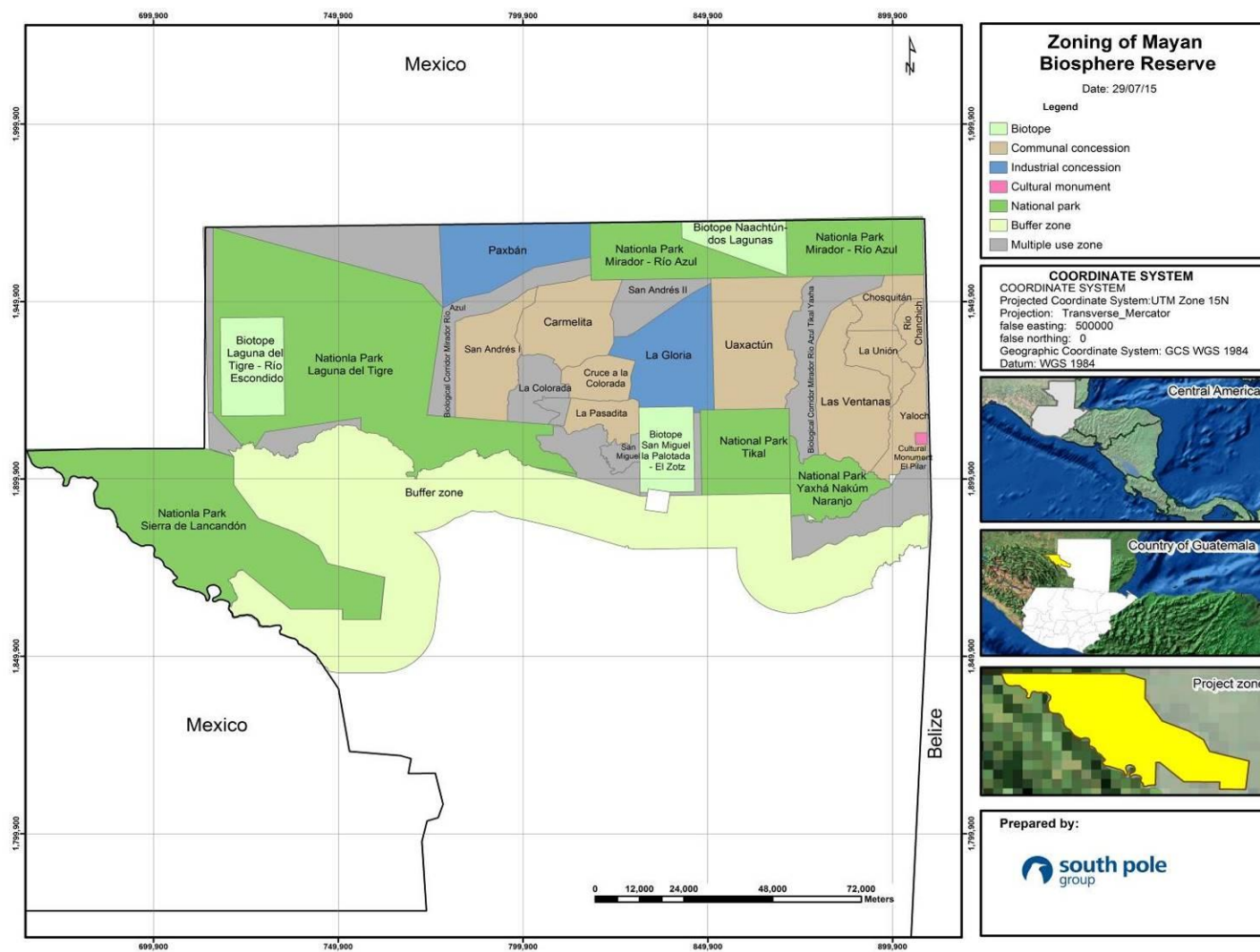


Figure 3. Zoning of Mayan Biosphere Reserve – Location of the National Park Sierra de Lacandón.

Source: Estado de la Reserva de la Biosfera Maya⁷.

⁷ State of the Maya Biosphere Reserve. Available at <http://stateofthembr.org/es-es/mapas.aspx>

Project Area – First instance

G1.4 According to the methodology VM0015 used for this project, the project area is the area of forest within a given region. For the project first (I) instance corresponds to the total forest area of Unión Maya Itzá, La Técnica Agropecuaria and La Lucha cooperatives, all with legal land tenure; and the private properties of Fundación Defensores de la Naturaleza, Naranjitos and Centro Campesino areas. The total project area for the first instance is 45 288.81 ha.

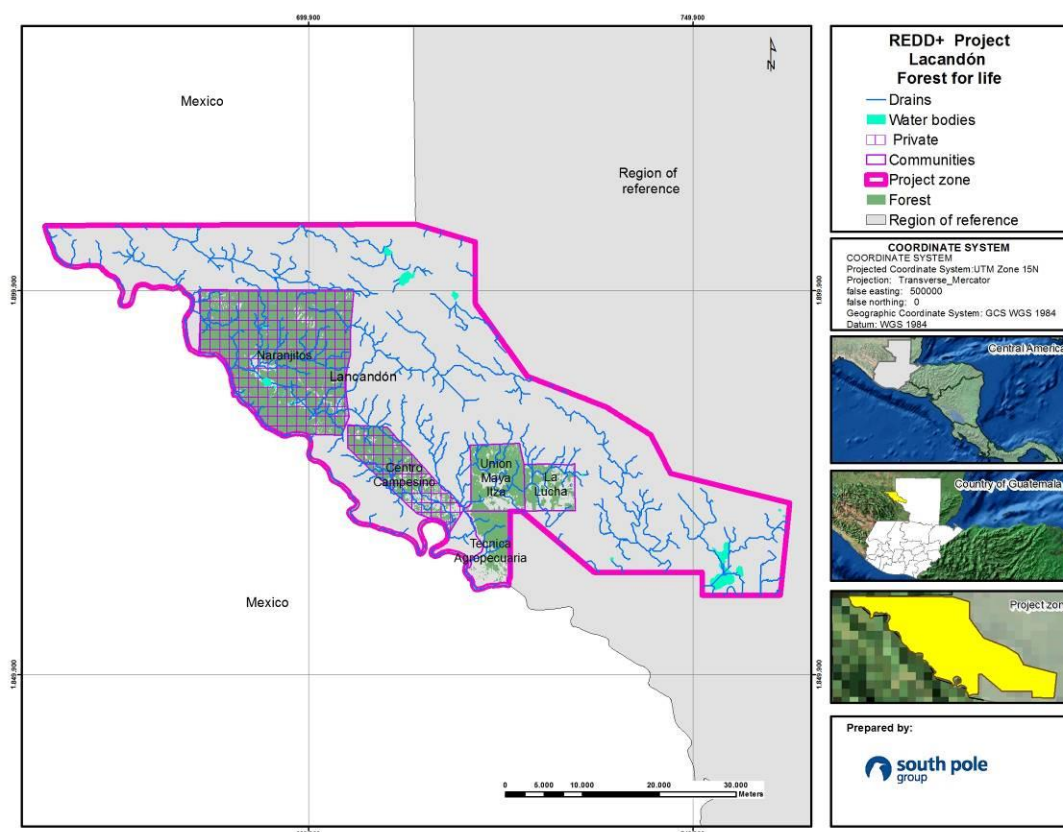


Figure 4. First instance project area

Table 1. Geodetic central coordinates

Cooperative (C) / Private property of FDN	Map area (ha)	Central coordinates			
		UTM coordinates		Geographic coordinates	
		X	Y	X	Y
La Técnica Agropecuaria (C)	4,642.03	723,634.36	1,866,217.55	-90.90	16.87
Unión Maya Itza (C)	6,068.24	724,404.11	1,875,457.29	-90.89	16.95
La Lucha (C)	3,974.03	731,252.31	1,874,259.56	-90.83	16.94
Private Property					
Centro Campesino – FDN	8,392.72	712,185.22	1,876,092.83	-91.01	16.96
Naranjitos - FDN	30,807.2	696,651.53	1,891,676.93	-91.15	17.10
Total	53,884.22				

1.3 Conditions Prior to Project Initiation (G1, G2, G5, CL1, CM1 & B1)

G1.3 / G2.1 Baseline scenario is the same as the conditions existing prior to the project initiation. The natural resources of the department of Petén, have been under severe pressure by processes of colonization, together with public policies to change the use of land as an incentive to move from forest uses to agriculture and livestock suitable preferably extensively in land for forestry. Furthermore, cultural and archaeological richness in the department, has been a cause for looting and disorderly exploitation of this good.

The causes of forest loss, which are manifold, need to be addressed:

- Owners of large and medium farms clear forests for new pasture for cattle ranching.
- Existing communities expand their farming lands (unsustainable livestock) using shifting cultivation and slash and burn agriculture.
- Illegal activities of loggers, illegal new settlements and illegal sales of land.
- Illicit activities that help an ungovernability surrounding (traffic of persons and of substances).
- Forest fires: Slash and burn practices intended to prepare land for agricultural use is common. However, the fires often spread to the bordering land and become difficult to control.
- The extraction of natural resources, mainly wood, xate and hunting.

Farmers are private owners or settlers and not organized group dedicated to livestock activities of dual purpose (meat and milk). Small producers operator through the process slash and burn agriculture; while large producers use mechanized processes for marketing purposes.

These agents of deforestation have a strong impact in the SLNP due to a latent absence of governance in the area and unfavorable livelihoods for the population, low income, few economic alternatives and low education.

State funds and presence of government institutions and organs in the protected area are to low to guarantee an effective implementation and functioning of the protected area to conserve the forest resources. This is demonstrated quite clearly by the ongoing high deforestation rates in the area (FDN, 2011).

Is expected the increase in the magnitude and frequency of natural phenomena such as storms, droughts, frosts; impacting especially the most vulnerable populations involving: i) the reduction in the availability and quality of water; II) movement of plagues, vectors, predators and diseases to new geographic areas; III) disturbances and blockages in the food chain in the terrestrial and coastal marine systems; IV) increased wildfires by drought and plagues; V) loss of infrastructure; VI) increased food insecurity due to crop loss; VII) destruction of natural areas and biodiversity; VIII) negative impacts on all human livelihoods, identity cultural and traditional and ancestral knowledge; and IX) reducing the amount and soil quality; among others.

The project activities have been designed as part of the REDD+ project with the intention of reducing CO₂ emissions from deforestation and degradation compared to baseline levels. The major goal of the project is to slow down the rate of forest loss together with the communities, and other local partners. The project zone is current affected by deforestation, where large areas of

forested land are converted to farmland and cattle ranches. Other specific threats have included petroleum exploration and associated road building, as well as organized illegal colonization⁸.

In the absence of the REDD+ project, it is likely that the drivers of deforestation continue destroying existing forest resources, increasing the area affected by forest fires - especially in years of climatic stress, and creating new opportunities for livestock expansion by cattle ranchers.

1.3.1 Project Physical Parameters:

G1.3 The country is part of an isthmus and is located in a highly vulnerable region. It is situated between three intercontinental plates and geomorphological and hydric characteristics. Located in an intertropical convergence zone, as well in the zone of influence of El Niño and La Niña phenomena, and between the Atlantic and Pacific Ocean. It lies in the path of hurricanes and tropical storms in the Caribbean making it a vulnerable and fragile country. The impact related to climate variability in Guatemala has an effect of 1.3% to 3.7% annually in Gross Domestic Product (GDP) and it is estimated that between 40% and 70% of the impact is in the agricultural sector⁹. Guatemala is exposed to extreme events. In the last sixteen years (1998 to 2014), there have been recorded a total of eight hydro-meteorological events linked to climate change (tropical storms, hurricanes and important droughts). The accumulated losses and damages amounted to more than US \$ 3.5 billion dollars, mainly distributed in the affected sectors of infrastructure, agriculture and health. Between 1998 and 2010, climate variability caused economic losses in the agriculture sector in the order of US \$ 1.85 billion.

Life zone

Attending to Holdridge classification, in the Park occur two different life zones, whereas the Subtropical humid forest “bh-S(c)”, 197 746.27 ha, is the most widely represented and the Subtropical very humid forest “bmh-S(c)”, 2 449.37, is very scarcely represented. The Subtropical humid forests receive high overall rainfall with a warm summer wet season and a cooler winter dry season. Some trees in these forests drop some or all of their leaves during the winter dry season. Attending to previous classifications¹⁰ in the SLNP nine different terrestrial ecosystems plus two different aquatic systems occur. The most represented ecosystems correspond to dense humid broadleaved lowland forests, humid broadleaved forest of the hills and bushy areas with broadleaved.

⁸ Hodgdon, B.; Hughell, D.; Ramos, V.; Balas, R. 2015. Deforestation Trends in the Maya Biosphere Reserve, Guatemala. http://www.rainforest-alliance.org/sites/default/files/publication/pdf/MBR-Deforestation_150213-2.pdf

⁹ Gobierno de Guatemala. 2015. Contribución prevista y determinada a nivel nacional. Ministerio de Ambiente y Recursos Naturales. Available at: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Guatemala/1/Gobierno%20de%20Guatemala%20INDC-UNFCCC%20Sept%202015.pdf>

¹⁰ INAB. 2001. “Mapa de Ecosistemas Vegetales de Guatemala; Memoria Técnica”. Instituto Nacional de Bosques (INAB). Guatemala. 39 pp. + anexos.

Climate

The climate particularity of the Sierra del Lacandón to the rest of RBM is its high rainfall. They have records of a minimum annual rainfall of 1 481 mm (1968) and a maximum of 2 527 mm (1981).

The project area presents hot sub-tropical climate. The rainy season usually occurs during May to December, while the months of January until May are dry. The temperatures reach an average maximum of 40.1 °C and a minimum average of 14 °C. The overall average temperature is of 25.9 °C. The annual humidity percentage average is of 85.5%, and the average precipitation is of 1600.6 mm¹¹.

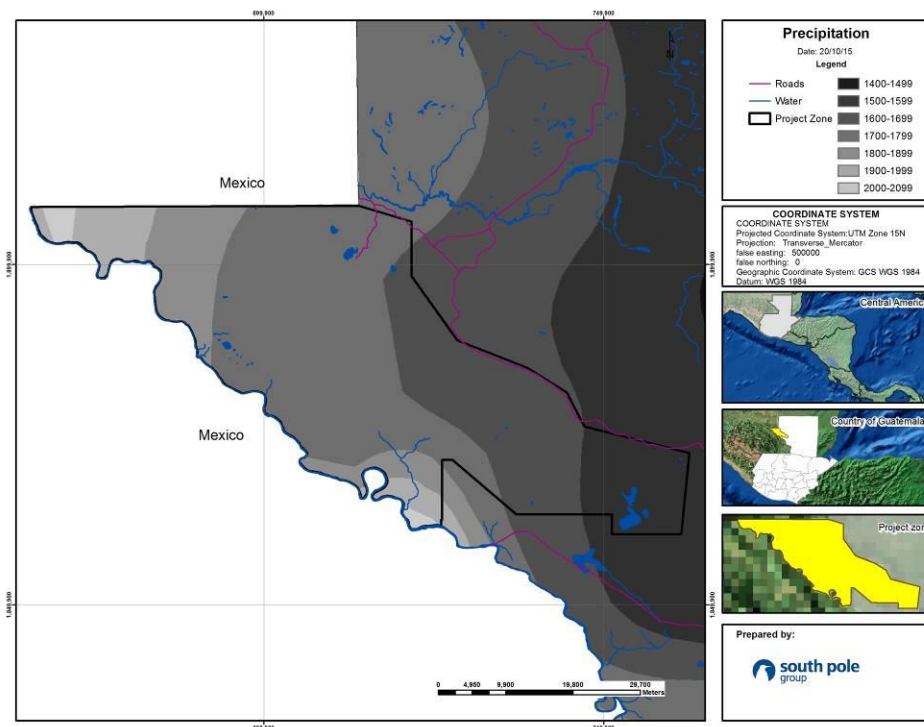


Figure 5. Precipitation of the project zone

¹¹ Data INSIVUMEH Bethel Station, 2009

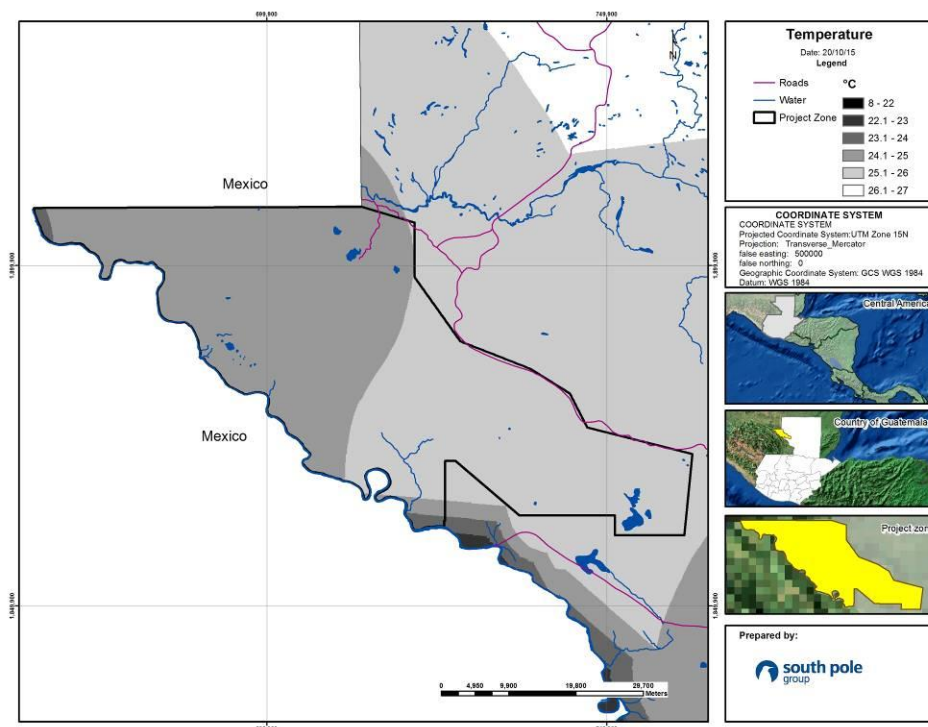


Figure 6. Temperature of the project zone

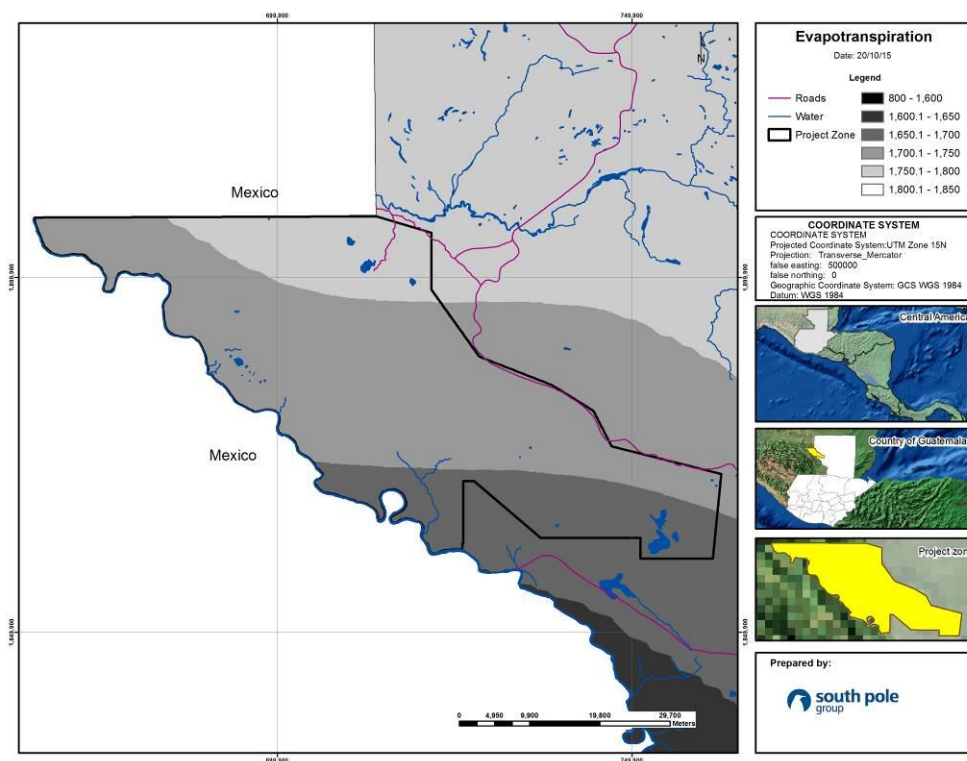


Figure 7. Evapotranspiration of the project zone

Geology

Guatemalan geology is characterized by the presence of active volcanoes, rugged terrain in the central cordillera, transform faulting, northern lowlands and extensive karst topography. Soils in the Department of Petén are mainly formed by alluvium from the Quaternary, Eocene, Paleocene-Eocene and Cretaceous Eras. In the northern lowlands of Petén and the central Alta Verapaz regions of Guatemala, the upper portion of the “Todos Santos” Formation includes interbedded carbonates and evaporites, merging in places with overlying Cretaceous carbonates.

Marine transgression commenced in the early Cretaceous period, during which time massive shelf carbonates were formed along a passive margin in the proto-Yucatan region. Massive carbonates are responsible for the karst terrain of much of northern and central Guatemala. These thick deposits are characterized by about a kilometer of dark gray, fossil-free dolomite and limestone containing lithoclastic breccias, overlain by a central section of fine-grained clastics and topped by another kilometer of finegrained gray/brown layers including microfossils. The seismic activity in the region has generated a surface that shows several faults.

This region presents the higher altitudes within the Department of Peten, together with the region of Mayan Mountains. The rocky structure formed in the Lacandón area belongs to the Cretacic and Cenozoic eras¹²¹³.

The structure is divided in two overlapped limestone formation called “Lacandón” and “Campur”. Additionally, in the north-east and south-west part of the SLNP, the structure present small stripes of alluvial soils, associated to the River San Pedro and to the stream Yaxchilán, respectively¹⁴.

¹² Stanford Alpine Project. 2005. Field Guide to Guatemalan Geology. Department of Geological and Environmental Sciences, Stanford University. Available at https://pangea.stanford.edu/research/mahood/bio/SAP_Guatemala_guidebook.pdf

¹³ APESA. 1993. Evaluación Ecológica Rápida de la Reserva de la Biosfera Maya. Guatemala, Guatemala. APESA/TNC/PBM-USAID. 356 p. + Mapas temáticos.

¹⁴ Consejo Nacional de Áreas Protegidas (CONAP), FDN, USAIP, TNC. 2005. Plan Maestro 2006 – 2010. Parque Nacional Sierra del Lacandón. Available at <http://www.defensores.org.gt/sites/default/files/Plan%20Maestro%20PNSierra%20del%20Lacandón%202006-2010.pdf>

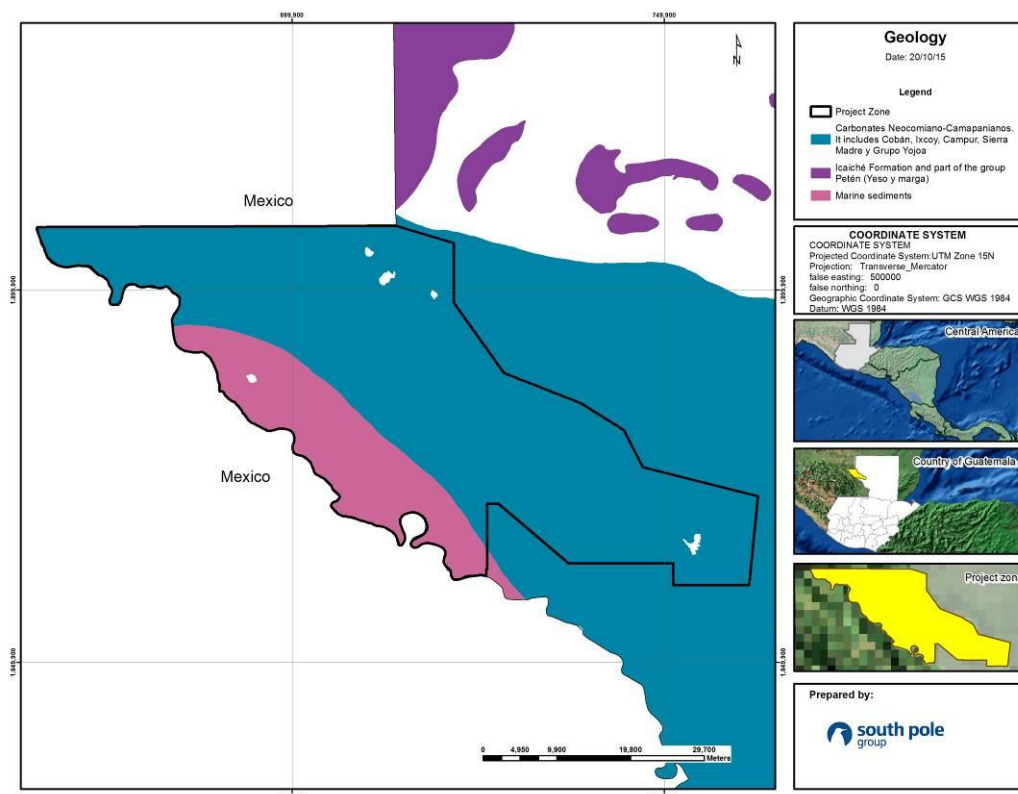


Figure 8. Geology of the project zone

Physiography and soils

According to physiographic studies developed previously in the area¹⁵, the main origin of the geologic strata present in the project area is of limestone and dolomitic precedence. The associated topography consists of karstic formations with an incomplete and broken up draining net.

Within the SLNP, four main landscapes exist. The most representative is the karstic mountains of Sierra de la Pita, Sierra del Lacandón and Sierra de la Ribera and the alluvial plains of the El Repasto and the Yaxchilan that are between the mountain ranges.

The soils present in the area correspond to formations presenting Rendzinas/Litosols/Cambisols or Rendzinas/Cambisoles/Vertisoles.

¹⁵ Alvarado, G. y Herrera, I. 2000. Mapa Fisiográfico-Geomorfológico de la República De Guatemala Escala 1:250000. Unidad de Políticas e Información Estratégica (UPIE), Área de Planificación, Ministerio de Agricultura, Ganadería y Alimentación, Guatemala. Available at http://web.maga.gob.gt/wp-content/blogs.dir/13/files/2013/widget/public/mapa_fisiografia_memoria_2001.pdf

Table 2. Types of soils in the SLNP

Type of soils	% of area within SLNP	Description
Rendzinas/Litosoles/Cambisoles (Series Chacalté - Cuxu)	65%	Mother material of limestone (hard and soft), cracked relief with declines averaged 50% and very high risk of erosion, with good internal drainage and relatively high fertility.
Rendzinas/Cambisoles/Vertisoles (Quinil - Yaxhá - Chapayal - Uaxactún)	30%	They are located in the inter-mountain areas of the "Serranía". Plain relief (0-30% gradient), mother material of limestone, with varying internal drainage, reduced danger of erosion, and higher fertility than the series Chacalté - Cuxu.
Gleysols	3%	Associated with scattered small wetlands and swamps located in SLNP (El Repasto Lagoon, Laguneta Lacandón, etc.). Usually formed by unconsolidated sediments and flood.
Cambisoles Gleicos/ Gleysols (series Bolom)	2%	Associated to the floodplains at east of Parcelamiento Retalteco. Similar characteristics to Gleysols.

Source: APESA, 1993.

Within the SLNP 4 large landscapes are recorded, the most represented Lacandón karst mountain (representing 72% of SLNP) and colluvial sedimentary plain of Yaxchilán-El Subín-Machaquila (22% of SLNP).

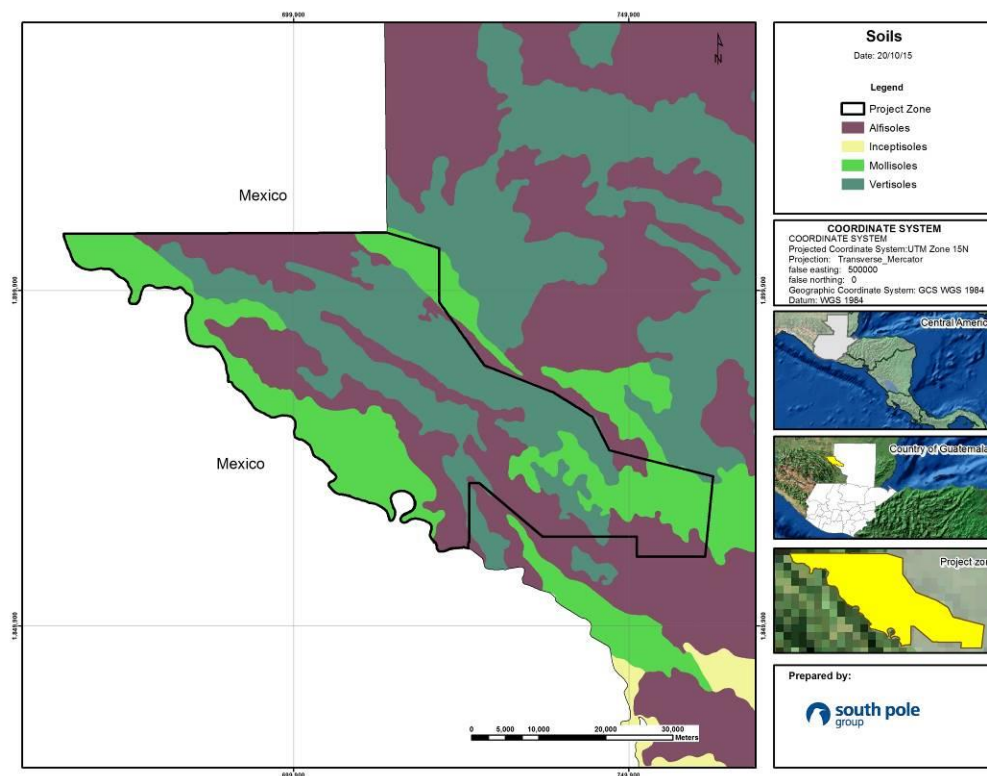


Figure 9. Types of soils of the project zone

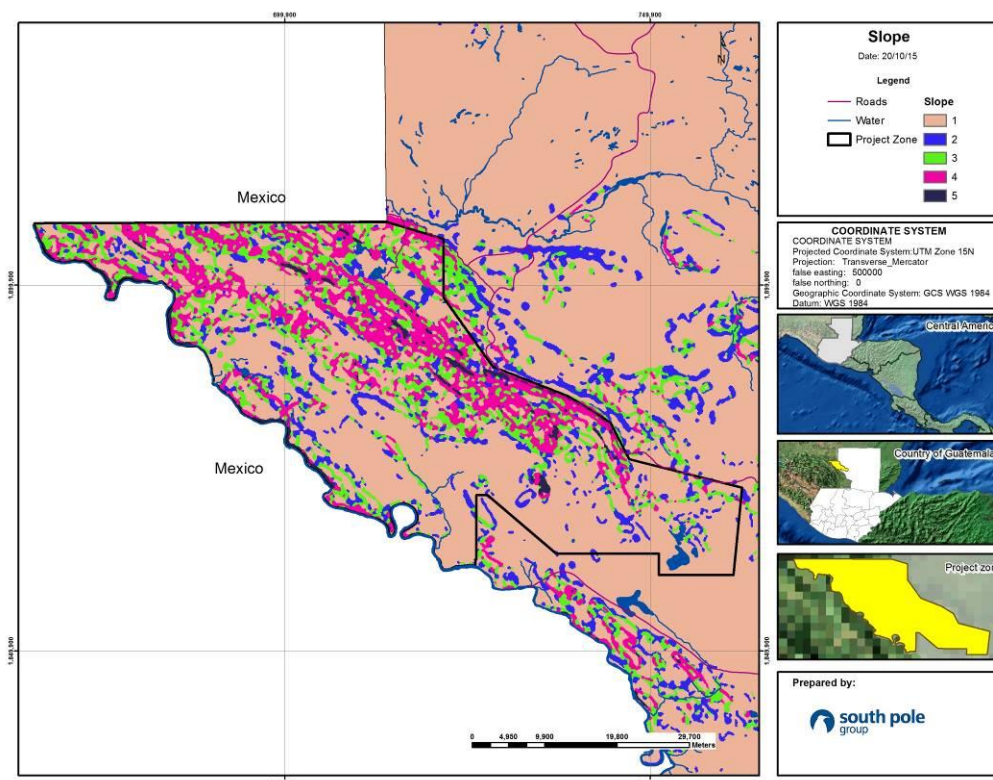


Figure 10. Slope of the project zone

Topography

Topographically, the SLNP can be divided into two major categories: Mountains areas and low areas.

- Mountains areas or “Serranías”: The Mountains are formed by a series of hill through the National Park in southeast-northwest direction, parallel to the course of Usumacinta River. Exist three “serranías” in the NPSL: Sierra de la Ribera, Sierra del Lacandón and Sierra La Pita.
- Low areas or low seasonally flooded: distributed within the SLNP in longitudinal axis northwest-southeast, between the mountains or “sierras” of La Ribera and Lacandón¹⁶.

Hidrology

Around 361 lineal km of water courses can be found within the SLNP. These include rivers and streams supplying the watersheds of the Usumacinta River (the largest river by discharge of water in Central America) and the watershed of the San Pedro River, the two main hydrographical features present in the area.

The most representative in terms of extension in the National Park is the Usumacinta River watershed, covering around 161,614 ha that corresponds to 81% of the National Park. It has as well significant importance at social/administrative and political level, since its affluent are the natural feature delimiting the border with the Mexican states of Chiapas and Tabasco.

The most important water courses flowing to the Usumacinta River are the Yaxchilán and the Macabiero Rivers. On the borders of the river are established several human settlements and communities such as La Lucha, Unión Maya Itzá and La Técnica Agropecuaria. The Yaxchilán River drains the South West part of the Park and the River Macabiero drains the plains of the region between Sierra de La Ribera and Sierra del Lacandón. The last one presents scarce human disturbance.

Table 3. Watershed and subwatershed in the SLNP

Watershed	Subwatershed	Area within SLNP (ha)	% area within SLNP
San Pedro River	Pejelagarto creek	2432.5	1%
	El Repasto lagoon	20274.9	10%
	Paraíso lagoon	5743.8	3%
	San Pedro River capture area	10129.7	5%
Total San Pedro River		38580.9	19%
Usumacinta River	Usumacinta River capture area	131718.4	66%
	El Chorro creek	1594.8	1%
	La Guadalupe lagoon	2454.9	1%

¹⁶ CONAP. 2005. Plan Maestro 2006 – 2010. Parque Nacional Sierra del Lacandón.

Watershed	Subwatershed	Area within SLNP (ha)	% area within SLNP
	Lacandón lagoon	18077.3	9%
	Mendoza lagoon	7769.3	4%
Total Usumacinta River		161614.7	81%
General total		200195.6	100%

Source: CONAP, 2005.

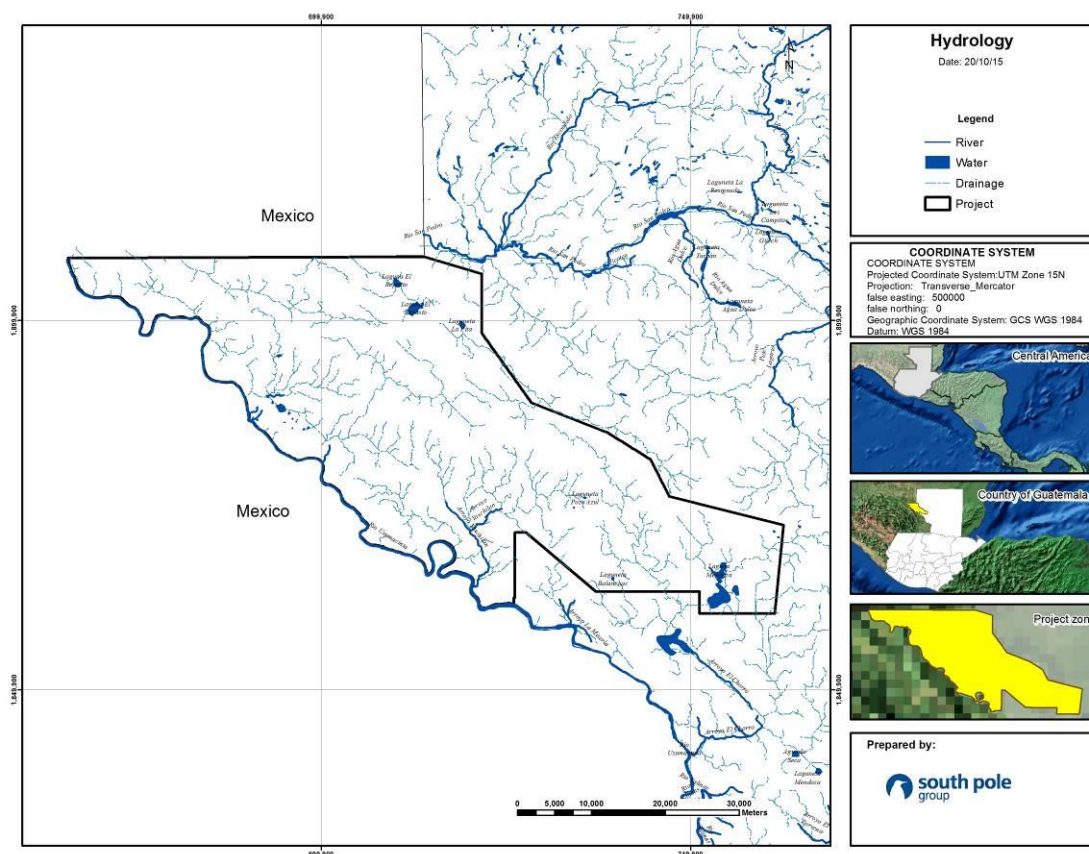


Figure 11. Hydrology of the project zone

1.3.2 Current land use

G1.3/ G2.1 The SLNP has a total area of 202,865 hectares. Some 95,529 hectares are forests that have been well preserved, another 54,000 hectares are currently being regenerated. More than 28,000 hectares of this forest area were lost between 1986 and 2009, which is an average of 1,240 hectares each year. The area of the land that lies outside the SLNP boundaries is 5876.34 ha owned by Unión Maya Itzá and La Técnica Agropecuaria cooperatives.

The main threats affecting conservation of biodiversity in the SLNP are forest fires, advancing agricultural frontier, deforestation and illegal traffic, human settlements, extraction of timber and non-timber forest products and fishing.

It is a critical conservation area due to massive colonization and population growth in recent years, causing major changes in land use in order to have economic options and allocate forest to farming and livestock areas.

The SLNP is characterized by an average rate of precarious employment where 85.60% are engaged in agriculture, hunting and fishing activities, taking into account that 60% of the population of that area is classified as economically active, this leads to a persistent environmental degradation due to the lack of economic alternatives resulting in the need to extract natural resources (wood, xate palm, subsistence crops).

The farming activities have been limited by topography, but in the lowlands abutting the road, degradation is evident. Agricultural activities in the area, where uncontrolled slash and burn is used (a technique to prepare land that will be used in planting crops or pasture and even future occupations) are the main cause of forest wildfires affecting large areas of forest that would not necessarily be for agriculture and cattle raising activities.

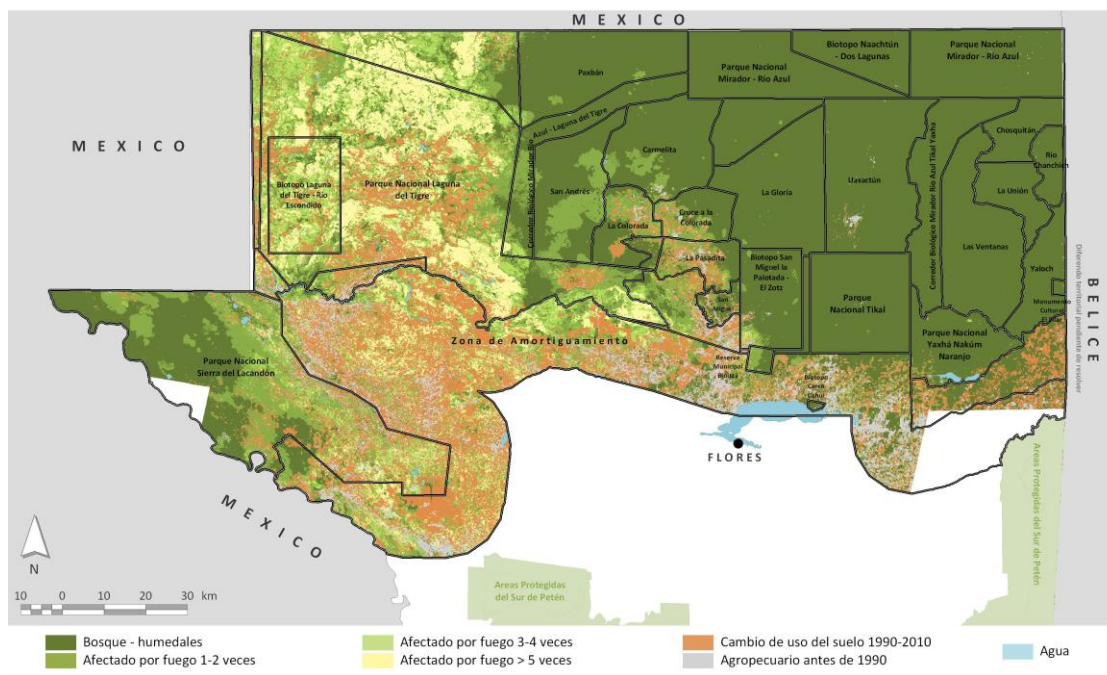


Figure 12. Land use changes and fire. Source: Estado de la Reserva de la Biosfera Maya¹⁷

¹⁷ Estado de la Reserva de Biósfera Maya. Available at: <http://stateofthembr.org/es-es/mapas.aspx>

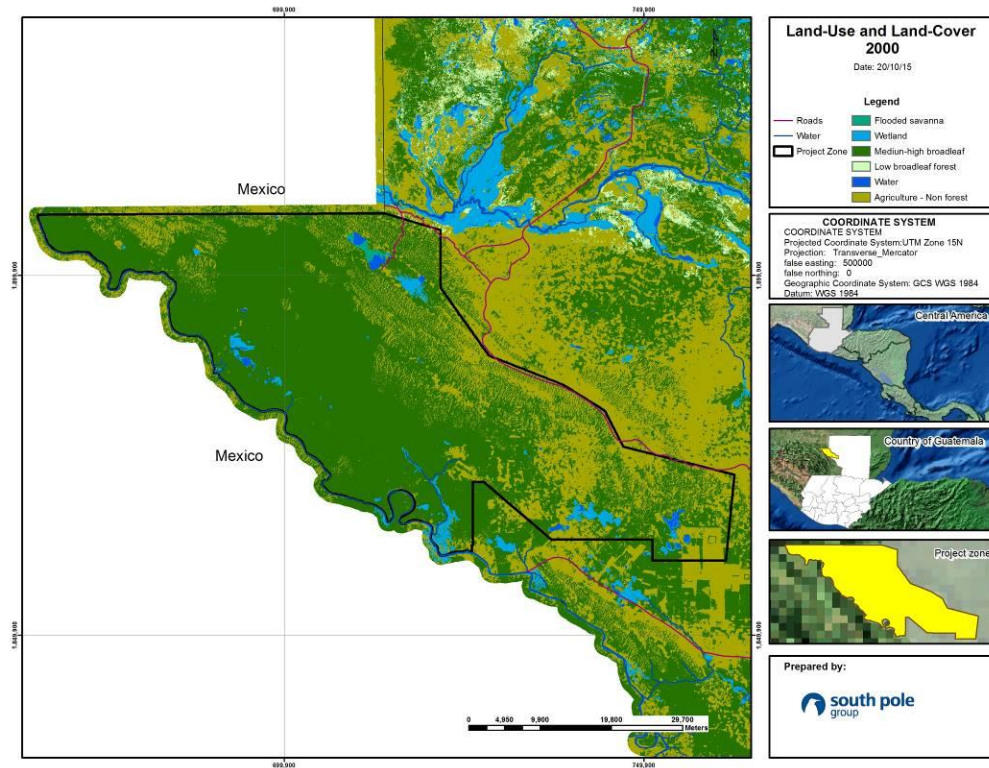


Figure 13. Land use and land cover of the project zone – year 2000

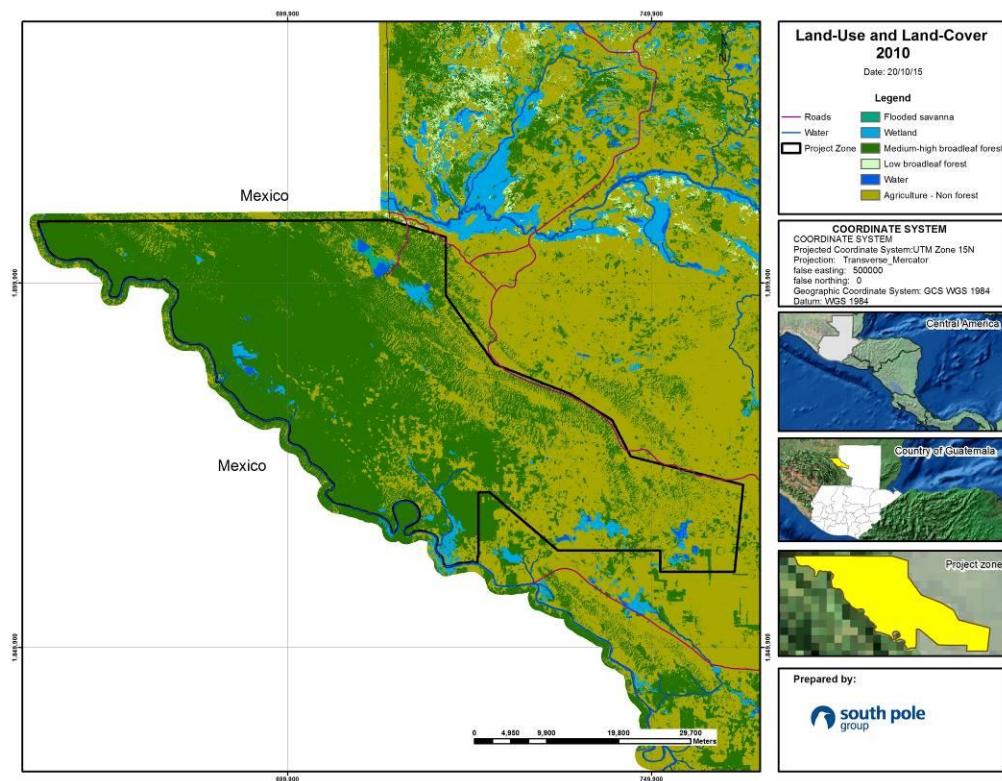


Figure 14. Land use and land cover of the project zone – year 2010

1.3.3 Deforestation system

G1.3 / G2.1 It is the interaction of spatial and not spatial factors, both directly and indirectly, allow the description of the current and future deforestation processes in a specific area. The system contemplates social, economic and environmental variables giving a global scope to the problem of deforestation.

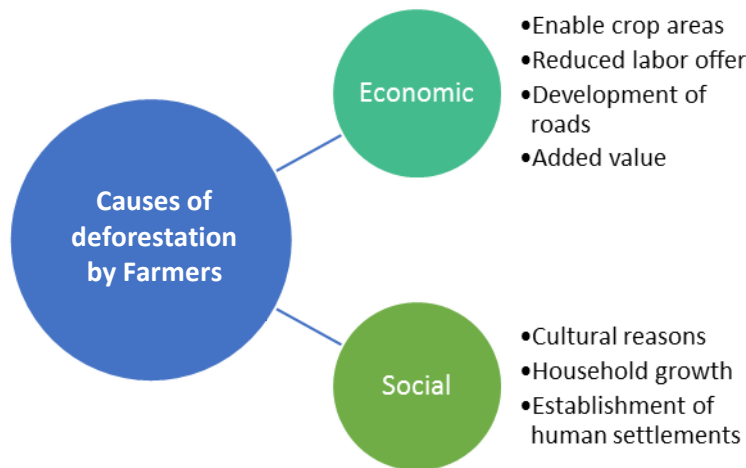
Table 4. Description of the variables of the deforestation system in the SLNP

N°	Variable	Description
1	Access to the area	Primary and secondary roads that allow entry to areas under forest cover.
2	Migration	Groups of people arriving at Petén department from other departments of Guatemala.
3	Institutional presence	Governmental and non-governmental organizations related to environmental protection and compliance with environmental legislation in the country.
4	Forest fires	Unplanned and uncontrolled forest fires. Require intervention to control.
5	Population growth	Average annual rate of change in population size for a particular territory or geographic area.
6	Economic alternatives	Family productive activities that generate income to cover basic needs. They are not linked to traditional farming and extensive cattle ranching.
7	Water bodies	Bodies that store volumes of water, which can be extracted superficially like rivers, lakes, lagoons.
8	Areas suitable for farming	Areas within the SLNP with conditions for the development of agriculture (climate, soil type, slope, access to water).
9	Human settlements	Establishment of a demographic conglomerate in an area physically located.
10	Health and education	Access to basic services.
11	Areas suitable for livestock	Areas within the SLNP who have conditions for the development of livestock (climate, soil type, slope, access to water).

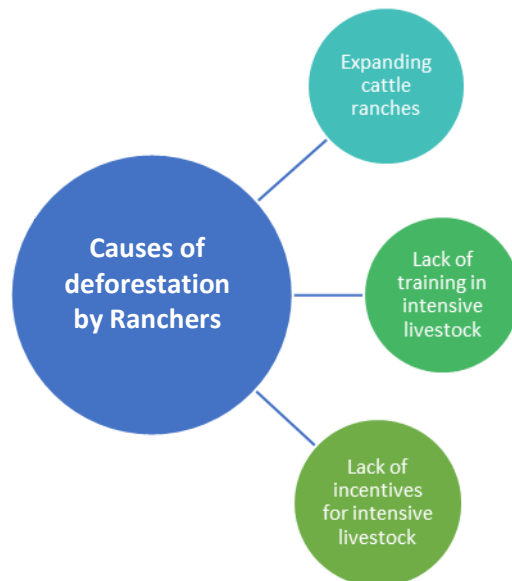
1.3.4 Identification and description of the deforestation agents

G2.1 Portillo & Rojas (2011) described the agents of deforestation in the SLNP, which are closely linked with economic activities and governance of the territory.

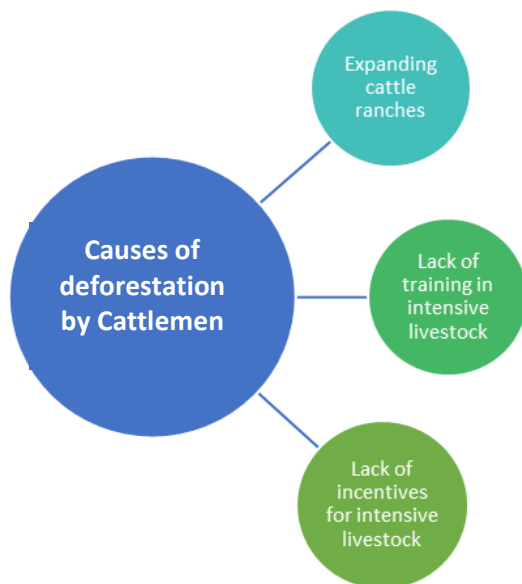
- **Agricultural:** no organized farmer groups dedicated to farming of basic grains and fruit trees for subsistence. Use slash and burn methods.



- **Livestock:** no organized farmer groups dedicated to dual purpose livestock activities.



- **Invasions:** usurpation of land in protected areas for the development of agriculture, livestock and drug trade.



1.3.5 Without-Project Community Scenario

CM1.1 According to the International Strategy for Disaster Reduction (UNISDR in local name Estrategia Internacional para la Reducción de Desastres) and data from IPCC ANNEX I.8 e), the socio-environmental vulnerability of the country is reflected in the high levels of poverty (approximately 51% of the population in poverty and 15% in extreme poverty), 49% child malnutrition and low Human Development Index (HDI). The population groups most impacted are the indigenous peoples, subsistence farmers, artisanal fishermen, including women and children.

Guatemala, despite being the largest economy in Central America, is one of the countries with higher levels of inequality in Latin America, such as high rates of poverty, particularly in rural and indigenous peoples resulting in one of lower HDI in Latin America¹⁸.

Poverty is a complex and multidimensional phenomenon, both in its causes and its effects. The Municipalities of La Libertad and Las Cruces have high rates of poverty and extreme poverty, resulting in precarious livelihoods.

Without the project activities, the SLNP population would continue with low income, few economic alternatives, low education and ineffective governance leading to a lower quality of life.

¹⁸ Gobierno de Guatemala. 2015. Contribución prevista y determinada a nivel nacional. Ministerio de Ambiente y Recursos Naturales. Disponible en: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Guatemala/1/Gobierno%20de%20Guatemala%20INDC-UNFCCC%20Sept%202015.pdf>

Deforestation will continue and increase due to the advance of the agricultural frontier to satisfied food requirements in the communities. More agricultural land would be incorporated to increase household income and complete the family diet.

The type of livestock is extensive, for which a considerable amount of land is necessary. This scheme would continue if the project is not implemented.

These main activities will increase the sale of illegal land resulting in new settlements and consequently in farming or pasture.

Description of communities in the project zone

CM1.1 The SLNP was created together with the Maya Biosphere Reserve in 1990 through the Decreto 5-90¹⁹. FDN co-administrates the SLNP together with CONAP since 1999. The territory SLNP had already been partially populated before it was placed under official protection in 1990. Accordingly, the people living in these settlements have the right to remain in the region and be involved in the activities proposed.

The colonization of the Lacandon region started with the establishment of the first cooperatives in the sides of Usumacinta and La Pasión rivers during the year 1966. The settlement was supported by the Government of Guatemala for enforcing the presence of Guatemala in a frontier region that was absolutely unpopulated and as response to the Mexican idea of establishing a hydroelectric complex in the area²⁰. The original inhabitants of the area were the indigenous Hach Winik ("True People"), also known as the Lacandón Maya. For 2004, there were approximately 700 Lacandón Maya living in the tropical jungles of southern Mexico, being the Mexican villages of Mensäbäk and Naha', the location with higher densities of Hach Winik people²¹. Currently, most documented Mexican villages are the village of Naha with about 200 inhabitants; village of Mensäbäk, which is the smallest settlement of the Lacandón people; village of Lacanha Chansayab and finally village of The Sierra Cojolita, which is the largest community of Lacandón with about 500 inhabitants²².

The indigenous people living nowadays within the SLNP come from many different ethnic groups that had to migrate during the armed conflict in Guatemala. Previous investigations have stated the presence of Q'eqch'is, representing 18.3% of the total population in the SLNP, while the ethnics Achi', Itzá, Jakalteko, Kaqchikel, Mam, Poqomchí, Q'anjob'al and K'iche' are as well represented and conform altogether 8.7% of the total population. Ladinos²³ represent 73% of the population²⁴. This is of utmost importance for this project, since the lands where these

¹⁹ Congreso de la República. 1990. Decreto Número 5 – 90. Guatemala

²⁰ Milián, B.; Grünberg, G.; Cho, M. 2000. La Conflictividad Agraria en las Tierras Bajas del Norte de Guatemala: Petén y la Franja Transversal del Norte. CARE. Guatemala, Flacso, Minugua, Contierra

²¹ Khashanipour & McGee, 2004. Northern Lacandón Maya Medicinal Plant Use in the Communities of Lacanja Chan Sayab and Naha', Chiapas, Mexico. Available at:

<http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1065&context=jea>

²² Lacandóns Mayans. Information consulted October 2015. Available at <http://anth323.angelfire.com/>

²³ Mixture of Central American Indigenous and European or descendent of European

²⁴ Ramos, V.; Solís, N.; y Zetina, J. 2001. "Censo de Población en seguimiento a la Base de Datos sobre Población Tierras y Medio Ambiente en la Reserva de Biosfera Maya." CONAP y CARE Guatemala, cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón. Coadministración Fundación Defensores de la Naturaleza – CONAP. Unpublished. Document available for auditors upon request.

communities are settled nowadays do not correspond to their ancestral locations and behaviours related to land management are severely influenced by this fact. Due to the higher productivity of the lands along the Yaxchilán Stream the human presence in these areas is higher, and concurrently the development of infrastructures²⁵. A more recent study reveals that in 2008²⁶ the majority of the population is still Ladinos, and that their percentage in the population has increased (from 73% to 75%).

The socio-economic environment of the National Park has been severely influenced by the construction of two roads, namely the route to Bethel, bordering the southern part of the Park, and the route to the border El Ceibo, along the east limit of the Park. During the decades of 1980 and 1990 other important infrastructures were developed with the aim of reaching the region of Laguna del Tigre National Park, where important reserves of crude oil were discovered at that time.

In year 2000 there were around 11,000 people within or influencing the SLNP²⁷. For 2003 these numbers have been increased to more than 13,000²⁸. A study developed during 2008 reflected that this population had increased until 25,000²⁹. The trend on population growth and the fact that the age distribution shows that the most representative age group is people below 15 years old suggests that the SLNP will be under great pressure in the following years.

In 2008 all communities had primary schools, whereas only nine offered the basic level, the primary subsequent level. The percentage of attendance in the primary school is above 50%. The percentage of population going to school for studying the basic level is much lower. In 2013 there were two health centres located in the communities of Bethel and Nuevo Paraíso 107. All other communities' health infrastructures are very basic or inexistent.

²⁵ Herrera, R. y Paiz, M. 1999. Plan Maestro 1999-2003 Parque Nacional Sierra del Lacandón. Consejo Nacional de Áreas Protegidas, The Nature Conservancy (TNC), Centro Maya & CARE. 45 pp., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón. Coadministración Fundación Defensores de la Naturaleza – CONAP. Unpublished. Document available for auditors upon request.

²⁶ Suter, L., López-Carr, D. 2010. "El Nivel de Desarrollo Humano en el Parque Nacional Sierra del Lacandón". 109 pp + anexos, cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón. Coadministración Fundación Defensores de la Naturaleza – CONAP. Unpublished. Document available for auditors upon request.

²⁷ Ramos, V.; Solís, N.; y Zetina, J. 2001. "Censo de Población en seguimiento a la Base de Datos sobre Población Tierras y Medio Ambiente en la Reserva de Biosfera Maya." CONAP y CARE Guatemala, cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón. Coadministración Fundación Defensores de la Naturaleza – CONAP. Unpublished. Document available for auditors upon request.

²⁸ MSPAS. 2003. "Consolidado censo de población por grupos de edad año 2003". Área de Salud Norte, Sayaxché. Ministerio de Salud Pública y Asistencia Social. Petén, Guatemala. 3 pp., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón. Coadministración Fundación Defensores de la Naturaleza – CONAP. Unpublished. Document available for auditors upon request.

²⁹ Suter, L., López-Carr, D. 2010. "El Nivel de Desarrollo Humano en el Parque Nacional Sierra del Lacandón". 109 pp + anexos, cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón. Coadministración Fundación Defensores de la Naturaleza – CONAP. Unpublished. Document available for auditors upon request.

The municipality of La Libertad has an average rate of precarious employment. The 85.60% of the economically active population is related to the use of natural resources, leading to increased pressure on ecosystems. Communal services occupy 9.82% of the population and the major and minor trade contributes 1.79%³⁰.

The living situation of these communities is precarious which is reflected in the high levels of poverty (79.4%), and even extreme poverty (25.1%). There are almost no state institutions present. The National Park is also experiencing a high level of demographic growth (5% annual growth), and 63.45 percent of the population is under 20 years old. The level of education in these communities is low with 40.02 percent having no formal academic education. 91 percent of the literate population has completed primary education and only seven percent secondary education.

The processes of establishment of irregular settlements (called locally “invasions³¹”) in the project zone continue and this project will focus on avoiding deforestation linked to them. The invasions are a latent threat. Currently, exists 2 “invasions” who settled before 2011. Financing and security support is needed to conserve the National Park.

Project activities and monitoring are designed to improved the quality of life and level of organization of both communities and community groups.

CM1.3 As described in this section, the most likely land use is the continuity of frontier agricultural and livestock under conventional conditions of low productivity. In this scenario the social conditions of the communities will continue with high levels of poverty and will not have the expected benefits in the well-being conditions described in Table 48.

1.3.6 Description of current biodiversity within the project zone

B1.1 The SLNP is composed of a wide variety of ecosystems due to its geomorphological features. The unique biodiversity of its flora and fauna helps to sustain a series of ecosystem services and ecological processes and functions that preserve the integrity of the protected area.

There are nine terrestrial and two aquatic ecosystems in the park, according to the National Institute of Forestry (*Instituto Nacional de Bosques*, or INAB). Nearly 100 percent of the national park is lowland tropical rainforest and 90 percent is part of river ecosystems, primarily the mighty Usumacinta River. It is part of the core zones of the Mayan Biosphere Reserve. For this reason, ranks as one of the most diverse in the country.

³⁰ Portillo, M. 2011. Causas y Agentes de la deforestación en el Parque Nacional Sierra de Lacandón. Guatemala.

³¹ Gobierno de Guatemala, CONAP. 2009. Portal Nacional sobre Diversidad biológica en Guatemala. Information online. Available at <http://www.chmguatemala.gob.gt/instituciones/noticias-internacionales/pretenden-ocupar-sierra-de-Lacandón>

Table 5. Types of ecosystems by INAB

Ecosystem type	Area within SLNP (ha)	% within SLNP
Shrub swamp not dominated by carrizal with scattered trees	2083.951	1%
Broadleaf humid hill forests	78807.365	39%
Dense humid lowland broadleaf forests	47723.624	24%
Very humid lowland broadleaf forests	1224.742	1%
Dominated by broadleaf	13312.43	7%
Swampy grasslands	189.625	0%
Swampy grasslands with palms and / or shrubs	2242.197	1%
Lagoons	940.234	0%
Shrub with broadleaf	50978.705	26%
Livestock pastures	2102.38	1%
Rivers	164.243	0%
General total	199796.496	100%

Flora

Since much of the Petén is not well known botanically, it is difficult to estimate the number of vascular plants or endemics. The floristic diversity of the Maya Biologic Reserve is considered exceptional, with over 3000 plant species³². The overall region's flora is considered distinctive; e.g. many of the Petén's regionally endemic taxa are shared to varying extents with northern Belize and Mexico's majority of the Yucatán Peninsula to eastern Tabasco and the eastern highlands of Chiapas^{33,34}. Most local Petén endemics have been found in areas that allow little human intervention, such as steep hills and swamps³⁵.

³² CONAP (1992). Plan maestro de la Reserva de la Biósfera Maya RBM. CONAP, Guatemala City. 25 pp., cited in an online article of the Department of Botany of the Smithsonian National Museum of Natural History, available at <http://botany.si.edu/projects/cpd/ma/ma13.htm>

³³ Breedlove, D.E. (1981). Introduction to the Flora of Chiapas. In Breedlove, D.E. (ed.), Flora of Chiapas. Part 1. California Academy of Sciences, San Francisco. 35 pp., cited in an online article of the Department of Botany of the Smithsonian National Museum of Natural History, available at <http://botany.si.edu/projects/cpd/ma/ma13.htm>

³⁴ Wendt, T. (1993). Composition, floristic affinities, and origins of the canopy tree flora of the Mexican Atlantic slope rain forests. In Ramamoorthy, T.P., Bye, R., Lot, A. and Fa, J.E. (eds), Biological diversity of Mexico: origins and distribution. Oxford University Press, London. Pp. 595-680., cited in an online article of the Department of Botany of the Smithsonian National Museum of Natural History, available at <http://botany.si.edu/projects/cpd/ma/ma13.htm>

³⁵ Lundell, C.L. (1937). The vegetation of Petén. Carnegie Institution of Washington Public. No. 478, Washington, D.C. 244 pp., cited in an online article of the Department of Botany of the Smithsonian National Museum of Natural History, available at <http://botany.si.edu/projects/cpd/ma/ma13.htm>

The vegetation includes 138 tree species, 122 epiphytes and four species that are entirely aquatic. Morales and Flores (2001) pointed out that scientists may still discover new types of vegetation due to its vastness, biodiversity, and wealth of natural resources.

In the areas of the sinkholes, 338 plant species belonging to 70 families were found. The most diverse families are Orchidaceae, Bromeliaceae, Araceae and Rubiaceae. As for the vertical distribution, the stratum with higher richness species was the arboreal with 139 species, followed by epiphytic and shrub species with 122 and 30 respectively.

The most characteristic and dominant frequency in the upper strata of high evergreen forest trees are: Ramon (*Brosimum alicastrum*), chechén negro (*Metopium brownei*) and zapotillo (*Pouteria* sp.); in the valleys can be found Santa María (*Calophyllum brasiliense*) and chicozapote (*Manilkara achras*). In the Mountains (Serranía as local name) it is abundant (*Alseis yucatanensis*), sufricay (*Rollinia microcephala*) and cedrillo de hoja ancha (*Guarea excelsa*). The underwood of the highest and shady areas may contain an abundance of palms like corozo (*Orbignya cohune*), guano (*Sabal morrisiana*) xate (*Chamaedorea* sp.) and bayal (*Desmoncus ferox*).

The six plant associations reported for the SLNP by Castaneda (1998) are the following³⁶:

- Plant association in flood areas (communities Pucté and San Juan), which are flooded for most of the rainy season;
- Plant association in hilltops (communities Cheché Negro and Zapotillo hoja fina) with a undulating terrain and located on the hilltops of the Ribera and Lacandón mountains, and small hills located between the valleys;
- Plant association in intercolinar valley (communities tamarindo, barillo-chicozapote and ramón blanco) that includes small areas between the hills;
- Plant association in Sierra del Lacandón (communities som-sufricay, cedrillo hoja ancha and ramón negro-som-sufricay);
- Plant association in the Sierra de la Ribera (community zapotillo hoja fina-ramón) located in the Sierra de la Ribera of the Usumacinta River;
- Plant association of savannah between the Guayacán and Repasto lagoons. Its characterized by mainly plain areas, with human disturbance, natural grasslands and few trees separated each other.

Within the SLNP forest, after an intervention is made, first a number of herbaceous plants that are quickly dominated by rapidly growing softwood trees, which in some years reached almost as high as the jungle that was replaced, constituting a high secondary forest. The most common species are: *Belotia campbellii*, *Cecropia obtusifolia*, *Heliocarpus donnell-smithii*, *Heliocarpus mexicanus*, *Ochroma bicolor*, *Schizolobium parahybum* (Miranda, 1978).

³⁶ Márquez, J. 2013. Determinación del carbono secuestrado y liberado en los bosques naturales y sistemas de uso de la tierra del Parque Nacional Sieraa del Lacandón, Peten, Guatemala.

In areas where agriculture has been more continuous, there are invasive species such as the genus *Croton*, *Luehea*, *Montingia*, *Spondias*, *Trema*, *Trichilia* and *Zanthoxylum*.

Fauna

There are two types of aquatic ecosystems: lakes and rivers. Within the SLNP there are about 361 linear kilometers of water stream, of which 154 km are of permanent stream and 207 km of temporary stream. Also, there are about 51 lentic bodies of water: ponds, lagoons, sinkholes (called “cenotes” in Spanish, but lexicon actually arising from Maya language) totaling 1105 ha of water surface.

A study by García (2001) reports 75 species of reptile and amphibian species, including 21 whose existence was not previously reported in the investigations, but had been mentioned on distribution maps by Lee (1996). Among the amphibian species found are: *Mexican Bolitoglossa*, *Eleutherodactylus Rhodopis*, *Leptodactylus melanonotus*, *Bufo marinus*, *Bufo valliceps*, *Agalychnis callidryas*, *Hyla loquax*, *Rana berlandieri* and *Rana vaillanti*. And for the reptile species are: *Staurotypus triporcatus*, *Kinosternon acutum*, *Trachemys cripta*, *Sphaerodactylus millepunctatus*, *Norops bourgeaei*, *N. Tropidonotus*, *Basiliscus vittatus*, *Sphenomorphus cherriei*, *Leptodeira* sp., *Spilotes pullatus*, *Colubrid* sp., *Crocodylus moreletii*.

Kihn (2001) reported 34 species of fish belonging to 27 genus in a study carried out in lagoons and sinkholes. In addition, there are nearly 213 sedentary and migratory bird species, according to the ecological classification for avifauna by Castañeda (1998).

Until 2014, 31 species of mammals have been registered. However, the list is still incomplete as the orders Insectivora and Lagomorpha were not studied yet. Consequently, the number of species within the SLNP could potentially increase to some 117 species, which would mean that 59 percent of all species of mammals in Guatemala are represented in SLNP.

Hunting has been traditionally undertaken by the local population for subsistence purposes. Studies developed in the Mexican border of the Lacandon mountain range suggest that the most hunted species are paca (*Agouti paca*), red brocket deer (*Mazama temama*), white-tailed deer (*Odocoileus virginianus*), and collared peccary (*Pecari tajacu*)³⁷. Whereas subsistence hunting seems only to occur in the communities of the Bmanageethel route, in the Naranjo route commercial hunting can be found³⁸. FDN has knowledge of activities of illegal extraction of bird, reptiles and amphibious species for their irregular commercialization as pets. The white-nosed coati (*Nasua narica*) and the raccoon (*Procyon lotor*) are hunted because of the damage they generate in the agricultural fields. Their meat is considered to have low value.

³⁷ Naranjo *et al.*, 2004. Subsistence hunting by three ethnic groups of the Lacandón Forest, Mexico. Journal of Ethnobiology 24(2): 233-253. Available online at: <http://ethnobiology.org/sites/default/files/pdfs/JoE/24-2/Naranjo2004.pdf>

³⁸ Plan Maestro del Parque Nacional Sierra del Lacandón 2011-2015. Unpublished

G1.7 / CM1.2 / B1.2 High Conservation Values

The project zone includes High Conservation Values (HCVs). The HCV have been identified from Geographic Information Systems and Management plans for sustainable use of the principal species such as Spanish Cedar, Large-leaved Mahogany, Breadnut and Allspice. Each owner has identified and defined their areas and identified if it has archaeological features.

- The area contains globally, regionally or nationally significant concentrations of biodiversity values, as clearly exposed by the status of IUCN red list regarding some of the species present in the project zone. CONAP has developed Guatemala's National Council of Protected Areas' Red List and described many of the species present in the project zone³⁹;
- Protected areas. The SLNP is considered as a legally protected area equivalent to IUCN Protected Area Management Category II.
- *Tapirus bairdii*, *Tayassu pecari* and *Panthera onca* are endangered species considered by IUCN.
- Several publications^{40,41} show that the SLNP together with the Mexican Sierra Lacandona is a crucial area for the conservation of endemic species of birds, mosses, to the region. Moreover, a scientific publication⁴² presents the project zone as a Pleistocene refuge from evidence of centres of endemism and the distribution of endemic species.
- Regionally or nationally significant large landscape-level: The Jaguar (*Panthera onca*) plays a very important role in the balance of ecosystems. In different monitoring reports, most registers were found in very specific areas, areas near the Usumacinta river and near to Piedras Negras archaeological site. Therefore, it can be deduced that the occupation of the jaguar is defined by the type and quality of habitat preferred by the species, making it more vulnerable to anthropogenic and environmental pressures.
- The unexplored sinkholes (water ecosystem service) present in the project area could represent an opportunity for discovering threatened or rare ecosystems;

³⁹ CONAP, 2001b. Listado de especies de fauna y flora silvestre amenazadas de extinción (Lista Roja de Flora). Resolución ALC 028-2001 del Consejo Nacional de Áreas Protegidas. Guatemala. Available at: [http://www.google.ch/url?sa=t&rct=j&q=listado%20de%20especies%20de%20flora%20silvestre%20amenazadas%20de%20extinci%C3%B3n%20\(lista%20roja%20de%20flora\).%20resoluci%C3%B3n%20alc%20028-2001%20del%20consejo%20nacional%20de%20%C3%A1reas%20protegidas&source=web&cd=1&ved=0CDIQFjAA&url=http%3A%2F%2Fwww.chmguatemala.gob.gt%2Fcolecciones%2Fespecies-endemicas%2FLista%2520Roja%2520de%2520Fauna.pdf%2Fdownload%2Ffile&ei=0U5CUa-OKer-2QXDqYGoDw&usq=AFOjCNFRuKMtpQ3sd1MfctHRg_CyWwyO4A&bvm=bv.43828540.d.b2l](http://www.google.ch/url?sa=t&rct=j&q=listado%20de%20especies%20de%20flora%20silvestre%20amenazadas%20de%20extinci%C3%B3n%20(lista%20roja%20de%20flora).%20resoluci%C3%B3n%20alc%20028-2001%20del%20consejo%20nacional%20de%20%C3%A1reas%20protegidas&source=web&cd=1&ved=0CDIQFjAA&url=http%3A%2F%2Fwww.chmguatemala.gob.gt%2Fcolecciones%2Fespecies-endemicas%2FLista%2520Roja%2520de%2520Fauna.pdf%2Fdownload%2Ffile&ei=0U5CUa-OKer-2QXDqYGoDw&usq=AFOjCNFRuKMtpQ3sd1MfctHRg_CyWwyO4A&bvm=bv.43828540.d.b2l)

⁴⁰ Eisermann & Avendaño, 2008. Available at: http://www.partnersinflight.org/pubs/mcallenproc/articles/PIF09_Decision%20Support%20Tools/Eisermann_PIF09.pdf

⁴¹ Delgadillo & Cardenas, 2002. Available at: [http://www.bioone.org/doi/abs/10.1639/0007-2745\(2002\)105%5B0327:TLFCMA%5D2.0.CO%3B2](http://www.bioone.org/doi/abs/10.1639/0007-2745(2002)105%5B0327:TLFCMA%5D2.0.CO%3B2)

⁴² Toledo, 1982; Wendt, 1989 and Wendt, 1993, cited in Domínguez-Vazquez et al., 2004. Available at <http://www.sciencedirect.com/science/article/pii/S0034666704000478>

- The project zone is fundamental for meeting the basic needs of local communities and is critical for the traditional cultural identity of communities since most of the areas present high cultural, ecological, economic and religious significance for the local communities.

Therefore, the HCVs identified in the project zone are:

- HCV1: Concentrations of biological diversity including endemic species, and rare, threatened or endangered species.
- HCV5: Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous people.
- HCV6: Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous people.

Many species on the verge of extinction are listed on the CITES lists (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and the List of Threatened Species (*Lista de Especies Amenazadas*, or LEA), which is maintained by CONAP. There are a variety of important species as the Jaguar, White-lipped peccary and Tapir, which have a high biological relevance for the ecosystems where they live (ecological niche) maintaining the ecological balance. They have a large area requirement, so preserving them indirectly helps to preserve other species and habitats.

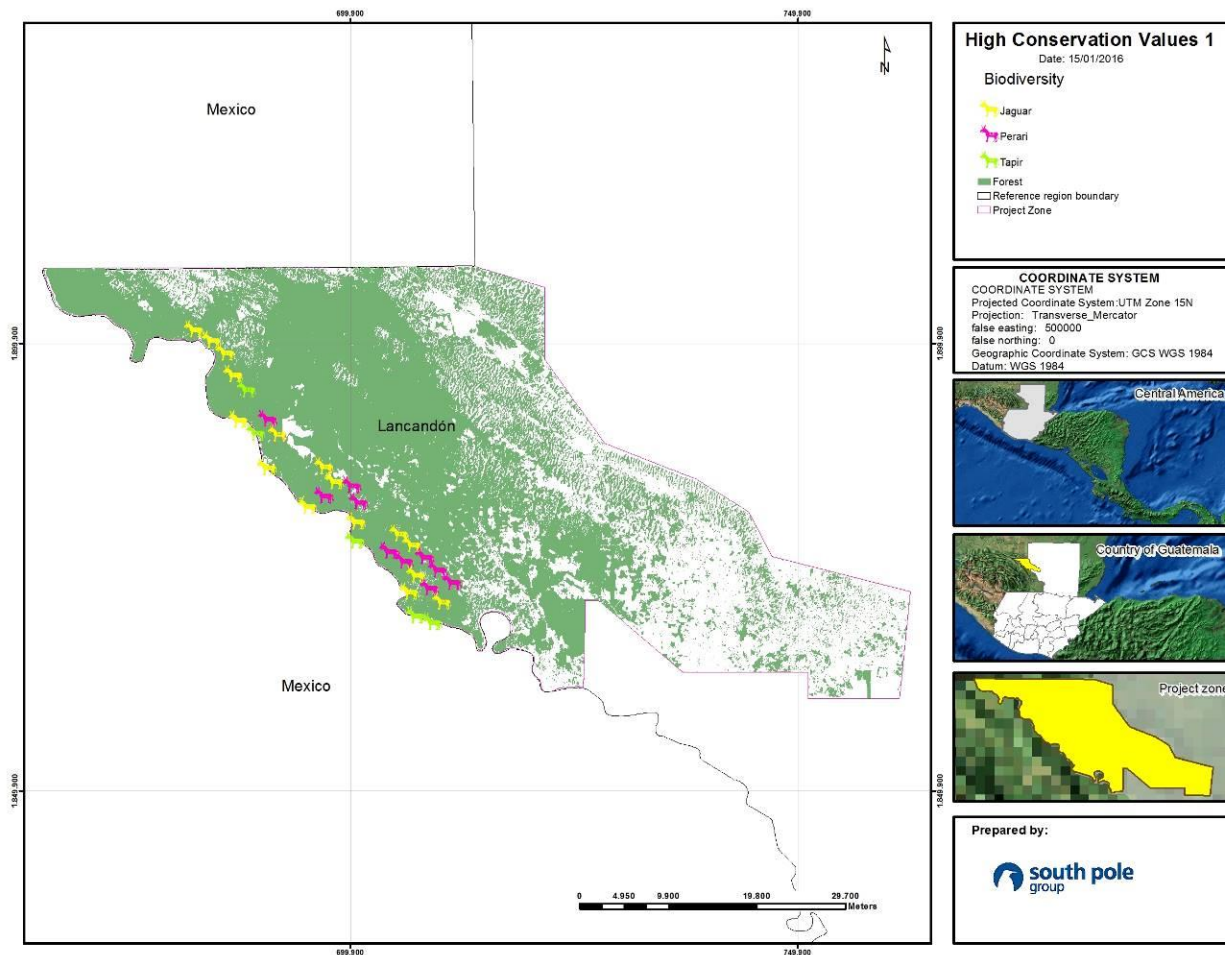
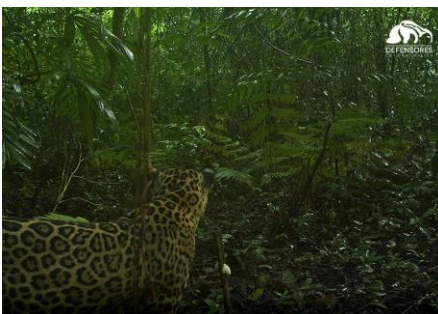


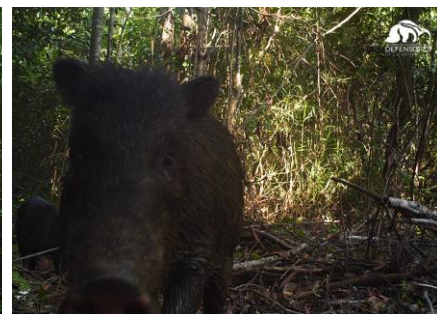
Figure 15. HCV1 – Concentrations of biological diversity / endangered species



Tapirus bairdii



Panthera onca



*Tayassu pecari*⁴³

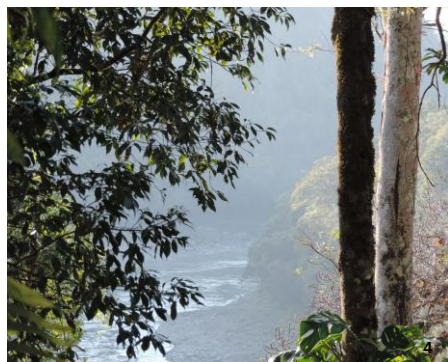
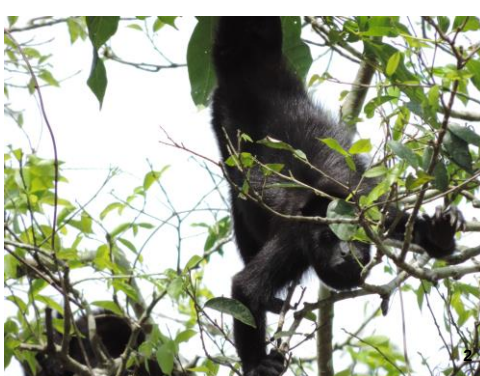


Figure 16. 1. Iguana (*Iguana iguana*). 2. Howler monkey. 3. Heliconia 4. Usumacinta River. 5. Totolaca (*Aramus guarauna*) 6. Lacandona Lagoon.

⁴³ Photos by Defensores de la Naturaleza. Availables at <http://www.quatesostenible.com/camaras-de-trampa-revelan-tesoros-animales-en-sierra-de-Lacandón-peten/>

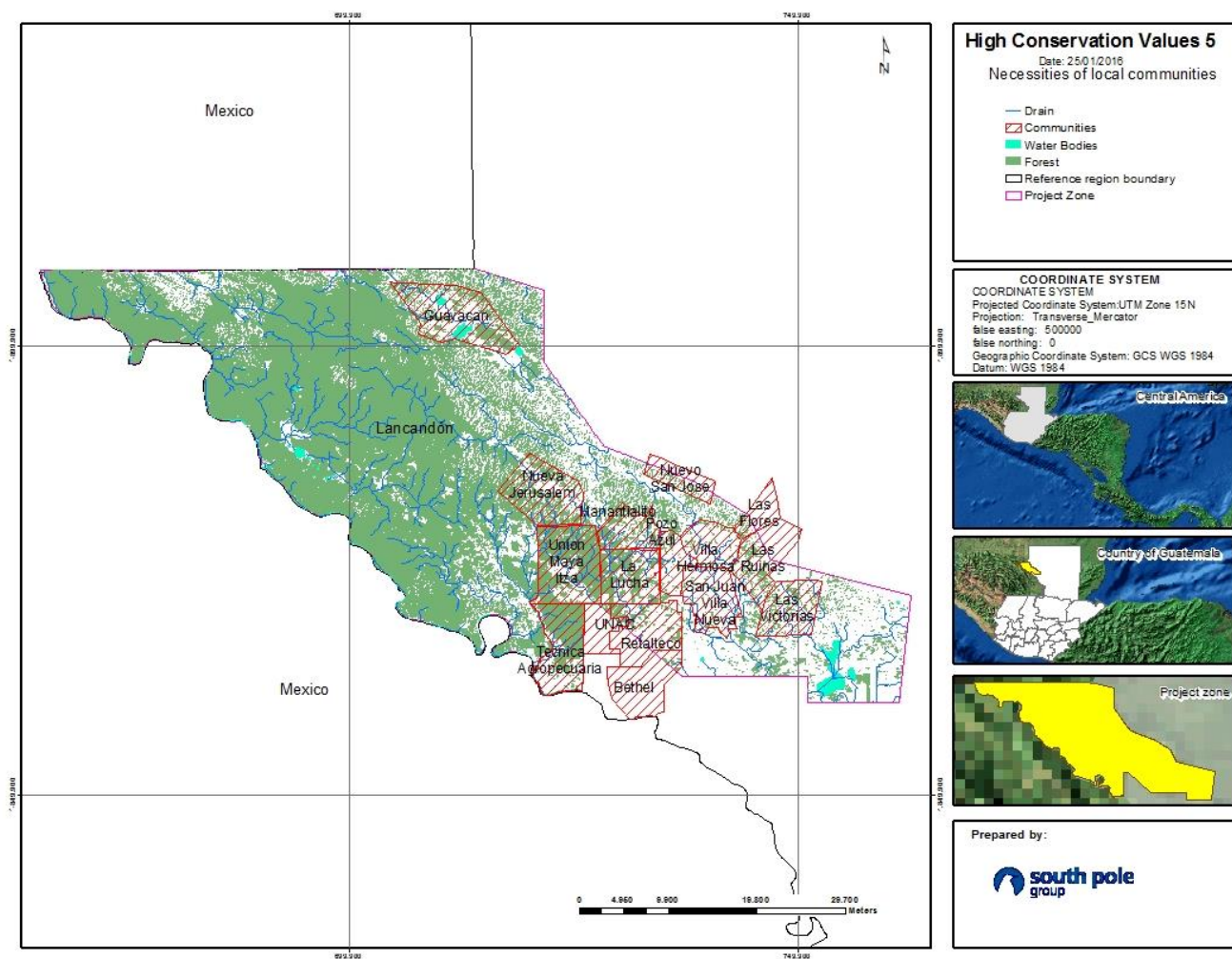


Figure 17. HCV5 - Sites and resources fundamental for satisfying the basic necessities of local communities



Figure 18. 1. Fungus. 2. Malerio seeds (*Aspidosperma megalocarpum*) 3. Family Unit Management Plan. 4. Forest nursery (*Pimenta dioica*). 5. Community gathering Ramon seeds 6. Natural fiber (Pita Floja) 7. Students establishing family gardens.

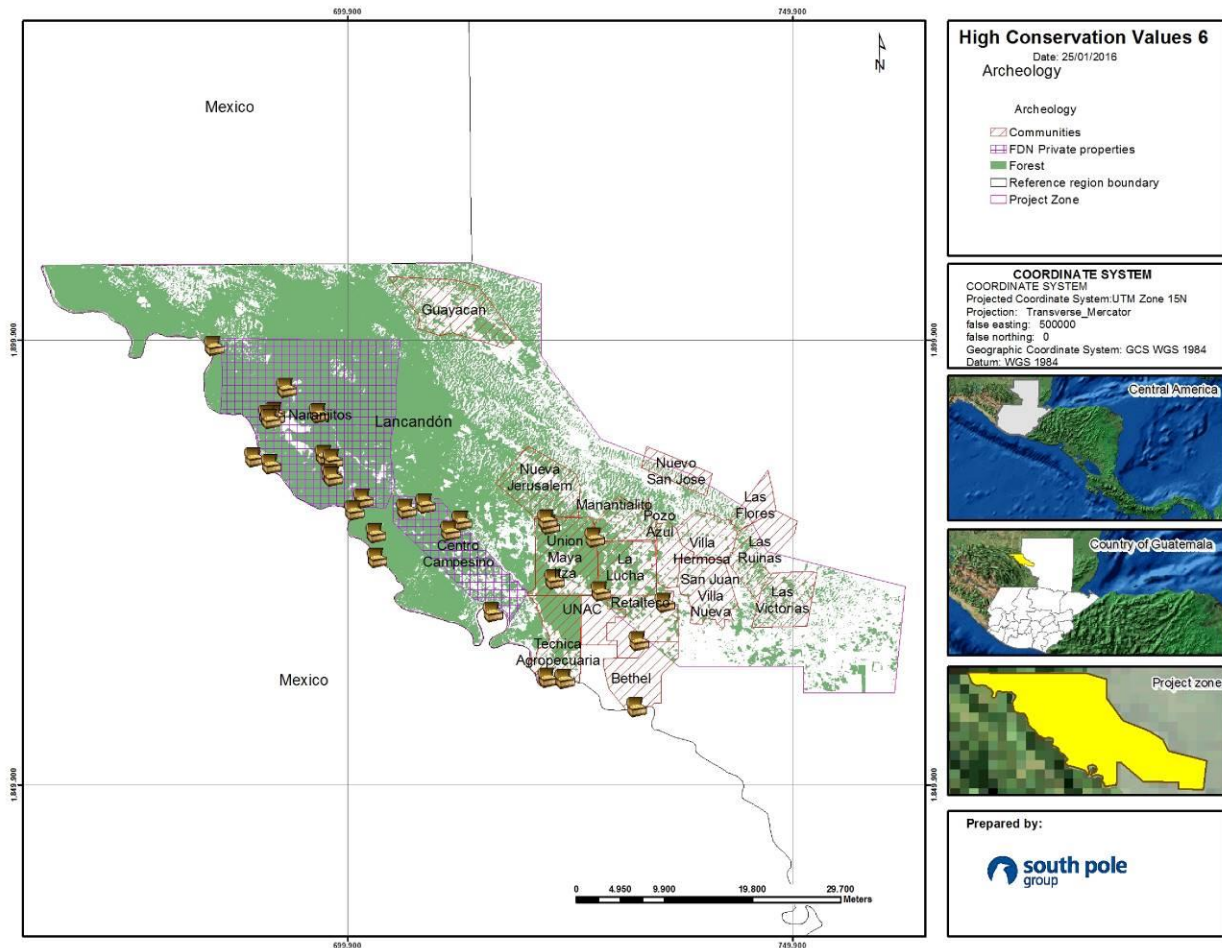


Figure 19. HCV6 - Archaeological significance for the project area

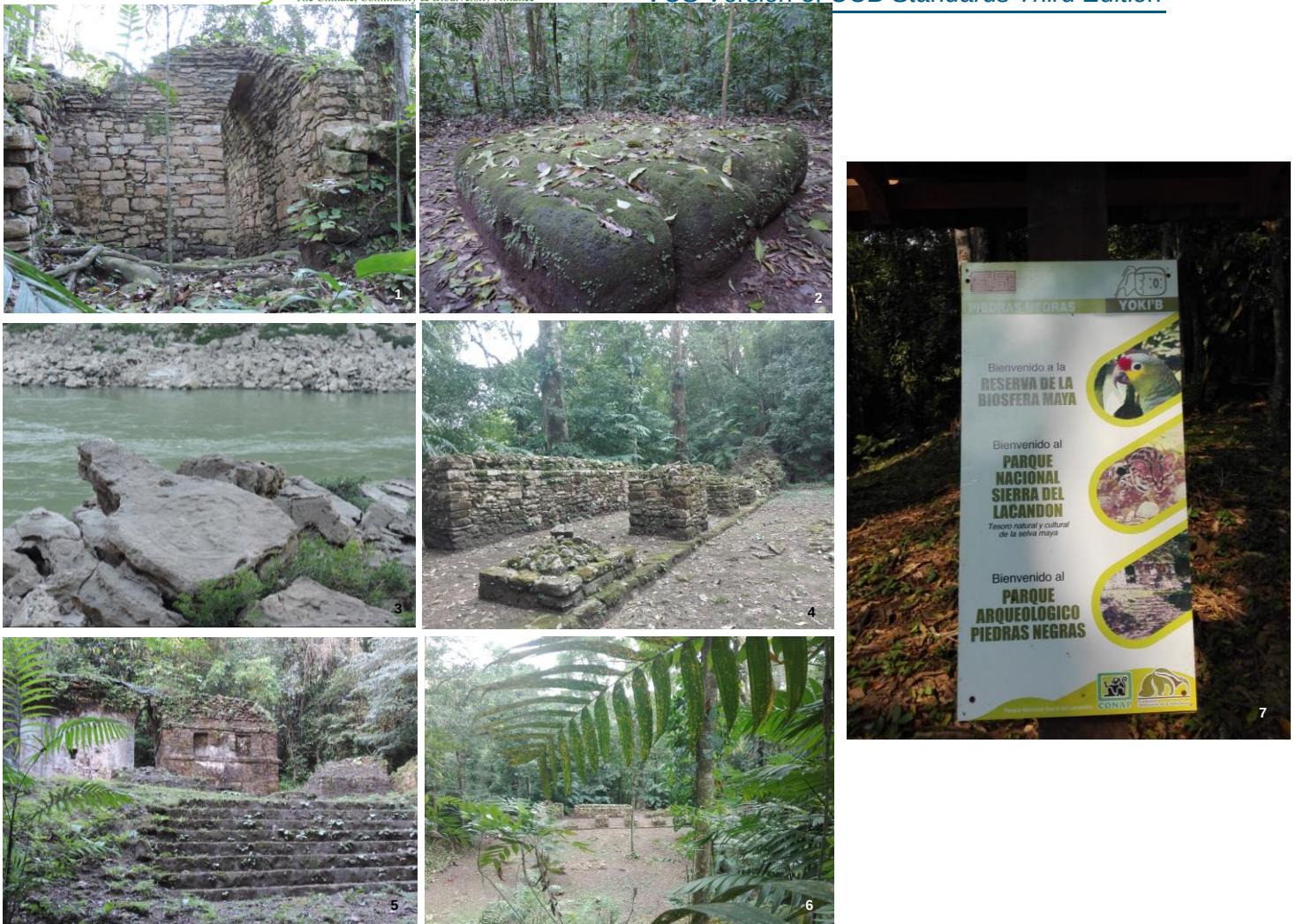


Figure 20. 1-7 Archaeological remains – Piedras Negras Archaeological Park

1.3.7 Types and condition of vegetation within the project zone.

G1.3 / B1.1 The project considers a sub-division of the broad lived forests vegetal ecosystems attending to their biomass contents. The classification results in the following sub-classes of broad lived forests:

- Sub-humid broadleaved lowland forest
- Sub-humid broadleaved middle-high forests
- Humid broadleaved middle-high forest
- Sustainably managed sub-humid broadleaved lowland forest
- Sustainably managed sub-humid broadleaved middle-high forests
- Non-sustainably managed sub-humid broadleaved lowland forest
- Non-sustainably managed sub-humid broadleaved middle-high forests.

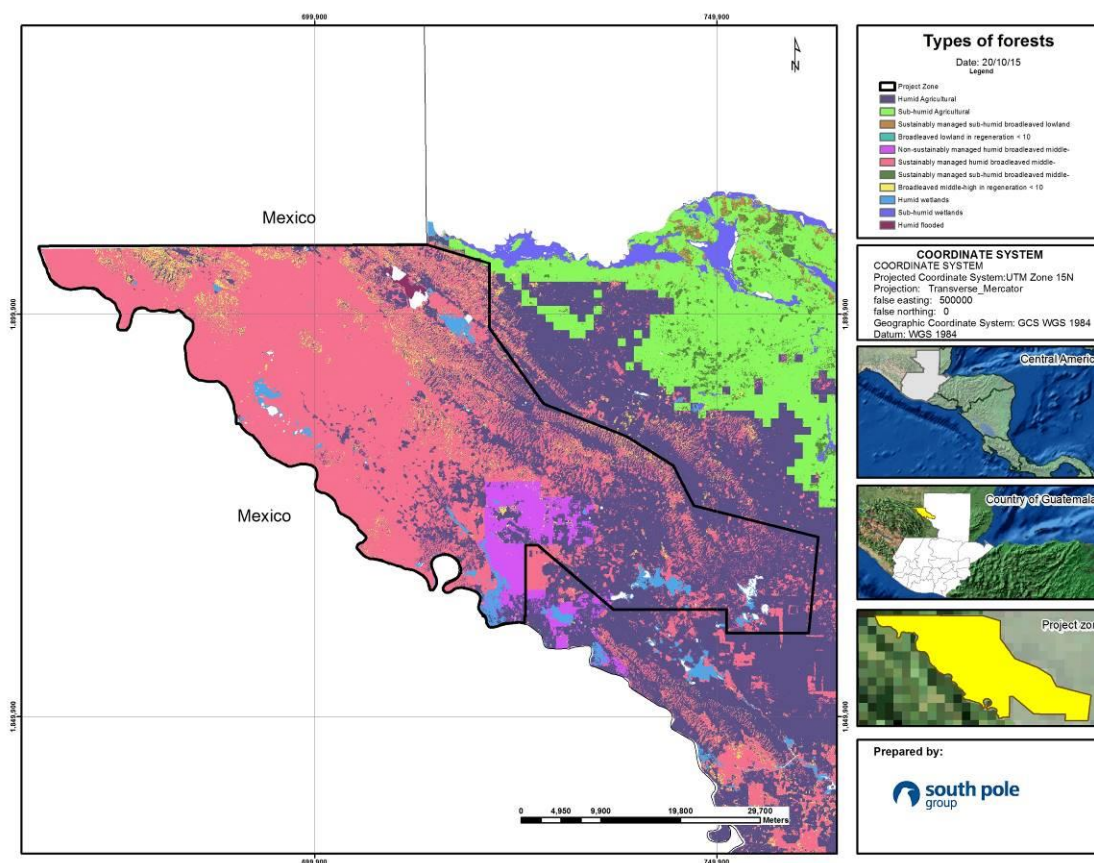


Figure 21. Types of forest in the project zone

Broad leaved forests are usually dense, with their canopy reaching 20-25 meters height or even more, with individuals reaching 35 meters, mostly in the riparian areas. These areas located along the rivers and water streams are mainly present in the south and west part of the project areas. The most common species present are Pucté (*Bucida buceras*), Zapote bobo (*Pachira acuatica*) and Chechén negro (*Metopium brownei*), Palo tinto (*Haematoxylum campechianum*), *Lonchocarpus hondurensis* and *Inga vera*⁴⁴. In forest formations of the lowlands that are away from water bodies the formation of strata occurs at around 15-20 metres height with an understory of up to 6 metres. The most representative species are Ramón (*Brosimum alicastrum*) while Chechén negro (*Metopium brownei*) and Zapotillo (*Pouteria sp.*) are easily found at the top of the hills and Santa María (*Calophyllum brasiliense*) and Chicozapote (*Manilkara achras*) occur in the valleys. In the areas of the mountain ranges are common the Son (*Alseis yucatanensis*), the Sufricay (*Rollinia microcephala*) and the Cedrillo de hoja ancha (*Guarea excelsa*) while in the understory the palms like the Corozo (*Orbignya cohune*), Guano (*Sabal morrisiana*), Xate (*Chamaedorea sp.*) and Bayal (*Desmoncus ferox*) are the most representative species⁴⁵.

⁴⁴ CONAP, 2001. Plan Maestro de la Reserva de la Biosfera Maya 2001-2006. Serie coediciones técnicas número 30. Consejo Nacional de Áreas Protegidas. Guatemala.

⁴⁵ The Nature Conservancy, 1998a. Base de datos del Parque Nacional Sierra del Lacandón. Guatemala.

The areas of the North and South West part of the SLNP present forest being developed on heavy soils with high clay content. The pedogenic characteristics of these soils determine that the areas where they are found are seasonally flooded during the rainy season. This feature determines the floristic composition of these areas. Typically the vegetal formations occurring reach heights between 6-20 meters, being higher in North-West and South West of the SLNP while the areas in the surrounding of the lake El Repasto, in the North-East side of the SLNP, is not higher than 6 metres⁴⁶. The most common species and species associations are Pucté (*Bucida buceras*) and San Juan (*Vochysia hondurensis*). Other species that can be found in these areas are Palo tinto (*Haematoxylum campechianum*), Papaturro (*Coccoloba sp.*) y Laurel Blando (*Nectandra membranacea*), and palms like the Guano (*Sabal morrisiana*) and the Escobo (*Chrysophila argentea*)⁴⁷. Near the areas of El Repasto also occur savannah ecosystems with major presence of species of the Poaceae and Bambuseae.

1.3.8 Without-project Biodiversity Scenario

B1.3 Without the project activities, the SLNP faces different threats:

a. Elements of natural and cultural preservation:

- Forest fires: fires are associated with the economic and social dynamics of human settlements in and around the SLNP, including areas in the Mexican territory. Agricultural activities (subsistence agriculture and livestock) in the area where the slash (not controlled manner) is used as a technique to prepare land that will be used in planting crops or pasture, and even future encroachments, are the main cause of forest fires.
- Land use change: Human migration, agriculture through the process of slash and burn the forest and its subsequent change to pasture for cattle production are the greatest impact caused the natural landscape.

b. Natural elements:

- Removal of wildlife: fishing, poaching (causing change in the forest structure due to the animals play a vital role in pollination, seed dispersal and germination) and removal of live animals (used as pet).
- Discharge of pollutants: direct threat to water sources, specially in physico-chemical and microbiological quality of water due to presence in water of chemicals used in cattle production and crops, presence of soap and detergent in water, presence of hydrocarbons, oils and grease used in the operation of marine engines, increase in the number of colonies of *E. coli* and fecal and total coliforms.
- Extraction of timber and non-timber forest products: overuse of valuable species (selective logging) such as *Swietenia macrophylla*, *Cedrela odorata*, *Astronium graveolens* and *Chamaedorea oblonga*.

⁴⁶ The Nature Conservancy, 1998b. Parque Nacional Sierra del Lacandón. Estado actual, 1997. Guatemala, cited in Parkswatch.org. Available at: http://www.parkswatch.org/parkprofiles/pdf/slnp_spa.pdf

⁴⁷ CONAP, 2001a. Plan Maestro de la Reserva de la Biosfera Maya 2001-2006. Serie condiciones técnicas número 30. Consejo Nacional de Áreas Protegidas. Guatemala.

- Erosion: linked to sedimentation and the dragging of nutrients and pollutants to water sources.
- Introduction of exotic species: they are introduced as productive alternatives, but tend to occupy an ecological niche of some native species especially in water sources.

1.3.9 Current carbon stocks within the project zone

CL1.1 The area presents three main forest formations, namely Broadleaf forest low / sub humid (BB-SH), Broadleaf forest medium high / humid (BMA-H) and Broadleaf forest medium high / sub humid (BMA-SH). These forest formations average 327, 427 and 391 tCO₂/ha respectively⁴⁸. Previous available studies had considered values of carbon being sequestered in these forests of around 1,657 tCO₂/ha, but they were considered non-conservative by this project⁴⁹.

However, the forest formations described previously are sometimes found with different degrees of human disturbance, which has severe influence in its carbon content. The project has considered average values⁵⁰ for the carbon content of the three main forest formations attending to their condition of sustainably managed and non-sustainably managed, and has classified them into forest classes. Find a detailed overview of the values in Table 6.

⁴⁸ The data on carbon content of the different forest formations has been obtained from a previous work developed by Carbon Decisions International (Vallejo, A., Navarrete, D., Villegas, J.F., Pedroni, L., Schlesinger, P., Guadamuz, R., Mateo, S., 2012. "Anexo al PD-VCS al PD-VCS del Proyecto REDD+ en la ZUM de la RBM", unpublished). The values have been calculated after the data provided by inventories that satisfy the requirements of the methodology VM0015 and that were developed by the next institutions:

Fundalachuá, FAO (Inventario Forestal Nacional de Guatemala), Fundacion Defensores de la Naturaleza / Parque Nacional Sierra del Lacandón, forestry concessions of Árbol Verde, Colorada, Custosel, Laborant, Pasadita, Paxbán, Uaxactún, Yaloch and by the National System of Permanent Sampling Plots (Sistema Nacional de Parcelas Permanentes de Muestreo, INAB). The inventories are available upon request of the auditors.

The equations used consider aspects mentioned in the next scientific papers:

1. Brown S. 1997. Estimating biomass and biomass change of tropical forests. A primer. FAO Forestry Paper No.134. Rome, Italy. 55 p. Available at: <http://www.fao.org/docrep/W4095E/W4095E00.htm>
2. IPCC. 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gpqlulucf/gpqlulucf.html>
3. FAO. 2004. Inventario Forestal Nacional 2002-2003 / Marquez L. 1999. Elementos técnicos para inventarios de Carbono en uso del suelo. Fundación Solar. Guatemala. Available at: <http://www.fao.org/forestry/23224-015b0b120eb03aa8b646ce6e3095c7a6a.pdf>
4. Arreaga, W. 2002. Almacenamiento del carbono en bosques con manejo forestal sostenible en la Reserva de Biosfera Maya, Peten, Guatemala. Available at: <http://orton.catie.ac.cr/repdoc/A0249E/A0249E.PDF>

⁴⁹ De Jong, Ben H.J., Ochoa-Gaona, Susana; Castillo-Santiago, Miguel Angel; Ramírez-Marcial, Neptalí and Cairns, Michael A. 2000. Carbon Flux and Patterns of Land-Use/ Land-Cover Change in the Selva Lacandón, Mexico. Ambio Vol. 29 No. 8.

⁵⁰ Based on the previous work of Vallejo *et al* mentioned in Carbon Decisions International consultancy. Available at <http://www.marn.gob.gt/Multimedios/550.pdf>

Table 6. Average carbon content considered for each forest class present in the project zone. Values obtained from the sub-national baseline

Name of the class	Average carbon stock per hectare $\pm 90\%$ Confidence Interval, CI (tCO ₂ /ha)		
	tCO ₂ /ha stock above ground	tCO ₂ /ha stock below ground	tCO ₂ /ha stock total
Broadleaf forest low / sub humid (BB-SH)	264	63	327
Broadleaf forest medium high / humid (BMA-H)	344	83	427
Broadleaf forest medium high / sub humid (BMA-SH)	315	76	391

1.3.10 Customary and legal property rights

G1.6 / G1.7 / G5.1 / G5.5 The areas included in the project zone present diverse tenure status. The most representative are:

- Private owners organized in communities.
- Communities established prior to the creation of the SLNP on state-owned lands, with signed cooperation agreements.
- Communities established prior to the creation of the SLNP on state-owned lands, but still in process of acknowledgment by Guatemalan Government.
- Illegal settlements established irregularly that are not recognised by the Guatemalan Government.
- Land owned by the NGO Fundación Defensores de la Naturaleza (FDN) and other private owners.
- State-owned land.

In total, there are 28 human settlements and 2 private conservation area of FDN within or overlapping partially with the areas of the National Park. Communities have established Communal Councils of Development (Consejos Comunitarios de Desarrollo, COCODES). These are structures legally recognised by the Article 4 of the Decreto 11/2002 of Guatemala and represent the lowest level of organization in the Systems of Councils for Development. They are formed by a Communal Assembly, integrated by all residents of a given community and the Coordination Organ, which is established according to the principles, values, normative and procedures of the community. The objectives of the COCODES are several, being the most important to promote, facilitate and support the organization and participation of the community on the processes of development that it may experience. It is relevant to mention that communities with historic land rights, that do not have signed cooperation agreements and thus no legally recognize status within the SLNP, have COCODES and these councils have been the contact points between FDN and the communities in the process of design of this REDD+ project. They are in the moment in the process of negotiating the cooperation agreement that will adequate their permanence within the SLNP.

There are nine communities that were established within the protected area before the declaration of the National Park occurred. Still today only three of them have clear and defined land use rights through signed cooperation agreements. This is the case of Poza Azul, San Juan

Villanueva and Villa Hermosa communities, which were established before the Law for Protected Areas⁵¹ was launched and that signed a cooperation agreement⁵² with CONAP in 1997. The compliance with these agreements is monitored today by FDN as one of the tasks assumed in the agreement with CONAP for the co-management of the SLNP. Some of the activities considered under the cooperation agreements focus on environmental education and processes for land use planning but their implementation relies exclusively on financing provided by development aid projects.

Guayacan, Nueva Jerusalén II, El Pital, Poza del Macho and Nuevo Paraíso 107 communities are also located within the SLNP and were as well established prior to the establishment of the protected area law. CONAP and FDN work currently on obtaining signed cooperation agreements for these communities to adequate their situation according to the legal jurisdiction that is applicable in the areas of the SLNP.

Strategy 1 of the project is focused on the signature of cooperation agreements between FDN/CONAP and the communities to adequate the permanence of communities within the SLNP are not finished yet. This project activity will seek enforcing the currently applicable Guatemalan Law on Protected Areas, through securing land use rights for communities that have historic land rights within the park (example of Cooperation Agreement Template available to auditor).

Current condition of communities in the Sierra de Lacandón National Park are detailed in the next table:

⁵¹ Congreso de la República. 1989. Ley de Áreas Protegidas. Guatemala.

⁵² The “agreements of intent” and the “relocation agreements” (previously called “Agreement of intentions”) are compromises acquired during January, 1997 and October 1998 between CONAP and 19 communities that were settled in protected areas of Petén. Under this agreement the communities could stay in the area fulfilling certain conditions, like the delimitation of their respective polygons, adoption of practices that contribute to stop the advances of the agricultural frontier and the degradation of natural resources in the area. In some of them was considered the future abandonment of the area and subsequent relocation.

Table 7. Communities within SLNP

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
1.	San Juan Villanueva	Located in the Special Use Zone of SLNP; Intention Agreement since 1997	Intention agreement signed	Identify as Q'eqch'í ethnicity, with the majority originating in Baja and Alta Verapaz. This group signed a Cooperation Agreement with CONAP in 1997. The community produces its food through subsistence agriculture (corn, beans, squash, and chili). Squash and chili are produced in excess and support family incomes along with rearing of hens, pigs, turkey, and – less commonly – cows. Public infrastructure includes schools, shops that sell basic commodities, a typist academy, and Catholic and Evangelical churches. In terms of public health, not all families have toilets. Drinking water is sourced from a contaminated local stream. There is limited urban development. The community is connected to the village of Las Ruinas via a dirt road that connects to a paved road along the Naranjo Route. This community is in the phase of updating their agreement. Conflict in this community is related to purchase and sale of land. Those involved in this conflict include farmers and other people who do not know the terms of the Agreement.
2.	Poza Azul	Located in the Special Use Zone of SLNP; Intention Agreement since 1997	Intention agreement signed	Identify as Q'eqch'í ethnicity, with the majority originating in Baja and Alta Verapaz. This group signed a Cooperation Agreement with CONAP in 1997. The community produces its food through subsistence agriculture (corn, beans, squash, and chili). Squash and chili are produced in excess and support family incomes along with rearing of hens, pigs, turkey, and – less commonly – cows. Public infrastructure includes schools, shops that sell basic commodities, a typist academy, and

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
				Catholic and Evangelical churches. In terms of public health, not all families have toilets. Drinking water is sourced from a contaminated local sinkhole. There is limited urban development. The community is connected to the village of Las Ruinas via a dirt road that connects to a paved road along the Naranjo Route. Being a community with difficult access, poverty is more evident in the community, it is difficult for commodities. This community is in the phase of updating their agreement. Conflict in this community is related to purchase and sale of land. Those involved in this conflict include farmers and other people who do not know the terms of the Agreement.
3.	Villa Hermosa	Located in the Special Use Zone of SLNP; Intention Agreement since 1997	Intention agreement signed	Majority Ladino population, originally from the interior of the country (southern and western coasts). This community signed a Cooperation Agreement with CONAP in 1997. The community produces its food through subsistence agriculture (corn, beans, squash, chili, sesame). Squash, chili, and sesame are produced in excess and support family incomes along with rearing of hens, pigs, turkey, and – more commonly – cows. Public infrastructure includes schools, shops that sell basic commodities, a typist academy, and Catholic and Evangelical churches. In terms of public health, not all families have toilets. Drinking water is sourced from a contaminated local stream and from some spring-fed ponds. There is limited urban development. The community is connected to the village of Las Ruinas via a dirt road that connects to a paved road along the Naranjo Route. This community is in the phase of updating their agreement. Conflict in this community is related to purchase and sale of land. Those involved in

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
				this conflict include farmers and other people who do not know the terms of the Agreement.
4.	Nueva Jerusalén II	Located in the Recovery Zone and the “Untouchable Zone” of SLNP; community was present before the creation of the park was declared	Recognized; dialogue and negotiation process has been initiated to obtain permanent settlement rights in SLNP	Community is recognized as predating park creation. In the dialogue process for signing the Cooperation Agreement. There is not an adequate access route, and community infrastructure is minimal. Some shops and small pharmacies are present in the community. Food production relies on corn, beans, and less commonly, squash/pumpkin seeds. The main areas of conflict in this community are pressure for the purchase and sale of lands and leaders that hinder dialogue with CONAP.
5.	Guayacán	Located in the Recuperation Zone and the “Untouchable Zone” of SLNP; community was present before creation of the park	Recognized; dialogue and negotiation process has been initiated to obtain permanent settlement rights in SLNP	Community is recognized as predating park creation. In the dialogue process for signing the Cooperation Agreement. There is an unpaved access route, which is adequate in the summer. Community infrastructure includes Catholic and Evangelical churches, a school, access to piped water in their homes and a health clinic (Unidad Minima de Salud), as well as small shops. Food production relies on corn, beans, and less commonly, squash/pumpkin seeds, but some families have cows. The main areas of conflict in this community are pressure for the purchase and sale of lands and leaders that hinder dialogue with CONAP, in addition to the community’s proposed expansion towards the “Intangible Zone or Core Zone”.
6.	El Pital	Located in the current Recuperation Zone, community was present before creation of the park	Advanced stages of the negotiation process to obtain permanent settlement rights in SLNP	Old settlement, currently undergoing negotiations to sign the Cooperation Agreement. Access to the community is inadequate. Infrastructure is minimal. limited only to a small school and an Evangelical church. Food production relies on corn, beans, and squash/pumpkin seeds, though some families have small herds of cattle. Water is scarce in the community, with few available

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
				sources (waterholes). It is common that women walk six (6) kilometers to the San Pedro River to wash clothing. Conflict in this area is related to the sale and purchase of land and dispute over the southern boundary with Guayacán, which has slowed the signing of an agreement.
7.	Manantialito	Agreement reached in 2015	Intention agreement signed	Community is recognized as predating park creation. The community signed a Cooperation Agreement in 2015. The access route to this settlement is inadequate (gaps). It is approximately eight (8) kilometers and connects to Pozo Azul. Community infrastructure includes Catholic and Evangelical churches, a school, small shops and a health clinic (Unidad Minima de Salud) where health workers arrive 2 times a month. Food production includes hens, turkeys, pigs, corn, beans, and occasionally squash/pumpkin seeds and sesame. Some families have cows. Water is scarce in this community, derived primarily from two drainages with levels that drop during summer. This is compounded by the fact that one of the springs is located on private land. The owner denies use of this water and has constructed spring-fed ponds that do not always have water. Conflict in this community is driven by the pressure caused by the sale and purchase of land by farmers.
8.	Las Victorias	Located in the Special Use Zone of SLNP, no intention agreement. Permanence was established previous to the creation of the park	Although the right to an intention agreement is recognized, the opportunity to advance negotiations has not been taken.	Settlement recognized as having existed prior to park creation. Unpaved access road that connects to the paved road leading to El Naranjo. Community infrastructure includes Catholic and Evangelical churches, a school, and some shops. Food is produced using hens, turkey, pigs, corn, and beans, and sometimes with squash/pumpkin seeds and sesame. Some families have cattle. The majority of families have

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
				access to water via spring-fed ponds. Conflict in this area relates to pressure from the purchase by and sale of land to farmers. The land in this community has been subject to a severe degree of deforestation.
9.	Unión Maya Itzá	Private property in the Special Use Zone	Individual plots, communally organized	Private cooperative, composed of families from various ethnic populations and have returned to this land in 1995. Access via unpaved road that connects to the Bethel route. Community infrastructure includes Catholic and Evangelical churches, a school, community store, and a public transportation line. Food production from hens, turkey, pigs, corn, and beans, and to a lesser degree squash/pumpkin seeds. The community sources water from the Yaxchilán stream. Conflict in this area is related to the internal purchase buy and sale of land to farmers that own large portions of the mountain with the intent of converting said lands to extensive pasture and monoculture, especially of African palm. One of the principal economic activities is the harvest of wood thru a management plan.
10.	El Retalteco	Private property in the Special Use Zone	Individual plots	Old arrangement of properties in which many families recently complete the legal procurement of their lands due to the creation of laws concerning protected areas. This community consists of families from Retalhuleu and the oldest inhabitants are present due to Government policies in the early 70's of populating the border regions. Access via unpaved road that connects to the Bethel route. Community infrastructure includes Catholic and Evangelical churches, a school, and stores. Food production from hens, turkey, pigs, corn, and beans, and to a lesser degree squash/pumpkin seeds. Some of the oldest families in the cooperative have small and medium quantities of cattle. Conflict in this area is

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
				related to the purchase by and sale of land to farmers.
11.	La Lucha	Private property in the Special Use Zone	Individual plots, communally organized	Old, private cooperative, consisting of families from the southern and eastern coasts. Access via unpaved road that connects to the Bethel route. Community infrastructure includes Catholic and Evangelical churches, a school, and stores. Food production from hens, turkey, pigs, corn, and beans, and to a lesser degree squash/pumpkin seeds. Some of the families in the cooperative have small quantities of cattle. Production activities include management of forest products and other sustainable projects. Conflict arises from the sale of land to and purchase by farmers that desire extensive pasture. One of the principal economic activities is the harvest of wood and non-wood products thru a management plan.
12	Técnica Agropecuaria	Private property in the Buffer Zone of the Maya Biosphere Reserve. Due to the importance of this group to the conservation of the park, it is included even though located outside of the park	Individual plots, communally organized	Old cooperative. Access via unpaved road that connects to the Bethel route. Commerce is tightly bound to Mexico via use of the Usumacinta Rivera. Community infrastructure includes Catholic and Evangelical churches, a school, stores, restaurants, hotels, and currency exchanges. Food production relies on hens, turkey, pigs, corn, and beans, and to a lesser degree squash/pumpkin seeds, sesame, and chili. Some of the families in the cooperative have small quantities of cattle. Conflict arises from the sale of land to and purchase by farmers that cut forest to create extensive pasture and plant African palm.
13.	El Esfuerzo	Located in the Special Use Area in the southeast of SLNP. No agreement is in place	Dialogue is being initiated with the community	Old arrangement of properties, in which many families could not complete the legal procurement of their lands due to the creation of laws concerning protected areas. This community consists of families from Retalhuleu and the oldest inhabitants are present due to Méndez

No.	Communities	Relationship to the Park (SLNP)	Land Ownership	Socioeconomic Description
				Montenegro Administration policies of populating the border regions. Access via unpaved road that connects to the Bethel route. Community infrastructure includes Catholic and Evangelical churches, a school, and stores. Food production from hens, turkey, pigs, corn, and beans, and to a lesser degree squash/pumpkin seeds and sesame. Some of the oldest families in the cooperative have small quantities of cattle. Conflict in this area is related to the purchase by and sale of land to farmers.
14.	Lagunitas, Paraíso 107, Santa Amelia, Nuevo San José, Nuevo Edén, Las Flores, Las Ruinas, Nueva Canaan, Nueva Candelaria , El Esqueleto, Cruce Los Esclavos, La Llorona, Poza del Macho, Las Marías, and Tierra Linda Zapotal	All are communities that pre-date park creation. All are partially located within the Special Use Zone and subject to the signing of the Appropriateness of Use Agreement.	These communities participate in micro-region dialogs of the Naranjo Route (Defensores – CONAP – SLNP Advisory Committee and the Municipal Agrarian Office (OMA))	Old communities located at the legal limit of the park. The majority of families come from the south and east of the country. Access via a paved road that heads from the central area towards El Naranjo, border. In this area, community infrastructure is more extensive than in the communities within the park. This includes Catholic and Evangelical churches, stores, pharmacies, and other basic services of interest to the population. Food production is related to hens, turkey, pigs, corn, beans, and less commonly, squash/pumpkin seeds and sesame. The majority of these communities have access potable water from mechanical wells financed by the municipality, In this zone, cattle grazing has been extensively developed. Conflict in this area results from land pressure, including the sale of lands to farmers that graze cattle extensively. No cooperation agreements have been signed between these communities and CONAP.

Communities and private properties

Legend:

- Drain
- Water Bodies
- Forest
- Proprietary Zone
- FOM Private properties
- Communities
- Guaymas
- Naranjos
- Lancardón
- Centro Campestre
- Unión Maya Itza
- La Lucha
- UNAC
- Técnica Agropecuaria
- Bethel
- Manantial
- Pozo Azul
- Nuevo San José
- Las Flores
- Las Palmas
- Las Victorias
- Villa Nueva

COORDINATE SYSTEM

Projected Coordinate System: UTM Zone 15N
 Projection: Transverse_Mercator
 false easting: 500000
 false northing: 0
 Geographic Coordinate System: GCS WGS 1984
 Datum: WGS 1984

Prepared by:

south pole group

Community groups identified in Section 2.7:

ACOFOP (Asociación de Comunidades Forestales de Petén): This is a community-based association consisting of twenty-three rural and indigenous organizations. The association facilitates community forestry, guaranteeing that natural forests will be maintained in perpetuity in the Multiple Use Zone of the Maya Biosphere Reserve.

Pastoral Social of Petén: This is a religious organization that functions through the continuous and public action of the Catholic Church. The organization has knowledge and experience of the social and economic realities of life in these local populations, and it uses this perspective to define the most

appropriate forms of intervention to transform and improve their situations. Actions are organized with communities through the parishes and various committees, which work directly with beneficiaries in order to respond to a diverse set of needs.

The Pastoral Social of Petén organizes six committees, which focus on the following topics: Human Rights, Human Migration (Refugees and Displaced Persons), Commission for Women, Commission for Health, Commission for Education, and the Coordination Commission.

Forest Monitoring Committee for Cooperative: The Monitoring Committee is the body responsible for the control and supervision of each Cooperative. This authority is responsible for examining the operations of the cooperative and verifying the sustainable use of natural resources, taking into account the approved management plans.

Young Promoters of Sexual and Reproductive Health: Young Promoters provides educational talks and half-day workshops in schools throughout the communities of Nueva Jerusalem, Guayacán, Manantialito, Pozo Azul, Villa Hermosa, San Juan Villa Nueva, La Técnica, Retalteco, La Lucha and Unión Maya Itza. An additional training is held for two consecutive days so that young people can gain a dynamic understanding of sexual and reproductive health. This training emphasises and develops the capacity of youths to critically assess and reflect on the lifelong impacts and consequences of sexual decisions taken at an early age. Young people are trained to strengthen their confidence and self-esteem, with the aim of empowering participants to become leaders and create mini knowledge-transfer networks to inform other youths in their communities.

Community Tourism in La Técnica Agropecuaria Cooperative: Organized group composed by local young people. The main objective is to provide ecotourism services to Sierra de Lacandón National Park, including the archaeological site of Piedras Negras, Usimacinta River and the cooperative itself. This group is supported by ACOFOP and FDN.

1.3.11 Description of the First instance

G1.6 / CM1.1 The name and description of the cooperatives and private property areas identified where project activities will be implemented are detailed next:

La Lucha consists of areas which are private property of the community and are located in the “area of special use” of the SLNP. The forest cover of the community is significant and forestry activities are regulated by an approved management plan. There have been activities of FDN in the community focusing on, reforestation, forest enrichment, environmental and health education among others.

La Técnica Agropecuaria is a community outside of the boundaries but in the Buffer Zone of the SLNP. The land is owned by several families that are organized in a cooperative scheme. They have previous experience in forest management. Fires due to agricultural expansion affected the area in 1998 and 2003. The community is very interested in eco-tourism, since they are located near by the river being the border with Mexico and receive tourist from the Guatemalan and the Mexican side.

Unión Maya Itzá is a community consisting of a settlement and with private forest areas with regular land ownership titles. The properties are located in the “areas of special use” of the SLNP

and present updated forest management plan. FDN has traditionally undertaking divulgation activities about environmental and health issues.

Naranjitos and Centro Campesino are land areas owned by FDN the “preservation area” of the SLNP. These private properties were bought by FDN in the latest 90s when they recently began working in the SLNP.

Brief Description of Cooperatives

Inhabitants

The oldest community is La Técnica, with the first settlers of this group arriving to this area in 1975. In 2010, Sutter crafted a detailed picture of the communities within Sierra del Lacandón National Park. In the case of UMI, its founding dates back to 1995. By 2008, this group had expanded to an estimated 6,200 hectares, 75% of which fall within the Park. La Lucha was founded in 1976, and by 2008, this group covered an area of 3,800 hectares, 100% of which found within the Park.

In terms of population, in 2008 UMI consisted of 1,042 people, with a density of 7.9 persons per caballería⁵³. Projections estimate that by 2018, the population will drop by 6% to 976 persons and a density of 7.4 persons per caballería. La Lucha consisted of 460 people in 2008 with a density of 5.3 persons per caballería. In contrast to UMI, its population is expected to increase 66% by 2018, for a total population of 764 and a density of 8.8 persons per “caballería”.

Land Ownership

In 2009, UMI did not hold illegally occupied or seized land. 135 houses existed on the cooperative’s lands and another twenty-five (25) houses were rented from their respective owners. La Lucha held eighty-five (85) houses on private lands and fifteen (15) houses on rented lands.

Incomes

Average salaries per day have increased from Q. 25.00 in 1998 to Q. 40.00 in 2009 (nowadays is Q 81.87). However, this increase has not kept pace with the increases in the cost of basic goods. In addition, farmers have endured additional cost burdens during this period due to increased reliance on agrochemicals as a result of decreased soil productivity. While nearby communities have more diverse economic activities such as tourism, raising of livestock, and commerce, the majority of households within the cooperative rely on agriculture.

Dwellings

In 2008, the majority of dwellings in the cooperatives consisted of galvanized sheet metal roofs, wooden walls, and earthen floors, although some homes were observed in a state of conversion to cement construction. In terms of sanitary services in the same year, ten out of ten families of Union Maya Itzá had toilets, as opposed to La Lucha, where only five of ten families had access to such services.

⁵³ “Caballería” is a local measurement unit equivalent to 45 hectares.

Water and Energy

With respect to water, the three cooperatives have piped water systems, though the water is not chlorine-treated and thus the population is at risk for gastrointestinal illness. For UMI, this water is sourced from a spring, while La Lucha sources its water from wells in each house.

All three cooperatives have access to electricity service, however, many homes are not electrified due to the low incomes of this region. Thus firewood sourced from nearby fallows serves as the main fuel for cooking.

Education

The three cooperatives currently have elementary schools. In 2008, 90% of UMI school-age children attended elementary school of ten teachers, with a student-teacher ratio of twenty-five to one (25:1). In that same year, 72% of UMI school-age children attended elementary school with two teachers, with a student-teacher ratio of forty-five to one (45:1). UMI is the only cooperative that provides a complete basic education, with an institute of five teachers and around seventy students.

There is no university-level education within the cooperatives, and thus very few students have access to higher education. Those who do often are students with families in urban areas that can help facilitate housing during their studies.

Health

Social workers focused on health care exist within the cooperatives, known as “health promoters.” While the number of individual promoters has not changed between 1998 and 2008, the distribution of these workers has become more equitable, with each cooperative in the zone having access to at least one. The most common illnesses and diseases within the cooperatives are malaria, influenza, intestinal infections, and respiratory infections.

In 2008, UMI had four health promoters, three midwives, and one health center, while La Lucha had one health promoter, one midwife, and one Minimum Health Unit.

Ethnicity and Religion

In 2008, 40% of the UMI population belonged to the Q’echi’ ethnicity with the remaining 60% identified as “other” (currently, there are 9 different ethnicities). 30% were Catholic, 60% were Evangelical, and the remaining 10% did not subscribe to any religious community. For La Lucha, there is a fifty-fifty split between the Ladino and Q’echi’ ethnicities and 50% were Catholic and 50% Evangelical.

Community Organization and Institutional Presence

The UMI and La Lucha Cooperatives have an organization structure with auxiliary governments, Community Development Committees, Women’s Groups (just reactivated in La Lucha), Agricultural Committees, Forestry Committees, Health Committees, and Fire Committees.

Institutions present and working jointly with the communities for development include Pastoral Social, INAP, CONAP, ACOFOP, NPV, and mainly, Foundation Defenders of Nature (Fundación Defensores de la Naturaleza).

Knowledge of SLNP

In 2008, a series of surveys showed that zero out of ten knew of the park but did not know its limits. In La Lucha, nine out of ten knew of the park and were conscious of the need to conserve it whether or not the communities need the products or space occupied by the forest. FDN has played a key role in bringing this idea into the community consciousness and empowering community members with regard to the protection and conservation needs of the park through educational workshops, trainings, logistics, and projects to improve quality of life in harmony with the forest.

Access Roads

This has been the main limiting factor delaying the cooperatives' access to basic services, in addition to complicating the viability of commerce and tourism. While there is a large, paved road, nearly half of the road leading to the cooperatives is unpaved. The conditions of the unpaved road worsen during the rainy season. From Santa Elena to UMI, 72 km of road are paved while another 70 km are unpaved. On the road that leads to La Técnica, 72 km of road are paved while the remaining 88 km are unpaved.

1.4 Project Proponent (G1 & G4)

The project proponents are the Fundación Defensores de la Naturaleza (FDN), owners of Naranjitos and Centro Campesino lands, and the Cooperatives Unión Maya Itzá, La Lucha and La Técnica Agropecuaria, all of them with legal ownership/management rights on the lands.

G1.1 Primary Project Proponent - Fundación Defensores de la Naturaleza is a Guatemalan institution with respective and relevant track records of more than 30 years, having a strong motivation for a long-term involvement in the project. FDN has a formal co-management agreement with CONAP and cooperates in other areas as well with government institutions in order to feed the project experiences on REDD into national processes in Guatemala and adapt project strategies to national developments. Also has an extensive track record of management regarding the management of community-based projects, conservation projects, and integration of socio-economic activities within protected areas and monitoring of biodiversity and cultural heritage. **Naranjitos and Centro Campesino** are land areas owned by FDN. These private properties were bought by FDN in the latest 90s when they recently began working in the SLNP.

La Lucha Cooperative are private property located in the "area of special use" of the SLNP.

La Técnica Agropecuaria Cooperative is a community located in the buffer zone of SLNP. The land is owned by several families that are organized in a cooperative scheme.

Unión Maya Itzá Cooperative are private property located in the "area of special use" within SLNP.

G3.6 The project is managed through the "Governance Committee of the Project" that meets periodically and in which each entity has a representative with voting rights. The Governance Committee will be responsible for the design and implementation of project activities, monitoring and general management of the project on site. The cooperatives will participate in the decision making through representation in the Governance committee and collaborate in the implementation of project activities in joint with FDN.

The committee will be composed of one principal representative and one alternate representative from each Cooperative and by FDN, as private owners and project partners. The Governance Committee will be operational for the entire duration of the project.

Some actions of the Governance committee is to approve the annual work plan and any instrument of project planning, promote the socialization of the project, define strategies and approval the sale of carbon credits⁵⁴.

G4.1 Community-based REDD projects designed in a pro-poor, pro-biodiversity manner require a lot of different skills and knowledge in order to be successful over the long run. This project has managed to create a team that covers all aspects of the projects with excellent and experienced experts.

The project is managed by an alliance of experienced project partners. Together, the project partners have a successful track record in working with communities and with ecosystem management, including fire management. The project has also a relevant track record with regard to development projects for the carbon markets. Furthermore, the project proponents have the financial capacity to make all necessary initial investment before the project is generating any revenue.

Name	Address	Role
Fundación Defensores de la Naturaleza	4a. Avenida 23-01 Zona 14 Ciudad de Guatemala Guatemala Contact: Javier Marquez Email: jmarquez@defensores.org.gt Phone (+502) 2310-2929	Fundación Defensores de la Naturaleza ⁵⁵ is a non-governmental and not-for profit organization that has worked for more than 25 years helping to preserve Guatemala's environmental and cultural values. Defensores de la Naturaleza co-administrates together with CONAP four protected areas of Guatemala, including the SLNP, which has been co-administrated since 1999. FDN will design and implement project activities, monitoring and general management of the project.
Unión Maya Itzá	Las Cruces, Petén, Guatemala Governance committee representative: Juan Carlos Pérez Phone: (+502) 4185-7328	Design and implement project activities, monitoring and general management of the project.
La Lucha	Las Cruces, Petén, Guatemala Governance committee representative: Angel Velarde Phone: (+502) 4908-6978	Design and implement project activities, monitoring and general management of the project.

⁵⁴ For more information, please refer to the folder "Communities agreements"

⁵⁵ Institutional website. Available at <http://www.defensores.org.gt/>

Name	Address	Role
La Técnica Agropecuaria	Las Cruces, Petén, Guatemala Governance committee representative: Haroldo Ramirez Phone: (+502) 5336-0807	Design and implement project activities, monitoring and general management of the project.

G4.2 The scientific studies and technical documents developed by Fundación Defensores de la Naturaleza in the SLNP are multidisciplinary, and can provide an overview of the areas of knowledge by the institution: “Impact of hunting by a community within the Sierra del Lacandón National Park, La Libertad, Petén, on big vertebrates and tree vegetation”, “Sierra del Lacandón National Plan”, “Environmental Impact Assessment of the control point El Ceibo, La Libertad, Petén”, “Elements of analysis for enhancing the co-administration as a mechanism for management of protected áreas in Guatemala”, “Current state of the Sierra del Lacandón National Park, 1997”, “Arqueologic regional Project, Sierra del Lacandón”, “Co-administration Sierra del Lacandón National Park”, “Forest management plan for Unión Maya Itzá. La Libertad, Petén, Guatemala”, “Habitat use and migration patterns of *Ara macao cyanooptera* in the Sierra del Lacandón National Park, La Libertad, Petén”, and “Characterization of vegetal communities in the central zone of the Sierra del Lacandón National Park”⁵⁶.

- Forestry Engineer Javier Marquez is Director of Institutional Development at Fundación Defensores de la Naturaleza. His experience at national and international level has allowed the institution having contact with relevant partners for developing protection projects in Guatemala.
- Agronomy Engineer Edín Lopez is the director of the Sierra del Lacandón National Park and has been directly involved with several projects of social and biodiversity monitoring, measurement of biomass contents in different types of forests, definition of land tenure, improvement of agricultural practices and payment for environmental services within the SLNP.

1.5 Other Entities Involved in the Project (G4)

G4.2 OroVerde is a German institution with a long and relevant track record in monitoring the financial management of projects linked to conservation of nature ecosystems. Thus, we consider any “internal” and project management risks of project failure as minor.

The project is also collaborating with the German University of Eberswalde in defining an adaptive procedure for risk management procedure following the MARISCO approach⁵⁷.

⁵⁶ All these documents are available for the auditor upon request.

⁵⁷ Geiger, L., S. Kreft & P.L. Ibisch (2012): Reducing blindspots: MARISCO, a planning approach that integrates risk management into biodiversity conservation. In: In: Ibisch, P.L., L. Geiger & F. Cybulla (Hg.): Global Change Management. Knowledge Gaps, Blindspots, and Unknowables. Nomos-Verlag.

Name	Address	Role
OroVerde – Die Tropenwaldstiftung Tropical Forest Foundation	Kaiserstraße 185-197 53113 Bonn Phone: 0228/24 29 0 - 0 Fax: 0228/24 29 0 - 55	OroVerde was founded in 1989 by renowned personalities from industry and science. Its work focuses on concrete and permanently effective contributions to the conservation of tropical forests.

The goal of OroVerde⁵⁸ is the conservation of biodiversity and of the climate function of tropical forests. The work in the institution is organized and coordinated by a small interdisciplinary team in Bonn headquarter (Germany). Since its foundation OroVerde initiates, designs and encourages financially conservation projects, and is engaged with more than nine different projects worldwide, more than three of them in Guatemala⁵⁹. This is achieved by carefully selecting reliable local partners like Fundación Defensores de la Naturaleza. OroVerde and FDN have a collaboration history of 9 years. OroVerde experts accompany the projects and constantly monitor the use of funds. The main components where OroVerde collaborates consider activities such as reforestation, environmental education, introducing forest friendly farming practices and establishment of protected areas.

- Dr. Elke Mannigel is the team leader for international projects in OroVerde. She has broad experience in ensuring cooperation of different organizations from different countries for reaching conservation goals.

Name	Address	Role
South Pole Carbon Asset Management S.A.S.	Calle 10A # 34-11 Poblado Office 4005 Medellín Colombia Phone: +57 4 352 4428	South Pole S.A.S (“South Pole”) provides expertise in project development, carbon monitoring and accounting. South Pole is a globally active carbon project developer and consultant, with a successful track record in forest-based carbon projects.

G4.2 South Pole S.A.S belongs to a bigger group of Companies focusing on Environmental Markets, and on which South Pole Asset Management Ltd. has a long and successful track record working on forestry-based carbon projects, including the first forestry VCS project that issued credits in Latin America⁶⁰ and the largest REDD+ project in extension in Zimbabwe (Africa)⁶¹. South Pole Asset Management Ltd has

⁵⁸ OroVerde website. Available at <http://www.oroverde.de/>

⁵⁹ OroVerde international projects. Available at <http://www.oroverde.de/projekte-international.html>

⁶⁰ Additional information available at:
<https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=1&t=1>

⁶¹ Additional information available at:
<https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=2&i=902&lat=-16%2E8184067184111&lon=28%2E7615526227228&bp=1>

acted as start point for founding South Pole S.A.S., so it was ensured that the entire previous experience and knowledge acquired in the company formed the base for South Pole S.A.S to start its activities.

The company offers a wide spectrum of sustainability services, including climate policy and strategy advisory. Its expertise covers the key sustainability-related areas of climate change, forests and land use, water, sustainable cities and buildings, as well as renewable energy and energy efficiency.

South Pole Carbon Asset Management Ltd. was elected the Best Project Developer of the Voluntary Carbon Markets in 2011, 2012, 2013, 2014 and 2015⁶².

- Andrea Vera and Pablo Llopis were directly involved in the development of the carbon documentation for the project.

Alliance of entities:

G4.1 The combination of all skills described ensures that the project can be implemented successfully.

CARBON MONITORING AND MEASUREMENT

South Pole oversees the development of appropriate project design and monitoring techniques in line with the guidelines of the CCBS and the VCS.

FDN has an agreement with CEMEC/CONAP, institution that will be responsible for carbon monitoring of Lacandón – Forest for life REDD+ Project.

FDN has a long track record in working with natural resources in the project area. The professionals working for FDN have an average experience of 17 years. Defensores de la Naturaleza's extensive track record includes environmental impact assessments, environmental management mandates, socio-economic and archaeological and historical assessments. A capability statement of Defensores de la Naturaleza is available upon request for the auditor.

COMMUNITY ENGAGEMENT

FDN is very experienced in working with communities all over Guatemala. Most of the experience related to the SLNP was gathered during community extension and development work as well as in the investigation undertaken for determining the drivers and agents of deforestation present in the project sub-national region. FDN participated in the initial community assessment (baseline study) in the project area developing a substantial part of the social assessment in order to determine drivers and agents of deforestation. FDN will monitor the community impacts.

BIODIVERSITY ASSESSMENT

The project's biodiversity assessment is designed and developed by FDN. FDN has several field teams specialized on biodiversity monitoring and that have already produced relevant results in the past regarding the monitoring of biodiversity in the area. The project will include the communities in the process of biodiversity monitoring.

⁶² Additional information available at: <http://www.thesouthpolegroup.com/uploads/media/media-release-southpolegroup-best-project-developer-award-announcement.pdf>

1.6 Project Start Date (G1)

G1.9 The project started developing activities for avoiding deforestation on February, 1st, 2012.

1.7 Project Crediting Period (G1)

G1.9 The project crediting period is 30 years and 0 months. The start date of the crediting period is February 1st 2012 and the end date is January 31st 2042.

The baseline is reassessed every 10 years after the project start date and during the crediting period and is subsequently validated at the same time as the verification.

All the project proponents will keep working on the protection of the forests in the project zone once the crediting period has expired, and the forests included in the project area will be protected beyond the crediting period.

2 DESIGN

2.1 Sectoral Scope and Project Type

The project corresponds to VCS scope 14 “Agriculture, Forestry and Other Land Use (AFOLU)” as an Avoided Unplanned Deforestation and Degradation (AUDD) project. The project will use a programmatic approach (grouped project) where the first instance area is constituted by the cooperatives of La Técnica Agropecuaria, La Lucha, Unión Maya Itza and the private properties of Fundación Defensores de la Naturaleza, Centro Campesino and Naranjitos.

2.2 Description of the Project Activity (G1 & G5)

In the period 1990-2005 the country has had an average growth of emissions corresponding to 0.90 million tonnes of CO₂e per year. In addition, reported emissions in the last available inventory (base year 2005) show that the country issued a total of 31.45 million tonnes of CO₂e. The project will lead to the protection of both unlogged forest and previously logged forest that has the regenerative capacity to reach a mature ‘old growth’ state.

Previous studies suggest that limiting access to forest land, discouraging the adoption of livestock (particularly in consonance with land titling programs), encouraging more diverse and intensive agricultural practices, and promoting rural development such as improved education, health care including reproductive health, and alternative employment may be effective policies to help temper forest clearing among both Ladinos and Q’eqch’í ethnies⁶³.

G1.8 The project will employ a number of technologies that reduce GHG emissions and prevent deforestation through a suite of project activities based on a set of tools whose main axis is strategic planning. The development and implementation of plans will take to reach specific purposes and objectives, facilitating decision through taking into account the chains of consequences of causes and effects over time. The strategic planning tools used are: Open Standards for the Practice of Conservation

⁶³ Carr, D.L. 2004. Ladino and Q’eqch’ Maya land use and land clearing in the Sierra de Lacandón Lacandón National Park, Peten, Guatemala. Agriculture and Human Values. 21: 67-76. Available at: http://www.geog.ucsb.edu/~carr/DCarr_Publications/DLCarr_Ag.&HumanValues_04.pdf

(CMP), structural design based on an Impact Matrix Cross- Reference Multiplication Applied to a Classification (MICMAC) and operational planning SLNP.

The project proponents have defined seven main strategies that will be developed through, at least, one project activity per strategy. The number of project activities considered in each strategy can be expanded in the future, and those already existent can be modified if the project considers adequate for a better achievement of each strategy's goal.

Strategy 1: Adjustment of land uses and land use rights in communities without land registry

The Guatemalan War started in 1960 and ended formally in 1996 after the signature of Peace Agreements and generated over a million of displaced people along its 36 years of duration⁶⁴. A crucial aspect influencing the processes of deforestation occurring in the region is that historically there has been low control from the State of Guatemala on migration fluxes and settlement of communities across the entire national territory. These fluxes have brought to the region of Petén displaced people from different ethnicities, coming from different parts of the country and mostly looking for land that allows for subsistence economic activities⁶⁵.

Processes like the signature of cooperation agreements between FDN/CONAP and the communities to adequate the permanence of communities within the SLNP are not finished yet. This project activity will seek enforcing the currently applicable Guatemalan Law on Protected Areas, through securing land use rights for communities that have historic land rights within the park.

Project activity 1: Signature and enforcement of cooperation agreements

Strategy 2: Forest protection and biodiversity programs

This is one of the programs that require more funding, due to the land pressure and threats. Ensuring a regular source of financing will allow developing activities like Patrols conformed by personnel of different institutions and workshops in the communities about prevention measures for avoiding forest fires.

Project activity 2: Establishment of a program of patrols and surveillance subcommittee for each organization within the park.

Project activity 3: Workshops about fire management in the communities

Project activity 4: Program for conservation of habitats linked to endangered species and development of a plan for conservation of HCV

Strategy 3: Sustainable farming and livestock familiar management systems

The focus of this activity is to improve the productivity of the family management systems and to invest in the necessary education that leads to lower necessities for deforestation. This is particularly relevant for slash and burn practices commonly applied in the region. It also pursues the study and understanding of current agricultural practices in order to be able to analyse practices that can be improved in order to meet basic household needs at lower environmental costs. This project activity considers the capacity

⁶⁴ Archibald, J. Human rights in Guatemala. Available at <http://www.du.edu/korbel/hrhw/researchdigest/latinamerica/guatemala.pdf>

⁶⁵ Ybarra, M et al., 2012. Availble at: <http://www.meganybarra.net/tierra-migracioacuten-y-vida.html>

building of technical personnel and professionals of the SLNP in practices for a sustainable agriculture and development of workshops in the communities.

Project activity 5: School of agroforestry promoters for enhancing practices sustainable agriculture in the communities

Strategy 4: Diversification and use of communal forestry resources

The characteristics of the land and the mixture between indigenous people (mostly Q'eqchí) and Ladinos have been studied and the average deforestation necessary per household for undertaking subsistence agriculture (more practiced by indigenous people) and cattle ranching (more practiced by ladinos) practices has been standardized⁶⁶. However, this project has experienced that the procedures and goods being respectively practiced and valued are similar in all ethnic groups present in the SLNP. Therefore, it has been considered necessary to analyse the diversion of land uses currently present in the area as well as to sustainably explore populations of flora/fauna that have historically been subject to commercial extraction so it is possible gaining knowledge on what could be the value of alternative forest and non-forest products.

Project activity 6: Identification of alternative NTFPs and market study on each case.

Project activity 7: Development of a census of populations of species of flora/fauna that have historically been subject to commercial extraction and their most common geographical location.

Project activity 8: Development of sustainable forest management plans for small holders and communities.

Project activity 9: Establishment and reinforcement of a program of micro-credits and the promotion of conservation and forest management.

Strategy 5: Improved management of the SLNP

The financing for paying the salaries of the personnel working currently in the SLNP is partially paid by the Government of Guatemala but FDN must steadily look for financing coming from development programs in order to be able to pay them. The project will ensure a stable budget through the additional funding provided by the carbon credits. This will allow for a higher capacity of planning on the medium and long term regarding available human resources

Project activity 10: Human resources plan focusing on contracting permanent personnel (not seasonal jobs).

Strategy 6: Community dialog, education and capacitation

This activity considers the development of periodical workshops and events in communities concerning environmental education for kids, young people and adults (for example the important ecological functions of forests for local livelihoods) and for the socialization of environmental legislation, specifically, legislation related to protected areas and rural development. Thus, it is expected that there will be a significant improvement in the enforcement of systems of control and monitoring of governance at a local

⁶⁶ Carr, 2005. Ladino and Q'eqchí Maya land use and land clearing in the Sierra de Lacandón National Park, Petén, Guatemala. Agriculture and Human Values 21: 171–179, 2004.

level. The activity also considers the establishment of systems of community self-management, including measures in case of non-compliance with applicable laws. These workshops will thus also focus on the self-empowerment of the communities for the application of the environmental legislation.

Project activity 11: Community empowerment and capacity building

Strategy 7: Health and welfare of communities

This activity considers the transfer on knowledge to the communities in aspects related to health and welfare and their relation with daily practices that could be improved by the members of the communities. It considers specially the enhancement on awareness about sexual and reproductive knowledge and facilitates the access to measures of family planning and on water management, including the management of human waste and use of latrines.

Project activity 12: Workshops about sexual and reproductive health in communities

Project activity 13: Workshops water and waste management

G1.9 The implementation schedule planned for the project is:

Table 8. Implementation schedule

Strategies / Activities	Project Lifetime (years)					
	1-5	5-10	10-15	15-20	20-25	25-30
Adjustment of land uses and land use rights in communities without land registry						
Signature and enforcement of cooperation agreements	x	x	x	x	x	x
Forest protection and biodiversity programs						
Establishment of a program of patrols and surveillance subcommittee for each organization within the park		x	x			
Workshops about fire management in the communities	x	x	x	x		
Program for conservation of habitats linked to endangered species and development of a plan for conservation of HCV		x	x	x	x	x
Sustainable farming and livestock familiar management systems						
School of agroforestry promoters for enhancing practices sustainable agriculture in the communities	x	x	x	x	x	x
Diversification and use of communal forestry resources						
Identification of alternative NTFPs and market study on each case	x	x	x	x	x	

Strategies / Activities	Project Lifetime (years)					
	1-5	5-10	10-15	15-20	20-25	25-30
Development of a census of populations of species of flora/fauna that have historically been subject to commercial extraction and their most common geographical location		x	x	x	x	x
Development of sustainable forest management plans for small holders and communities.	x	x	x	x	x	x
Establishment and reinforcement of a program of micro-credits and the promotion of conservation and forest management	x	x	x	x	x	x
Improved management of the SLNP						
Human resources plan focusing on contracting personnel permanent (not seasonal jobs)		x	x	x	x	x
Community dialog, education and capacitation						
Community empowerment and capacity building	x	x	x	x	x	x
Health and welfare of communities						
Workshops about sexual and reproductive health in communities	x	x	x	x	x	x
Workshops water and waste management	x	x	x	x	x	x

2.3 Management of Risks to Project Benefits (G1)

G1.10 The project proponents have assessed the non-permanence risks that are applicable to the project. In most cases these risks are mitigated by either the project proponent's management activities or the project activities.

Table 9. Management of Risk

Risk Area	Positive impact	Negative impact	Mitigation measures
Biophysical	- Contribution to climate change mitigation. - Improving of the ecosystem functions of forests of the SLNP - Improving the quality of wildlife habitat of the SLNP	Displacement and / or disappearance of species of high economic value	- Monitoring of biodiversity using camera trap method. - Monitoring illegal wildlife trafficking - Monitoring illegal logging - Monitoring illegal hunting - Land use plan - Cooperation agreements

Risk Area	Positive impact	Negative impact	Mitigation measures
			Control and surveillance patrols.
Socioeconomic	Increase in family income	- Increased social unrest by cultural aspects and land use (access to resources, border, community among other) - Abuse and family breakdown - Over-exploitation of non-timber forest products - Increased livestock production	- Monitoring plan of direct and indirect social impacts. - Monitoring of timber and non-timber products. - Continued presence of FDN technical personnel in the area. - Development of alternative productive activities.
Political	Territorial Control	Abuse of the government forces repressive	- Community legal advice by other organizations as Pastoral Social. - Cooperation agreement signed community voluntarily under several meetings with legal counselling.
Space	Increased Institutional Presence: National Council of Protected Areas (CONAP), Ministry of National Defense (MINDEF), Ministry of Public Health AND Social Assistance (MSPAS), Ministry of Education (MINEDUC)	NA	Strengthen relations institution – community.
Institutional	Strengthening of the administrative and operational capacities of the administration of the SLNP	Institutional image fissured by protests from anti -REDD groups	- Constant workshops and training with communities - Communication plan.

G1.11 The project has developed measures to mitigate risk to climate, community and biodiversity benefits over the project life through different activities.

In the case of climate risks, the payment for carbon credit aligns stakeholder interest with long-term, sustainable implementation. Besides, the project activities will directly mitigate human-induced climate benefit impacts through the forestry activities and the long term forest protection integrating communities' members in the conservation goals of the project.

Since this is a long term project, the expectation of the community may vary on time. The mitigation of the risk lies on a good policy and active participation of the community in the project management; and the effective manner to communicate the benefits related to the project in every phase.

For the biodiversity risks, the mitigation will be the monitoring and reporting mechanisms elaborated with the community. Coaching and training on monitoring will be provided to interested key members of the community.

The project is minimizing risks to the expected climate, community and biodiversity benefits and maintaining those benefits beyond the lifetime of the project⁶⁷. Specifically, the VCS project crediting period is 30 years, which has started in 2012 and will end in 2042, where the project benefits are expected to last far beyond this timeframe. In addition, the baseline is reassessed every 10 years after the project start date and during the crediting period, taking into account requirements of the REDD+ project.

2.4 Measures to Maintain High Conservation Values

2.4.1 High Conservation Values 5 and 6.

The project area is identified as being of the community-related High Conservation Values 5 (fundamental basic needs) and 6 (cultural identity). The project will not include restriction of access and therefore does not limit the local communities' ability to use the land for their cultural needs, especially for Mayan communities. In terms of fundamental needs, the project will follow an incentive-based approach to reduce the use of forest timber and non-timber resources, (see project activities to be implemented in section Description of the Project Activity (G1)). This implies a) that reduced benefits from not using forest resources are being (over) compensated for and b) forest resources are still available for use by locals.

For example, one major source of deforestation is expansion of the agricultural frontier. This is often undertaken due to poor agricultural techniques that exhaust the soil capacity in short terms or underperformance of the crops due to inappropriate selection of sites for establishment of crops. With its activities to improve the local agriculture, the project aims to reduce the necessity of shifting agriculture by making the harvest more sustainable on a single plot. This in turn reduces the incentive to apply shifting agriculture. The result is a benefit for both the climate (reduced deforestation) and the local communities (higher agricultural output with less expenditure in chemical manure and products for control of pest).

In terms of the high conversation values related to the communities (HCV5 and HCV6), these are maintained by the community-based project approach. This is one of the major challenges for this project, since we aim to change natural resource management by setting incentives, providing viable alternatives

⁶⁷<https://forestcarbonpartnership.org/sites/fcp/files/2014/May/GU-T1194%20Estrategia%20Social%20y%20Ambiental.pdf>

to deforestation, training and community participation through education. Through the enforcement of the Guatemalan Law for Protected Areas⁶⁸, this project will reduce deforestation while providing alternatives for satisfying the basic necessities of local communities and taking into account the presence of any sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities⁶⁹.

- Measures for the Area of High Conservation Value 5: Local Basic needs:

- Support and implement productive projects for local communities.
- Generate timber and non-timber forest management plans.

- Measures for the Area of High Conservation Value 6: Cultural sites

- Management and conservation of cultural sites such as Piedras Negras and El Tecolote, under supervision of the Ministry of Culture and Sports - Direction of Cultural and Natural Heritage.

2.4.2 High Conservation Values 1

Habitat loss remains the greatest threat to terrestrial biodiversity with deforestation as the main activity. The biological diversity, jaguar (*Panthera onca*), tapir (*Tapirus bairdii*) and white-lipped peccary (*Tayassu pecari*); endangered species included in the IUCN Red List will be monitored by camera traps. These species are closely associated with native and primary forest; therefore, conservation strategies are developed to protect the forest and the threatened species (see section Description of the Project Activity (G1)).

- Measures for the Area of High Conservation Value 1: Biodiversity and threatened species:

- Annual monitoring of endangered wildlife and indicator of stable ecosystems.
- Register of other species in the project zone through camera-traps sampling.
- Patrols conducted to avoid invasions.
- Awareness and workshops on forest fires.
- Control over illegal extraction of natural resources.
- Generate research and wildlife management threatened.

By reducing the deforestation rate, the habitat conditions for threatened wildlife in the project zone will significantly improve.

2.5 Project Financing (G1 & G4)

G1.12 FDN co-administrates the SLNP together with CONAP since 1999. During this time CONAP has co-financed part of the activities undertaken by FDN and that aim for protecting the area of Sierra del Lacandón according to its status of Protected Area.

⁶⁸ Available at http://www.marn.gob.gt/sub/portal_rbm/documentos/ANEXO3Decreto4-89%C3%A1reasprotegidas.pdf

⁶⁹ It is worth to recall here the fact that none of the major ethnic groups established in the area are settled in their ancestral lands. The project will investigate if any representative of the indigenous Hach Winik ("True People", called LacandónLacandónes in Spanish) is still present in the area and will consider the remarks they could do about their ancestral land.

As a complementary source for financing activities focusing on the management and protection of the Sierra del Lacandón, FDN seeks continuously additional financing from international development aid programs/initiatives that have limited time horizon and consider specific goal achievements. This has been the way FDN has financed activities focusing on lowering environmental impacts from the socio-economic sectors present in the region. Even FDN having ensured the financial feasibility for undertaking protection and management activities for the next years and achieved the goals requested in the development programs that has been involved with, the fact is that SLNP has experienced more than 28,000 hectares loss between 1986 and 2009.

The project activities to stop deforestation and degradation are designed to be financially self-sufficient in the long run. Up to date, the majority of the activities undertaken have been reliant on financing coming from developing agencies and non-governmental organizations based on projects and within a limited time frame. Even with these sources of financing the activities implemented were not sufficient to curb historically significant deforestation rates.

Opening new sources of income and after initial investments have been made and capacity reaches a certain level, it is expected that the local population will perpetuate the project activities because it will be in their self-interest to do so. Thus, following this logic, project activities will continue far beyond the lifetime of the project. The project's crediting period, as well as the project activities, is set at 30 years, starting from February 1st, 2012 and ending on January 31st, 2042.

FDN has defined programs and strategies for the management of the SLNP in the past. However, many of the activities implemented for the achievement of the goals of each strategy were based on a financing source that is defined and finite in time and resources.

OroVerde has been supporting small forest conservation and reforestation projects in the SLNP since 2004 and applied together with FDN in 2010 for an EU grant in order to allow for the preparation of a larger project to reduce deforestation in the National Park. The Project initiated with funding from the EU and the German Environmental Ministry through the International Climate Initiative on the 01.01.2011 and provides funding for the preparation of this project and initial activities that will not have further financing after the termination of the project in the end of 2015. On February 22nd of 2013, CONAP, FDN and OroVerde signed a cooperation agreement that aims to reduce the deforestation in the National Park Sierra del Lacandón (SLNP)⁷⁰ and proposed REDD+ as a mechanism for ensuring the necessary financing for developing additional activities that allow lowering the deforestation rates that the SLNP had experienced historically and that account for more than 28,000 hectares lost between 1986 and 2009⁷¹.

The preparation project "Lacandón - Forests for Life" is funded by the European Union (EU) with funds from the thematic programme for Environment and Sustainable Management of Natural Resources of the European Union (ENRTP), and the International Climate Initiative of the German Federal Ministry for the Environment, Nature Protection and Nuclear Safety (BMU-IKI). The EU is funding a share of 80% of the project budget. The International Climate Initiative of the German Federal Ministry for the Environment, Nature Protection and Nuclear Safety is contributing the lacking 20% of the costs. Additionally the

⁷⁰ Lacandón – Forest for life website: Available at <http://www.bosques-Lacandón.org/en/news/detail/article/unterzeichnung-eines-uebereinkommens-zur-reduzierung-der-entwaldung-im-departement-peten.html>

⁷¹ Lacandón – Forest for life website. Reducing deforestation. Information Online. Available at <http://www.bosques-Lacandón.org/en/reducing-deforestation.html>

National Park receives financing from the BMU-IKI for control and inspection activities. Both projects will end in December 2015.

The project proponents do not have a fixed budget to implement the project activities and relies on specific agreements and programs that are signed in the majority of cases at international level with governmental and non-governmental organizations. For more information see Non-Permanence risk tool folder.

On February 22nd of 2013, CONAP, FDN and OroVerde signed a cooperation agreement that aims to reduce the deforestation in Sierra del Lacandón National Park and proposed REDD+ as a mechanism for ensuring the necessary financing for developing additional activities that allow lowering deforestation rates.

G4.3 A comprehensive online search was performed and as a result, there are no reports that demonstrate that the Project Participants (project proponent and project developers) are involved or complicit in any form of corruption.

2.6 Employment Opportunities and Worker Relations (G3)

G3.9 / G3.12 FDN has extensive experience in conservation and community development projects. Communication and capacity building activities have been undertaken in the communities since the beginning of the co-administration of the SLNP in 1999. For the activities in which people from the communities have an active role, FDN has always provided training and, when necessary, safety equipment. In tasks, where worker's safety cannot be guaranteed (fire control, chainsaw utilization, etc.), FDN makes sure that the risks are minimized using best practices in occupational health and safety management; establishing and maintaining a preventative culture through active participation of workers in workshop to ensure a safe environment and healthy work. Permanent workers of different institutions have social insurance. Communities have constantly training in actions to reduce risks.

Specific training will be provided to support project activities such as the establishment of a program of patrols, capacitation for enhancing practices sustainable agriculture and conservation agriculture in the communities, development of sustainable forest management plans for small holders and communities, agriculture techniques, among others that will add value to the cash crops, therefore it will be necessary the training for the establishment and reinforcement of a program of micro-credits.

G3.10 The implementation of a REDD+ project will represent maintaining, at least, the status quo of the employment opportunities for the communities. This project ensures that all individuals will be given an equal opportunity (based on Guatemala's laws ^{72 73}) to fill all employment positions (including management) if the job requirements are met and that benefits reach women and the most vulnerable and/or marginalized people in the community without any discrimination of age, sex, marital status, ethnicity, social status or religious convictions, political ideas and/or sexual orientation. Documents explaining national rules on worker's rights and the obligations of both contracting parties will be made available in local languages when relevant.

⁷² Congreso de la República. 1993. Constitución Política de Guatemala. Available at: http://www.mintrabajo.gob.gt/images/organizacion/leyesconveniosyacuerdos/Leyes_Constitucionales/Constitucion_Politica_de_Guatemala.pdf

⁷³ PNUD Guatemala. 2010. Políticas públicas sobre mujeres y equidad de género en Guatemala 1989 – 2009. Available at: <http://desarrollhumano.org.gt/sites/default/files/PoliticasPublicasSobreMujeresyEquidadDeGenero.pdf>

On the other hand, FDN believes and has validated through its extensive experience on the field that without the participation of the people living in the communities any conservation strategy will be successful. This project aims to build capacity in communities focusing on enhancing capacities for generating alternative sources of income that diversify the dependence from unsustainable forestry and agricultural practices. Thereby, new self-employment opportunities including minority and underrepresented groups will appear for people living in the communities.

FDN looks actively for improving the skills that can be undertaken “in house” and organizes capacitation sessions for their employees. The participation of technical and non-technical staff in the development of this REDD+ project has been considered since the beginning and applied during the phase of design. OroVerde, South Pole Group and CONAP have had a participative role during the process of designing the REDD+ project. FDN ensures that the knowledge acquired by its technical team is shared and transmitted to other members of the team through periodical meetings and internal workshops (Please refer to General Procedure for Induction of New Staff in FDN document).

2.7 Stakeholder (G1 & G3)

2.7.1 Identification of Stakeholders

G1.5 FDN co-manages the SLNP since 1999. Through different lines of action such as Conservation and Sustainable Use of natural resources, Policies and Legislation, Sustainable development, Environmental Education, Data base researches and Institutional development; FDN has worked with the communities and implemented sustainable management projects for the SLNP.

In 2011, FDN and OroVerde Foundation initiated the Lacandón - Forests for Life Project with financial support from the European Union and the German Ministry of Environment through the International Climate Initiative. This project began to work with communities that had signed cooperation agreements with CONAP and communities with private property.

The project was designed and financed initial activities to stop deforestation and it was decided to develop a REDD+ project where communities can benefit from the positive actions they are taking to reduce the effects of climate change through the reduction of deforestation and the conservation of biodiversity.

In a first stage it was contemplated to integrate all communities within the SLNP. However, in the SLNP there are several regimes of land tenure: state owned land, cooperatives with private ownership, individually private property as well as the communities on state owned land with historic land rights and with or without signed cooperation agreements. Due to these different categories of land tenure within the SLNP, negotiation with all actors was difficult. Therefore, it was decided to initiate the first instance of the project with private landowners only: Técnica Agropecuaria, La Lucha, Unión Maya Itza (which are private ownerships) and the private properties of FDN.

Identification of Community Groups

The community groups were identified due to their level of organization and participation directly with the communities involved in the project.

Various institutions and NGOs have provided technical assistance from the 90s to achieve the formalization of different groups. Hence, the community groups working for community development in the region identified are:

- Women's Committee of Ramon
- ACOFOP
- Pastoral Social of Petén
- Forest Monitoring Committee for Cooperative
- Young Promoters of Sexual and Reproductive Health
- Community Tourism in La Técnica Agropecuaria Cooperative

Finally, stakeholders consultation were initiated in 2013 and have been ongoing during each phase of the project. For all activities, open and transparent communication and regular exchange between the communities within the SLNP and FDN are important aspects (Supporting doc available to auditor).

2.7.2 Stakeholder Engagement

G3.1 From the start of the project, communities and other stakeholders who would be potentially affected by the project activities have been involved in the project design through a well-constructed consultation process.

The process consisted in inform, train and achieve the Free, Prior and Informed Consent (FPIC) of the 3 communities participating in the REDD+ project with sufficient time and transparency, this way the community could determine, without any pressure or coercion, if they wished to participate or not.

G3.2 / G5.2 The workshops started in 2013 and were constant with cooperatives exposing general concepts of climate change, CO₂, deforestation and basic concepts of REDD+. At these meetings the objectives, possible positive and negative impacts expected from the project, benefits and implications that the project could have for their communities and quality of life were explained by FDN. Print media were also used to inform local people, performing an illustrated summary of the Project Design Document and a comic book on climate change which was translated into Q'eqchi language. In addition, periodic newsletter were issued and distributed to communities about the process of the project⁷⁴.

⁷⁴ Sierra del Lacandón Newsletter. Available at <http://www.bosques-lacandon.org/en/news/newsletter.html>

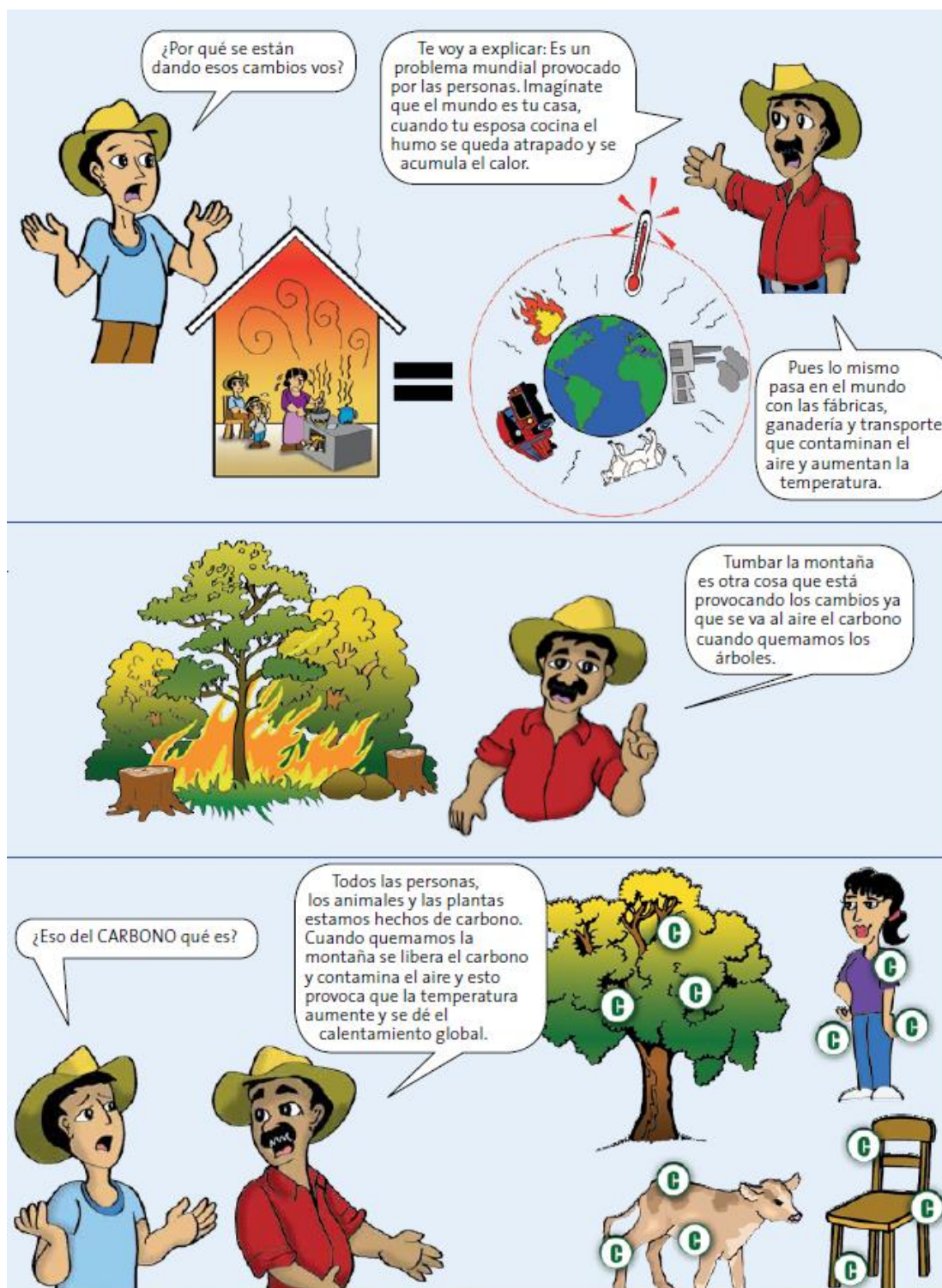


Figure 23. Part of the comic informative delivered to communities

After the informative stage, they were carried out Extraordinary Assemblies (Asambleas Extraordinarias) to determine if people wanted to participate in the REDD+ project. The three Cooperatives signed an Act of Acceptance of the project, with accompaniment of the organizations ACOFOP, CONAP, Naturaleza para la Vida as witnesses. And regarding to La Técnica Agropecuaria, Rainforest Alliance and Pastoral Social were involved. After obtaining the Act of Acceptance, it proceeded to identify priority activities to implement by the project to reduce deforestation.

The proposed project activities were identified in the workshops with communities where they emphasized the following activities: support for the technification of agriculture and familiar management systems and control and protection of forests. From these meetings emerged the seven project activities strategies. In addition, participants showed interest in women also have active participation in the project. Therefore, FDN held workshops exclusively with the wives of participants, where they were shown the tentative project activities and could also propose new ideas. The objective was to identify the main activities to be implemented. At the end, the proposed activities were prioritized and included in the strategies presented.



Figure 24. Community workshops for identify project activities

Additionally, informative workshops were conducted in the other communities as UNAC, Poza Azul, San Juan Villa Nueva and Villa Hermosa in 2014; to manage the possibility of working together and prevent and/or reduce deforestation within SLNP. The agenda consisted in informing about the project, advantages and disadvantages, voluntary mechanism and climate change (Supporting doc available to auditor). And the invitation to final consultation was used loudspeakers to announce and invite all communities to be part of the process.



Figure 25. Invitation to final consultation

On May 8, 2015, the UMI and La Lucha cooperatives approved the Free, Prior and Informed Consent for participation in a REDD+ project jointly with FDN and other cooperatives in the Sierra del Lacandón National Park. La Técnica Agropecuaria approved the document on June 9, 2015.

This activity was held in the community hall of each of the cooperatives, where more than 50% of partners and several non-community partners participated. Representative of CONAP, ACOFOP, Frente Petenero Contra Represas participated as observers of the process.

To conclude, reading the Final Act for approval was made and proceeded to the signing of the document where cooperatives provided their consent to participate in a REDD + project in the SLNP together with FDN.

G3.3 To inform communities about the validation and verification process, different communication methods are used. The main is done through their representatives in the Governance Committee, who will transmit this information to their communities. Additionally, FDN will support diffusion through releases and visits to strategic communities. On January 24, 2016; an extraordinary meeting was held to report 1) PDD Lacandón Forest for Life REDD + Project; 2) Progress of REDD+ Project; 3) Process and field visit of validation and verification process. At the end of the reunion, an Act was signed where committee representatives confirmed to be aware of the progress of the project, the process of validation and verification and that the information is available online (Signed Act available to auditor).

Regarding to the access of the project documentation or communication plan, dissemination of information is done through the representative of the Governance Committee of each cooperative. They are the communication channel between communities and project proponents as it established in the rules of procedure of the Governance Committee.



Figure 26. Community workshops in Unión Maya Itzá



Figure 27. Community workshops in La Lucha



Figure 28. Community workshops in La Técnica Agropecuaria

Table 10. Local consultation workshops performed

N°	Date	Cooperative	N° Participants	Men	Women	Activity
1	18/09/13	UMI	28	25	3	REDD+ Informative workshop
2	16/10/13	UMI	12	12	0	REDD+ Informative workshop
3	18/09/13	Lucha	20	18	2	REDD+ Informative workshop
4	19/09/13	La Técnica Agropecuaria	17	12	5	REDD+ Informative workshop
5	16/10/13	La Técnica Agropecuaria	10	7	3	REDD+ Informative workshop
6	19/09/13	Retalteco	20	18	2	REDD+ Informative workshop
7	22/10/14	UMI	14	14	0	REDD+ Informative workshop
8	21/10/14	La Técnica Agropecuaria	10	8	2	REDD+ Informative workshop
9	31/10/14	La Técnica Agropecuaria	28	19	9	REDD+ Informative workshop
10	24/02/15	La Lucha	21	18	3	Answer questions, define next meeting
11	10/03/15	La Lucha	21	16	5	A comic about climate change and a summary of PDD was delivered
12	11/03/15	La UMI	62	56	6	
13	12/03/15	La Técnica Agropecuaria	24	18	6	Answer questions, define next meeting
14	19/03/15	La Lucha	10	1	9	
15	25/03/15	La UMI	65	55	10	Date of final consultation was defined
16	17/04/15	La Técnica Agropecuaria	36	28	8	Date of final consultation was defined
17	26/03/15	La Lucha	12	12	0	Date of final consultation was defined
18	26/03/15	La Lucha	14	0	14	REDD+ explication, answer questions,
19	9/04/15	La Lucha	26	0	26	Explain Project Impacts
20	9/04/15	La Lucha	18	18	0	Explain Project Impacts
21	16/04/15	La Lucha	15	15	0	Follow up to project impacts

N°	Date	Cooperative	N° Participants	Men	Women	Activity
22	16/04/15	La Lucha	26	0	26	Follow up to project impacts
23	28/04/15	La Lucha	28	0	28	REDD+ Informative workshop
24	8/05/15	La Lucha	49	33	16	Final consultation FPIC
25	15/04/15	UMI	26	16	10	Define guest for final consultation
26	21/04/15	UMI (La Laguna neighborhood)	36	36	0	Define guest for final consultation
27	21/04/15	UMI (Campeche neighborhood)	37	24	13	Define guest for final consultation
28	8/05/15	UMI	115	86	29	Final consultation FPIC
29	24/04/15	La Técnica Agropecuaria	8	6	2	Advances of consensus among REDD+ Project Proponents
30	6/05/15	La Técnica Agropecuaria	28	15	13	REDD+ Informative workshop
31	9/06/15	La Técnica Agropecuaria	45	28	17	Final consultation FPIC

Consultation

G3.4 FDN has worked closely in the past with the COCODES of the project area and outside of the project area. Therefore, the identification of who could be potentially affected by a REDD+ project, i.e. REDD+ project stakeholders, is based on the observation and experience gathered during more than thirteen (13) years of management of the SLNP. The most relevant stakeholders identified in this process are the communities present in the area with land tenure and land use rights that are already regulated or are in the process of regulating.

G3.5 FDN informed the communities through their COCODES and provided prior to the meeting hard copies with key concepts of a REDD+ project and complementary information about the celebration of stakeholder consultations. Additionally, the COCODES provided to the community people information about the meeting. The assistance to the meetings reflected that the information was made available to everybody (attendance records available for auditor). When necessary, indigenous language was used for transmitting the relevant concepts of the REDD+ project. From these consultations, the project activities were selected to be implemented in the project scenario.

After having undertaken Stakeholder Consultations in each community, the documentation that this process generated was stored in physic and electronic format (as applicable) and it is available for auditors upon request. During the stakeholder consultation the inhabitants of the communities were encouraged to provide their feedback and opinion about the project and questions and comments were recorded. The channels that could be used for these communications were diverse, comprising from the

direct communication with the technic personnel of FDN present in the area to emails or anonymous messages that could be left in the website of the CCBA during the public comment period, and from which all communities were informed about during the celebration of the meetings.

Anti-Discrimination

G3.7 The primary project proponent have excellent reputation (see Section 1.3) and is not involved in or complicit in any form of discrimination or sexual harassment with respect to the project.

The community involvement in the project has been inclusive, according to individual capabilities and independent of gender, cultural identity and religion. Recruiting personnel have as a principle employ qualified and reliable staff whose skills are in line with the requirements and objectives of the project, through technical, transparent and non-discriminatory procedures based on merit and excellence.

A comprehensive online search was performed and as a result, there are no reports that demonstrate that the Project Participants (project proponent and project developers) are involved or complicit in any form of discrimination or sexual harassment with respect to the project.

Feedback and Grievance Redress Procedure

G3.8 The process for handling conflicts and grievance is in process of implementation by the Governance Committee. However, in Guatemala exists a municipal affairs court responsible for resolving these conflicts; thus the project will use this judicial office. On the other hand, for being in constant contact with the community and workers, field technicians are the first responsible for responding to requests from the community. Additionally, the representative of the Governance Committee of each cooperative is the communication channel between communities and project proponents as it established in the rules of procedure of the Governance Committee.

3 LEGAL STATUS

3.1 Compliance with Laws, Statutes, Property Rights and Other Regulatory Frameworks (G3 & G5)

G5.6 Guatemala has initiated concrete actions to address the challenges of climate change. It has a National Change Climate Policy and one of the first laws of global climate change: Climate Change Framework Law, whereby the National Council on Climate Change (Art. 8), integrates different sectors of the country: government, municipalities, mayors created and indigenous, private, peasant authorities, non-governmental organizations, indigenous and universities^{75,76}.

Listed below are the laws and regulations relevant to the project:

- Protected Areas Law (Decree 4-89) and its reform in the Decree 19-89 and 110-96.
- Regulation of the Law on Protected Areas (Government Agreement 759-90).
- Biosphere Reserve Maya (Legislative Decree 5-90) and areas of Southern Petén (Decree 64-95) and Master Plans approved for each particular protected area.
- The Law of the Land Fund (Decree 24-9).
- Law of protection and improvement of the environment (Decree 68-89) and its reform in the Decree 1-93 and 90-2000.
- Regulation of Forestry Law (4.23.97 Resolution of Board of INAB).
- Law of the Ministry of Agriculture (Legislative Decree 102-70).
- Red List of flora for Guatemala (Resolution No. ALC 028/2001 of CONAP).
- Act Trifinio Biosphere Reserve (Legislative Decree 939-87).
- Act declaring Protected Area South of the Petén (Legislative Decree 64-95).
- Leasing State Reserve Areas (Government Agreement 199-93).
- Technical Cooperation Agreement between the Government of the Republic of Guatemala and the Government of the Republic of Finland on the management and sustainable use of natural coniferous forests Guatemala (Decree 10-93).

⁷⁵ Rivera, J. 2014. Ley marco para regular la reducción de la vulnerabilidad, la adaptación obligatoria ante los efectos del cambio climático y la mitigación de gases de efecto invernadero. Decreto 7 – 2013. Ministerio de Ambiente y Recursos Naturales. Disponible en:

http://www.unep.org/Transport/new/PCFV/pdf/Guatemala2014_2_JosLuisRivera.pdf

⁷⁶ Congreso de la República de Guatemala. 2013. Decreto número 7 – 2013. Disponible en: http://www.elaw.org/system/files/gt.ley_cambio.climatico.pdf

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973). According to Resolution 22/90 amendments to Appendices I and II of the Convention (24/06/92) (Legislative Decree 63-79) are allowed.
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Legislative Decree 4-86).
- Convention for the Conservation of Biodiversity and Protection of Wilderness Areas in Central America (Legislative Decree 5-95).
- Law on the Use and Marketing of Gum Protection and the Chicozapote Tree (Legislative Decree 99-96)

All areas comply with the legislation previously described.

G3.11 Laws and regulations covering worker's right

The Guatemalan Constitution⁷⁷ and Labour Code⁷⁸ recognize the right to freely associate and bargain collectively. Articles 34 and 102 (q) of the Constitution expressly provide that workers may freely associate without discrimination or previous authorization from the government. The Labour Code further elaborates on these basic protections. Guatemala has signed 47 agreements⁷⁹ within the International Labor Organization⁸⁰.

The main social safeguards in Guatemalan legislation can be found in the Constitution of 1985, the Peace Accords of 1996, the Municipal Code of 2002, and the Cadastre Information Registration Law of 2005.

The 1985 Constitution recognises indigenous and collective rights (Art 67) and says that the State will develop legislation and mechanisms to protect these rights (Constitution Art. 68 and 70). This further legislation has never been passed. Two of the Peace Accords, the Agreement on Indigenous Peoples' Identity and Rights (Section F) and the Agreement on Socio-economic Aspects and the Agrarian Situation (Chapter 3, Section E) also refer to indigenous communities' right to land.

At the international level, Guatemala has ratified ILO Convention 169 - The Indigenous and Tribal Peoples Convention, 1989; which is a legally binding international instrument open to ratification, which deals specifically with the rights of indigenous and tribal peoples. Also, is part of the United Nations Declaration on the Rights of Indigenous People, which constitute the minimum standards for the survival, dignity and well-being of the indigenous peoples of the world.

⁷⁷ Guatemala Constitution. 1993. Available at http://www.mintrabajo.gob.gt/images/organizacion/leyesconveniosyacueros/Leyes_Constitucionales/Constitucion_Politica_de_Guatemala.pdf

⁷⁸ National laws on labour, social security and related human rights. Available at: <http://www.ilo.org/dyn/natlex/docs/WBTEXT/29402/73185/S95GTM01.htm>

⁷⁹ Available at: http://www.minex.gob.gt/pBase.aspx?ID=/MAYT/MAYT_TRATADO_ACUERDO/MAYT_TRATADO_ACUERDO_VIGENTEWebReport.aspx

⁸⁰ Available at: <http://www.ilo.org>

Some publications⁸¹ remark that there still are serious deficiencies in the existing legislation with regard to the subject of freedom of association and collective bargaining in Guatemala and show different examples of non-compliance with the applicable legislation of Guatemala.

This project ensures that all workers are treated according to the requirements of the applicable legislation. All personnel of the REDD+ project will have to agree and sign a contract in which his/her obligations and rights will comply with the applicable legislation and will be clearly exposed.

3.2 Evidence of Right of Use (G5)

Proof of title for the first instance

There are not ongoing or unresolved disputes or conflicts regarding land. Fundación Defensores de la Naturaleza owned Centro Campesino and Naranjitos. The three communities La Lucha, La Técnica Agropecuaria and Unión Maya Itzá present legal land tenure. The proof of title documentation can be found on Land tenure folder. The project proponents have the rights over the land and over the Certified Emission Reduction to be generated by the project activities taking place in these areas.

G5.8 This project has establish a Governance Committee with legal entity in which representatives of the participating communities and FDN have representatives (one regular and one substitute). The carbon credits will be awarded to this committee, in which the decision of allocating revenues generated through its commercialization will have to be taken by consensus. OroVerde participates as an observer and international assessor with advisory capacity.

Representatives of CONAP as well as of communities that do not have a legal title of the land but are included in the project area in the coming instances, can participate as observers but will not have right for vote when deciding the allocation of financial resources (Act of Formation and Rules of Procedure available for auditor).

G5.7 Community workshops were developed with the approval and advice of the following authorities working with the communities:

- CONAP (Consejo Nacional de Áreas Protegidas)⁸² whose mission is to ensure the conservation and sustainable use of biological diversity and protected areas of Guatemala, as well as natural goods and services provided, through design, coordinate and monitor the implementation of policies, standards, incentives and strategies, in collaboration with other actors.
- ACOFOP (Asociación de Comunidades Forestales de Petén)⁸³ whose main objective is to improve the quality of life of forest communities through community forest management, thereby promoting social, ecological, economic and political sustainability of the Multiple Use Zone of the Mayan Biosphere Reserve.

⁸¹ Caldh & ILRF, 2004. Labor rights and legal, political, economic and cultural obstacles in Guatemala. Available at: <http://www.laborrights.org/sites/default/files/publications-and-resources/POLICYGuatemalaLaborLaws.pdf>

⁸² Website: <http://www.conap.gob.gt/>

⁸³ Website: <http://www.acofop.org/>

- Naturaleza para la Vida⁸⁴ whose mission is to provide local communities the capacity to sustainable use of natural and cultural resources to improve their living conditions.
- Religious organization Pastoral Social de la Tierra (from the municipalities of Santa Elena and La Libertad).

Other entities involved are INAB (Instituto Nacional de Bosques / National Institute of Forest), IDAEH (Instituto de Antropología e Historia / Institute of Anthropology and History), Guatemala Army, DIPRONA (División de Protección de la Naturaleza / Division of nature protection), and MARN (Ministerio de Ambiente y Recursos Naturales / Ministry of Environment and Natural Resources).

3.3 Emissions Trading Programs and Other Binding Limits (G5)

G5.9 GHG emission removals generated by the project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions. Given that Guatemala does not have any international compromise considering emission caps under any compliance scheme, no double counting issues are applicable to this case.

3.4 Participation under Other GHG Programs (G5)

G5.9 Not applicable. The project has not sought or received any other GHG-related environmental credit.

3.5 Other Forms of Environmental Credit (G5)

G5.9 Carbon credits are currently the only environmental credit being generated from this project. No other environmental credits will be generated or sold.

3.6 Projects Rejected by Other GHG Programs (G5)

G5.9 Not applicable. The project has not been rejected by any other GHG program.

3.7 Respect for Rights and No Involuntary Relocation (G5)

G5.3 FDN has informed all communities living within the SLNP that this project's goal is reducing deforestation and comply with the requirements described by the Guatemalan Law regarding the management procedures in protected areas. The process of information to the communities has been undertaken through the technicians of FDN and it has happened at the same time than the announcement for the stakeholder consultation meetings.

FDN together with CONAP has established guidelines for the land use in these protected areas that are reflected in cooperation agreements to be signed together by CONAP and the communities that are currently settled without legal documentation but with historic land rights.

The cooperation agreements reflect the legislation that is nowadays not enforced. CONAP has already expressed the willingness to maintain the settlements with historic land rights if they follow the guidelines considered by the applicable law.

⁸⁴ Website: <http://fnpv.org/>

However illegal settlements occurred after the establishment of the park and are still occurring in some areas. These have been relocated in the past after long legal processes and following the procedures established by the Government of Guatemala.

Thus, if any community or settlement is evicted from the project area will be due to the application of the Guatemalan Law of protected areas and not due to the implementation of the REDD+ project, as it happened already in the past⁸⁵.

For the first instance of the project, the three communities have land titles and the other lands are FDN's properties. No involuntary relocation will be made.

3.8 Illegal Activities and Project Benefits (G5)

G5.4 Several illicit activities that affect climate, community and biodiversity aspects present in the region have occurred in the project area in the past and still can be found nowadays. The strategic situation of the area, being an unpopulated region that borders with Mexico from which it is separated exclusively by a river, has benefited the traffic of illegal substances like drugs and protected fauna or even being persons^{86 87 88}. Moreover, the project area experiences the illegal extraction of precious woods and expansion of cattle ranching activities through provoked fires. It can be also find some minor examples of irregular mining and irregular but significant extraction of precious vegetative materials like xate (*Chamaedorea sp.*) and endangered and not-endangered wildlife.

This project has been designed in a significant percentage considering these illegal activities that occur currently within the borders of the SLNP. Project activities like the inter-institutional collaboration for patrolling the borders of the park, the regularization of land tenure, the maintenance of facilities that ease logistical implementation of controlling activities, the system for controlling materials coming out of the SLNP, the systems of quick alert in case of emergencies like fire, the capacitation on fire fighting, etc. are mostly focusing on lowering the impacts of the illegal activities that occur currently and seek the eradication of such practices from the area through creating an uncomfortable environment for the individuals that undertake such practices. None of the project benefits will be derived from illegal activities.

4 APPLICATION OF METHODOLOGY

The development of this section is according the requirements of the methodology VM0015. The Section 4 and 5 of the PDD are based on the descriptions presented in the VCS Technical Annex. For detailed and full application of the methodology (fully expanded sections), please refer to VCS Technical Annex.

⁸⁵ See newspaper publication <http://www.elperiodico.com.gt/es/pais/32539>

⁸⁶ Ybarra, M. 2012. Land, migration and life in Petén, Guatemala. Available at <http://www.meganybarra.net/tierra-migracioacuten-y-vida.html>

⁸⁷ Santiago-Cruz, M. 2010. Migration and Transmigration on the southern border of Mexico: Analysis on their relationship and impact on local development. Available at See <http://www.usc.es/congresos/xiirem/pdf/70.pdf>

⁸⁸ Inter-American Development Bank. 2015. Information online <http://www.iadb.org/en/countries/guatemala/guatemala-and-the-idb.1059.html>

4.1 Title and Reference of Methodology

- VCS Methodology for Avoided Unplanned Deforestation (VM0015 v1.1)
- Tool for the demonstration and assessment of additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) project activities
- VCS AFOLU Non-permanence Risk Tool: VCS Version 3.2
- Climate, Community & Biodiversity Standards (CCBS) 3rd edition

4.2 Applicability of Methodology

The applicability conditions of the methodology VM0015 are enumerated below. Please find a brief explanation of the conformity of the characteristics of this REDD+ project with the respective condition following to each enumerated paragraph.

- a) *Baseline activities may include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agricultural and grazing activities as long as the category is unplanned deforestation according to the most recent VCS AFOLU requirements.*

Baseline activities include planned and unplanned logging for timber, fuel-wood collection, agricultural and grazing activities. In addition, the baseline scenario contains unplanned (and illegal) forest conversion to land cover and land use classes related to agriculture and cattle ranching.

- b) *Project activities may include one or a combination of the eligible categories defined in the description of the scope of the methodology.*

The project is an Avoided Unplanned Deforestation (AUD) activity in a generally frontier, but locally mosaic landscape configuration. The scope of the project includes the eligible categories A, B, C & D. However, category “D” is the most relevant to the project due to the mix of legal and illegal timber harvest in the baseline scenario, and the continuance of legal harvesting in the project scenario.

		PROJECT ACTIVITY	
		Protection without logging, fuel wood collection or charcoal production	Protection with controlled logging, fuel wood collection or charcoal production
BASELINE	Deforestation	Old-growth without logging	A B
		Old-growth with logging	C ¹ D ¹
		Degraded and still degrading	E ¹ F ¹
		Secondary growing	G ¹ H ¹
	No-deforestation ²	Old-growth without logging	No change Degradation
		Old-growth with logging	IFM IFM-RIL
		Degraded and still degrading	IFM IFM
		Secondary growing	No change Degradation

1. Accounting for carbon stock increase in the project scenario is optional and can conservatively be omitted.

2. If the baseline is not deforestation, the change in carbon stocks is not covered in this methodology.

- c) *The project area can include different types of forest, such as, but not limited to, old-growth forest, degraded forest, secondary forests, planted forests and agro-forestry systems meeting the definition of “forest”.*

The project area includes only old-growth and degraded forests, meeting the applicable definition of forest of Guatemala that considers a single minimum tree crown cover value of 30%, a single minimum land area value of 0.5 ha and a single minimum tree height value of 5 meters. Specifically includes Broadleaf forest low/sub-humid, Broadleaf forest-medium high/humid and Broadleaf forest medium-high/sub-humid.

- d) *At project commencement, the project area shall include only land qualifying as “forest” for a minimum of 10 years prior to the project start date.*

The project area includes only forest land qualifying as forest since minimum 10 years prior to project start date. This criterion was demonstrated with an analysis of coverage of forest and non-forest for the years 2000, 2007 and 2010 by Landsat image classification; which show areas of forest and non-forest for the years mentioned.

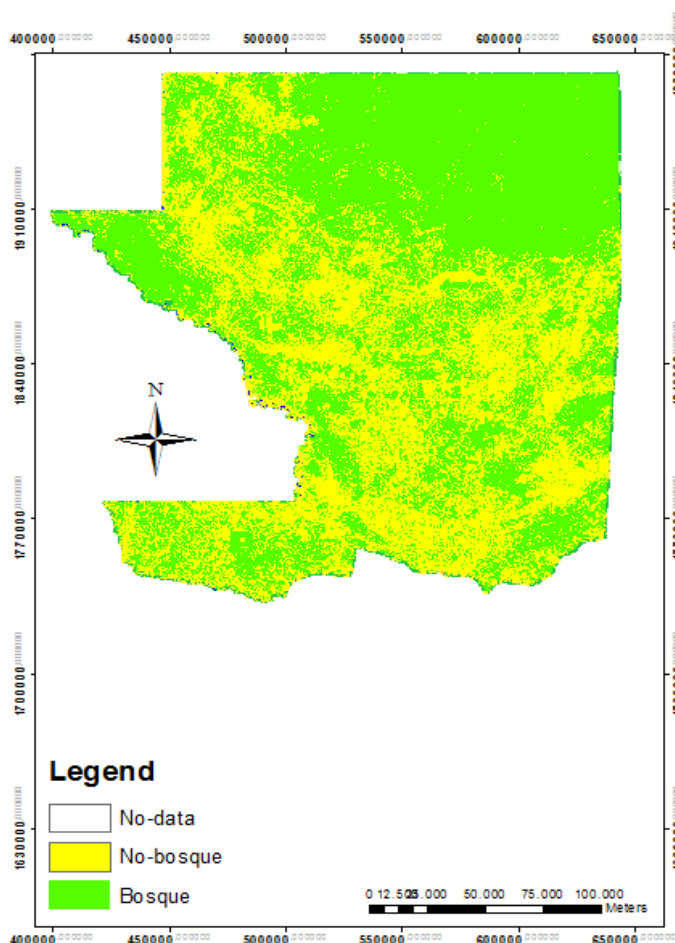


Figure 29. Map of Forest Vs. Non Forest in the subnational region of the north lowlands of Guatemala⁸⁹.

⁸⁹ Vallejo et al., 2011. Aplicación de la Metodología VM0015 al Desarrollo de una Línea Base de Emisiones por Deforestación en las Tierras Bajas del Norte de Guatemala.

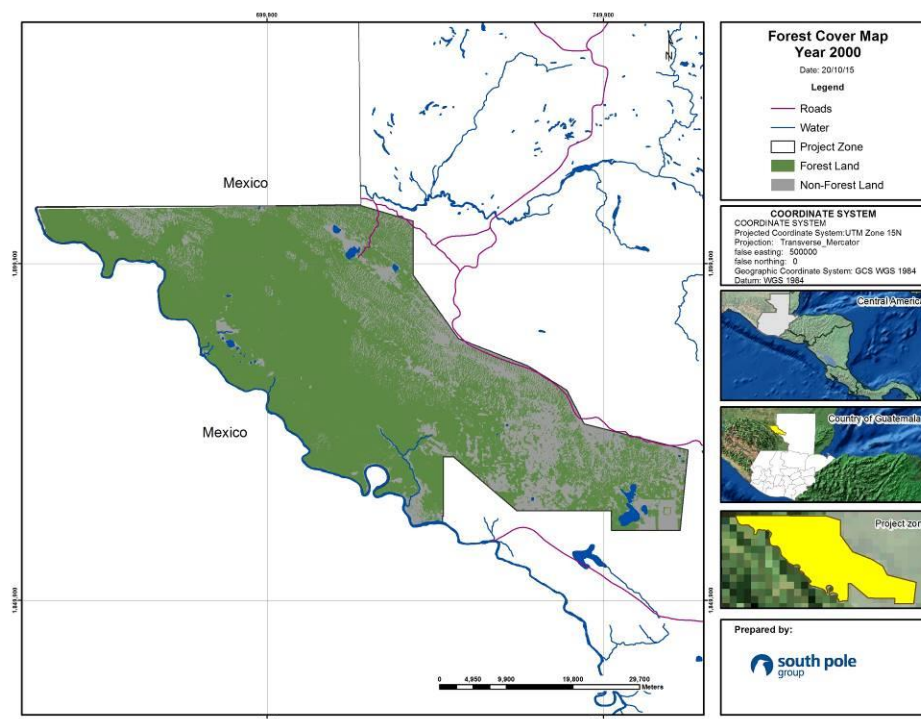


Figure 30. Forest cover map of the project zone – year 2000

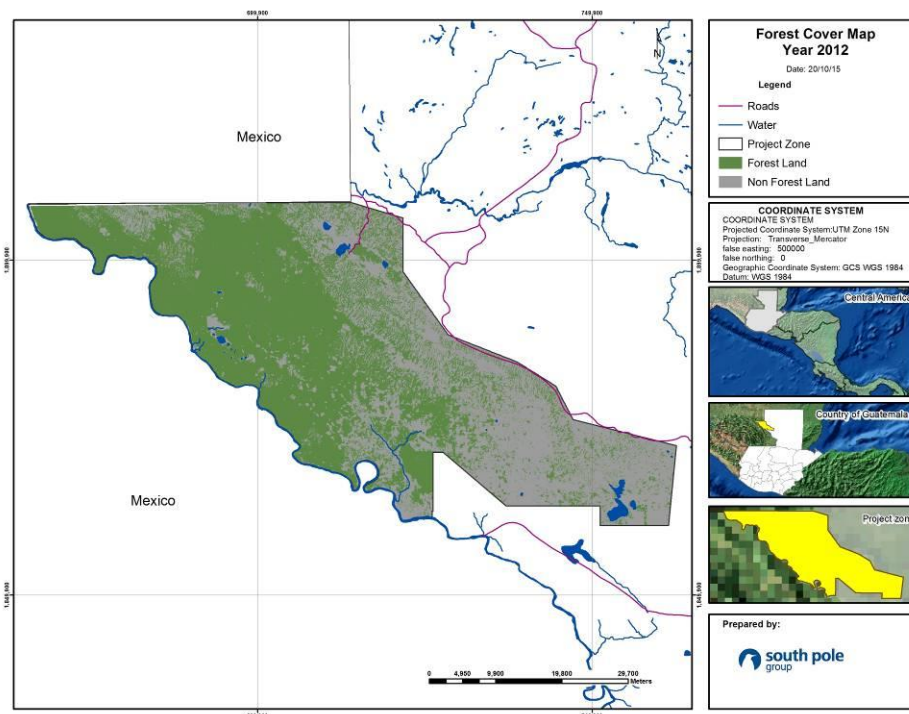


Figure 31. Forest cover map of the project zone – year 2012

- e) *The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm. If the project area includes a forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable.*

There are no forested wetlands growing on peat and no peat soils in the project area. In fact, a scientific publication establishes that there are almost no peatlands in Guatemala⁹⁰. CONAP & INAB (2012) conducted a map of Forest Cover by type and Subtype of Forest in Guatemala through the use of RapidEye images, images of a spatial resolution of 5 meters. One of the types of coverage identified are Wetlands described as "areas of marsh, wetlands, peatland or water surfaces, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water which depth at low tide does not exceed six meters". As a result for the department of Peten, it is not present the category "Wetlands with Forest".

4.3 Methodology Deviations

The methodology deviations are based and proposed by the Guatecarbon project (both projects use the same baseline), except for the Leakage Belt, which is for Lacandón REDD+ project. There are seven deviations in total:

Location	Description	Justification
Section 1.1.3– VCS Technical Annex/VM0015	Leakage Belt – The proponent applies a monitoring deviation based on its justification for using Option II (Mobility Analysis) for designing the project's leakage belt instead of Option I (Opportunity Cost Analysis). The project's leakage belt is based on documentation that suggest that agents of deforestation move 2 km to the sides of the roads.	The proponent can demonstrate that significant levels of deforestation have been attributable to migrant populations. The resulting design of the leakage belt based on option II is conservative and also, do not overlap with the Guatecarbon REDD+ project, located in the same reference region. The motivations for deforestation in the leakage belt are often related to security issues in the area and migrant settlement. However, the project is currently working with communities holding legal rights of properties, therefore, no movement is expected from the communities.

⁹⁰ The International Mire Conservation Group and International Peat Society accounts for a total of 1Km² of peatlands in Guatemala. Available at: http://www.gret-perg.ulaval.ca/fileadmin/fichiers/fichiersGRET/pdf/Doc_generale/WUMP_Wise_Use_of_Mires_and_Peatlands_book.pdf

Location	Description	Justification
Section 5.2 - VCS Technical Annex/VM0015 Tables 12 and 13b/13c	Zones of Post-Deforestation – VM0015 v1.1 requires that projects use “Method 1 – Historical Land Use Change” in section 5.2 of VM0015 for to assign post-deforestation land-uses to the projected areas of annual deforestation in same proportions as those observed on lands deforested during the historical reference period in the reference region. However, there is an error in the structure of VM0015 Table 12 which does not permit a user to accurately execute this requirement, and which also affects the results of Table 13. As a result the Guatecarbon project has implemented a measurement deviation to Table 12 and 13b and 13c in order to accurately calculate the area subjected to post-deforestation carbon stock estimates in accordance with the intent of VM0015 v1.1.	1. In order to properly assign the projected carbon stock estimates of areas of annual deforestation based on the same proportions of post-deforestation land uses as were observed during the historical reference period, the proportion of each post deforestation land use must be calculated only on the total amount of land use that transitioned from forest to non-forest. Left unchecked, the structure of Table 12 as written in VM0015 v1.1. creates a calculation error because it bases the proportion of each post-deforestation land use as a percentage of the total area of a “Zone”, which is defined in VM0015 Table 12 as the “Total of <u>all</u> other LU/LC classes present in the Zone”. This introduces a logical error into Table 12 because it suggests that the proportion of post-deforestation land uses must be calculated relative to ALL other LU/LC classes present in the Zone. The Guatecarbon project has corrected Table 12 in order to correctly calculate the historical proportions of post-deforestation LU/LC classes. In order to do this a “Zone” the project defines a “zone” as the stratum of forest in the project area. The structure of Table 12 is clarified so that the percentages are calculated only in reference to the sum of the area of the post-deforestation classes that occurred in each Zone during the historical reference period, and <u>not</u> against the full size of each Zone as suggested by VM0015 v1.1. The total size of a Zone is irrelevant, as only the area transitioning from forest to non-forest matters in this calculation. Otherwise the percentages of post-deforestation would be underestimated because they would be based on a much larger and irrelevant area. 2. The previously described modification requires a clarification to the information

Location	Description	Justification
		presented in Table 13b and 13c. Because Table 12 has previously defined a Zone as being the “Total of all other LU/LC classes present in the Zone”, the proponent has clarified that Table 13b and 13c should necessarily be the same the information presented in Tables 11b and 11c, since both ultimately intend to show the projected area of annual deforestation in the baseline scenario. This does not affect the accuracy of the information, but does introduce a more logical conceptual basis for understanding the function of this table and its relationship to other tables. Table 11 shows the projected activity data by forest class, which is the same activity data applied to the post-deforestation classes and their carbon stock estimates.
Section 5.2 - VCS Technical Annex/VM0015 Tables 12, step 6.1.1 (e), and net carbon stock calculations	% allocation of historical post-deforestation uses – Guatemala lacks any long-term carbon stock assessments of post-deforestation land uses as required by step 6.1.1 (e). The Guatecarbon project uses a measurement deviation for this step and incorporates the deviation into the figures represented in VM0015 Table 12, which in turn affects how net carbon stock calculations are determined. The full details of these calculations are described and presented in section 5.2 of the VCS Technical Annex.	The Guatecarbon project uses the proportions of post deforestation land uses that exist at the end of the 2000-2010 historical deforestation assessment conducted by this project and then applies a series of conservative assumptions to account for the fact that the project has no long term data on these parameters. 1. Any non-forest classes involving African oil palm are assumed to not lose any carbon stock over the project lifetime. 2. The mixed cover class (Agropecuaria-No Bosque - ANG) is a mix of non-forest uses including cattle pasture, agriculture, and other land covers that are difficult to discern with LandSat imagery. The project accounts for the temporal development in the size of this class after it is initially registered as deforestation event by applying the area changes endured by the same post-deforestation land use classes during the 2000-2010 historical reference period. This action helps to account for the fact that land

Location	Description	Justification
		cleared to a non-forest status endures a degree of dynamism over time where, for example, a portion of a newly created pasture may eventually undergo natural regeneration to secondary forest. This deviation considers the transitions from the ANG class to other forest classes and applies these changes, on a percentage basis, to the proportion of areas of post-deforestation that exist at the <u>end</u> of the historical reference period. This is conservative because otherwise the project has no guidance from VM0015 on how to handle this issue and could otherwise simply rely on the initial proportion of post-deforestation land uses at the end of the historical reference period and keep them static over time, which would be unrealistic and would overestimate net emissions reductions. These changes result in more conservative proportions of post-deforestation land uses because they incorporate changes from non-forest to forest and thus reduce the percentage of post-deforestation land that remains as non-forest, which has the lowest carbon stocks of any class determined by the project.
Section 6.1.1 (a) VCS Technical Annex/VM0015	Estimation of the average carbon stocks of each LU/LC class - assessing the existing data. VM0015 v1.1 requests and permits users to consider existing data that can help a project develop its carbon stocks more efficiently. Considering that Guatecarbon and Lacandón project encompass large areas under forest management where	Three of the nine data sets from forest inventories from across the reference region are older than 10 years old relative to the forest benchmark map. There are data sets from the concessions in the MUZ taken at the beginning of their concession contracts which date back to 1994, 1996 and 1999, and prior to legal harvesting operations. These data create a reference point from which the effects of legal harvest can be compared. Legal

Location	Description	Justification
	forest inventories have been developed previously, these sources were analysed and then used to develop its estimates of carbon stocks. However, VM0015 v1.1 stipulates that the data can only be used if they are less than 10 years old. Some of the data used in these estimates are up to 16 years old relative to the end of the historical reference period, which forms the basis for the forest benchmark map. The Guatecarbon project has applied a measurement deviation because it can show that this requirement does not overestimate carbon stock estimates.	harvests were determined to have a negligible ⁹¹ impact on forest carbon stocks. Nearly half (313,446 ha) of the MUZ are not authorized for legal harvest therefore the risk of measurement bias does not apply at all in these cases Furthermore, older measurements likely result in slightly younger forests, which likely translate into slightly lower biomass estimates. The measurements from 1994-2000 account for 57% of the measurements used by Guatecarbon project. The rest occurred between 2000-2010. When used together these data sets average together some of the temporal effects within these forests due to either natural forest dynamics or to illegal degradation, thus incorporating some degree of accounting of carbon stocks over time. Moreover these data enable the project to cover a wide geographic expanse, thus permitting a more robust estimate of forest carbon by taking into account a wide range of spatial variability across the MUZ. Lastly, the MUZ and the MBR in general have been harvested for timber well before the establishment of the MBR. It is unlikely that measurements that were taken at the beginning of the concession contracts are biasing the estimates in favor of higher carbon stocks since the area has been subjected to timber harvesting well before the establishment of the MBR. When considering this reality

⁹¹ The assumptions to estimate the effect of degradation from legal and illegal timber harvesting are presented in section 6.1.1 of the VCS Technical Annex. Under the most conservative assumptions legal and illegal degradation based on historical data, these activities are estimated to cause total biomass losses of approximately 5.2 tCO₂e ha⁻¹, of which 2.7 tCO₂e ha⁻¹ might result in harvested wood products, and which are conservatively assumed to be long-lived (no-decay). These details are more fully explained in section 6.1.1 of the VCS Technical Annex.

Location	Description	Justification
		alongside results of the significance test on the impact of illegal and legal harvesting in section 3.4.1, which suggest that these activities are less than half of 1% of emissions associated with the project activities, the effect of historical and current logging activities on the average carbon stock estimates is negligible. The forests of the MBR have been in use for centuries and have already had most of their biggest trees removed over the last several centuries following Spanish colonialism and into the modern era. Due to the reasons mentioned above, it is unlikely to think that having 16 year old data sets, as opposed to 10 year old data sets, significantly overestimates the forest carbon stock estimates in the project area.
Table 20.a VM0015	Carbon Stock Change factor for long-lived harvested wood products – Table 20.a of VM0015 contains an error in the carbon stock change factor calculations that are intended to guide users of the methodology in calculating the carbon stock changes in their project. In Year 1 of Table 20.a the carbon stock change factor associated with long-lived harvested wood products is listed as “zero”(0), when in fact it should be a positive non-zero number in year 1, and only in year 1 in order to account for the sequestration effect of producing a harvested wood product. This error is corrected in Guatecarbon project since the project assumes that all of its harvested wood products are long-lived due to a lack of data on the matter. Therefore the project designates this error in	When a forest experiences degradation from timber harvesting in the MUZ, be it legal or illegal, the non-commercial portion of the harvested tree will remain in the forest while a fraction of the commercial portion is converted into a wood product. The VCS assumes that emissions from aboveground biomass losses are emitted the year they were produced. By the same rationale, the forest carbon that remains sequestered in a harvested wood product is “produced” in the year the harvest occurs. Therefore there must be a positive and non-zero number in the change factor of Table 20.a associated with long-lived harvested wood products, followed by zeros in subsequent years to signify that no decay occurs. Guatecarbon project conservatively assumes that all of the estimated harvested wood products that occur in the baseline scenario are long-lived products. This correction does not ultimately affect the ex-ante GHG estimates because the emissions from HWP are shown to be de-

Location	Description	Justification
	VM0015 and the corrective action taken by the project as a measurement deviation because it is related to carbon stock change calculations.	minimis in section 3.4 of this document. However it is necessary to make the correction in order to accurately account for the sequestering effect of carbon from harvested wood products, and to conduct all subsequent GHG assessments required by VM0015 in an accurate way.
Section 7.1.1 of VM0015/VCS Technical Annex	Accounting for carbon stock changes due to planned activities. VM0015 requires that any planned degradation within the project area, such as the legal forest management activities within the active concessions, be quantified using a spatially-explicit assessment. Guatecarbon project argues that in the case of Guatecarbon it is conservative and sufficient to use a non-spatial model. This qualifies as a measurement deviation because it relates to processes used to change the procedures for quantifying the carbon stock changes associated with planned degradation in the project area.	The non-spatially explicit model developed for Guatecarbon projects areas designated for legal future forest management activities that are larger than the areas that were actually authorized during the same time periods, and which are likely to be authorized in the future. Of the total area in each concession only a portion of it is authorized for forest management. Each authorized area is divided into cutting blocks according to the estimated rotation age calculated for the concessions. Historically the full cutting block has not been authorized for harvesting by CONAP. Currently no cutting blocks outside of the current 5-year harvest plan have been authorized by CONAP, and were not available for modelling purposes. Therefore any spatial assessment would be equally as speculative, if not more so, than a non-spatial assessment. The project used the full area that can potentially be harvested in each concession, divided by the length of the concession contract. This creates annual harvest areas that are larger than those that have been or could be authorized by CONAP. Therefore this deviation renders a conservative representation of planned legal harvests and shows why a spatial assessment is unnecessary.
Section 8.2 of VM0015	Application of the Displacement Leakage Factor (DLF) for ex-ante GHG estimates. In section 8.2,	It is illogical to propose that the DLF used for calculating ex-ante leakage caused by displaced activities be calculated by multiplying the DLF by the baseline

Location	Description	Justification
	VM0015 v.1.1 requires that the DLF be applied to the “baseline carbon stock changes for the project area”. This is an error because in the case of leakage caused by the displacement of activities the emissions must be caused as result of implementing the project activities. The project instead proposes that the correct method should be to multiply the DLF by the product of the baseline carbon stock changes, multiplied and the project's effectiveness factor. Although this change is implemented to correct an error in the methodology, it must be categorized and identified as a measurement deviation.	carbon stock changes. This is because leakage is theoretically caused by the <u>project activities</u> and their level of effectiveness, and cannot logically be calculated by multiplying the DLF by only the baseline carbon stock changes. The correct method for applying the DLF is reached by multiplying carbon stock changes by the EI and multiplied again by the DLF. The correct equation is: $\Delta CADLK_t = \Delta CBSL_t * (EI\%)(DLF\%)$ The following is incorrect and is what what is suggested by VM0015: $\Delta CADLK_t = \Delta CBSL_t *(DLF\%)$

4.4 Project Boundary (CL1 & CL2)

CL1.1 / CL2.1 The compartments that will be evaluate are:

- **Aboveground biomass: Tree.** Included. Principal carbon stock in forest ecosystems. Is significant and binding.
- **Aboveground biomass: Non-Tree.** Included. This carbon stock is included in categories with final cover of perennial crops.
- **Below-ground.** Included. Optional according to the methodology. However, it assumes that carbon loss occurs in this reservoir stock over a period of time after deforestation on a linear decay.
- **Deadwood.** Excluded. Optional according to the methodology. Not significant.
- **Harvested Wood Products.** Excluded. Not significant.
- **Litter.** Excluded.
- **Soil Organic Carbon.** Excluded. Optional according to the methodology.

Table 11. Project boundaries

Source		Gas	Included?	Justification/Explanation
Baseline	Aboveground biomass: Tree	CO ₂	Included	Mandatory. According to VM0015 carbon stock change in this pool is always significant and must be included.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Aboveground biomass: Non-Tree	CO ₂	Included	Optional. Non-tree biomass is incorporated only in final land cover classes where non-tree biomass is the dominant vegetation. Non-tree biomass estimates only apply to the post-deforestation class "ANG", whose emissions factor is based on an aggregated weighted calculation of various post-deforestation classes, where non-tree biomass is part (Refer to Step 6 of the VCS Technical Annex)
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Below-ground	CO ₂	Included	Significant carbon pool. Optional and included due to below tree biomass is a significant component of emissions from deforestation.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Deadwood	CO ₂	Excluded	Insignificant carbon pool. Optional and excluded because a conservative approach is followed.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Harvested Wood Products	CO ₂	Excluded	Insignificant carbon pool both planned and unplanned degradation. According the Significance Analysis are considered insignificant because contribute with less than 1 % of total emissions associated with project activities (Refer to Section 9.1 to VCS Technical Annex).
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Litter	CO ₂	Excluded	Insignificant carbon pool. Optional and excluded because a conservative approach is followed.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015

Source		Gas	Included?	Justification/Explanation
Project	Soil Organic Carbon	CO ₂	Excluded	Insignificant carbon pool. Optional and excluded because a conservative approach is followed. Since the project objective is forest conservation, it is expected that SOC increase; therefore, it is conservatively excluded.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Aboveground biomass: Tree	CO ₂	Included	Mandatory. According to VM0015 carbon stock change in this pool is always significant and must be included.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Aboveground biomass: Non-Tree	CO ₂	Included	Optional. Not monitored in the project area. Accounted only in the post-deforestation class accumulation factor.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Below-ground	CO ₂	Included	Significant carbon pool. Optional and included due to below tree biomass is a significant component of emissions from deforestation.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Deadwood	CO ₂	Excluded	Insignificant carbon pool. Optional and excluded because a conservative approach is followed.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Harvested Wood Products	CO ₂	Excluded	Insignificant carbon pool both planned and unplanned degradation. According the Significance Analysis are considered insignificant because contribute with less than 1 % of total emissions associated with project activities (Refer to Section 9.1 to VCS Technical Annex).
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015
	Litter	CO ₂	Excluded	Insignificant carbon pool. Optional and excluded because a conservative approach is followed.
		CH ₄	Excluded	Not applicable according to VM0015

Source		Gas	Included?	Justification/Explanation
		N ₂ O	Excluded	Not applicable according to VM0015
	Soil Organic Carbon	CO ₂	Excluded	Insignificant carbon pool. Optional and excluded because a conservative approach is followed. In addition, conservatively excluded in the baseline and therefore not subject to monitoring.
		CH ₄	Excluded	Not applicable according to VM0015
		N ₂ O	Excluded	Not applicable according to VM0015

Lacandón – Forest for Life REDD+ Project is a grouped project in which the project proponent may add new project activity instances while meeting the project requirements. The “Geographic grouped project area” for the project is also called “Project Zone” (described in Section 1.2) and is the total area of the SLNP, where La Lucha cooperative is located, plus the areas of the cooperatives Unión Maya Itzá and La Técnica Agropecuaria, which are located partially and totally outside the National Park area as shown in Figure 32.

Since it is a grouped project, the initial project activity instances identified are Unión Maya Itzá, La Técnica Agropecuaria and La Lucha cooperatives, as well as the private properties of Fundación Defensores de la Naturaleza, Naranjitos and Centro Campesino areas. The physical locations where project activities take place are presented in Table 1 and Figure 33. The total area (forest and non-forest) for the project first instance is 53 884.22 ha; and the forest area is 45 288.81 ha.

The geographic areas within which new project activity instances may be developed are shown in the Figure 34; and correspond to areas of Sierra de Lacandón National Park. New instances meeting the pre-established criteria in Section 4.4.1 may be added to the project subsequent to project validation and must be included in the monitoring report with the sufficient information (technical, financial, geographic and other relevant information) in compliance with the eligibility criteria. In addition, must comply with VCS eligibility requirements.

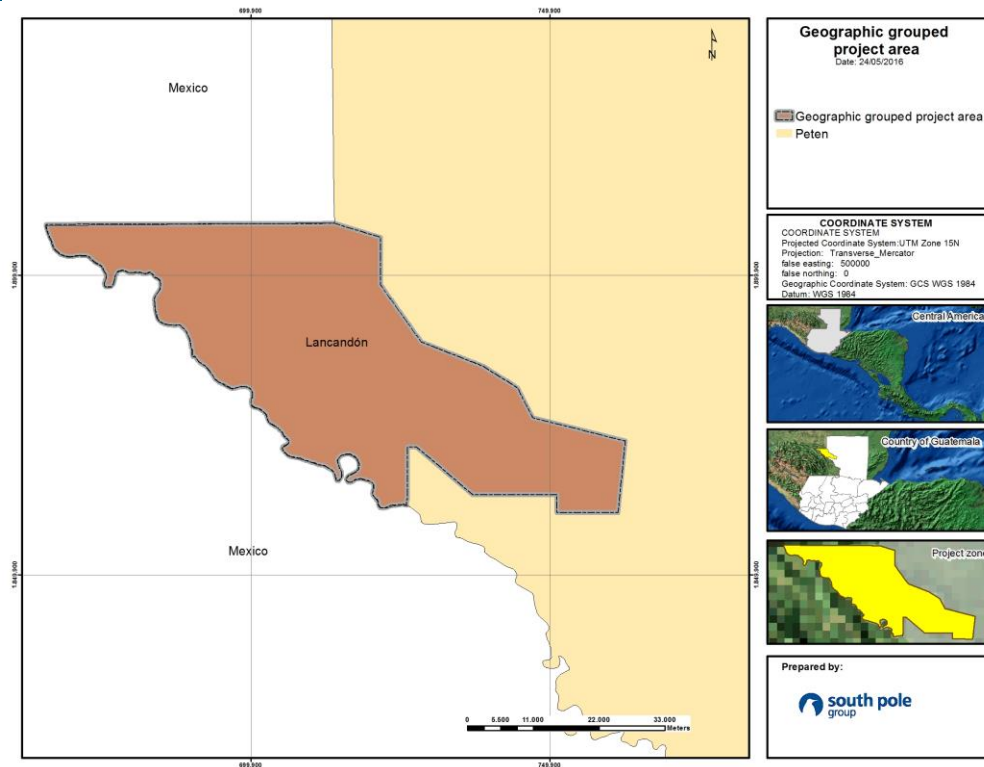


Figure 32. Geographic grouped project area

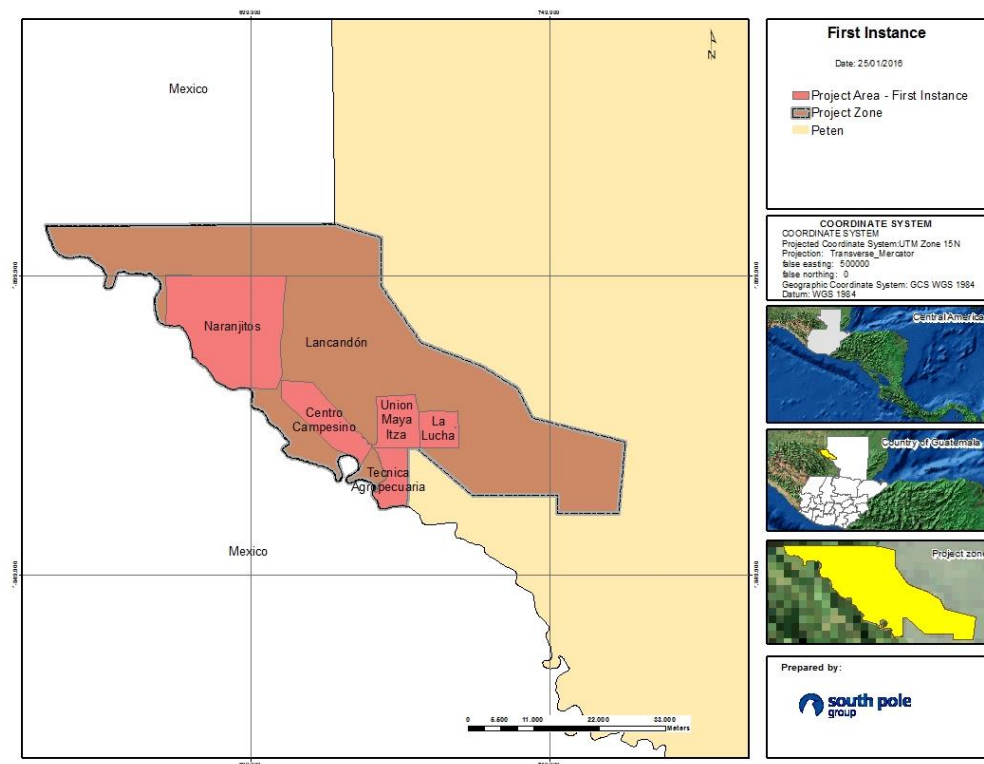


Figure 33. Project boundary – First Instance

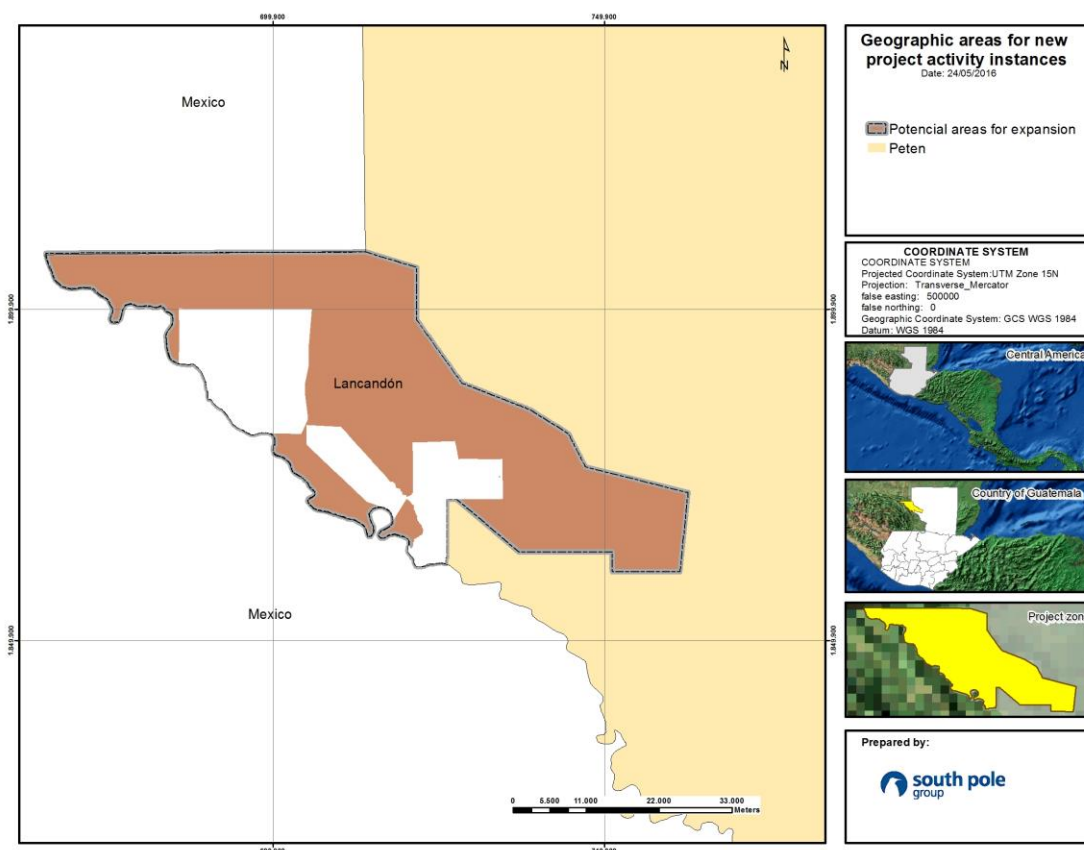


Figure 34. Geographic areas for new project activity instances

4.4.1 Additional Information Relevant to the Project

G1.13 Project areas that may be included, should be located within the Sierra del Lacandón National Park (Figure 32). All communities that meet the eligibility criteria specified below (G1.14) may be part of the project. New instances have not been yet included in the project to the date.

G1.14 Eligibility Criteria

- Legal land tenure
Communities or cooperatives with property title or certifies of land use rights. For each new project instance, it will require that the community or the State present a certificate of land use and tenancy emitted by the corresponding authority.
- Cooperation agreement signed
The cooperation agreement is signed between CONAP, FDN, Municipality of Las Cruces or La Libertad (depend on the location of the community) and the community involved. The main objective is to cooperate between the parties to adapt the legal permanence of the community in areas of the park and to ensure the integrity of the protected area.
The community undertakes to respect existing laws, not introduce or establish species of animals and plants that are not compatible with the rules of management of the park and ensure

sustainability of natural resources with accompanying FDN (Refer to Cooperation agreement folder for an example).

- Representative forest cover
GIS analysis will be performed to determine the potential forest areas to be deforested in the baseline case.
- Technical land eligibility criteria for forest carbon projects
Comply with the complete set of eligibility criteria and methodology tools described in Section 4.
- Adoption of project activities specified in the PDD
New instances should implement the project activities described in Section 2.2 in their areas.
- Free, prior and informed consent approved by the community
To include a new instance it must have developed local consultations and eventually must have a document signed by the community approving participate in the REDD+ project.
- Representative percentage of the families of the community in agreement with the project
The final document signed should have the approval of the families of the communities and no objection to those who do not want to be included.

It is expected that the expansion of the project will occur during the monitoring and verification of the previously validated instances. In addition, new instances should comply with VCS criteria:

- Meet the applicability conditions set out in the methodology and tools applied in this project. New instances must comply with 5 criteria (VM0015 methodology described in Section 4.2):
 - Unplanned deforestation (agriculture, grazing, fuel-wood, timber, charcoal) as long as fitting with most recent VCS AFOLU Guidelines
 - Can include one or more activities
 - Can include multiple forest types, ages, successional state, agro-forestry, natural, planted
 - Must have forest classification minimum 10 years before start date
 - Can include wetland forests unless they grow on peat (at least 65% organic matter, min. thickness 50 cm)
- Have the same baseline scenario determined in the project description which are agriculture and pasture cattle (Section 4.6). Determination of baseline scenario are based upon the initial project activity instances.
- New instances shall implement the same project activities described in Section 2.2.
- A Non-permanence risk buffer assessment shall be performed for each new instance.
- Demonstration of additionality are based upon the initial project activity instances. Face one of the same additionality barriers as the initial project instances (Section 4.7). The common practice analysis is necessary to be done by the time of the validation of new instances, in order to demonstrate that the project activity stills not a common practice.
- Not be included in another GHG program.

Inclusion of New Project Activity Instances:

1. Occur within one of the designated geographic areas specified in the project description. For the project is the areas of SLNP as described in Section 4.4.
2. Comply with the complete set of eligibility criteria for the inclusion of new project activity instances.
3. Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.
4. Be validated at the time of verification against the applicable set of eligibility criteria.
5. Have evidence of right of use, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance.
6. Be eligible for crediting from the start date of the instance through to the end of the project crediting period.

New instances have not been yet included in the project.

G1.15 The scalability of the project is limited to the forest cover of the SLNP. Primary project proponent is responsible for performing management activities and ensuring the sustainability of forest conservation as well as the monitoring. In addition, the scalability could be limited by financial resources. The addition of new instances should have a financial plan and a schedule for activities to ensure the development of the project and achieve the climate, social and biodiversity benefits. It is expected that the following areas to be included are those corresponding to CONAP (areas of the State of Guatemala) since the REDD+ National Strategy has identified as a priority conservation area the SLNP, therefore, any cost will be assumed by the State⁹²⁹³⁹⁴.

Furthermore, in case new project activities are added, it should have the approval of all project proponents (note that the project committee is formed by a representative of each cooperative) and have the necessary financial resources to promote such activity at least for the initial phase. On the other hand, a pre-feasibility study should be conducted to identify that community and biodiversity benefits are not affected by the implementation of the new activity.

Risks associated with the non-continuation of benefits, will be minimized by involving areas with communities committed to the project objectives and that meet the eligibility criteria.

4.5 Commercially Sensitive Information

Financial section is sensitive information for the project proponent.

⁹² Banco Interamericano de Desarrollo. 2016. Available at <http://www.iadb.org/es/proyectos/project-information-page,1303.html?id=GU-T1194>

⁹³ Ministerio de Ambiente y Recursos Naturales. Available at http://www.marn.gob.gt/s/redd_/paginas/Quines_coordinan

⁹⁴ Banco Interamericano de Desarrollo. 2014. Available at <https://forestcarbonpartnership.org/sites/fcp/files/2014/May/GU-T1194%20Estrategia%20Social%20y%20Ambiental.pdf>

4.6 Baseline Scenario (G2)

G2.1 The most likely land-use scenario in absence of the project are agriculture and pasture cattle. Identified agents deforest due to reduced productive economics alternatives. In addition, one important agent besides farmers and cattlemen, are the invaders, people from other places seeking for lands and extract illegally natural resources.

Sutter & Carr (2010) mention agricultural intensification represents a potential response to population density increases on a fixed quantity of farm land. These authors concluded changes in agricultural intensification in a context of rapidly expanding community and farm level population in an emerging agricultural frontier in SLNP. Agricultural frontiers are ideal for the adoption of livestock due large area of land and the little labor force required. The potential for an increase in deforestation rises with the introduction of cattle.

Previous investigations conclude that the likelihood of the deforestation rates are higher in the future. From these analysis it was concluded that the surrounding environment of these agents and drivers is very heterogeneous and present specific characteristics of the area:

- land tenure status,
- illicit markets,
- speculation with the land resources,
- incentives for agriculture, livestock and industrial uses of the land and
- the development of the population growth and the agricultural and livestock production associated

During the historic period taken as reference, the deforestation was driven by speculation on lands and migration of small holders practicing subsistence agriculture and cattle ranching that facilitated directly or indirectly the entrance of persons/entities with higher economic power in the area. These economically more powerful actors invested in cattle ranching as activity for generating profit while revalorized the land. In many cases, big landowners bought or took through coercion the land from smallholders and subsistence agriculture/cattle ranchers.

The region has experienced changes from the decade of '80s and land has been distributed unequally. This has favoured the development of cattle ranching of middle/big scale over the production of milpa systems (maize), which are activities associated to lower deforestation rates. The land tenure regime has evolved, but speculations with the land and unregulated areas regarding land ownership have led to high deforestation rates.

The analysis also reveals that forest areas are practically “frontiers” that are exposed to pressures like subsistence agriculture, small, middle and big cattle ranchers, and petrol industry. Usually these agents of deforestation do not have legal titles of the land they manage but they try to obtain advantages from it. Following this procedure, the forestland is converted into permanent pastures through a process that starts with an irregular occupation of land.

All these processes are likely to continue in absence of project activities.

The processes described above would have impacts affecting both social and biodiversity aspects in the project area. On one hand the communities present in the project zone would have access to more land to develop subsistence agriculture, but factually they would act as mere initiators of a process that initiates with deforestation and culminates with the deforested lands being owned by big landowners who

transform the land into grasslands for cattle ranching or other extensive industrial activities such as palm oil plantations. On the other hand, as a consequence of the reduction of forest cover, it is expected that several endangered species like the tapir (*Tapirus bairdii*) and other species with different status under IUCN like the jaguar (*Panthera onca*) depending on habitat consisting of wide expansions of forest will disappear from the region due to habitat loss.

The variables that require primary care to control deforestation, are the prevention of forest fires, institutional presence, migration and water bodies, due to weakness in these variables favors to increase accessibility to the project zone and the creation of new cultivation areas that will be converted to pastoral areas.

The most factors directly responsible in the absence of the project are lack of sustainable livelihood and economic alternatives, lack of funding for infrastructure, health and education programs, and the unsustainable exploitation of natural resources to meet short-term economic and capital needs.

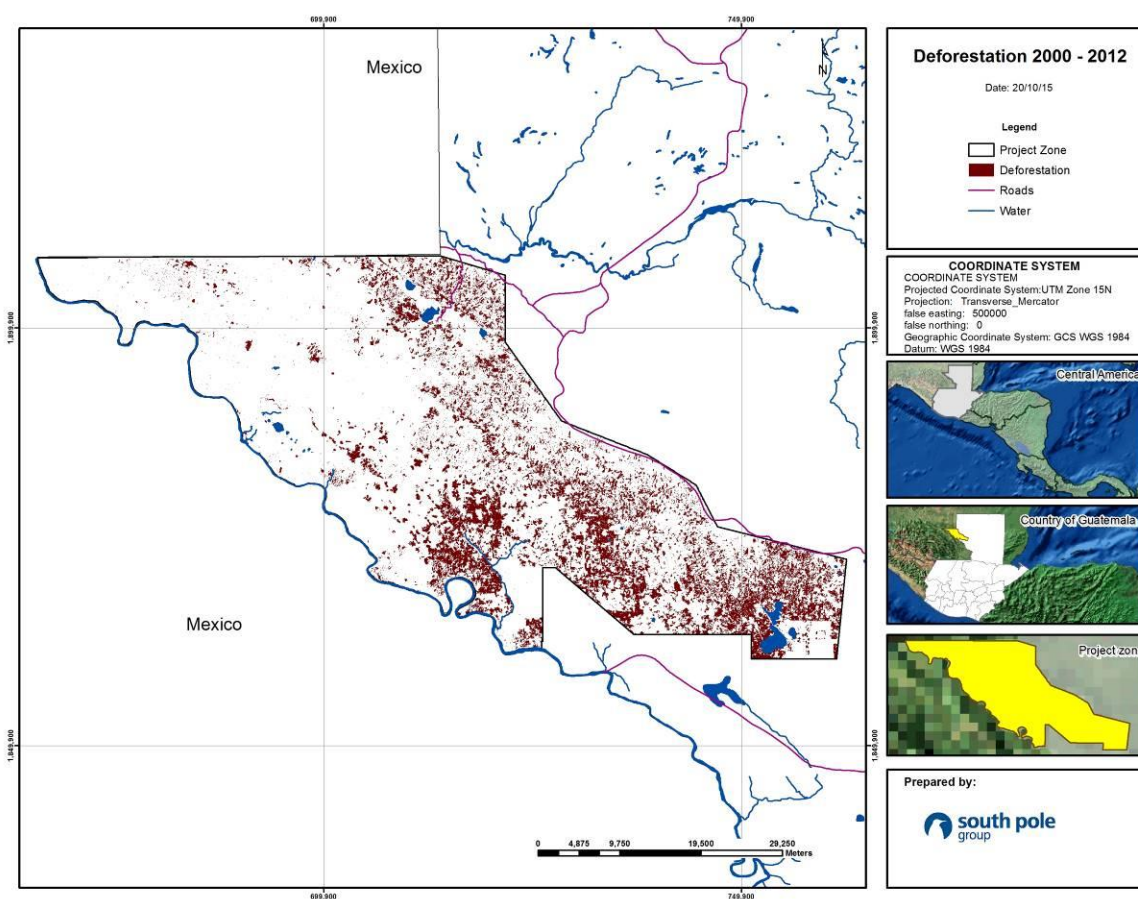


Figure 35. Deforestation of the project zone. Year 2000 - 2012

4.7 Additionality (G2)

G2.2 The additionality section of this project has been developed following the guidance of the “VCS Tool VT0001 VCS AFOLU Additionality Tool V.3.0”.

Applicability conditions:

The AFOLU activities developed as project activities do not represent any violation of the applicable Laws of Guatemala.

Procedure

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

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

Three different real and credible scenarios were identified for the project area in absence of REDD+ activity:

Scenario 1: Continuation of the pre-project land use

Poverty and deforestation may be associated with each other. The lack of alternative work and land use activities creates a restriction that often forces to carry out activities with low incomes. Among these activities is the transformation of forest areas into agricultural, even when they are not suitable for this type of use.

Beyond the deforestation processes occurring currently within the project boundaries, the insufficient control and lack of governability and long term finances in the area may lead to higher deforestation rates in the future. In this scenario the deforestation rates would increase due to:

1. Human migration and the cultivation of basic grains through the process of slash and burn causing the conversion of forest into subsistence agricultural lands and grasslands for subsistence cattle ranching. Until 2003, these actors have become 19.682 ha (10.62%) forest cover to land for agricultural use.
2. Forest fires associated with slash and burn processes, not being controlled affect large areas of forests which were not intended for agricultural activities. Also affected parts of the mountains (serranías in local language) that are extremely fragile and after being burned have very limited possibilities for short-term recovery.
3. Illegal selective logging for commercial timber production is present due to lack of enforcement of applicable laws and regulations, contributing to a continued impoverishment of the biomass stocks and leading to the generation of degraded and deforested lands.

Inside the project zone there are approved sustainably managed forest concessions, but their exploitation might occur illegally and expansion may occur within the borders of the project zone. The cooperation agreements between the government and the inhabitants might not be respected and generate uncertainty in the communities about the ownership and classification of the land, lack of control of the

territory and higher rates of change of land use. Improved road access, and thus increased land rents, could encourage land consolidation, meaning cattle ranching on the one hand or more intensive perennials for market on the other could become the main drivers of land cover change in the area. Or road access could accelerate colonization, expanding the milpa frontier further into the park.

Scenario 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project

This scenario considers the effective protection of the areas designed as “protected areas” and the associated biological corridors identified by the Government of Guatemala. These areas are officially managed by CONAP whereas in the case of SLNP the management is effectively undertaken by FDN, based on an agreement between both institutions. This scenario also considers the halt of the expansion processes of agriculture and cattle ranching areas and the forestry plantations to areas that are not considered in the management plans already approved by the relevant authorities. To the same extent, this scenario considers only those human settlements that already existed before the reserve was created and that remain according to the Decreto 5-90 Art.5-6, but also the enforcement of the law for protected areas (Decreto 4-89) in these communities.

This scenario would be only possible if CONAP and FDN had the capacity on their own and without any external support of executing control on the project area to avoid deforestation processes, the establishment of human settlements and its associated land use/land cover changes. Moreover, would occur if the Government of Guatemala would ensure and grant, without any external help, the enforcement of laws and politics currently available today. This would mean a clear and stable state of governability in the project area.

Nowadays the protection of forests in Guatemala does not consider the stand-alone capacity of the Government of Guatemala or its subsidiary bodies. Rather, the protection of forests and biodiversity is extremely reliant on development aid and conservation programs financed by external actors and often executed by national NGO in coordination with Guatemalan organizations. Thus, even if Scenario 2 is a feasible scenario, the time that it would take for achieving the protection of forests and biodiversity exclusively through funding and capacities stemming from Guatemalan institutions would jeopardize the conservation of forests that are nowadays experiencing relevant deforestation rates.

Scenario 3: Activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU project

The project proposes the coordinated work between communities and FDN through strategies for reduce deforestation in the long term and integrating the institutional strengthening environmental governance and development work in the field with local populations. Similar activities could be found in the area, or at least part of the area, but under external cooperation programmes with limited time financing.

For example, establishing cooperation agreements and developing programs for the sustainable development of the region (outside of SLNP) were funded by Conservation International and the Wildlife Conservation Society within a program with limited time and financing horizon. Also, Rainforest Alliance has had a significant role on actions for preserving forest in the region too, but also included within a program of action with limited time and financing. Even when these activities help reducing the rates of deforestation, they do not tackle the governability and land tenure problems that need to be solved and for which the financial support of the carbon credits can be crucial.

On the other hand, the project proponents are communities represented through the Governance committee which allow the community empowerment and there is no history of this activity in the project zone.

Outcome of Sub-step 1a:

- Scenario 1: Continuation of the pre-project land use.
- Scenario 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project.
- Scenario 3: Activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU project.

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

Scenario 2 and 3 are legal and enforced by mandatory applicable laws and regulations. Nevertheless even acting attending to the requirements of the Guatemalan Law, the deforestation rates occur.

Scenario 1: This scenario does not fulfil the requirements of the law for protected areas, since it is not allowed the change of land use or the development of unauthorized activities in a management plan. It is necessary for external agents with higher financial resources to support the local institutions that apply the legislation.

According to the used tool, any land use scenarios which are not in compliance with applicable mandatory laws and regulations must be removed from the land use scenarios identified in the sub-step 1a, unless it can be shown these land use scenarios result from systematic lack of enforcement of applicable laws and regulations.

In the case of Scenario 1, it is product of the failure to comply with applicable mandatory legislation. It is clear that the regulations for preventing the deforestation in Petén are not enforced as stated by the legislation. It was calculated that during the period 2000-2010 a deforestation rate of 1.8% occurred in areas that, according to the law, would have to be protected by the Government of Guatemala. This deforestation rate demonstrates that, even under the protection of the State of Guatemala deforestation occurs, demonstrating that the Law is not fully enforced. In a more relevant data, it was also demonstrated that from the 44 areas protected or awarded as concessions by the State of Guatemala in the entire reference region considered, 32 of them presented deforestation rates in different degrees while they should be protected (this is, deforestation rates should be zero). This implies that in 72% of these areas the control exerted by the state or its subsidiaries is not enough and suggest that more resources are needed. The areas in which no deforestation has been observed coincide with areas that present almost no accessibility to deforestation agents.

Outcome of Sub-step 1b:

- Scenario 1: Continuation of the pre-project land use.
- Scenario 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project.
- Scenario 3: Activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU project.

Sub-step 1c. Selection of the baseline scenario

Barrier analysis is used to identify the most likely baseline scenario.

Step 2. Investment analysis

NA

Step 3. Barrier analysis

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

Investment barriers

CONAP is the entity that manages the MBR, where SLNP is located. Its operational capacity is limited by a budget about \$ 1.78 million per year, which represents only 30% of optimal budget, as calculated by the regional office of CONAP, which would enable effective management of the MBR. Of this total, 70% is allocated to the MBR administration, 24% to the protection and restoration of the Laguna del Tigre National Park, and 6% to the promotion of the Patrimonial Fund for Yaxha-Nakum-Naranjo Park. More than 60% of the budget goes to personnel, so there are few funds for other ordinary expenses or investments on monitoring, research or restoration of biological resources. In addition, CONAP administers 32% of the national territory declared protected area, with an approximate budget allocation of 0.001% of the General Budget of the Nation.

Based on documented data, the budget for the protected area SLNP was almost US \$ 750,000 for 2003. Of this amount, US \$ 100,000 were for the archaeological site of Piedras Negras, about US \$ 19,000 to purchase equipment and approximately US \$ 83,000 to park protection (i.e., rangers salaries, patrols, training), food and fuel. The rest were funds to operations and payment of other staff. This budget is not sufficient to reduce deforestation rates.

Conservation initiatives depend, with few exceptions, of the external financing of projects, which can not meet the costs of management functions such as monitoring, prevention and control of fires, and surveillance. This dependence on external sources is a disincentive for that the government assume its responsibility for funding management.

In addition, FDN has no own financial funds for the administration of SLNP, and depends on projects with limited funding and time. Without these external financing it would be difficult the administration of SLNP for FDN.

Institutional barriers

Guatemalan State characterizes by huge deficiencies in its institutional structure. Corruption in public administration is one of the features that has been present as a constant in the governments, in collusion with private actors, benefiting the private use of Public Management. The concern increases when corruption attack public finances, especially, the management and use of public resources, mainly from the taxes.

In the Guatemalan context, it is possible to identify six ways that lead to corruption: a) outdated legislation; b) weak institutions; c) deficient access to public information; d) low citizen participation; e) existence of conflict of interest; and f) impunity⁹⁵.

The Law of Protected Areas, through Article 57, provides the ability to CONAP to form associations and formal partnerships with civil society (NGOs, communities and other groups) to develop research, conservation and resource natural management in the MBR and the SLNP. Through these partnerships the concept of co-management of protected areas arises between CONAP and NGOs, by which the technical, financial and administrative responsibilities are shared. This is the case of the SLNP and forming coadministration between CONAP and FDN.

However, institutional presence is not enough to cover the entire park. The lack of State presence in remote areas of national territory means a lack of control under the natural resources, as well as deficient supervision of economic activities.

According to the “Manual for Forest Management in Protected Areas”⁹⁶, the land use change for agricultural projects in plots with no more than five hectares continuous of forest cover is allowed. Nevertheless, the ability of forest recovery is very low (about 30%), and recovery of biodiversity is complex. In relation to the processes of forest management and reforestation of denude areas without forest cover, there are incentive forest programs, which are a reference to counter environmental degradation, this is evidence that more efforts in institutional and economic resources are needed and that the state should allocate to these programs⁹⁷.

In addition, another factor is mistrust in the entities that manage protected areas, together with policy of evictions, States of Siege and lack of attention from the relevant public bodies to communities for years have also led to mistrust institutions trying to negotiate their stay in protected areas⁹⁸.

Technological barriers

This barrier is linked to Investment barrier, where protected areas present a lack of necessary and sufficient resources to acquire equipment and tools, which is reflected in monitoring and surveillance process.

Most projects are carried out with external financial. Monitoring deforestation is performed with remote sensing. However, additional investigation in the field is needed. This includes, for example, the determination of biomass or the detection of changes of land-use. While for large scale instance, deforestation can be quite easily detected with remote sensing, but degradation of forests can hardly be

⁹⁵ OXFAM, 2015. La Corrupción. Sus caminos, su impacto en la sociedad y una agenda para su eliminación. Guatemala. Available at: https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/ints_la_corrupcion_sus_caminos_su_impacto_en_la_sociedad_y_una_agenda.pdf

⁹⁶ Consejo Nacional de Areas Protegidas (CONAP). 2012. Manual para la Administración Forestal en Áreas Protegidas. Guatemala Government.

⁹⁷ Secretaría de Planificación y Programación de la Presidencia (SEGEPLAN). 2013. Plan de Desarrollo Integral de Peten 2032. Gobierno de Guatemala. Available at: http://www.sgp.gob.gt/documentos/pdi_petrn_2032_plan_vf.pdf

⁹⁸ Peace Brigades International. 2014. Petén: comunidades desplazadas en áreas protegidas. Available at: http://www.pbi-guatemala.org/fileadmin/user_files/projects/guatemala/files/english/140123_Peten_Comunidades_desplazadas_en_areas_protegidas.pdf

discovered with medium high resolution pictures. Unfortunately, the use of higher resolution data has also higher costs, and it is impossible to obtain for the project at the present.

Barrier related to local tradition

Despite the biological importance and its designation as a core conservation zone, the SLNP experiences some of the highest rates of population growth, land invasions, and agricultural expansion in Petén. The rural economy revolves around subsistence maize production. Most of the settlers arrived in the Park since 1988. Following decades of high internal displacement due to a protracted civil war, Q'eqchi' colonization of the park increased during the 1990s (Carr, 2004).

Over half of Petén's forests have been eliminated during the past forty years. Most of the forest elimination was caused by Ladino and Q'eqchi' small farmers, the two main groups inhabiting the Petén. Some research has suggested that the Q'eqchi' are more destructive of the forest environment than other ethnic groups farming in Petén. Q'eqchi' farmers have tended to settle remote regions and cleared forest at a rapid pace to open up land for maize agriculture.

Barriers due to social conditions and land-use practices

Until the 50s, Peten was a jungle territory, cover 90% by forest, with minimal presence of Maya Q'eqchi population 'who had migrated from Alta Verapaz from the late 19th century. In 1959 was created the "Empresa de Fomento y Desarrollo de Petén - FYDEP" (Promotion Enterprise and Development of Peten), mandated to "colonize the department and generate agricultural development".

The overall average size of plots delivered by FYDEP was 91 ha per plot (or 2 "caballerizas"⁹⁹ in local language). Areas suitable for agriculture had smaller areas than those suitable for farming¹⁰⁰.

During this colonization, Arroyo Yaxchilan region was one of the regions recorded greater development, partly by presenting an increased agricultural productivity resulting from its fertile alluvial soils. The socio-economic development of the park has been strongly influenced by the construction of two roads: Bethel route along the southern boundary of the park, and Naranjo route border along the eastern boundary of the park.

Human migration and the cultivation of basic grains through the process of slash and burn the the forest are the causes of greater impact on the natural landscape of the SLNP. Furthermore, when the capacity of the soil decreases, these areas are converted to pasture for cattle production.

Barriers relating to land tenure, ownership, inheritance, and property rights

There are different classification about land tenure and communities living in the SLNP:

- Communities already relocated outside the "Intangible Zone" or "Recovery Zone" of the SLNP.
- Communities which have signed Cooperation Agreements, enabling the permanence of communities in areas under certain conditions, as establish the delimitation of their respective

⁹⁹ 1 caballeriza equals 45 hectares

¹⁰⁰ Grünberg, Jorge *et al.* 2012. Tierra e Igualdad. Desafíos para la Administración de Tierras en Petén, Guatemala. Available at:
https://nas.ucdavis.edu/sites/nas.ucdavis.edu/files/attachments/tierra_e_igualdad_final.pdf

polygons and the adoption of practices that contribute to halt the advance of agricultural frontier and degradation natural resources of the area.

- Communities in process to sign Cooperation Agreements.
- Communities with private properties.
- Communities with pending legal proceedings. This category includes those community groups that establish new settlements by force.

There are still communities that have not adapted its permanence within the park boundaries. In addition, SLNP presents constant risk of invasions. One strategy of the project seek enforcing the currently applicable Guatemalan Law on Protected Areas, through securing land use rights for communities that have historic land rights within the park.

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

The identified barriers would not prevent the continued use pre- project land use scenario. However, the scenario 2 and scenario 3 are prevented by institutional barriers (lack of control) and investment barriers (projects with limited time and budget execution) respectively. The baseline scenario selected is the Scenario 1: Continuation of the pre-project land use.

Step 4: Common practice analysis

CONAP and FDN have had the goal to reduce deforestation in MBR and SLNP. Previous projects with different institutions have promoted agroforestry as attractive alternatives for sustainable use of natural resources, training families in the areas of agroforestry and organic agriculture for their livelihood activities. There are some good examples of activities undertaken in the past and that have strong influence on the deforestation rates that the area experiences while, at the same time, handling both socio-economic and biodiversity aspects linked to the communities. However, all these experiences and lessons are pilot projects of great importance, as they serve as examples to develop this type of activity in the "Lacandon - Forests for life project". All programs developed where short-term (2-3 years) with limited financial support, involving farmers training and the installation of agroforestry systems, but do not take into account the monitoring process. Moreover, as pilot projects they do not involve all communities and / or private properties; in contrast to the present project.

In addition, the project will develop activities beyond those that had historically been developed in the project area by the FDN and/or CONAP or will give continuity to those activities that are currently financed by specific programmes and that have a specific time horizon beyond which there is no financial resource available for. During the last years the world economic crisis has limited the access that the region of Petén has had to funding for developing activities focusing on reducing deforestation and ensuring the sustainable development of the region.

Furthermore, exists selective and ilegal extraction of timber and non-timber natural resources (common practice). For timber species, the project proposes the sustainable forest management in communities within the protected area and for non-timber species, such as xate, it will incorporate market studies and potentially the establishment and improvement of local to international value chains.

As mentioned above, a common barrier is the specific time horizon and short life cycle for all initiatives existent where it is not possible to measure the real impact of the project on the quality of life of the population. This is exceeded by the long-term (30 years) of the REDD+ project.

Limiting access to forest land, discouraging the adoption of livestock, particularly in consonance with land titling programs, encouraging more diverse and intensive agricultural practices, and promoting rural development such as improved education, health care (including reproductive health), and alternative employment will be effective policies to reduce deforestation. The project costs will be generated by the additional investment on adjusting current uses and land use rights to applicable legislation, programs of forest protection and biodiversity, promotion of familiar systems for sustainable production, diversification and use of communal forestry resources, improved management of the SLNP, programmes of dialog with communities including capacitation and education and on programs of health in communities.

This additionality analysis reflects that the proposed VCS AFOLU project activity is not the baseline scenario and, hence, it is additional.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS (CLIMATE)

The complete details of the ex-ante baseline emissions quantification procedure and how it follows every step of VM0015 methodology are described in detail in the VCS Technical Annex. Please refer to this Annex to full description and detailed information.

5.1 Project Scale and Estimated GHG Emission Reductions or Removals (CL2)

Project	X
Large project	

Years	Estimated GHG emission reductions or removals (tCO ₂ e)
2012	83.291,0
2013	116.838,0
2014	106.833,0
2015	157.108,0
2016	146.875,0
2017	137.160,0
2018	178.961,0
2019	249.305,0
2020	279.724,0
2021	330.091,0
2022	358.356,0
2023	451.589,0
2024	460.924,0

Years	Estimated GHG emission reductions or removals (tCO ₂ e)
2025	558.631,0
2026	544.304,0
2027	538.409,0
2028	521.442,0
2029	396.687,0
2030	388.952,0
2031	332.366,0
2032	315.598,0
2033	225.574,0
2034	121.363,0
2035	67.518,0
2036	31.253,0
2037	22.285,0
2038	16.860,0
2039	12.464,0
2040	9.425,0
2041	6.081,0
Total estimated ERs	7.166.267,0
Total number of crediting years	30
Average annual ERs	238.875,6

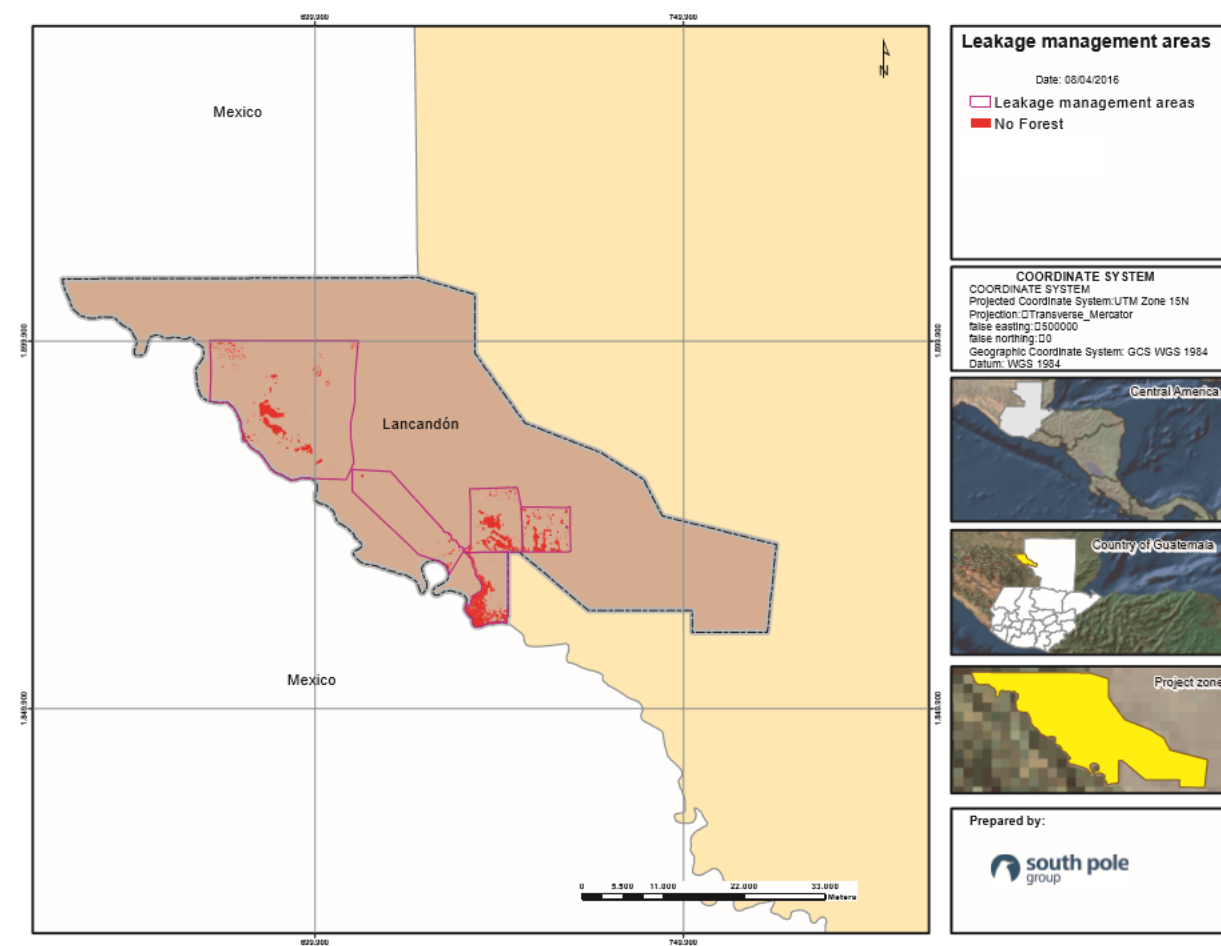
5.2 Leakage Management Areas (CL3)

CL3.2 The leakage management plan focuses on implement project activities in the non-forest areas. This project understands that leakage management will be a very important component of the emissions reductions effectively achieved by the proposed activities. Therefore, the project will undertake leakage mitigation activities in the so-called leakage management areas. These activities aim to reduce the impacts of deforestation agents that will leave the project area in the project scenario to maintain their current activities, generating CO₂ emissions elsewhere. This project has considered leakage management activities that in some cases are coincident with activities that will be also implemented within the project zone as project activities.

Leakage mitigation strategies for the project include afforestation/reforestation activities, agroforestry, sustainable agriculture, silvopastoral systems and the establishment of forest patrols; all which will improve socio-economic status and the strengthening of governance. Productive activities enable communities to have another source of income (not derived from illegal logging) and have access to certain commodities. The strengthening of local governance improves the ability of the community

councils to manage local participation in project activities and to effectively distribute the economic benefits. Finally, the presence of forest patrols may discourage illegal logging in the leakage area that directly borders the project area boundaries.

The leakage management areas correspond to non forest areas. Project activities are being implemented in communities where there is a legal land tenure, for which the displacement of these communities is considered low (FDN). The map was developed considering the non forest areas within Unión Maya Itzá, Técnica Agropecuaria, La Lucha cooperatives and FDN properties, Centro Campesino and Naranjitos. The leakage management area is 4764,62 ha.



5.3 Baseline Emissions (CL1)

CL1.1 Average carbon stocks were estimated for the forest classes existing within the project area, the forest classes existing within the leakage belt, the post-deforestation classes projected to exist in the project area in the baseline case, the post-deforestation classes projected to exist in the leakage belt in the project case; and the non-forest classes existing in leakage management areas. Data were obtained from inventories undertaken in the region under the requirements of the methodology VM0015. The technical details of these processes are described in detail in section 2 of the VCS Technical Annex

The Table 23 in Section 5.3.5 shows the Institutions that collaborated on the calculation of the carbon stocks in the different forest types.

Data Sources

The images used for the analysis of historical deforestation between 2000-2007 and 2007-2010 are Landsat Thematic Mapper (30m resolution) and Landsat Enhanced Thematic Mapper. The poor availability of images from 2005 prevented their use. The failure of the scan line corrector on ETM in 2003 forced to use a gap-fill technique using other images for correcting the scan line errors found in the images between 2003-2010. The full list of the images used is presented in Table 5 of VM0015.

Defining LU/LC

The project defined 18 LU/LC classes. The classes are divided by patterns of rainfall (humid vs. sub-humid) as an additional differentiator between them. The “Agropecuário-No Bosque Guamiles” (ANG) class is the non-forest class arising from the conversion of native forests to non-forest classes.

1. Agriculture – Non forest – Guamiles / humid
2. Agriculture – Non forest – Guamiles / sub-humid
3. Pine Mixed forest / humid
4. Broadleaf forest low / humid
5. Broadleaf forest low / sub-humid
6. Broadleaf forest medium-high / humid
7. Broadleaf forest medium-high / sub-humid
8. Wetlands / humid
9. Wetlands / sub-humid
10. African oil palm / humid
11. Regeneration 2000-2007 on land without forest since 2000 and remaining in 2010
12. Regeneration 2007-2010 on land without forest 2000-2007
13. Regeneration 2007-2010 on land without forest since 2000
14. Savannas / humid
15. Savannas / sub-humid
16. Flooded savannas / humid
17. Flooded savannas / sub-humid
18. No data
19. Water

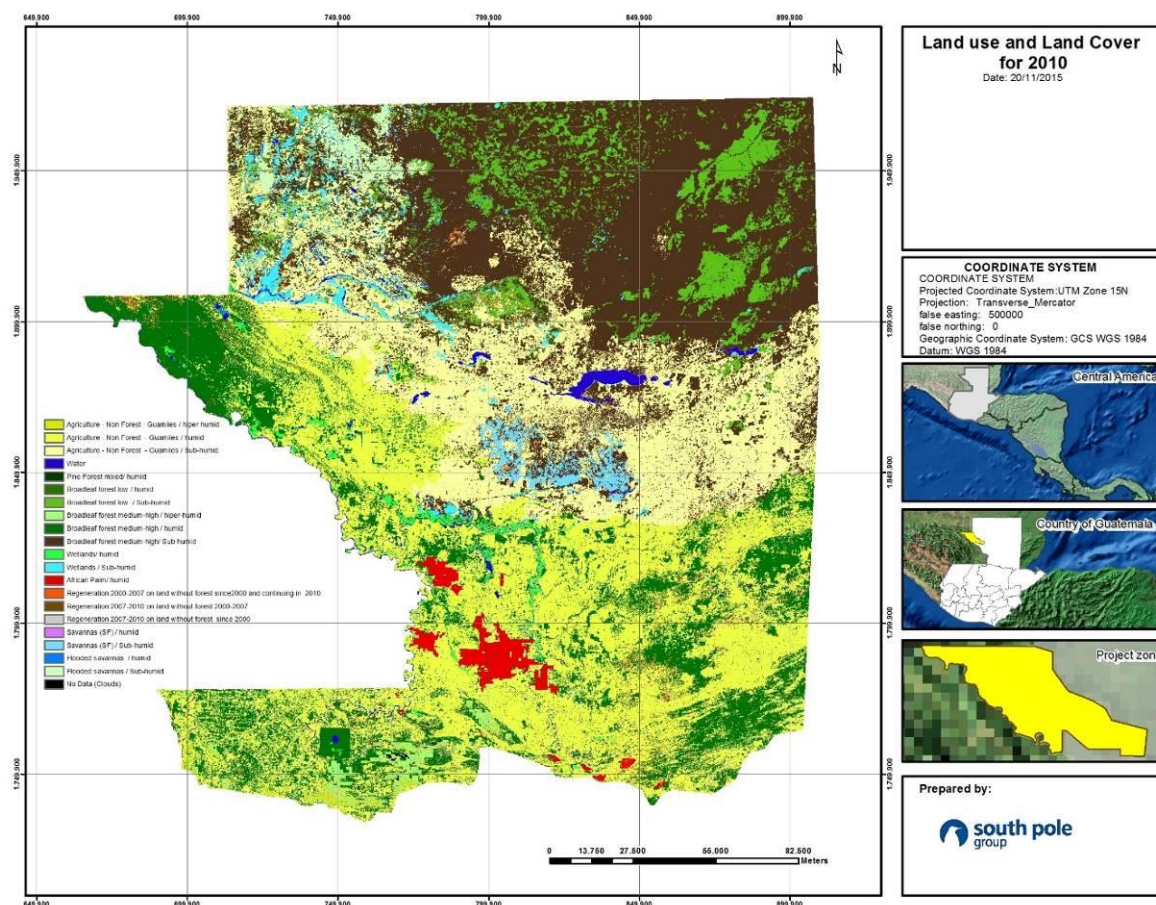


Figure 37. Land use and Land cover map of the reference region in 2010

The combination between the deforestation map 2000-2007-2010 in Figure 38 with the LU/LC classes from Figure 37 create a LU/LC change map presented in Figure 39.

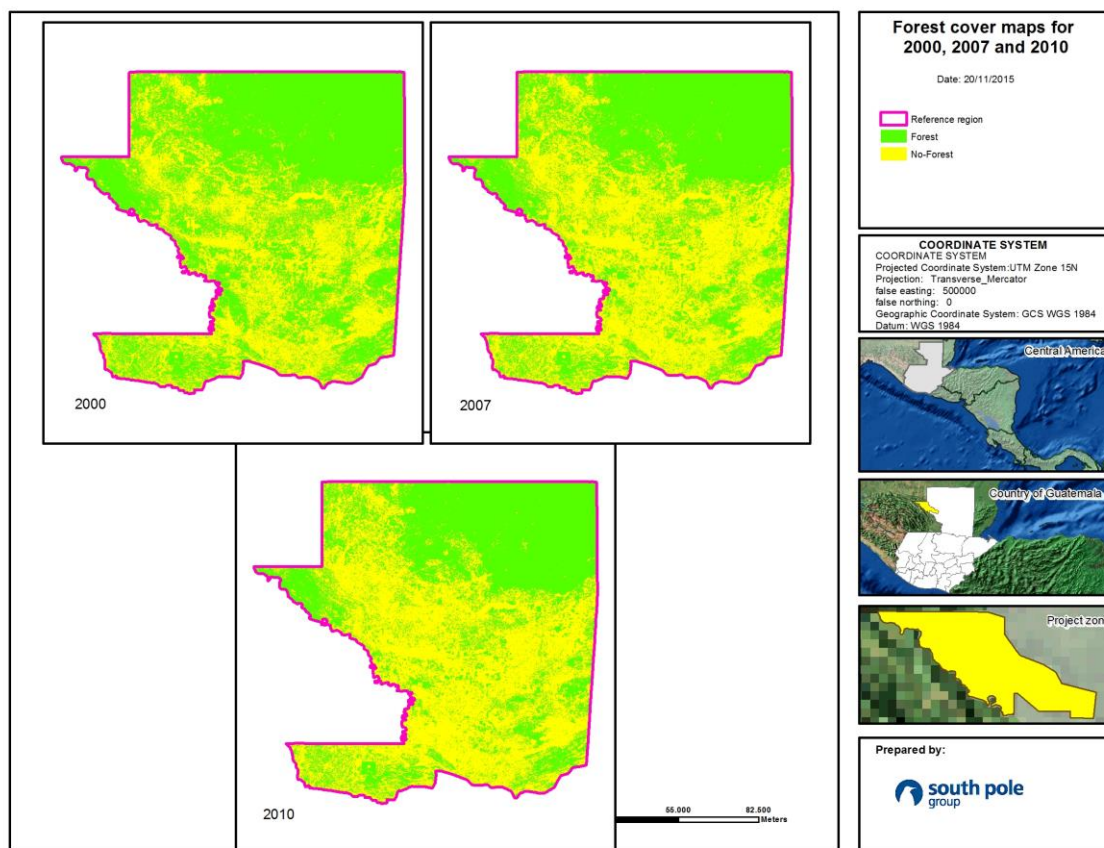


Figure 38. Changes in forest/non forest between 2000-2007-2010

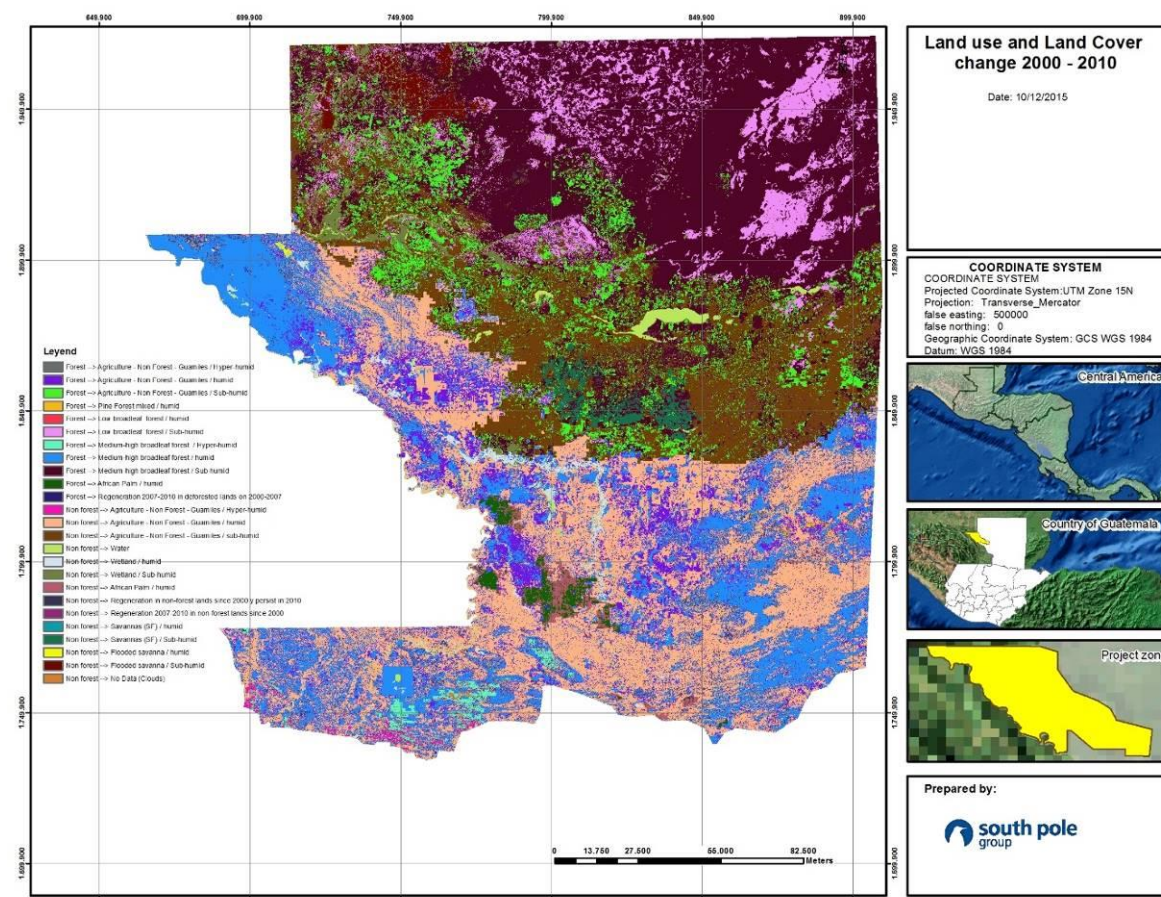


Figure 39. Land use and Land cover change 2000-2010

The transition between forest to non-forest classes are presented below. For detailed processing, please refer to the VCS Annex.

Table 12. Simplified Land cover change matrix 2000-2010 / Forest to non forest classes

Final classes	Initial classes					Total
	Pine Mixed forest humid /	Broadleaf forest low / humid	Broadleaf forest low / sub-humid	Broadleaf forest medium-high / humid	Broadleaf forest medium-high / sub-humid	
Agriculture – Non forest – Guamiles / humid	3,665.5	49.7		251,459.9		255,175.1
Agriculture – Non forest – Guamiles / sub-humid			19,667.0		214,143.2	233,810.2
Pine Mixed forest / humid	2,313.5					2,313.5
Broadleaf forest low / humid		116.4				116.4

Final classes	Initial classes					Total
	Pine Mixed forest humid	Broadleaf forest low / humid	Broadleaf forest low / sub-humid	Broadleaf forest medium-high / humid	Broadleaf forest medium-high / sub-humid	
Broadleaf forest low / sub-humid			237,665.3			237,665.3
Broadleaf forest medium-high / humid				577,410.8		577,410.8
Broadleaf forest medium-high / sub-humid					1,071,072.0	1,071,072.0
Degraded to non forest (Richard hurricane) / sub-humid			68.2		2,747.0	2,815.2
African oil palm / humid				25,227.8		25,227.8
Regeneration 2007-2010 on land without forest 2000-2007		3.5	166.1	18,612.0	5,172.4	23,954.0
No data				991.1		991.1
Total	5,979.0	169.6	257,566.5	873,701.6	1,293,134.6	2,430,551.2

Please refer to the Annex for the Map accuracy assessment. Overall forest cover benchmark map accuracy is estimated in 92.9%, while the class accuracy for the forest LU/LC class is 86.2% and non-forest is 87.4%. These values are sufficient to meet the requirements of VM0015.

The carbon stocks existing in each forest class in the project area prior to the year of baseline deforestation were calculated according to the requirements of the VM0015, assuming that carbon stocks and boundaries of the forest-classes remain the same. Regarding forest areas that are explicitly considered in the methodology as special cases, more detailed information is provided below.

- Project areas that are degrading and losing carbon stocks at the moment of the characterization of the baseline.
- Project areas that are increasing their carbon stocks.
- Project areas in which carbon stocks are decreasing more in the project case than in the baseline case.
- Project areas in which logging activities are undertaken in the baseline scenario.

Tables 15.a and 15.b of the Methodology were used for reporting the results of the special cases. Carbon stocks in the harvested wood products were estimated as the sum of planned and unplanned harvesting activities in the baseline case and the additional volume harvested prior to the deforestation event in year t* (if applicable).

The calculation of carbon stocks in the leakage belt in the baseline scenario consisted on the characterization of each forest class and was summarized in Table 15.b of the methodology. Carbon values were assumed to remain constant in time, except in some special cases that are described below:

- forest within certain polygons of the leakage belt is growing and carbon stocks are increasing
- forest within certain polygons of the leakage belt is degrading and losing carbon stocks

5.3.1 Projection of the quantity of future deforestation

CL2.2 The reference region was stratified into three strata and will be able to calculate the historical trend of deforestation. Its objective is to locate in space and time the baseline deforestation expected to occur within the reference region during the first fixed baseline period and, optionally, the project crediting period. For detailed information, please refer to Step 4 of VCS Technical Annex. The final result of this section are the estimated annual areas of future deforestation in the project area

Table 13. Description of the Stratum in the reference region

Stratum ID		Description	Fixed Area ha
ID _i	Name		
1	Stratum 1 – Maya Biosphere Reserve (with exclusions)	The stratum includes the MBR minus the buffer zone. It includes all concessions, cultural areas, biological corridors, and areas of strict protection.	1,624,422.0
2	Stratum 2 – The Buffer Zone	It is the buffer zone of the Maya Biosphere Reserve, which allows agriculture and other uses by the population near the reserve.	463,815.7
3	Stratum 3 –Tierras Bajas del Norte	Corresponds to the remainder of the reference region without Stratum 1 or 2.	2,036,754.7

Table 14. Deforestation rates within each Stratum in 2000–2007, 2007-2010 and 2000-2010

ID	RBSLRR, 2000-2007	RBSLRR, 2007-2010	RBSLRR, 2000-2010
Stratum 1	-0.58%	-1.53%	-0.87%
Stratum 2	-5.31%	-9.06%	-6.43%
Stratum 3	-4.57%	-5.24%	-4.77%

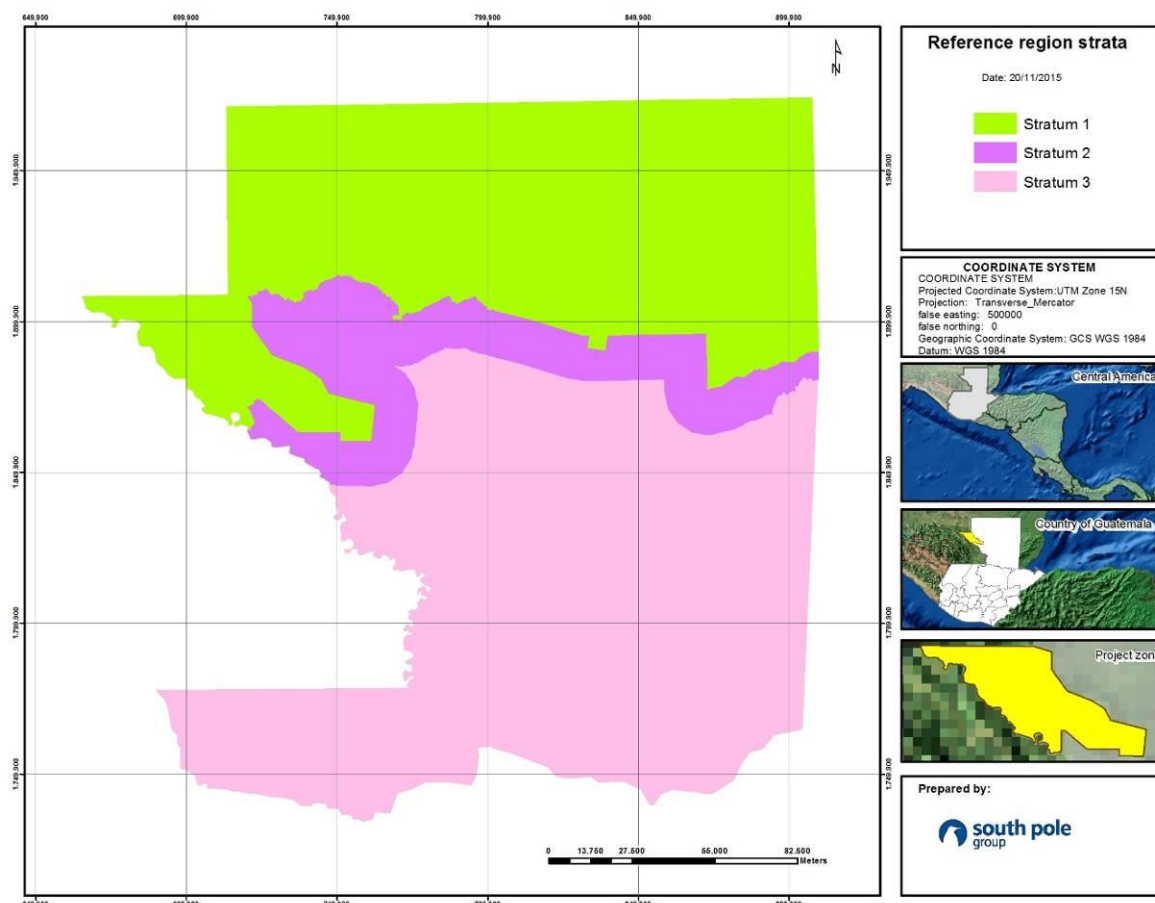


Figure 40. Strata of the VCS reference region

The VM0015 methodology offers three options for calculating the projected area of future deforestation, a) a Historical Average approach, b) a Time Function approach, and c) a Modelling approach. For stratum 1 the project uses b) a Time Function approach, which uses and justifies a relationship between the annual areas of deforestation and the pass of time. Stratum 2 and Stratum 3 use the a) the Historical Average approach because there is a reason to believe that the deforestation rate may stop rising during the project lifetime due to lack of forest land, and therefore a historical average may be more accurate. The calculations are shown in the VCS Annex to PD.

Approach “a”: Historical average

In the equation proposed in the methodology VM0015, $ABSLRR_{i,t}$ corresponds to the area of annual forest loss as result of applying the average rate of deforestation ($RBSLRR_{i,t}$) multiplied by the area of forest “available” ($ARR_{i,t-1}$) at the beginning of each year crediting period.

$$ABSLRR_{i,t} = ARR_{i,t-1} * RBSLRR_{i,t}$$

Deforestation rates 2000-2010 are used in the stratum 2 and stratum 3 corresponding to -6.43% and -4.77% respectively.

As the project start date is February 1, 2012, a discount of 8.49% to the value of $ABSLRR_{2,2010}$ and $ABSLRR_{3,2010}$ is applied to recalculate a new annual rate applicable only to the first year of modeling. This average discount rate corresponds to the 31 days between the start of the calendar year and 1 February. For stratum 2 results in deforestation rate of -5.89% and for stratum 3 results in -4.37%. For other years, the initial rates remains.

The following table shows the application rate for the period 2000-2010 for stratum 2 and 3 for the crediting period of the project. Forest 1 corresponds to the area of forest at the beginning of the year and Forest 2 corresponds to the surface remaining at the end of the year after the loss of area due to the deforestation rate of the year in which it is located.

Table 15. Projection of deforestation in Stratum 2

Project year t	Forest 1 (ha)	Forest 2 (ha)	$ABSLRR_{2,t}$ (ha)	Annual deforestation rate
1	110.828,16	104.304,45	6.523,71	-5,89%
2	104.304,45	97.594,90	6.709,55	-6,43%
3	97.594,90	91.316,95	6.277,95	-6,43%
4	91.316,95	85.442,84	5.874,11	-6,43%
5	85.442,84	79.946,60	5.496,25	-6,43%
6	79.946,60	74.803,90	5.142,69	-6,43%
7	74.803,90	69.992,02	4.811,88	-6,43%
8	69.992,02	65.489,67	4.502,35	-6,43%
9	65.489,67	61.276,94	4.212,73	-6,43%
10	61.276,94	57.335,21	3.941,74	-6,43%
11	57.335,21	53.647,03	3.688,18	-6,43%
12	53.647,03	50.196,10	3.450,93	-6,43%
13	50.196,10	46.967,15	3.228,94	-6,43%
14	46.967,15	43.945,91	3.021,24	-6,43%
15	43.945,91	41.119,02	2.826,89	-6,43%
16	41.119,02	38.473,98	2.645,05	-6,43%
17	38.473,98	35.999,08	2.474,90	-6,43%
18	35.999,08	33.683,38	2.315,70	-6,43%
19	33.683,38	31.516,64	2.166,74	-6,43%
20	31.516,64	29.489,28	2.027,36	-6,43%
21	29.489,28	27.592,34	1.896,95	-6,43%
22	27.592,34	25.817,41	1.774,92	-6,43%
23	25.817,41	24.156,67	1.660,75	-6,43%
24	24.156,67	22.602,75	1.553,92	-6,43%
25	22.602,75	21.148,79	1.453,96	-6,43%
26	21.148,79	19.788,36	1.360,43	-6,43%

Project year t	Forest 1 (ha)	Forest 2 (ha)	ABSLRR _{2,t} (ha)	Annual deforestation rate
27	19.788,36	18.515,44	1.272,92	-6,43%
28	18.515,44	17.324,41	1.191,04	-6,43%
29	17.324,41	16.209,99	1.114,42	-6,43%
30	16.209,99	15.167,26	1.042,73	-6,43%
	15.167,26			

Table 16. Projection of deforestation in Stratum 3

Project year t	Forest 1 (ha)	Forest 2 (ha)	ABSLRR _{3,t} (ha)	Annual deforestation rate
1	531.726,48	508.515,29	23.211,19	-4,37%
2	508.515,29	484.257,03	24.258,26	-4,77%
3	484.257,03	461.155,99	23.101,04	-4,77%
4	461.155,99	439.156,97	21.999,02	-4,77%
5	439.156,97	418.207,39	20.949,58	-4,77%
6	418.207,39	398.257,19	19.950,20	-4,77%
7	398.257,19	379.258,69	18.998,49	-4,77%
8	379.258,69	361.166,50	18.092,19	-4,77%
9	361.166,50	343.937,39	17.229,12	-4,77%
10	343.937,39	327.530,17	16.407,22	-4,77%
11	327.530,17	311.905,64	15.624,53	-4,77%
12	311.905,64	297.026,47	14.879,17	-4,77%
13	297.026,47	282.857,09	14.169,38	-4,77%
14	282.857,09	269.363,65	13.493,44	-4,77%
15	269.363,65	256.513,91	12.849,75	-4,77%
16	256.513,91	244.277,15	12.236,76	-4,77%
17	244.277,15	232.624,13	11.653,02	-4,77%
18	232.624,13	221.527,01	11.097,12	-4,77%
19	221.527,01	210.959,27	10.567,74	-4,77%
20	210.959,27	200.895,65	10.063,62	-4,77%
21	200.895,65	191.312,10	9.583,54	-4,77%
22	191.312,10	182.185,74	9.126,37	-4,77%
23	182.185,74	173.494,73	8.691,00	-4,77%
24	173.494,73	165.218,32	8.276,41	-4,77%
25	165.218,32	157.336,74	7.881,59	-4,77%
26	157.336,74	149.831,13	7.505,60	-4,77%
27	149.831,13	142.683,57	7.147,56	-4,77%

Project year t	Forest 1 (ha)	Forest 2 (ha)	ABSLRR _{3,t} (ha)	Annual deforestation rate
28	142.683,57	135.876,98	6.806,59	-4,77%
29	135.876,98	129.395,10	6.481,89	-4,77%
30	129.395,10	123.222,42	6.172,67	-4,77%
	123.222,42			

Approach “b”: Time function approach

The use of this approach is applicable only if there are several observations of deforestation in a historical reference period and allows to generate a regression model type: Deforested area = f (time). The project utilized a study from CEMEC that assessed land cover change from 1986-2010, and from which the data from 2000-2010 was extracted to correspond with the VCS historical deforestation period. Therefore, it was necessary to create a historical series of "forest" - "non-forest" coverage maps that allow calculate deforested areas in various periods of time for Stratum 1. The data from 2000-2010 was used to construct a linear regression.

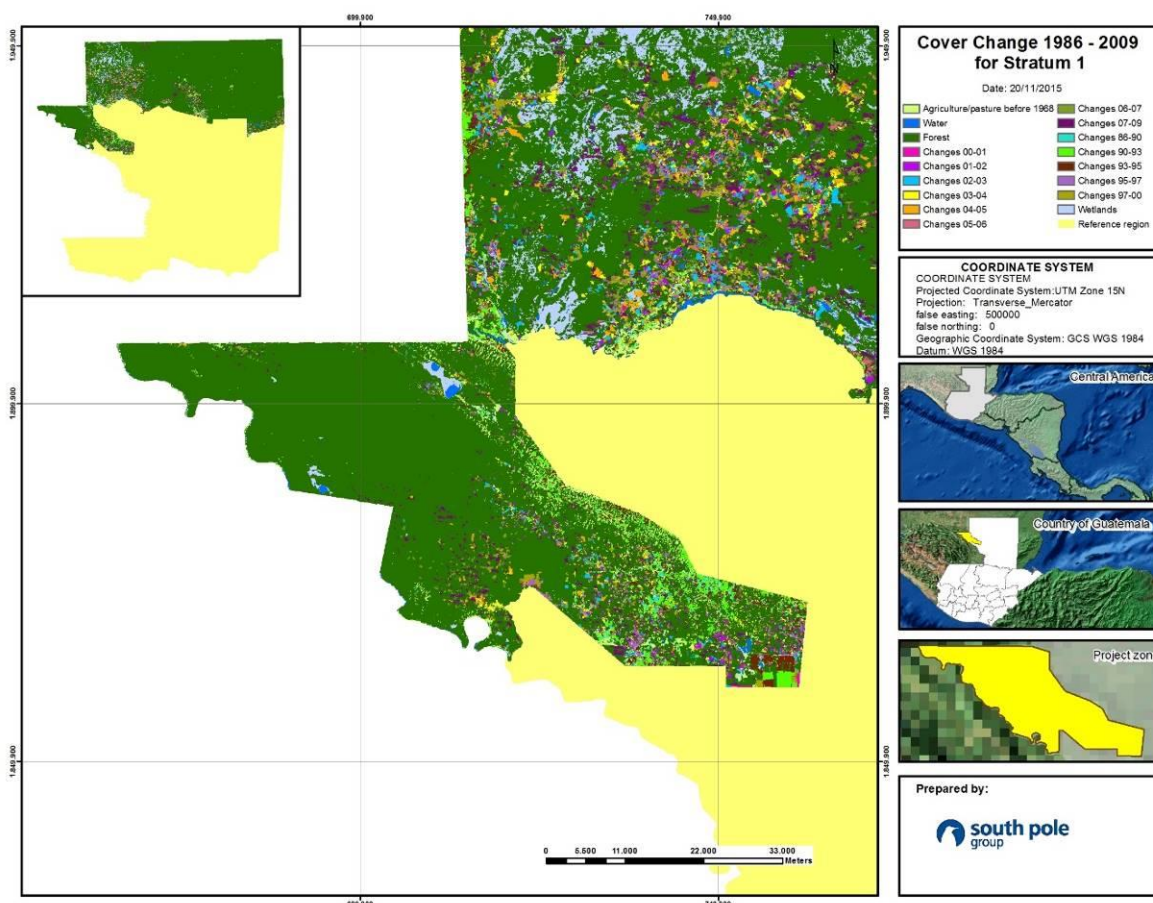


Figure 41. Cover change map 1986 – 2009 for Stratum 1

For this stratum a Linear regression was used with the following variables:

Time function for Stratum 1 – Reference region

$$ABSLRR_{i,t} = 1,225.37x - 2,447,617.33$$

Where:

x = year (2012, 2013, etc)

ABSLRR_{i,t} = deforested hectares (ha)

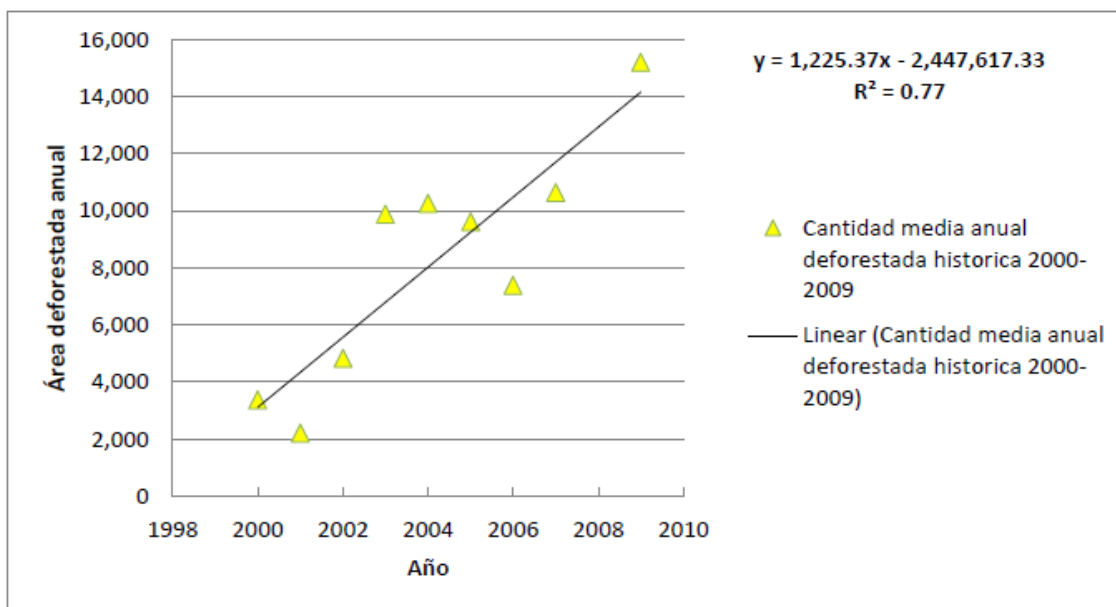


Figure 42. Graphical representation of annual time-step data of forest cover loss 2000 - 2010

Once the time function for stratum 1 is developed, VM0015 requires that it be used to project future deforestation within the stratum. However, this is an intermediate step since VM0015 requires that a “Constraint Analysis” be produced and applied when the Time Function (Approach “A”) is used. This analysis subjects the linear regression to an analysis of whether there are constraints that would limit the continual upward trend in deforestation.

The following biophysical and socioeconomic variables that restrict land use by groups of agents of deforestation were considered (The full analysis is presented in section 4.2 of the VCS Technical Annex):

- Land aptitude: it was anticipated that areas most suitable for agriculture and livestock could be the most sought by agents of deforestation.
- Slope: steeper slope impede the development of livestock and agriculture

- Water availability: this is a limiting factor for crops and especially for livestock. In Petén calcareous soils are very dry during the dry season.
- Access: usually near roads areas are preferred by agents of deforestation.
- Control and surveillance: as mentioned in the analysis of agents and causes of deforestation, the identified agents seek the border areas with low institutional control

The constraints analysis required by the methodology creates three suitability classes, optimal, average, and sub-optimal, within which the rate of projected deforestation is expected to decrease successively.

- o The “Optimal” class is projected to be fully deforested in year 14 of the project.
- o The “Average” class uses the deforestation projection applied to the last year of the “Optimal” class and maintains it constant for three years - the time needed to fully “consume” it with this assumption.
- o The area of land that remains in the “sub-optimal class” is projected to be deforested according to a 20-year decay function until the project crediting period ends defined in VM0015. Not all the sub-optimal class is deforested in baseline.

Table 17. Projected annual deforestation within the reference region in the baseline

Project year t	Stratum i in the reference region			Total	
	1	2	3	annual	cumulative
	$ABSLRR_{1,t}$ ha	$ABSLRR_{2,t}$ ha	$ABSLRR_{3,t}$ ha	$ABSLRR_t$ ha	$ABSLRR$ ha
1	15.191,73	6.523,71	23.211,19	44.926,63	44.926,63
2	17.827,11	6.709,55	24.258,26	48.794,92	93.721,55
3	19.052,48	6.277,95	23.101,04	48.431,47	142.153,01
4	20.277,85	5.874,11	21.999,02	48.150,98	190.304,00
5	21.503,22	5.496,25	20.949,58	47.949,05	238.253,05
6	22.728,59	5.142,69	19.950,20	47.821,48	286.074,53
7	23.953,96	4.811,88	18.998,49	47.764,34	333.838,86
8	25.179,33	4.502,35	18.092,19	47.773,87	381.612,73
9	26.404,70	4.212,73	17.229,12	47.846,55	429.459,28
10	27.630,07	3.941,74	16.407,22	47.979,03	477.438,30
11	28.855,44	3.688,18	15.624,53	48.168,15	525.606,45
12	30.080,81	3.450,93	14.879,17	48.410,91	574.017,36
13	31.306,18	3.228,94	14.169,38	48.704,50	622.721,86
14	32.531,55	3.021,24	13.493,44	49.046,23	671.768,09
15	32.531,55	2.826,89	12.849,75	48.208,19	719.976,28
16	32.531,55	2.645,05	12.236,76	47.413,36	767.389,64
17	32.531,55	2.474,90	11.653,02	46.659,47	814.049,10
18	30.904,97	2.315,70	11.097,12	44.317,79	858.366,90

Project year t	Stratum i in the reference region			Total	
	1 $ABSLRR_{1,t}$ ha	2 $ABSLRR_{2,t}$ ha	3 $ABSLRR_{3,t}$ ha	annual $ABSLRR_t$ ha	cumulative $ABSLRR$ ha
19	29.278,39	2.166,74	10.567,74	42.012,88	900.379,77
20	27.651,82	2.027,36	10.063,62	39.742,79	940.122,57
21	26.025,24	1.896,95	9.583,54	37.505,73	977.628,29
22	24.398,66	1.774,92	9.126,37	35.299,95	1.012.928,25
23	22.772,08	1.660,75	8.691,00	33.123,84	1.046.052,08
24	21.145,51	1.553,92	8.276,41	30.975,83	1.077.027,91
25	19.518,93	1.453,96	7.881,59	28.854,48	1.105.882,39
26	17.892,35	1.360,43	7.505,60	26.758,39	1.132.640,78
27	16.265,77	1.272,92	7.147,56	24.686,25	1.157.327,03
28	14.639,20	1.191,04	6.806,59	22.636,82	1.179.963,85
29	13.012,62	1.114,42	6.481,89	20.608,93	1.200.572,78
30	11.386,04	1.042,73	6.172,67	18.601,45	1.219.174,23

Table 18. Projected annual deforestation within the project area in the baseline

Project year t	Stratum i of the reference region in the project area	Total	
	1 $ABSLPA_{1,t}$ ha	annual $ABSLPA_t$ ha	cumulative $ABSLPA$ ha
1	561,06	561,06	561,06
2	781,47	781,47	1.342,53
3	706,31	706,31	2.048,84
4	1.037,95	1.037,95	3.086,79
5	958,70	958,70	4.045,49
6	883,73	883,73	4.929,22
7	1.156,53	1.156,53	6.085,75
8	1.618,89	1.618,89	7.704,64
9	1.807,70	1.807,70	9.512,34
10	2.129,01	2.129,01	11.641,35
11	2.303,83	2.303,83	13.945,18
12	2.916,74	2.916,74	16.861,92
13	2.957,65	2.957,65	19.819,56
14	3.596,74	3.596,74	23.416,31
15	3.474,01	3.474,01	26.890,32
16	3.408,56	3.408,56	30.298,88
17	3.271,88	3.271,88	33.570,76
18	2.415,08	2.415,08	35.985,84
19	2.356,94	2.356,94	38.342,78

Project year t	Stratum i of the reference region in the project area	Total	
	1 $ABSLPA_{1,t}$ ha	annual $ABSLPA_t$ ha	cumulative $ABSLPA$ ha
20	1.973,50	1.973,50	40.316,29
21	1.863,83	1.863,83	42.180,12
22	1.267,88	1.267,88	43.448,00
23	582,69	582,69	44.030,69
24	249,94	249,94	44.280,62
25	37,69	37,69	44.318,32
26	10,78	10,78	44.329,10
27	6,65	6,65	44.335,75
28	0,97	0,97	44.336,72
29	3,92	3,92	44.340,64
30	0,97	0,97	44.341,61

Table 19. Projected annual deforestation within the leakage area in the baseline

Project year t	Stratum i of the reference region in leakage management areas	Total	
	1 $ABSLK_{1,t}$ ha	annual $ABSLK_t$ ha	cumulative $ABSLK_{1,t}$ ha
1	3.174,98	3.175	3.175
2	2.075,58	2.076	5.251
3	2.329,41	2.329	7.580
4	1.337,78	1.338	8.918
5	1.287,20	1.287	10.205
6	1.329,13	1.329	11.534
7	797,08	797	12.331
8	773,31	773	13.104
9	608,67	609	13.713
10	386,24	386	14.099
11	473,00	473	14.572
12	248,32	248	14.821
13	211,07	211	15.032
14	282,62	283	15.314
15	269,57	270	15.584
16	276,83	277	15.861
17	176,35	176	16.037
18	144,65	145	16.182
19	118,28	118	16.300
20	62,55	63	16.363

Project year t	Stratum i of the reference region in leakage managment areas	Total	
	1 $ABSLLK_{i,t}$ ha	annual $ABSLLK_t$ ha	cumulative $ABSLLK_{i,t}$ ha
21	68,70	69	16.431
22	117,10	117	16.548
23	79,47	79	16.628
24	70,87	71	16.699
25	53,02	53	16.752
26	47,22	47	16.799
27	35,84	36	16.835
28	29,31	29	16.864
29	16,89	17	16.881
30	14,73	15	16.896

5.3.2 Projection of the location of future deforestation

The model used analyzes a variety of factor maps and chose the combination of factor maps that best predicted the location of deforestation validation of the results against historical deforestation data, using the Figure of Merit as the basis for the selection The risk map of future deforestation was created using the following variables:

- Distance from oil pipelines
- Slope
- Legal land use designation
- Land aptitude
- Road networks (paved and unpaved)
- Distance from rivers
- Distance from other bodies of water
- Distance from schools
- Forest type
- Distance from oil palm processing plants
- Distance from forest edge (dynamic)

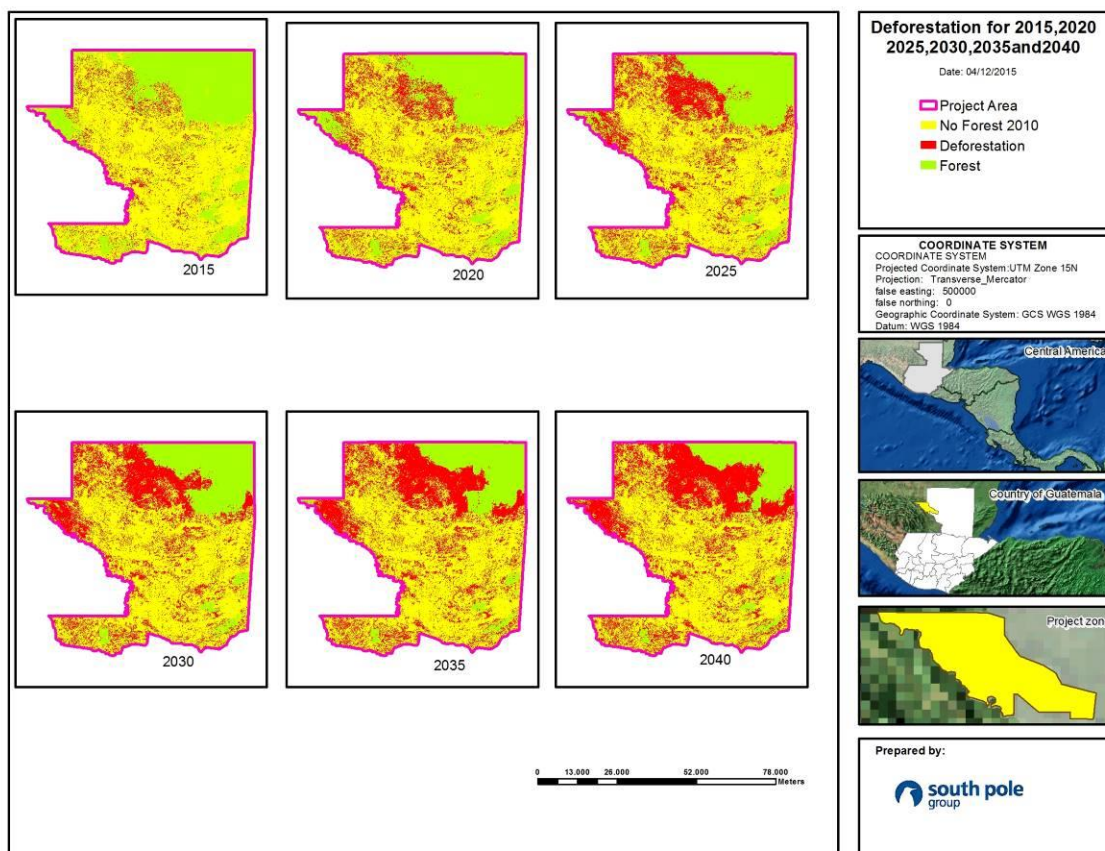


Figure 43. A visual representation of the deforestation under the risk model over the project lifetime in 5-year time lapse

5.3.3 Calculation of baseline activity data per forest class

The aim of this step is to segregate the annual deforested areas in forest classes. These annual areas of deforestation by forest class can be combined with their respective emissions factors in order to estimate GHG emissions from deforestation.

Exist three relevant classes of forest in total in the project area and leakage belt:

1. Broadleaf forest low / sub-humid
2. Broadleaf forest medium-high / humid
3. Broadleaf forest medium-high / sub-humid

Table 20. Projected annual areas deforested per forest classes within the project area

Area deforested per forest classes <i>icl</i> within the project area				Total baseline deforestation in the project area	
<i>ID_{icl}</i> >	005	006	007	<i>ABSLPA_t</i>	<i>ABSLPA</i>
Name >	Broadleaf forest low / sub-humid (BB-SH)	Broadleaf forest medium-high / humid (BMA-H)	Broadleaf forest medium-high / sub-humid (BMA-SH)	annual	cumulative
Project year <i>t</i>	ha	ha	ha	ha	ha
0				-	
1	-	561,06	-	561,06	561,06
2	-	781,47	-	781,47	1.342,53
3	-	706,31	-	706,31	2.048,84
4	-	1.037,95	-	1.037,95	3.086,79
5	-	958,70	-	958,70	4.045,49
6	-	883,73	-	883,73	4.929,22
7	-	1.156,53	-	1.156,53	6.085,75
8	-	1.618,89	-	1.618,89	7.704,64
9	-	1.807,70	-	1.807,70	9.512,34
10	-	2.129,01	-	2.129,01	11.641,35
11	-	2.303,83	-	2.303,83	13.945,18
12	-	2.916,74	-	2.916,74	16.861,92
13	-	2.957,65	-	2.957,65	19.819,56
14	-	3.596,74	-	3.596,74	23.416,31
15	-	3.474,01	-	3.474,01	26.890,32
16	-	3.408,56	-	3.408,56	30.298,88
17	-	3.271,88	-	3.271,88	33.570,76
18	-	2.415,08	-	2.415,08	35.985,84
19	-	2.356,94	-	2.356,94	38.342,78
20	-	1.973,50	-	1.973,50	40.316,29
21	-	1.863,83	-	1.863,83	42.180,12
22	-	1.267,88	-	1.267,88	43.448,00
23	-	582,69	-	582,69	44.030,69
24	-	249,94	-	249,94	44.280,62
25	-	37,69	-	37,69	44.318,32
26	-	10,78	-	10,78	44.329,10
27	-	6,65	-	6,65	44.335,75
28	-	0,97	-	0,97	44.336,72
29	-	3,92	-	3,92	44.340,64
30	-	0,97	-	0,97	44.341,61
Total	-	44.341,6	-	44.341,6	

Table 21. Projected annual areas deforested per forest classes within the leakage belt

Area deforested per forest classes <i>ic/</i> within the leakage belt				Total baseline deforestation in the leakage belt	
<i>ID_{ic/}</i> >	005	006	007	<i>ABSLLK_t</i>	<i>ABSLLK</i>
Name >	Broadleaf forest low / sub-humid (BB-SH)	Broadleaf forest medium-high / humid (BMA-H)	Broadleaf forest medium-high / sub-humid (BMA-SH)	annual	cumulative
Project year <i>t</i>	ha	ha	ha	ha	ha
0				-	
1	5,05	3.081,32	88,60	3.174,98	3.174,98
2	2,61	2.027,54	45,43	2.075,58	5.250,56
3	-	2.281,58	47,83	2.329,41	7.579,97
4	-	1.316,64	21,15	1.337,78	8.917,75
5	-	1.250,89	36,31	1.287,20	10.204,95
6	-	1.300,66	28,47	1.329,13	11.534,08
7	2,79	770,30	23,99	797,08	12.331,16
8	-	754,93	18,39	773,31	13.104,47
9	0,64	572,65	35,38	608,67	13.713,14
10	4,23	356,94	25,07	386,24	14.099,38
11	-	443,97	29,03	473,00	14.572,38
12	-	232,14	16,18	248,32	14.820,70
13	0,14	193,13	17,80	211,07	15.031,77
14	-	270,29	12,32	282,62	15.314,38
15	-	263,15	6,41	269,57	15.583,95
16	0,26	249,19	27,37	276,83	15.860,78
17	-	168,86	7,49	176,35	16.037,13
18	2,15	136,88	5,63	144,65	16.181,78
19	-	110,08	8,20	118,28	16.300,06
20	-	60,19	2,37	62,55	16.362,61
21	-	63,71	4,98	68,70	16.431,31
22	-	114,90	2,20	117,10	16.548,41
23	-	76,78	2,69	79,47	16.627,88
24	1,93	63,54	5,40	70,87	16.698,75
25	0,96	43,61	8,45	53,02	16.751,77
26	-	44,05	3,17	47,22	16.798,99
27	-	33,45	2,39	35,84	16.834,83
28	-	28,81	0,49	29,31	16.864,14
29	-	14,05	2,84	16,89	16.881,03
30	-	12,66	2,07	14,73	16.895,76
Total	20,75	16.336,89	538,12	16.895,76	

5.3.4 Calculation of baseline activity data per post-deforestation forest class

The project elected to use “Method 1: Historical LU/LC Change” to establish the activity data associated with the post-deforestation class and to establish their relative proportions. Surfaces and percentages of classes “fcl” in each zone containing a setting that incorporates the variability of each class through time and has some methodological deviations to facilitate the calculation of carbon stocks in the kind of post-deforestation. Despite there are three forest classes, Guatecarbon project propons these considerations:

- Although there is a statistically significant difference between the carbon stocks of the forest classes in the project area and leakage belt, there is insufficient evidence to suggest that the post-deforestation classes that are established within a humid vs sub-humid zone would have major differences in their carbon stocks. Therefore the humid vs. sub-humid distinctions were eliminated by combining the LU/LC classes that were made distinct only by their moisture regime classification. The result is that only two zones of post deforestation have been identified.
- Any secondary forest regrowth that was registered by the land cover assessments were conservatively assumed to remain as forest over time. This had the effect of significantly lowering the percentage of land use associated with the Agriculture-Non forest – Guamiles land use, which is associated with the lowest carbon stocks (see step 6 of VM0015).

Therefore, the post – deforestation classes are:

Zone (icl)		Name		Name		Name		(icl) to (fcl) transitions in the historical reference period	
		Agropecuario - No bosque - Guamiles		African oil palm		Regeneration		fcl Area in zone	Total of only fcl in zone
		ID _{fcl}	001+002	ID _{fcl}	010	ID _{fcl}	013		
		Area	% of total fcl in Zone	Area	% of total fcl in Zone	Area	% of total fcl in Zone		
IDz	Name	ha	%	ha	%	ha	%	ha	ha
BB-SH	Zone 1	19.503,93	98,00%	-	-	397,32	2,00%	19.901,25	100,0%
BMA	Zone 2	368.340,33	71,2%	46.807,98	9,0%	102.213,99	19,8%	517.362,30	100,0%
TOTAL		387.844,26		46.807,98		102.611,31		537.263,55	

Please note that the total annual values area the same as those defined in Table 20 and Table 21 due to the areas of post deforestation must correspond to the projected areas of annual deforestation. For further information refer to Section 5.2 of the VCS Technical Annex.

5.3.5 Estimation of baseline carbon stock change

This step allow estimate the baseline stocks by calculating the average carbon stocks of each LU/LC class, determining the carbon stock change factors, and then calculating the baseline carbon stock changes. Non-CO₂ emissions are not taken into account because is both optional and conservative to exclude them.

Estimation of the average carbon stocks of each LU/LC class

The area is dominated by the “humid” and “sub-humid” classifications that characterize rainfall in the area, which are expected to have impacts on the growth potential of these forests and therefore can affect carbon stock levels. The table below re-identifies these forest classes and states the presence or absence of each forest type in the project area and the leakage belt respectively.

Table 22. Forest class in the project area and leakage belt

	Project area	Leakage belt
Bosque latifoliado bajo sub-húmedo (BB-SH)	NO	YES
Bosque latifoliado medio-alto húmedo (BMA-H)	YES	YES
Bosque latifoliado medio-alto sub-húmedo (BMA-SH)	NO	YES

The project utilized forest inventory data from the four (4) sources with a total of 731 measurement plots across the MUZ and Reference Region:

- Forest inventories from the concessions in the MUZ (“Concesiones” in local language)
- Permanent forest monitoring plots (PPM)
- Forest inventory data from the Lachuá protected area, gathered by the Universided del Valle in Guatemala (UVG-CEA), (UVG-Lachuá)
- Forest inventory and carbon assessment from Sierra del Lacandón National Park (“FDN – Lacandón”)

Table 23. Inventory information by source and data date

Source and data date	n	% by source	% of Total
Concessions	548		
1994	35	6%	5%
1996	118	22%	16%
1999	264	48%	36%

Source and data date	n	% by source	% of Total
2000	131	24%	18%
FDN-LACANDON	63		
2010	63	100%	9%
PPM	85		
2005	21	25%	3%
2006	46	54%	6%
2009	18	21%	2%
UVG-LACHUA	35		
2008	35	100%	5%
Total	731	n.a	100%

The following tables summarize the inferential statistics derived by combining the aforementioned datasets. It is used the simple mean of the data instead of a weighted average method because the differences in these methods were negligible.

Table 24. Statistical results of average carbon stocks in the aboveground biomass pool per hectare grouped according to forest type

	n	Average tC ha ⁻¹	Average tCO ₂ ha ⁻¹	S ²	S.D	S.E	% S.E	CI_90%	CI+	CI-
BB-SH	27	72	264	5217.80	72.2	13.9	5.3%	23.71	287.6	240.2
BMA-H	114	94	344	38881.08	197.2	18.5	5.4%	30.63	374.4	313.2
BMA-SH	590	86	315	5217.96	72.2	3.0	0.9%	4.90	319.6	309.8

n = number of plots; *tC ha-1*= tons of carbon per hectare; *tCO2ha-1*=tons of carbon dioxide per hectare; *S2* = variance; *S.D.* = Standard deviation; *S.E.* = Standard Error; % *S.E* = % standard error; *CI* 90% = 90% confidence interval; *CI+* and *CI-* = range of the 90% confidence interval

Table 25. Average carbon stocks in the below ground biomass pool grouped according to forest class

Forest Class	tCO ₂ ha ⁻¹	CI_90%	CI+	CI-
BB-SH	63	5.3	68.6	58.0
BMA-H	83	6.9	89.4	75.6
BMA-SH	76	6.3	81.9	69.2

Table 26. The long – term 20 year average of carbon stocks average in post-deforestation classes

Zone		Above ground biomass (Cab_{fcl})	Below ground biomass (Cbb_{fcl})
<i>ldz</i>	<i>lcl class</i>	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
1	BB-SH	16.7	26.8
2	BMA	25.4	22.6

Carbon stocks of above and below-ground biomass

The project utilized the allometric relationship which was developed by Arreaga (2002) in order to convert the previously described forest inventory data into above ground biomass. The belowground biomass was calculated based on a root to shoot ratio developed by Mokany (2006) of 0.24.

Post-deforestation carbon stocks

The carbon stocks in post-deforestation LU/LC classes are used to calculate net emissions reductions as result of the carbon stock accumulations that might occur after a deforestation event.

The three post-deforestation land use classes are:

- Agropecuario –No Bosque – Guamiles (ANG)/ Cattle-Pasture-Fallows: Is a land use and land cover mixture that not classified as forest but are excessively different to determine a single value of carbon.
- Palma Africana (PA)/ African Oil Palm
- Regeneración (REG)/ Secondary forest

The ANG post-deforestation carbon stock was estimated by modelling carbon stock evolution of the ANG sub-classes based on IPCC values. The PA and REG classes were estimated by simple growth conservative simulation. In both cases these were 20-year simulations resulting in a 20 year average value.

Harvested Wood Products

The project area contains planned forest degradation activities resulting from legal timber harvest from Forest Management Plans. The cooperatives carrying out legal timber harvest are La Lucha and Unión Maya Itzá (Note that only La Lucha, UMI and La Técnica Agropecuaria have legal permission to harvest timber in the SLNP). This activity is part of the baseline and project scenario, therefore, VM0015 required the project to estimate the effect of legal harvests might have on the net calculation of emissions reductions. To model the scenarios, data from forest management plans of both cooperatives are used. Please refer to Section 7.1 of the VCS Technical Annex.

For legal timber harvest it is used the historical legal degradation factor of $2.7 \text{ tCO}_2\text{ha}^{-1}$. It is assumed that 52% of harvestable tree is left as deadwood (Dw) or $2.5 \text{ tCO}_2\text{ha}^{-1}$, and of the volume coming out of the forest the efficiency factor is 48%, leaving $1.3 \text{ tCO}_2\text{ha}^{-1}$ for timber products. Guatecarbon project conservatively assumes that if there is deforestation after harvesting, the degradation factor of 2.7 is taken equal although probably not exist profitable benefits for illegal actors. Timber products are "long life" and do not generate emissions but waste products are recorded as short-lived and emit emissions the same year of harvesting.

5.3.6 Calculation of carbon stock change factors

The carbon stock change in each pool are:

- Above-ground biomass – Negative value. Emissions are fully accounted for in, and only in, the same year as a deforestation event.
- Below-ground biomass – Negative value. The emissions factor is subject to a 10-year linear decay function to simulate the slower rate of emissions.
- Dead wood - Negative value. The emissions factor is subject to a 10-year linear decay function to simulate the slower rate of emissions.
- Short-lived Harvested Wood Products – Negative value. Emissions are fully accounted for in, and only in, the same year as a deforestation event.
- Long-lived Harvested Wood Products – Positive value. The sequestration effect is fully accounted for in, and only in, the same year as a deforestation event and are not subject to decay (negative values) in subsequent years, which is represented by zeros in every year afterward.
- Post-deforestation zones: The long-term 20 year average calculated for each zone is accumulated using a 10-year linear growth model, which starts in year 1 and ends in year 10.

Table 27. Carbon stock change factors for areas subjected to unplanned deforestation

Years after deforestation	ΔC_{ab_i} cl,t	ΔC_{bb_i} cl,t	ΔC_{ab_i} cl,t	ΔC_{bb_i} cl,t	$\Delta C_{ab_{icl}}$ t	$\Delta C_{bb_{icl}}$ t	ΔC_{dw_i} cl,t	ΔC_{lic} l,t	ΔC_{soc_i} cl,t	$\Delta C_{wpi_{cl,t}}$		
	BB-SH	BB-SH	BMA-H	BMA-H	BMA-SH	BMA-SH				short-lived	medium-lived	long-lived
1	-263,87	-6,33	-343,80	-8,25	-314,66	-7,55	0,00	0,00	0,00	0,00	0,00	1,29
2	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
3	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
4	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
5	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
6	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
7	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
8	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
9	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
10	0,00	-6,33	0,00	-8,25	0,00	-7,55	0,00	0,00	0,00	0,00	0,00	0,00
11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
17	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
19	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
28	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 28. Carbon stock change factors for areas subjected to planned degradation only

Years after deforestation	ΔC_{ab_i} cl,t BB-SH	ΔC_{bb_i} cl,t BB-SH	ΔC_{ab_i} cl,t BMA-H	ΔC_{bb_i} cl,t BMA-H	$\Delta C_{ab_{ic}}$ l,t BMA-SH	$\Delta C_{bb_{ic}}$ l,t BMA-SH	ΔC_{dw_i} cl,t	ΔC_{lic} l,t	ΔC_{soc_i} cl,t	$\Delta C_{wpi_{cl,t}}$		
										short-lived	medium-lived	long-lived
1	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	-1,40	0,00	1,29
2	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
3	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
4	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
5	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
6	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
7	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
8	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
9	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
10	0,00	0,00	0,00	0,00	0,00	0,00	-0,25	0,00	0,00	0,00	0,00	0,00
11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
17	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
19	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
28	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 29. Carbon stock change factors for zones of post-deforestation

Years after deforestation	$\Delta C_{ab_{icl},t}$	$\Delta C_{bb_{icl},t}$	$\Delta C_{ab_{icl},t}$	$\Delta C_{bb_{icl},t}$	$\Delta C_{dw_{icl},t}$	$\Delta C_{l_{icl},t}$	$\Delta C_{soC_{icl},t}$	$\Delta C_{wp_{icl},t}$		
	Zone 1	Zone1	Zone 2	Zone 2				short-lived	medium-lived	long-lived
1	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
2	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
3	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
4	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
5	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
6	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
7	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
8	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
9	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
10	1,67	2,68	2,54	2,26	0,00	0,00	0,00	0,00	0,00	0,00
11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
17	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
19	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
28	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

5.3.7 Calculation of baseline carbon stock changes

The baseline carbon stock changes were calculated by combining the annual areas of projected deforestation by forest class, and the projected areas of planned degradation with the carbon stock change factors.

Table 30. Total net carbon stock change in the aboveground biomass of the initial forest classes in the project area

Total carbon stock change in the aboveground biomass of the initial forest classes in the project area		
$\Delta\text{CabBSLPA}_t$		$\Delta\text{CabBSLPA}_i$
Annual		Cumulative
Project Yr	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
0	0	0
1	- 191.472,0	- 191.472,0
2	- 265.264,0	- 456.736,0
3	- 237.630,7	- 694.366,7
4	- 349.016,5	- 1.043.383,2
5	- 319.335,6	- 1.362.718,8
6	- 291.317,8	- 1.654.036,6
7	- 382.170,2	- 2.036.206,8
8	- 537.021,3	- 2.573.228,1
9	- 597.348,3	- 3.170.576,4
10	- 702.412,0	- 3.872.988,3
11	- 758.089,3	- 4.631.077,7
12	- 963.389,9	- 5.594.467,6
13	- 971.739,2	- 6.566.206,8
14	- 1.184.967,5	- 7.751.174,3
15	- 1.136.386,4	- 8.887.560,7
16	- 1.107.475,4	- 9.995.036,1
17	- 1.055.114,8	- 11.050.150,9
18	- 758.520,7	- 11.808.671,6
19	- 737.137,1	- 12.545.808,7
20	- 605.704,3	- 13.151.513,0
21	- 569.115,6	- 13.720.628,6
22	- 368.410,9	- 14.089.039,6
23	- 138.867,2	- 14.227.906,8
24	- 32.962,0	- 14.260.868,8
25	31.284,7	- 14.229.584,2
26	31.909,8	- 14.197.674,3
27	25.043,1	- 14.172.631,2
28	20.865,5	- 14.151.765,7
29	13.879,8	- 14.137.885,9
30	9.884,7	- 14.128.001,2
Total	- 14.128.001,2	

Table 31. Total net carbon stock change in the belowground biomass of the initial forest classes in the project area

Total net carbon stock change in the belowground biomass of the initial forest classes in the project area		
Project Yr	$\Delta C_{bbBSLPA,t}$	$\Delta C_{bbBSLPA}$
	Annual	Cumulative
	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
0	0	0
1	- 3.360,7	- 3.360,7
2	- 8.041,7	- 11.402,5
3	- 12.272,5	- 23.674,9
4	- 18.489,8	- 42.164,7
5	- 24.232,3	- 66.397,0
6	- 29.525,9	- 95.922,9
7	- 36.453,4	- 132.376,3
8	- 46.150,5	- 178.526,7
9	- 56.978,5	- 235.505,3
10	- 69.731,2	- 305.236,5
11	- 80.170,3	- 385.406,9
12	- 92.960,5	- 478.367,4
13	- 106.445,9	- 584.813,3
14	- 121.773,0	- 706.586,3
15	- 136.839,6	- 843.425,9
16	- 151.963,2	- 995.389,1
17	- 164.634,1	- 1.160.023,3
18	- 169.403,3	- 1.329.426,6
19	- 172.693,2	- 1.502.119,8
20	- 171.761,7	- 1.673.881,6
21	- 169.126,2	- 1.843.007,7
22	- 159.249,6	- 2.002.257,3
23	- 145.023,7	- 2.147.281,0
24	- 124.976,4	- 2.272.257,4
25	- 104.393,0	- 2.376.650,4
26	- 84.040,5	- 2.460.690,9
27	- 64.481,8	- 2.525.172,8
28	- 50.021,4	- 2.575.194,2
29	- 35.926,9	- 2.611.121,1
30	- 24.111,5	- 2.635.232,6
Total	- 2.635.232,6	

Table 32. Total carbon stock change from illegal harvested wood products from the initial forest classes in the project area

Carbon Stock changes resulting from harvested wood products per initial forest class <i>ic/</i>				Total carbon stock change from illegal harvested wood products from the initial forest classes in the project area	
IDcl>	004	005	006	$\Delta C_{wpBSLPA,t}$	$\Delta C_{wpBSLPA}$
Name >	BB-SH	BMA-H	BMA-SH	Annual	Cumulative
Project Yr	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
1	0	724,1	0	724,1	724,1
2	0	1.008,5	0	1.008,5	1.732,6
3	0	911,5	0	911,5	2.644,1
4	0	1.339,5	0	1.339,5	3.983,6
5	0	1.237,2	0	1.237,2	5.220,8
6	0	1.140,5	0	1.140,5	6.361,3
7	0	1.492,5	0	1.492,5	7.853,8
8	0	2.089,2	0	2.089,2	9.943,1
9	0	2.332,9	0	2.332,9	12.276,0
10	0	2.747,6	0	2.747,6	15.023,5
11	0	2.973,2	0	2.973,2	17.996,7
12	0	3.764,1	0	3.764,1	21.760,8
13	0	3.816,9	0	3.816,9	25.577,8
14	0	4.641,7	0	4.641,7	30.219,5
15	0	4.483,3	0	4.483,3	34.702,8
16	0	4.398,9	0	4.398,9	39.101,6
17	0	4.222,5	0	4.222,5	43.324,1
18	0	3.116,7	0	3.116,7	46.440,8
19	0	3.041,7	0	3.041,7	49.482,5
20	0	2.546,9	0	2.546,9	52.029,4
21	0	2.405,3	0	2.405,3	54.434,7
22	0	1.636,2	0	1.636,2	56.071,0
23	0	752,0	0	752,0	56.823,0
24	0	322,5	0	322,5	57.145,5
25	0	48,6	0	48,6	57.194,2
26	0	13,9	0	13,9	57.208,1
27	0	8,6	0	8,6	57.216,6
28	0	1,3	0	1,3	57.217,9
29	0	5,1	0	5,1	57.223,0
30	0	1,3	0	1,3	57.224,2
Total	-	57.224,2	-	57.224,2	

Table 33. Total net carbon stock change in the project area including illegal Harvested Wood Products (Cwp included)

Total net carbon stock change in the aboveground + belowground biomass (Cwp included) of the initial forest classes in the project area		
$\Delta C_{totBSLPA,t}$		$\Delta C_{totBSLPA}$
Annual		Cumulative
Project Yr	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
1	- 194.108,7	- 194.108,7
2	- 272.297,2	- 466.405,9
3	- 248.991,6	- 715.397,5
4	- 366.166,8	- 1.081.564,3
5	- 342.330,7	- 1.423.895,0
6	- 319.703,2	- 1.743.598,2
7	- 417.131,1	- 2.160.729,2
8	- 581.082,5	- 2.741.811,8
9	- 651.993,9	- 3.393.805,7
10	- 769.395,7	- 4.163.201,3
11	- 835.286,5	- 4.998.487,9
12	- 1.052.586,3	- 6.051.074,1
13	- 1.074.368,2	- 7.125.442,3
14	- 1.302.098,8	- 8.427.541,1
15	- 1.268.742,7	- 9.696.283,8
16	- 1.255.039,7	- 10.951.323,6
17	- 1.215.526,5	- 12.166.850,1
18	- 924.807,3	- 13.091.657,4
19	- 906.788,6	- 13.998.446,0
20	- 774.919,2	- 14.773.365,2
21	- 735.836,4	- 15.509.201,6
22	- 526.024,3	- 16.035.225,9
23	- 283.138,9	- 16.318.364,8
24	- 157.615,9	- 16.475.980,7
25	- 73.059,7	- 16.549.040,5
26	- 52.116,7	- 16.601.157,2
27	- 39.430,1	- 16.640.587,3
28	- 29.154,7	- 16.669.742,0
29	- 22.042,0	- 16.691.784,0
30	- 14.225,6	- 16.706.009,6
Total	- 16.706.009,6	

Table 34. Total carbon stock change from legal harvesting from all initial forest classes in the project area

		Total carbon stock change from legal harvesting from all initial forest classes in the project area	
		$\Delta C_{hw_totBSLPA,t}$	$\Delta C_{hw_totBSLPA}$
		Annual	Cumulative
Project Yr		t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
1	-	98,1	98,1
2	-	68,4	166,6
3	-	124,3	290,9
4	-	107,4	398,3
5	-	154,0	552,3
6	-	164,0	716,3
7	-	156,7	873,0
8	-	182,5	1.055,5
9	-	226,8	1.282,2
10	-	211,0	1.493,2
11	-	142,6	1.635,8
12	-	142,6	1.778,3
13	-	103,6	1.881,9
14	-	103,6	1.985,5
15	-	71,1	2.056,6
16	-	54,3	2.110,9
17	-	54,3	2.165,2
18	-	36,3	2.201,5
19	-	-	2.201,5
20	-	-	2.201,5
21	-	-	2.201,5
22	-	-	2.201,5
23	-	-	2.201,5
24	-	-	2.201,5
25	-	-	2.201,5
26	-	-	2.201,5
27	-	-	2.201,5
28	-	-	2.201,5
29	-	-	2.201,5
30	-	-	2.201,5
Total	-	2.201,5	

Table 35. Total net carbon stock change (legal+illegal Cwp included) of the initial forest classes in the project area

Total net carbon stock change i (legal+illegal Cwp included) of the initial forest classes in the project area		
$\Delta C_{totBSLPA,t}$		$\Delta C_{totBSLPA}$
Annual		Cumulative
Project Yr	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
0	0	0
1	- 194.206,8	- 194.206,8
2	- 272.365,7	- 466.572,5
3	- 249.116,0	- 715.688,4
4	- 366.274,2	- 1.081.962,6
5	- 342.484,7	- 1.424.447,3
6	- 319.867,2	- 1.744.314,5
7	- 417.287,8	- 2.161.602,2
8	- 581.265,0	- 2.742.867,2
9	- 652.220,7	- 3.395.087,9
10	- 769.606,7	- 4.164.694,6
11	- 835.429,1	- 5.000.123,6
12	- 1.052.728,8	- 6.052.852,5
13	- 1.074.471,8	- 7.127.324,2
14	- 1.302.202,4	- 8.429.526,6
15	- 1.268.813,8	- 9.698.340,4
16	- 1.255.094,0	- 10.953.434,5
17	- 1.215.580,8	- 12.169.015,3
18	- 924.843,7	- 13.093.858,9
19	- 906.788,6	- 14.000.647,5
20	- 774.919,2	- 14.775.566,7
21	- 735.836,4	- 15.511.403,1
22	- 526.024,3	- 16.037.427,4
23	- 283.138,9	- 16.320.566,4
24	- 157.615,9	- 16.478.182,3
25	- 73.059,7	- 16.551.242,0
26	- 52.116,7	- 16.603.358,7
27	- 39.430,1	- 16.642.788,9
28	- 29.154,7	- 16.671.943,6
29	- 22.042,0	- 16.693.985,6
30	- 14.225,6	- 16.708.211,1
Total	- 16.708.211,1	

Table 36. Total carbon stock change in the aboveground biomass of the initial forest classes in the leakage belt

Total carbon stock change in the aboveground biomass of the initial forest classes in the leakage belt		
Project Yr	$\Delta\text{CabABSLKK}_{\text{icl},t}$	$\Delta\text{CabABSLKK}_{\text{icl}}$
	Annual	Cumulative
	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
0	0	0
1	- 1.080.530,4	- 1.080.530,4
2	- 698.739,1	- 1.779.269,5
3	- 780.231,5	- 2.559.501,0
4	- 436.687,1	- 2.996.188,1
5	- 415.586,9	- 3.411.774,9
6	- 426.858,4	- 3.838.633,3
7	- 241.822,4	- 4.080.455,7
8	- 232.073,5	- 4.312.529,2
9	- 173.376,7	- 4.485.906,0
10	- 95.942,0	- 4.581.848,0
11	- 132.849,4	- 4.714.697,4
12	- 60.612,7	- 4.775.310,1
13	- 53.126,6	- 4.828.436,7
14	- 80.573,6	- 4.909.010,3
15	- 78.842,4	- 4.987.852,7
16	- 83.378,5	- 5.071.231,2
17	- 51.008,3	- 5.122.239,5
18	- 41.590,2	- 5.163.829,8
19	- 33.864,7	- 5.197.694,4
20	- 15.694,2	- 5.213.388,7
21	- 18.756,6	- 5.232.145,3
22	- 35.812,0	- 5.267.957,2
23	- 23.194,8	- 5.291.152,0
24	- 20.542,5	- 5.311.694,5
25	- 14.945,6	- 5.326.640,1
26	- 13.765,2	- 5.340.405,3
27	- 10.231,6	- 5.350.636,9
28	- 8.331,4	- 5.358.968,3
29	- 4.251,1	- 5.363.219,4
30	- 3.653,7	- 5.366.873,1
Total	- 5.366.873,1	

Table 37. Total net carbon stock change in the belowground biomass of the initial forest classes in the leakage belt

Project Yr	Total net carbon stock change in the belowground biomass of the initial forest classes in the leakage belt	
	$\Delta C_{bb}ABS_{LKK,t}$	$\Delta C_{bb}ABS_{LKK}$
	Annual	Cumulative
	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
0	0	0
1	- 18.944,2	- 18.944,2
2	- 31.339,0	- 50.283,2
3	- 45.258,6	- 95.541,9
4	- 53.257,1	- 148.798,9
5	- 60.942,0	- 209.740,9
6	- 68.883,5	- 278.624,4
7	- 73.634,7	- 352.259,1
8	- 78.253,9	- 430.513,0
9	- 81.873,6	- 512.386,6
10	- 84.159,7	- 596.546,3
11	- 68.028,5	- 664.574,8
12	- 57.109,8	- 721.684,6
13	- 44.441,7	- 766.126,3
14	- 38.127,5	- 804.253,8
15	- 32.052,8	- 836.306,6
16	- 25.749,7	- 862.056,3
17	- 22.049,6	- 884.105,8
18	- 18.287,8	- 902.393,7
19	- 15.371,0	- 917.764,6
20	- 13.457,8	- 931.222,5
21	- 11.052,9	- 942.275,4
22	- 10.276,7	- 952.552,1
23	- 9.499,3	- 962.051,4
24	- 8.231,3	- 970.282,7
25	- 6.930,5	- 977.213,3
26	- 5.572,8	- 982.786,0
27	- 4.734,7	- 987.520,7
28	- 4.052,4	- 991.573,1
29	- 3.448,8	- 995.021,8
30	- 3.162,5	- 998.184,4
Total	- 998.184,4	

Table 38. Total net carbon stock change (illegal Cwp included) in the project area

Total net carbon stock change (illegal Cwp included) in the project area		
Project Yr	$\Delta C_{bb}ABS_{LKK,t}$	$\Delta C_{bb}ABS_{LKK}$
	Annual t CO ₂ e ha ⁻¹	Cumulative t CO ₂ e ha ⁻¹
0	0	0
1	- 1.095.377,2	- 1.095.377,2
2	- 727.399,5	- 1.822.776,7
3	- 822.484,0	- 2.645.260,7
4	- 488.217,7	- 3.133.478,4
5	- 474.867,6	- 3.608.346,0
6	- 494.026,6	- 4.102.372,7
7	- 314.428,4	- 4.416.801,1
8	- 309.329,5	- 4.726.130,6
9	- 254.464,8	- 4.980.595,4
10	- 179.603,3	- 5.160.198,7
11	- 200.267,5	- 5.360.466,2
12	- 117.402,0	- 5.477.868,2
13	- 97.295,9	- 5.575.164,1
14	- 118.336,3	- 5.693.500,4
15	- 110.547,3	- 5.804.047,7
16	- 108.771,0	- 5.912.818,6
17	- 72.830,3	- 5.985.649,0
18	- 59.691,4	- 6.045.340,4
19	- 49.083,0	- 6.094.423,3
20	- 29.071,4	- 6.123.494,7
21	- 29.720,8	- 6.153.215,5
22	- 45.937,5	- 6.199.153,1
23	- 32.591,5	- 6.231.744,6
24	- 28.682,3	- 6.260.427,0
25	- 21.807,7	- 6.282.234,7
26	- 19.277,1	- 6.301.511,7
27	- 14.920,0	- 6.316.431,7
28	- 12.345,9	- 6.328.777,7
29	- 7.678,1	- 6.336.455,7
30	- 6.797,2	- 6.343.253,0
Total	- 6.343.253,0	

5.3.8 Baseline non-CO₂ emissions from forest fires

Although forest fires are caused by deforestation agents is not mandatory include emissions of gasses different than CO₂. The exclusion is conservative.

5.4 Project Emissions (CL2)

5.4.1 Ex ante estimation of actual carbon stock changes and non-CO₂ emissions in the project area

The objective is to provide an ex-ante estimate of carbon stock changes and non-CO₂ emissions in the scenario with the project activities implementation.

The project scenario consider an ex-ante effectiveness rating of the project of 45% and is applied to the unplanned deforestation that was simulated to occur in the forest management areas. At the end of the methodology, the difference between baseline and project scenario (with the significance analysis) resulted insignificant.

The project does not consider non-CO₂ emissions.

Table 39. Ex ante projections for areas subjected to illegal and legal forest degradation in the project scenario

Deforestation in Forest management áreas (ha)	Deforestation in other áreas (ha)	Total Def	%Def_Forest management areas	%Def in other areas	Legal degradation in project scenario (ha)
158,3	150,3	308,6	28,2%	26,8%	405
319,4	110,4	429,8	40,9%	14,1%	0
262,2	126,3	388,5	37,1%	17,9%	372
324,6	246,3	570,9	31,3%	23,7%	0
437,1	90,2	527,3	45,6%	9,4%	488
224,4	261,7	486,1	25,4%	29,6%	251
278,7	357,3	636,1	24,1%	30,9%	197
221,7	668,7	890,4	13,7%	41,3%	254
181,0	813,2	994,2	10,0%	45,0%	295
320,8	850,1	1171,0	15,1%	39,9%	0
238,1	1029,0	1267,1	10,3%	44,7%	0
197,8	1406,4	1604,2	6,8%	48,2%	0
144,0	1482,7	1626,7	4,9%	50,1%	0
133,6	1844,7	1978,2	3,7%	51,3%	0
79,2	1831,5	1910,7	2,3%	52,7%	0
55,5	1819,2	1874,7	1,6%	53,4%	0
30,1	1769,4	1799,5	0,9%	54,1%	0
19,8	1308,5	1328,3	0,8%	54,2%	0
22,1	1274,2	1296,3	0,9%	54,1%	0
11,9	1073,6	1085,4	0,6%	54,4%	0
7,7	1017,4	1025,1	0,4%	54,6%	0
3,7	693,6	697,3	0,3%	54,7%	0
2,0	318,5	320,5	0,3%	54,7%	0
0,0	137,5	137,5	0,0%	55,0%	0
0,0	20,7	20,7	0,0%	55,0%	0
0,3	5,7	5,9	2,5%	52,5%	0
1,2	2,4	3,7	18,6%	36,4%	0
0,0	0,5	0,5	0,0%	55,0%	0
0,7	1,4	2,2	18,7%	36,3%	0
0,5	0,0	0,5	55,0%	0,0%	0

Table 40. Ex ante estimated actual carbon stock decrease due to planned logging in the project area

Areas of planned logging activities x Carbon stock change (decrease) in the project area			Total carbon stock decrease due to planned logging activities.	
Name >	IDcl>		Annual	Cumulative
Project Yr	APLPAicl,t ha	ΔC_{tot} t CO ₂ e ha ⁻¹	$\Delta CPLdPA_t$ t CO ₂ e ha ⁻¹	$\Delta CPLdPA_t$ t CO ₂ e ha ⁻¹
0	0	0	0	0
1	405	- 0,1	- 43,6	- 43,6
2	0	- 0,1	-	- 43,6
3	372	- 0,1	- 40,0	- 83,6
4	0	- 0,1	-	- 83,6
5	488	- 0,1	- 52,5	- 136,1
6	251	- 0,1	- 27,0	- 163,1
7	197	- 0,1	- 21,2	- 184,3
8	254	- 0,1	- 27,3	- 211,6
9	295	- 0,1	- 31,7	- 243,2
10	-	-	-	- 243,2
11	-	-	-	- 243,2
12	-	-	-	- 243,2
13	-	-	-	- 243,2
14	-	-	-	- 243,2
15	-	-	-	- 243,2
16	-	-	-	- 243,2
17	-	-	-	- 243,2
18	-	-	-	- 243,2
19	-	-	-	- 243,2
20	-	-	-	- 243,2
21	-	-	-	- 243,2
22	-	-	-	- 243,2
23	-	-	-	- 243,2
24	-	-	-	- 243,2
25	-	-	-	- 243,2
26	-	-	-	- 243,2
27	-	-	-	- 243,2
28	-	-	-	- 243,2
29	-	-	-	- 243,2
30	-	-	-	- 243,2
Total	2.261,8		- 243,2	

Table 41. Total ex ante carbon stock decrease due to planned activities in the project area

project year t	Total carbon stock decrease due to planned deforestation		Total carbon stock decrease due to planned logging activities		Total carbon stock decrease due to planned fuel-wood and charcoal activities		Total carbon stock decrease due to planned activities	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	Cumulative
	ΔCPDdPA t	ΔCPDdPA	ΔCPLdP At	ΔCPLdPA	ΔCPFdP At	ΔCPFdPA	ΔCPAdP At	ΔCPAdPA
	t CO2e ha-1	t CO2e ha- 1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha- 1	t CO2e ha-1	t CO2e ha- 1
1	0	0	-98,1	-98,1	0	0		
2	0	0	-68,4	-166,6	0	0		
3	0	0	-124,3	-290,9	0	0		
4	0	0	-107,4	-398,3	0	0		
5	0	0	-154,0	-552,3	0	0		
6	0	0	-164,0	-716,3	0	0		
7	0	0	-156,7	-873,0	0	0		
8	0	0	-182,5	-1055,5	0	0		
9	0	0	-226,8	-1282,2	0	0		
10	0	0	-211,0	-1493,2	0	0		
11	0	0	-142,6	-1635,8	0	0		
12	0	0	-142,6	-1778,3	0	0		
13	0	0	-103,6	-1881,9	0	0		
14	0	0	-103,6	-1985,5	0	0		
15	0	0	-71,1	-2056,6	0	0		
16	0	0	-54,3	-2110,9	0	0		
17	0	0	-54,3	-2165,2	0	0		
18	0	0	-36,3	-2201,5	0	0		
19	0	0	0,0	-2201,5	0	0		
20	0	0	0,0	-2201,5	0	0		
21	0	0	0,0	-2201,5	0	0		
22	0	0	0,0	-2201,5	0	0		
23	0	0	0,0	-2201,5	0	0		
24	0	0	0,0	-2201,5	0	0		
25	0	0	0,0	-2201,5	0	0		
26	0	0	0,0	-2201,5	0	0		
27	0	0	0,0	-2201,5	0	0		
28	0	0	0,0	-2201,5	0	0		
29	0	0	0,0	-2201,5	0	0		
30	0	0	0,0	-2201,5	0	0		

Ex ante estimation of carbon stock changes due to unavoidable unplanned deforestation within the project area

The estimate ex ante changes in carbon pools has been calculated based on the rate of effectiveness of project which is 45% and according to the next equation:

$$\Delta CUDdPA_t = \Delta CBSL_t * (1 - EI) \quad |\Delta CUDdPA_t = \Delta CBSL_t * (1 - 45\%)|$$

Where:

$\Delta CUDdPA_t$ = Total ex ante actual carbon stock change due to unavaoided unplanned deforestation at year t in the project area; tCO₂-e

$\Delta CBSL_t$ = Total baseline carbon stock change at year t in the project area; tCO₂-e

EI = Ex ante estimated Effectiveness Index; %

t = 1, 2, 3 ... T, a year of the proposed project crediting period; dimensionless

Table 42. Ex ante estimated carbon stock change in the project area under the project scenario

proj ect year t	Total carbon stock decrease due to planned activities		Total carbon stock increase due to planned activities		Total carbon stock decrease due to unavaoided unplanned deforestation		Total carbon stock change in the project case	
	annual	cumulativ e	annual	cumula tive	annual	cumulative	annual	Cumulative
	ΔCPA_dP_{At}	ΔCPA_dP_A	ΔCPA_dPA_t	ΔCPA_dPA	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e
1	- 98,1	- 98,1			- 106.759,8	- 106.759,8	- 106.857,9	- 106.857,9
2	- 68,4	- 166,6			- 149.763,5	- 256.523,3	- 149.831,9	- 256.689,8
3	- 124,3	- 290,9			- 136.945,4	- 393.468,6	- 137.069,7	- 393.759,5
4	- 107,4	- 398,3			- 201.391,7	- 594.860,4	- 201.499,2	- 595.258,7
5	- 154,0	- 552,3			- 188.281,9	- 783.142,2	- 188.435,9	- 783.694,6
6	- 164,0	- 716,3			- 175.836,8	- 958.979,0	- 176.000,7	- 959.695,3
7	- 156,7	- 873,0			- 229.422,1	- 1.188.401,1	- 229.578,8	- 1.189.274,1
8	- 182,5	- 1.055,5			- 319.595,4	- 1.507.996,5	- 319.777,8	- 1.509.051,9
9	- 226,8	- 1.282,2			- 358.596,6	- 1.866.593,1	- 358.823,4	- 1.867.875,3
10	- 211,0	- 1.493,2			- 423.167,6	- 2.289.760,7	- 423.378,6	- 2.291.254,0
11	- 142,6	- 1.635,8			- 459.407,6	- 2.749.168,3	- 459.550,1	- 2.750.804,1

project year t	Total carbon stock decrease due to planned activities		Total carbon stock increase due to planned activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	Cumulative
	ΔCPAdP At	ΔCPAdP A	ΔCPAd PAt	ΔCPAd PA	ΔCUDdPA t	ΔCUDdPA	ΔCPSPA t	ΔCPSPA
	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e
12	-	-			-	-	-	-
13	142,6	1.778,3			578.922,4	3.328.090,8	579.065,0	3.329.869,1
14	-	-			-	-	-	-
15	103,6	1.881,9			590.902,5	3.918.993,3	591.006,1	3.920.875,2
16	-	-			-	-	-	-
17	103,6	1.985,5			716.154,3	4.635.147,6	716.257,9	4.637.133,1
18	-	-			-	-	-	-
19	71,1	2.056,6			697.808,5	5.332.956,1	697.879,6	5.335.012,7
20	-	-			-	-	-	-
21	54,3	2.110,9			690.271,9	6.023.228,0	690.326,2	6.025.338,9
22	-	-			-	-	-	-
23	54,3	2.165,2			668.539,6	6.691.767,5	668.593,9	6.693.932,7
24	-	-			-	-	-	-
25	36,3	2.201,5			508.644,0	7.200.411,6	508.680,4	7.202.613,1
26	-	-			-	-	-	-
27	-	2.201,5			498.733,7	7.699.145,3	498.733,7	7.701.346,8
28	-	-			-	-	-	-
29	-	2.201,5			426.205,5	8.125.350,8	426.205,5	8.127.552,4
30	-	-			-	-	-	-
31	-	2.201,5			404.710,0	8.530.060,9	404.710,0	8.532.262,4
32	-	-			-	-	-	-
33	-	2.201,5			289.313,4	8.819.374,2	289.313,4	8.821.575,8
34	-	-			-	-	-	-
35	-	2.201,5			155.726,4	8.975.100,7	155.726,4	8.977.302,2
36	-	-			-	-	-	-
37	-	2.201,5			86.688,7	9.061.789,4	86.688,7	9.063.990,9
38	-	-			-	-	-	-
39	-	2.201,5			40.182,9	9.101.972,2	40.182,9	9.104.173,8
40	-	-			-	-	-	-
41	-	2.201,5			28.664,2	9.130.636,5	28.664,2	9.132.838,0
42	-	-			-	-	-	-
43	-	2.201,5			21.686,6	9.152.323,0	21.686,6	9.154.524,6
44	-	-			-	-	-	-
45	-	2.201,5			16.035,1	9.168.358,1	16.035,1	9.170.559,7
46	-	-			-	-	-	-
47	-	2.201,5			12.123,1	9.180.481,2	12.123,1	9.182.682,8
48	-	-			-	-	-	-
49	-	2.201,5			7.824,1	9.188.305,3	7.824,1	9.190.506,8

5.5 Leakage (CL3)

CL3.1 Leakage may not be significant in this project. The project does not consider a decrease in carbon stocks and increased emissions resulting from leakage prevention measures. The analysis of the leakage belt that would be applicable has been conducted following the guidance provided by the Section 1.1.3 “Leakage belt” of the Methodology VM0015. Option II was followed “Mobility analysis”.

The criteria was the established roads in the project zone and in the Maya Biosphere Reserve. The agents of deforestation could move throughout the leakage area, but due to the regulatory control in the MBR, the concentration will be higher in the buffer zone of the Biosphere; therefore the leakage control efforts would be major in this area.

The calculation of the leakage belt following the procedure described in the methodology VM0015 generated an average result in which the furthest point included within the leakage belt is 2 km from the border of the the road nearest to the border of the project area.

As identified in RBM documentation, the more significant agents of deforestation in the region are:

- Farmers practicing subsistence agriculture and cattle ranching
- Middle scale cattle ranchers
- Big scale cattle ranchers
- Illegal settlements

The leakage management activities focus on mitigating and providing alternative solutions to the development of agriculture and cattle ranching activities outside of the project area. Please see Section 5.2 for more information.

The analysis of land-uses that deforestation agents implement in the project area in the baseline case, average selling prices for the main products generated in them, most important selling points for each main product, average *in situ* production costs per ton of product and description of the system variables of deforestation in the SLNP were obtained from “Causes and Agents of Deforestation in National Park Sierra de Lacandón” by FDN.

CL3.3 While some publications¹⁰¹ consider the leakage channels like land markets, labour markets, capital markets, technological innovation, output markets, income generation, ecological conditions, this project has calculated the amount of leakage based in the two sources of leakage detailed under the methodology VM0015.

¹⁰¹ Wunder, S., How do we deal with leakage? In: Angelsen, A. (ed.) 2008, Moving ahead with REDD: Issues, options and implications. CIFOR, Bogor, Indonesia. Available online at: http://www.cifor.org/publications/pdf_files/Books/BAngelsen0801.pdf

1. Decrease in carbon stocks and increase in GHG emissions associated with leakage prevention measures:

- Leakage management measure would not occasion any decrease in carbon stocks or increases in GHG emissions. Protected Area category requires that land uses are regulated. Within these regulations it is allowed to maintain and regulating existing livestock areas, but their expansion is prevented and monitored.
- Legal logging is permitted with forest management plans.
- The non forest areas are the leakage management areas. The activities to be carried out in these areas are considerer within the project activities prior signing conservation agreements.
- Non-forest classes presented in the areas of leakage management are the same class of non-forest present in the project area.
- The carbon stocks of leakage management areas are the same stocks from post deforestation class.
- The project does not consider changes in carbon stocks within the management areas of leakage due to project activities.

Whence, decrease in carbon stocks and increase in GHG emissions associated with leakage prevention measures is excluded.

2. Decrease in carbon stocks and increase in GHG emissions associated with activity displacement leakage:

- The procedure for estimating ex-ante carbon stock changes and GHG emissions due to activity displacement leakage is based on the “Displacement Leakage Factor” (DLF); which is an estimate for leakage emissions as a percentage of avoided unplanned deforestation resulting from the project activities. The DLF estimate is 5%.
- Not significant reduction of carbon stocks and/or increase in GHG emissions occurred compared with the baseline scenario. Therefore leakage emissions associated with the leakage prevention measures was not accounted and ex post monitoring will not be undertaken.

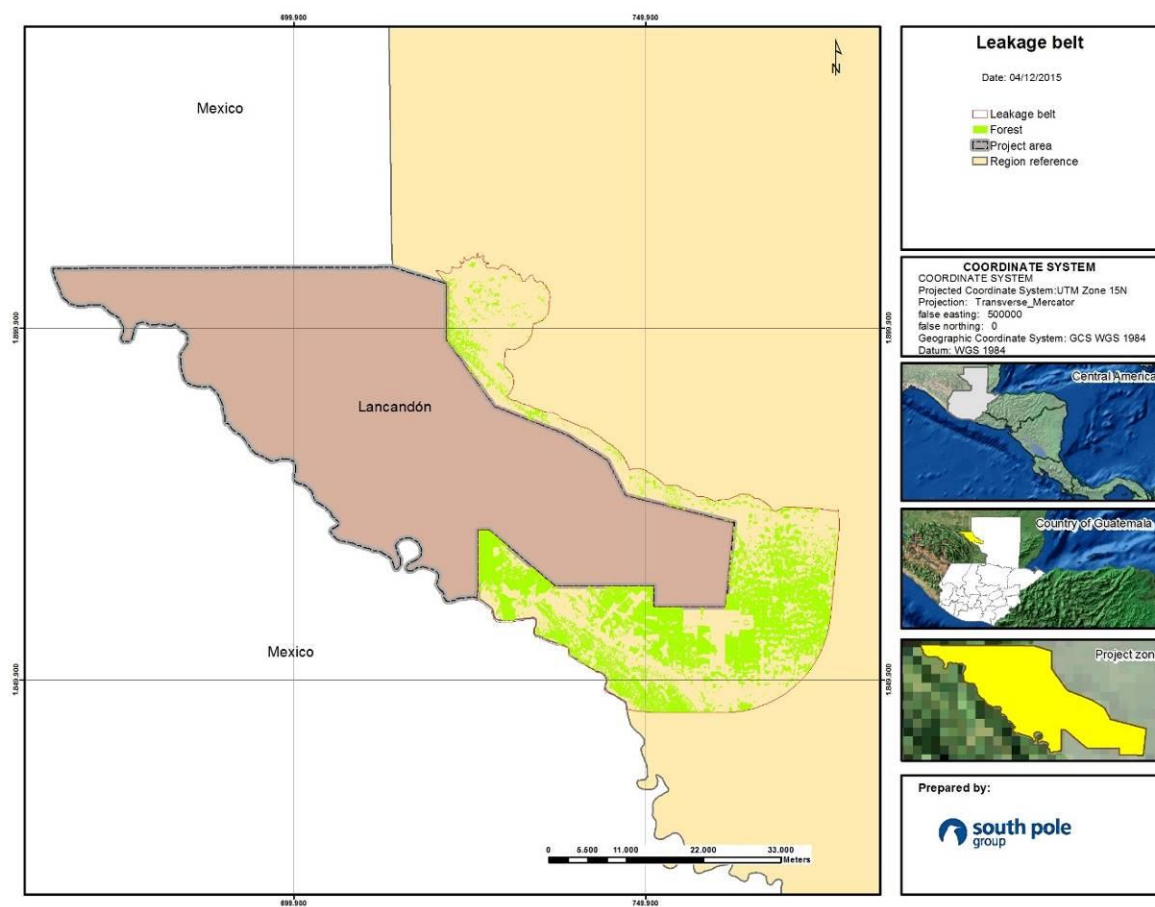


Figure 44. Leakage area of Lacandón REDD+ Project

Table 43. Ex ante estimated leakage due to displacement

project year t	Total ex ante estimated decrease in carbon stocks due activity displaced leakage		total ex-ante estimated increase in GHG emissions due to displaced forest fires	
	annual	cumulative	annual	cumulative
	ΔCADLKt	ΔCADLK	ΔEADLKt	ΔEADLK
	t CO2e	t CO2e	t CO2e	t CO2e
1	- 4.383,7	- 4.383,7	n.a	0,0
2	- 6.149,4	- 10.533,1	n.a	0,0
3	- 5.622,8	- 16.155,9	n.a	0,0
4	- 8.268,9	- 24.424,8	n.a	0,0
5	- 7.730,3	- 32.155,1	n.a	0,0
6	- 7.219,0	- 39.374,1	n.a	0,0
7	- 9.419,0	- 48.793,1	n.a	0,0
8	- 13.121,4	- 61.914,5	n.a	0,0
9	- 14.722,4	- 76.636,8	n.a	0,0
10	- 17.373,2	- 94.010,1	n.a	0,0
11	- 18.860,8	- 112.870,9	n.a	0,0
12	- 23.767,9	- 136.638,8	n.a	0,0
13	- 24.259,2	- 160.898,0	n.a	0,0
14	- 29.401,7	- 190.299,6	n.a	0,0
15	- 28.647,6	- 218.947,2	n.a	0,0
16	- 28.337,4	- 247.284,6	n.a	0,0
17	- 27.444,4	- 274.728,9	n.a	0,0
18	- 20.878,3	- 295.607,2	n.a	0,0
19	- 20.471,2	- 316.078,4	n.a	0,0
20	- 17.493,0	- 333.571,4	n.a	0,0
21	- 16.610,4	- 350.181,8	n.a	0,0
22	- 11.872,4	- 362.054,2	n.a	0,0
23	- 6.387,5	- 368.441,7	n.a	0,0
24	- 3.553,6	- 371.995,3	n.a	0,0
25	- 1.644,9	- 373.640,3	n.a	0,0
26	- 1.172,9	- 374.813,2	n.a	0,0
27	- 887,4	- 375.700,6	n.a	0,0
28	- 656,0	- 376.356,6	n.a	0,0
29	- 496,1	- 376.852,7	n.a	0,0
30	- 320,1	- 377.172,8	n.a	0,0

Table 44. Total estimate of ex-ante leakage

project year t	Total ex ante GHG emissions from increased grazing activities		Total ex ante increase in GHG emissions from displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total ex ante decrease in carbon stocks due to leakage prevention measures		Total net carbon stock change due to leakage		Total net carbon increase in emissions due to leakage	
	annual	cumulative	annual	cumulative	annual	cumulative	Annual	cumulative	annual	cumulative	annual	cumulative
	ΔEg _L Kt	ΔEg _{LK}	ΔEAD _L Kt	ΔEAD _{LK}	ΔCAD _{LK} t	ΔCAD _{LK} t	ΔCLP _{ML} Kt	ΔCLP _{ML} K	ΔCL _K t	ΔCL _K t	EL _K t	EL _K t
	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e	t CO ₂ e
1	n.a	n.a	n.a	n.a	-4.383,7	-4.383,7	n.a	n.a	-4.383,7	-4.383,7	n.a	n.a
2	n.a	n.a	n.a	n.a	-6.149,4	-10.533,1	n.a	n.a	-6.149,4	-10.533,1	n.a	n.a
3	n.a	n.a	n.a	n.a	-5.622,8	-16.155,9	n.a	n.a	-5.622,8	-16.155,9	n.a	n.a
4	n.a	n.a	n.a	n.a	-8.268,9	-24.424,8	n.a	n.a	-8.268,9	-24.424,8	n.a	n.a
5	n.a	n.a	n.a	n.a	-7.730,3	-32.155,1	n.a	n.a	-7.730,3	-32.155,1	n.a	n.a
6	n.a	n.a	n.a	n.a	-7.219,0	-39.374,1	n.a	n.a	-7.219,0	-39.374,1	n.a	n.a
7	n.a	n.a	n.a	n.a	-9.419,0	-48.793,1	n.a	n.a	-9.419,0	-48.793,1	n.a	n.a
8	n.a	n.a	n.a	n.a	-13.121,4	-61.914,5	n.a	n.a	-13.121,4	-61.914,5	n.a	n.a
9	n.a	n.a	n.a	n.a	-14.722,4	-76.636,8	n.a	n.a	-14.722,4	-76.636,8	n.a	n.a
10	n.a	n.a	n.a	n.a	-17.373,2	-94.010,1	n.a	n.a	-17.373,2	-94.010,1	n.a	n.a

project year t	Total ex ante GHG emissions from increased grazing activities		Total ex ante increase in GHG emissions from displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total ex ante decrease in carbon stocks due to leakage prevention measures		Total net carbon stock change due to leakage		Total net carbon increase in emissions due to leakage	
	annual	cumulativ e	annual	cumulativ e	annual	cumulativ e	Annual	cumulativ e	annual	cumulative	annu al	cumulativ e
	ΔEgL Kt	ΔEgLK	ΔEADL Kt	ΔEADLK	ΔCADLKt	ΔCADLK	ΔCLPML Kt	ΔCLPML K	ΔCLKt	ΔCLK	ELKt	ELK
	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e
11	n.a	n.a	n.a	n.a	- 18.860,8	- 112.870,9	n.a	n.a	- 18.860,8	- 112.870,9	n.a	n.a
12	n.a	n.a	n.a	n.a	- 23.767,9	- 136.638,8	n.a	n.a	- 23.767,9	- 136.638,8	n.a	n.a
13	n.a	n.a	n.a	n.a	- 24.259,2	- 160.898,0	n.a	n.a	- 24.259,2	- 160.898,0	n.a	n.a
14	n.a	n.a	n.a	n.a	- 29.401,7	- 190.299,6	n.a	n.a	- 29.401,7	- 190.299,6	n.a	n.a
15	n.a	n.a	n.a	n.a	- 28.647,6	- 218.947,2	n.a	n.a	- 28.647,6	- 218.947,2	n.a	n.a
16	n.a	n.a	n.a	n.a	- 28.337,4	- 247.284,6	n.a	n.a	- 28.337,4	- 247.284,6	n.a	n.a
17	n.a	n.a	n.a	n.a	- 27.444,4	- 274.728,9	n.a	n.a	- 27.444,4	- 274.728,9	n.a	n.a
18	n.a	n.a	n.a	n.a	- 20.878,3	- 295.607,2	n.a	n.a	- 20.878,3	- 295.607,2	n.a	n.a
19	n.a	n.a	n.a	n.a	- 20.471,2	- 316.078,4	n.a	n.a	- 20.471,2	- 316.078,4	n.a	n.a
20	n.a	n.a	n.a	n.a	- 17.493,0	- 333.571,4	n.a	n.a	- 17.493,0	- 333.571,4	n.a	n.a
21	n.a	n.a	n.a	n.a	- 16.610,4	- 350.181,8	n.a	n.a	- 16.610,4	- 350.181,8	n.a	n.a
22	n.a	n.a	n.a	n.a	-	-	n.a	n.a	-	-	n.a	n.a

project year t	Total ex ante GHG emissions from increased grazing activities		Total ex ante increase in GHG emissions from displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total ex ante decrease in carbon stocks due to leakage prevention measures		Total net carbon stock change due to leakage		Total net carbon increase in emissions due to leakage	
	annual	cumulativ e	annual	cumulativ e	annual	cumulativ e	Annual	cumulativ e	annual	cumulative	annu al	cumulativ e
	ΔEgL Kt	ΔEgLK	ΔEADL Kt	ΔEADLK	ΔCADLKt	ΔCADLK	ΔCLPML Kt	ΔCLPML K	ΔCLKt	ΔCLK	ELKt	ELK
	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e
					11.872,4	362.054,2			11.872,4	362.054,2		
23	n.a	n.a	n.a	n.a	- 6.387,5	- 368.441,7	n.a	n.a	- 6.387,5	- 368.441,7	n.a	n.a
24	n.a	n.a	n.a	n.a	- 3.553,6	- 371.995,3	n.a	n.a	- 3.553,6	- 371.995,3	n.a	n.a
25	n.a	n.a	n.a	n.a	- 1.644,9	- 373.640,3	n.a	n.a	- 1.644,9	- 373.640,3	n.a	n.a
26	n.a	n.a	n.a	n.a	- 1.172,9	- 374.813,2	n.a	n.a	- 1.172,9	- 374.813,2	n.a	n.a
27	n.a	n.a	n.a	n.a	- 887,4	- 375.700,6	n.a	n.a	- 887,4	- 375.700,6	n.a	n.a
28	n.a	n.a	n.a	n.a	- 656,0	- 376.356,6	n.a	n.a	- 656,0	- 376.356,6	n.a	n.a
29	n.a	n.a	n.a	n.a	- 496,1	- 376.852,7	n.a	n.a	- 496,1	- 376.852,7	n.a	n.a
30	n.a	n.a	n.a	n.a	- 320,1	- 377.172,8	n.a	n.a	- 320,1	- 377.172,8	n.a	n.a

5.6 Summary of GHG Emission Reductions and Removals (CL2)

5.6.1 Significance assessment

CL2.2 The inclusion of any of the carbon pools considered in the VM0015 Methodology for emission calculations depends on the outcome of the analysis of significance of each carbon stock. The methodology recommended to use the tool to test the significance of GHG emission Project Activities A / R CDM, which defines as "significant" those stocks totaling more than 5% of the total emissions generated by GHG.

$$RC_{Ei} = \frac{E_i}{\sum_{i=1}^I E_i}$$

Where:

RC_{Ei} = Relative contribution of each source i to the sum of project and leakage GHG emissions;

E_i = GHG emissions by sources of project and possible decreases in carbon pools and leakage emissions i as estimated;

i = Index for individual sources of project and leakage GHG emissions (I = total number of sources considered).

The stocks considered are the one that together reach a threshold of not less than 0.95, which are considered significant; the other stocks are considered not significant.

The analysis shows that the emissions associated with avoided deforestation and leakage account for 99.68% of emissions/emissions reductions due to the project. Therefore the emissions associated with legal and illegal harvested wood products from the project area account for less than half of one percent of cumulative emissions (0.32%), which are considered insignificant and excluded in the final ex-ante estimates. And despite the leakage do not reach 5% (4.75%), are considered important for the project and the methodology request reach at least 0.95.

5.6.2 Calculation of ex-ante estimation of total net GHG emissions reductions

The project followed the calculation given in VM0015 v1.1 for calculating the ex-ante estimation of total net GHG emissions. Result are show below:

$$\Delta REDDt = (\Delta CBSLPAt + EBBBSLPAt) - (\Delta CPSPAt + EBBPSPAt) - (\Delta CLKt + ELKt)$$

Where:

$\Delta REDDt$ = Ex ante estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t ; tCO_2e

$\Delta CBSLPAt$ = Sum of baseline carbon stock changes in the project area at year t ; tCO_2e Note: The absolute values of $CBSLPAt$ shall be used in equation 19.

$EBBBSLPAt$ = Sum of baseline emissions from biomass burning in the project area at year t ; tCO_2e

$\Delta CPSPAt$ = Sum of ex ante estimated actual carbon stock changes in the project area at year t ; tCO_2e

Note: If $CPSPAt$ represents a net increase in carbon stocks, a negative sign before the absolute value of $CPSPAt$ shall be used. If $CPSPAt$ represents a net decrease, the positive sign shall be used.

$EBBPSPAt$ = Sum of (ex ante estimated) actual emissions from biomass burning in the project area at year t ; tCO_2e

$\Delta CLKt$ = Sum of ex ante estimated leakage net carbon stock changes at year t ; tCO_2e Note: If the cumulative sum of $CLKt$ within a fixed baseline period is > 0 , $CLKt$ shall be set to zero.

$ELKt$ = Sum of ex ante estimated leakage emissions at year t ; tCO_2e

$t = 1, 2, 3 \dots T$, a year of the proposed project crediting period; dimensionless

Table 45. Ex ante net anthropogenic GHG emission reductions attributable to AUD project activity

Project year t	Baseline carbon stock changes		Baseline GHG emissions		Ex ante project carbon stock changes		Ex ante project GHG emissions		Ex ante leakage carbon stock changes		Ex ante leakage GHG emissions	
	annual $\Delta CBSLPA_t$	cumulative $\Delta CBSLPA$	annual $EBBBSLP_{A_t}$	cumulative $EBBBSLP_A$	annual $\Delta CPSPA_t$	cumulative $\Delta CPSPA$	annual $EBBPSP_{A_t}$	cumulative $EBBPSP_A$	annual ΔCLK_t	cumulative ΔCLK	annual ELK_t	cumulative ELK
	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
1	194.832,8	194.832,8	N.A	N.A	107.158,0	107.158,0	N.A	N.A	4.383,7	4.383,7	N.A	N.A
2	273.305,7	468.138,5	N.A	N.A	150.318,1	257.476,2	N.A	N.A	6.149,4	10.533,1	N.A	N.A
3	249.903,1	718.041,6	N.A	N.A	137.446,7	394.922,9	N.A	N.A	5.622,8	16.155,9	N.A	N.A
4	367.506,3	1.085.547,9	N.A	N.A	202.128,4	597.051,3	N.A	N.A	8.268,9	24.424,8	N.A	N.A
5	343.567,9	1.429.115,8	N.A	N.A	188.962,4	786.013,7	N.A	N.A	7.730,3	32.155,1	N.A	N.A
6	320.843,7	1.749.959,5	N.A	N.A	176.464,0	962.477,7	N.A	N.A	7.219,0	39.374,1	N.A	N.A
7	418.623,6	2.168.583,1	N.A	N.A	230.243,0	1.192.720,7	N.A	N.A	9.419,0	48.793,1	N.A	N.A
8	583.171,7	2.751.754,8	N.A	N.A	320.744,5	1.513.465,2	N.A	N.A	13.121,4	61.914,5	N.A	N.A
9	654.326,8	3.406.081,6	N.A	N.A	359.879,7	1.873.344,9	N.A	N.A	14.722,4	76.636,8	N.A	N.A
10	772.143,2	4.178.224,9	N.A	N.A	424.678,8	2.298.023,7	N.A	N.A	17.373,2	94.010,1	N.A	N.A
11	838.259,7	5.016.484,5	N.A	N.A	461.042,8	2.759.066,5	N.A	N.A	18.860,8	112.870,9	N.A	N.A
12	1.056.350,4	6.072.834,9	N.A	N.A	580.992,7	3.340.059,2	N.A	N.A	23.767,9	136.638,8	N.A	N.A
13	1.078.185,1	7.151.020,1	N.A	N.A	593.001,8	3.933.061,0	N.A	N.A	24.259,2	160.898,0	N.A	N.A
14	1.306.740,5	8.457.760,6	N.A	N.A	718.707,3	4.651.768,3	N.A	N.A	29.401,7	190.299,6	N.A	N.A
15	1.273.226,0	9.730.986,6	N.A	N.A	700.274,3	5.352.042,6	N.A	N.A	28.647,6	218.947,2	N.A	N.A

Project year t	Baseline carbon stock changes		Baseline GHG emissions		Ex ante project carbon stock changes		Ex ante project GHG emissions		Ex ante leakage carbon stock changes		Ex ante leakage GHG emissions	
	annual $\Delta CBSLPA_t$	cumulative $\Delta CBSLPA$	annual $EBBBSLP_{A_t}$	cumulative $EBBBSLP_A$	annual $\Delta CPSPA_t$	cumulative $\Delta CPSPA$	annual $EBBPSP_{A_t}$	cumulative $EBBPSP_A$	annual ΔCLK_t	cumulative ΔCLK	annual ELK_t	cumulative ELK
	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
16	1.259.438,6	10.990.425,2	N.A	N.A	692.691,2	6.044.733,9	N.A	N.A	28.337,4	247.284,6	N.A	N.A
17	1.219.749,0	12.210.174,2	N.A	N.A	670.861,9	6.715.595,8	N.A	N.A	27.444,4	274.728,9	N.A	N.A
18	927.924,1	13.138.098,2	N.A	N.A	510.358,2	7.225.954,0	N.A	N.A	20.878,3	295.607,2	N.A	N.A
19	909.830,3	14.047.928,5	N.A	N.A	500.406,7	7.726.360,7	N.A	N.A	20.471,2	316.078,4	N.A	N.A
20	777.466,0	14.825.394,6	N.A	N.A	427.606,3	8.153.967,0	N.A	N.A	17.493,0	333.571,4	N.A	N.A
21	738.241,8	15.563.636,3	N.A	N.A	406.033,0	8.560.000,0	N.A	N.A	16.610,4	350.181,8	N.A	N.A
22	527.660,5	16.091.296,9	N.A	N.A	290.213,3	8.850.213,3	N.A	N.A	11.872,4	362.054,2	N.A	N.A
23	283.890,9	16.375.187,8	N.A	N.A	156.140,0	9.006.353,3	N.A	N.A	6.387,5	368.441,7	N.A	N.A
24	157.938,4	16.533.126,2	N.A	N.A	86.866,1	9.093.219,4	N.A	N.A	3.553,6	371.995,3	N.A	N.A
25	73.108,4	16.606.234,6	N.A	N.A	40.209,6	9.133.429,0	N.A	N.A	1.644,9	373.640,3	N.A	N.A
26	52.130,7	16.658.365,3	N.A	N.A	28.671,9	9.162.100,9	N.A	N.A	1.172,9	374.813,2	N.A	N.A
27	39.438,7	16.697.804,0	N.A	N.A	21.691,3	9.183.792,2	N.A	N.A	887,4	375.700,6	N.A	N.A
28	29.155,9	16.726.959,9	N.A	N.A	16.035,8	9.199.828,0	N.A	N.A	656,0	376.356,6	N.A	N.A
29	22.047,1	16.749.007,0	N.A	N.A	12.125,9	9.211.953,8	N.A	N.A	496,1	376.852,7	N.A	N.A
30	14.226,8	16.763.233,8	N.A	N.A	7.824,7	9.219.778,6	N.A	N.A	320,1	377.172,8	N.A	N.A

Table 46. Summary of ex-ante net GHG emission reductions

Years	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
1	194.832,8	107.158,0	4.383,7	83.291,0
2	273.305,7	150.318,1	6.149,4	116.838,0
3	249.903,1	137.446,7	5.622,8	106.833,0
4	367.506,3	202.128,4	8.268,9	157.108,0
5	343.567,9	188.962,4	7.730,3	146.875,0
6	320.843,7	176.464,0	7.219,0	137.160,0
7	418.623,6	230.243,0	9.419,0	178.961,0
8	583.171,7	320.744,5	13.121,4	249.305,0
9	654.326,8	359.879,7	14.722,4	279.724,0
10	772.143,2	424.678,8	17.373,2	330.091,0
11	838.259,7	461.042,8	18.860,8	358.356,0
12	1.056.350,4	580.992,7	23.767,9	451.589,0
13	1.078.185,1	593.001,8	24.259,2	460.924,0
14	1.306.740,5	718.707,3	29.401,7	558.631,0
15	1.273.226,0	700.274,3	28.647,6	544.304,0
16	1.259.438,6	692.691,2	28.337,4	538.409,0
17	1.219.749,0	670.861,9	27.444,4	521.442,0
18	927.924,1	510.358,2	20.878,3	396.687,0
19	909.830,3	500.406,7	20.471,2	388.952,0
20	777.466,0	427.606,3	17.493,0	332.366,0
21	738.241,8	406.033,0	16.610,4	315.598,0
22	527.660,5	290.213,3	11.872,4	225.574,0
23	283.890,9	156.140,0	6.387,5	121.363,0
24	157.938,4	86.866,1	3.553,6	67.518,0
25	73.108,4	40.209,6	1.644,9	31.253,0
26	52.130,7	28.671,9	1.172,9	22.285,0
27	39.438,7	21.691,3	887,4	16.860,0
28	29.155,9	16.035,8	656,0	12.464,0
29	22.047,1	12.125,9	496,1	9.425,0
30	14.226,8	7.824,7	320,1	6.081,0
Total	16.763.233,8	9.219.778,6	377.172,8	7.166.267,0

5.6.3 Calculation of ex ante Verified Carbon Units (VCUs)

CL2.1 The number of Verified Carbon Units (VCUs) to be generated through the proposed AUD project activity at year t is calculated according to VM0015 methodology. The Risk factor used is 10% as was determined in the VCS Non-Permanence Risk Report.

$$VCUt = \Delta REDDt - VBCt$$

$$VBCt = (\Delta CBSLPAt - \Delta CPSPAt) * RFt$$

Where:

$VCUt$ = Number of Verified Carbon Units that can be traded at time t ; t CO₂-e

$\Delta REDDt$ = Ex ante estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t ; tCO₂-e ha⁻¹

$VBCt$ = Number of Buffer Credits deposited in the VCS Buffer at time t ; t CO₂-e

$\Delta CBSLPAt$ = Sum of baseline carbon stock changes in the project area at year t ; tCO₂e

$\Delta CPSPAt$ = Sum of ex ante estimated actual carbon stock changes in the project area at year t ; tCO₂-e ha⁻¹

RFt = Risk factor used to calculate VCS buffer credits; 10%

$t = 1, 2, 3 \dots T$, a year of the proposed project crediting period; dimensionless

Table 47. Ex – ante net anthropogenic GHG emission reductions, buffer credits and VCUs

<i>Ex ante</i> net anthropogenic GHG emission reductions		<i>Ex ante</i> buffer credits		<i>Ex ante</i> VCUs tradable	
annual $\Delta REDD_t$ tCO ₂ -e	cumulative $\Delta REDD$ tCO ₂ -e	annual VBC_t tCO ₂ -e	cumulative VBC tCO ₂ -e	annual VCU_t tCO ₂ -e	cumulative VCU tCO ₂ -e
83.291,0	83.291,0	8.767,0	8.767,0	74.524,0	74.524,0
116.838,0	200.129,0	12.298,0	21.065,0	104.540,0	179.064,0
106.833,0	306.962,0	11.245,0	32.310,0	95.588,0	274.652,0
157.108,0	464.070,0	16.537,0	48.847,0	140.571,0	415.223,0
146.875,0	610.945,0	15.460,0	64.307,0	131.415,0	546.638,0
137.160,0	748.105,0	14.437,0	78.744,0	122.723,0	669.361,0
178.961,0	927.066,0	18.838,0	97.582,0	160.123,0	829.484,0
249.305,0	1.176.371,0	26.242,0	123.824,0	223.063,0	1.052.547,0
279.724,0	1.456.095,0	29.444,0	153.268,0	250.280,0	1.302.827,0
330.091,0	1.786.186,0	34.746,0	188.014,0	295.345,0	1.598.172,0
358.356,0	2.144.542,0	37.721,0	225.735,0	320.635,0	1.918.807,0
451.589,0	2.596.131,0	47.535,0	273.270,0	404.054,0	2.322.861,0
460.924,0	3.057.055,0	48.518,0	321.788,0	412.406,0	2.735.267,0
558.631,0	3.615.686,0	58.803,0	380.591,0	499.828,0	3.235.095,0
544.304,0	4.159.990,0	57.295,0	437.886,0	487.009,0	3.722.104,0
538.409,0	4.698.399,0	56.674,0	494.560,0	481.735,0	4.203.839,0
521.442,0	5.219.841,0	54.888,0	549.448,0	466.554,0	4.670.393,0
396.687,0	5.616.528,0	41.756,0	591.204,0	354.931,0	5.025.324,0
388.952,0	6.005.480,0	40.942,0	632.146,0	348.010,0	5.373.334,0
332.366,0	6.337.846,0	34.985,0	667.131,0	297.381,0	5.670.715,0
315.598,0	6.653.444,0	33.220,0	700.351,0	282.378,0	5.953.093,0
225.574,0	6.879.018,0	23.744,0	724.095,0	201.830,0	6.154.923,0
121.363,0	7.000.381,0	12.775,0	736.870,0	108.588,0	6.263.511,0
67.518,0	7.067.899,0	7.107,0	743.977,0	60.411,0	6.323.922,0
31.253,0	7.099.152,0	3.289,0	747.266,0	27.964,0	6.351.886,0
22.285,0	7.121.437,0	2.345,0	749.611,0	19.940,0	6.371.826,0
16.860,0	7.138.297,0	1.774,0	751.385,0	15.086,0	6.386.912,0
12.464,0	7.150.761,0	1.312,0	752.697,0	11.152,0	6.398.064,0
9.425,0	7.160.186,0	992,0	753.689,0	8.433,0	6.406.497,0
6.081,0	7.166.267,0	640,0	754.329,0	5.441,0	6.411.938,0

5.7 Climate Change Adaptation Benefits (GL1)

GL1.1 Guatemala presents a socio-economic environment in which one tenth (1/10) of the gross domestic product (GDP), two fifths (2/5) of the exports volume and almost half (1/2) of the work force available in the country is directly related to the agriculture sector, which is extremely vulnerable to changes in climate. The Economic Commission for Latin America and the Caribbean (ECLAC called CEPAL by its acronym in Spanish) has studied the vulnerability of the agricultural sector in Guatemala and has concluded that the economic impact of the climate change could represent a loss of 3-15% of the GDP by 2100¹⁰². For the estimation the study was based on the recent climatic disasters that affected Guatemala, namely hurricane Mitch (year 1998) and the hurricane Stan (year 2005).

Guatemala is particularly vulnerable to the adverse effects of climate change. It expected the increasing of size and periodicity of natural phenomena such as storms and droughts, with effects on reduction of water availability and quality, displacement of pest, vectors, predators and diseases into new geographical areas, disturbances and blockages in the food chain; increased of forest fires by drought, loss of infrastructure; increased of food insecurity due to crop failure; destruction of natural habitats; negative impacts on all forms of human subsistence and reduction of soil quality (Ley Marco para regular la reducción de la vulnerabilidad, la adaptación obligatoria ante los efectos del cambio climático y la mitigación de gases de efecto invernadero)¹⁰³.

Project activities will help reduce population vulnerability to food insecurity through implementation of alternative productive activities. Furthermore, with the implementation of environmental education, sexual and health workshops, along with patrols and forest conservation, sustainable forest management will be achieved.

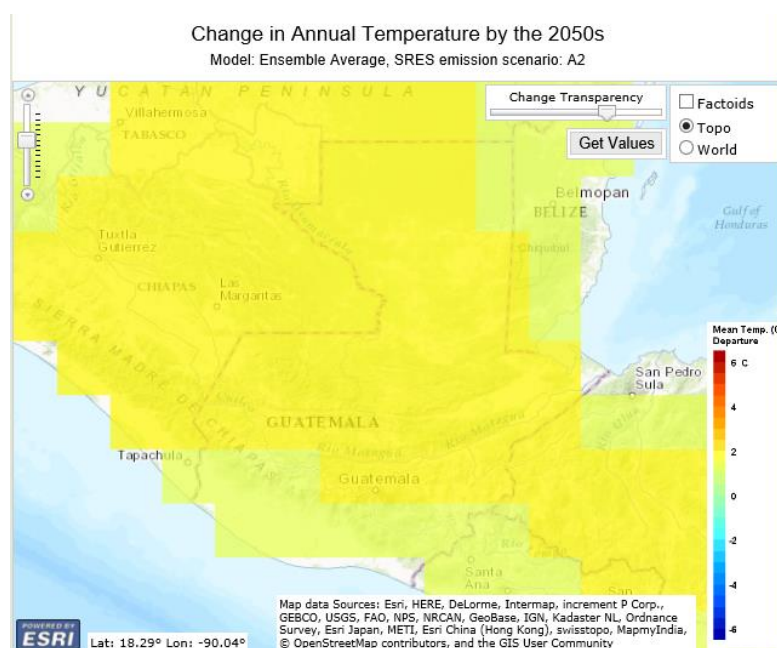


Figure 45. Change in annual temperature by 2050

¹⁰² Mora et al., 2010. Available at http://repositorio.cepal.org/bitstream/handle/11362/25917/LCmexL963_es.pdf?sequence=1

¹⁰³ Congreso de la República Gt. Decreto Número 7-2013

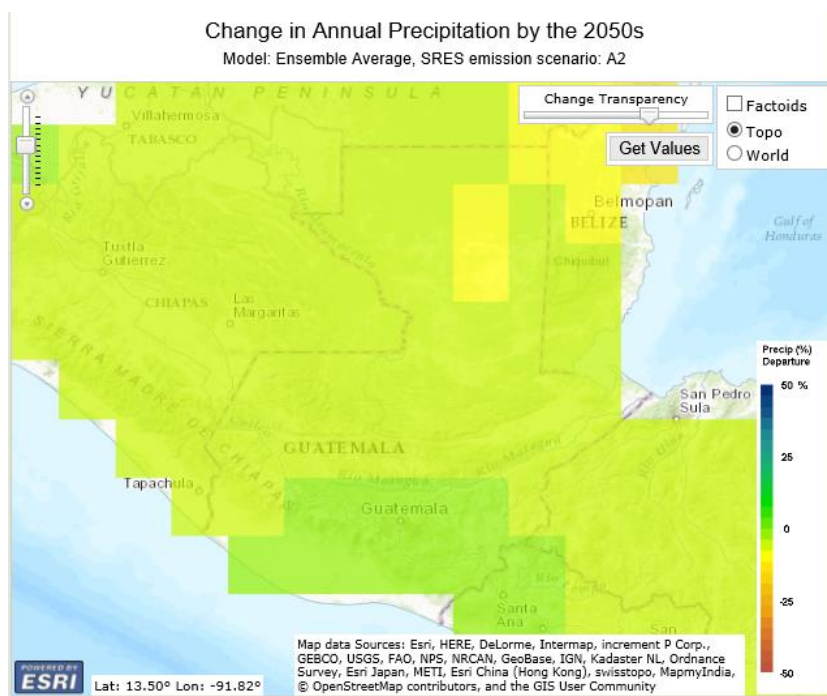


Figure 46. Change in annual precipitation by 2050

GL1.2 The increase in atmospheric temperature and sea, reduction and regime instability rainfall and sea level rise, further the intensification of weather phenomena extremes such as droughts and hurricanes will impact production, infrastructure, livelihoods, health and safety of the population, and that will weaken the ability of environment to provide vital resources and services. Due to its socio-economic conditions local communities will be implicitly forced to adapt to this changing climate. Their results show that, in a rather severe climate scenario, the value of land 30% for 2100 will be reduced. According to ClimateWizard, Guatemala by 2050 would have an increase on temperature of nearly 2 °C.

CEPAL¹⁰⁴ conducted an assessment of the economic impacts related to climate change on Guatemala's agricultural sector by the year 2100, shows that the losses could range from 3% and 15% of GDP (considering a discount rate of 2%), depending on the severity of climate scenario estimate.

This project's community enhancement and conservation activities will not be threatened by climate change, that is, they will not be more vulnerable than under any baseline scenario. Furthermore, the project will strengthen the communities' capacity to cope with future climate change. We perceive our forest conservation efforts as an investment in ecosystem health, which is an accepted measure of climate change adaptation. The project explicitly addresses scenarios that are predicted attending to future climate change, e.g. by selecting agricultural techniques that better conserve moisture and the soil fertility (see section Description of the Project Activity (G1)). Implementation of the project is expected to create positive net climate change impacts. The increase in forest cover and sequestration of carbon in living biomass will contribute to the reduction of green house gas emissions by acting as sinks of CO₂.

¹⁰⁴ Guatemala: Efectos del cambio climático sobre la agricultura. 2010. Available at: http://repositorio.cepal.org/bitstream/handle/11362/25917/LCmexL963_es.pdf?sequence=1

The complex nature of interactions between climate change and natural resources virtually ensures that over the lifetime of the project new risks will emerge; risks that have not yet been identified and anticipated. The project addresses this in the best possible way by applying an adaptive management strategy (see section Management of Risks to Project Benefits (G1)). This ensures that new impacts of climate change that emerge over the lifetime of the project will be recognized and appropriately addressed in the project management.

GL1.3 Most common adaptation strategies include diversification of income beyond agriculture, different crops and varieties, investigation of alternative NTFPs and markets, sustainable water management and conservational agriculture.

Additionally, the creation of new business models can contribute to creation of new job profiles that were inexistent in the project region until now. This project employs as many locals as possible and the forecast is that additional workforce will be necessary in the future. For complete information, please refer to Section 5.

GL1.4 Along its agricultural improvement activities, the project will enhance the use of agricultural techniques that lower the amount of fertilizer and pest controlling chemical products. This will enhance the food sovereignty of farmers and will lead to an agricultural approach that is less dependent on the supply of chemical soil correctors and pest controlling products through study and improvement of current agricultural practices. For complete information, please refer to Section 4.

The project comprises a range of activities beneficial to climate change adaptation. These include, but are not limited to:

- Diversification of employment and income beyond agriculture, such as identification of new NTFP.
- Improvement of agricultural practices with the aim of granting higher productivities and slowing the amount of hectares deforested per household/year.
- The project's adaptive management will identify and address further issues of climate change adaptation.
- Monitoring of these climate adaptation impacts will go in line with other monitoring activities. Indicators concerning agricultural productivity and employment opportunities such as through commercialization of alternative NTFP will also be used to monitor climate adaptation impacts.

6 COMMUNITY

6.1 Net Positive Community Impacts (CM1 & CM2)

CM2.1 The project has used the Participatory Rural Appraisal (PRA) in order to understand what are the most relevant aspects to achieve sustainable development within the communities.

The analysis of the net benefits to the communities resulting from the project activity is organized around the Sustainable Livelihoods Approach (SLA). The SLA includes a framework for understanding the complexities of poverty and guiding principles for action. This framework is designed to centre on people and the influences that affect how they can support themselves and their families.

The main objective related to community well-being is to promote the sustainable development of local communities living in the project area, through productive activities adapted to local cultural, geographic, infrastructure and access to markets. The basic units of SLA analysis are livelihood assets, which are divided into five categories: human capital, social capital, physical capital, natural capital and financial capital. One of the key factors that affect access to livelihood assets is the vulnerability context. This idea incorporates into the analysis economic, political, technological trends as well as shocks and seasonality.

The guiding principles of the SLA are:

- **Be people-centred.** SLA begins by analyzing people's livelihoods and how they change over time. The people themselves actively participate throughout the project cycle.
- **Be holistic.** SLA acknowledges that people adopt many strategies to secure their livelihoods, and that many actors are involved; for example the private sector, ministries, community-based organizations and international organizations.
- **Be dynamic.** SLA seeks to understand the dynamic nature of livelihoods and what influences them.
- **Build on strengths.** SLA builds on people's perceived strengths and opportunities rather than focusing on their problems and needs. It supports existing livelihood strategies.
- **Promote micro-macro links.** SLA examines the influence of policies and institutions on livelihood options and highlights the need for policies to be informed by insights from the local level and by the priorities of the poor
- **Encourage broad partnerships.** SLA counts on broad partnerships drawing on both the public and private sectors
- **Aim for sustainability.** Sustainability is important if poverty reduction is to be lasting

CM1.3 / CM2.3 The evaluation of the net benefits to the community and community groups of the project have been based on a comparison with the baseline scenario and structured based on the Sustainable Livelihoods Approach. The below table summarizes the improvements in each category of livelihood asset that the project has provided to the local communities.

Table 48. Expected impacts

Livelihood Asset		Without Project Scenario	With Project Scenario	Net Effect	Relevant Area
Human Capital	Health& Education	No additional investments in health and education in the project area.	FDN support in the management and search for projects to improve education and health centers.	Positive. Increased life expectancy	Improve access to education and health. More accessibility to investment funds
	Knowledge and skills	Low education and capacity building efforts	The project activity contributes to the accumulation of knowledge at the local level. Employees will receive extensive training. Specifically, members of FDN teams will receive comprehensive training to enable them to fulfill their different responsibilities. Locals will benefit from the capacity-buildings that refer to the project activities to be implemented. Further training and awareness raising will be included as part of workshop system.	Positive. Improvement in skills and knowledge in forest management	Improved community capacities and skills
	Forest resources	Low capacities in forest monitoring	Primary project proponent have executed educational activities and specific training for the communities. Several workshops were implemented about conservation of the	Positive. Increase in perception/ recognition of the value of forest resources	Improved community capacities and skills. Improved social well being

Livelihood Asset		Without Project Scenario	With Project Scenario	Net Effect	Relevant Area
			biodiversity and several community programs. In addition, trainings are expected, to people who have responsibilities in monitoring the use of methodologies and materials / equipment, samples and the use of the notebook and field formats, both for biodiversity as community monitoring.		
Social Capital	Community participation on the Governance Committee	Communities without participation and empowerment in decision-making	Governance Committee of the project increases community leadership and strengthens local capacity.	Positive. Increase in local decision-making abilities	Conflict resolution
	Relationships	No instance of cooperation are presented	Implementation of communities policies.	Relations of trust and mutual support	Improved social well being
Physical Capital	Infra-structure	No significant investments in local infrastructure.	Project activities will improve the infrastructure of the communities through More access to investment funds	Positive. New or improved transportation infrastructure	Improved social well being
	Access to market	No significant investments in local infrastructure.	Development of product value chains and market research.	Positive. Improved access to markets (due to new or improved	Improved social well being

Livelihood Asset		Without Project Scenario	With Project Scenario	Net Effect	Relevant Area
Financial Capital	Employment	Very low level of formal employment, with no long term security for the jobs.	The project proponents perceive the creation of self employment as a key to project success, for which aim to – wherever possible – fill positions with local employees.	Positive. Employment (direct and indirect)	Improved social well being
	Investment	No new sources of income available, due to the lack of investment activities.	The project activity will open new sources of income. The project activities are designed to be financially self-sufficient in the long run. After initial investments have been made and capacity reaches a certain level, the local population will perpetuate the project activities because it will be in their self-interest to do so.	Positive. Increase in cash income from carbon payments	Reduction in poverty

This REDD+ Project is both community based and incentive based. Virtually all project activities aim on improving the local communities' livelihoods and providing attractive alternatives to the unsustainable use of natural resources. The communities will benefit in many ways from the project, and it is virtually certain that the benefits will not materialize in the absence of the project.

More specifically, the project activities considering signature of cooperation agreements, development and divulgation of "social cartography", establishment of a program of microcredits, study and implementation of sustainable agricultural activities, coordinate the process of generation of licenses for management of land, investigation on alternative NTFP and their subsequent markets and value chains, practices of forest enrichment and the seasonal health and reproductive campaigns will significantly improve the livelihoods of the communities in the project area. As the project considers investing in the community as a whole, the benefits towards even broader and poorer sections of the communities are ensured. This is realized via the Governance committee (see section Evidence of Right of Use (G5)).

As all of these benefits will most surely not materialize without the project. The project proponents believe strongly that the project will have a positive impact on the local communities.

6.2 Negative Offsite Stakeholder impacts (CM3)

CM3.1 / CM3.2 / CM3.3 No negative offsite stakeholder impacts are expected to occur¹⁰⁵. No negative impacts have been identified on other stakeholders, and therefore no measures or activities have been developed. The project also serves as an example of good practices and innovative approaches in the communities that can be adapted by outside communities.

6.3 Exceptional Community Benefits (GL2)

GL2.1 The Human Development Index of 2013 puts Guatemala in position 133 of all ranked countries (187), with a value of 0.581. To give a comparison, the three first rated countries are Norway, Australia and United States of America and score 0.955, 0.938, 0.937, respectively. The last three rated countries are Mozambique, Democratic Republic of Congo and Niger, scoring 0.327, 0.304 and 0.304, respectively¹⁰⁶.

Previous studies on the population of the SLNP revealed that education levels were well below the national rural average, auguring poorly for alternative employment opportunities for settlers and for widening the career horizons of settler children. When asked to heads of households, only 11% finished primary school. The proportion of school-aged children in primary school was of 32%¹⁰⁷.

These parts of the communities are seen as the lowest category of wellbeing. The poorest parts are explicitly addressed by the project through the project activities included in the strategy Health and welfare of communities (see section Description of the Project Activity (G1)). This education program

¹⁰⁵ Weischet y Caviedes, 1993 cited in Carr, 2006. Población, Uso del Suelo y Deforestación en El Parque Nacional Sierra de Lacandón, Petén, Guatemala. Available online at: <http://ccp.ucr.ac.cr/seminario/pdf/carr.pdf>

¹⁰⁶ Information available online at: http://hdr.undp.org/en/media/HDR_2013_EN_complete.pdf

¹⁰⁷ Carr, D. L. (In Press). Population, rural development, and land use among settler households in an agricultural frontier in Guatemala's Maya Biosphere Reserve. Geographical Review . Available online at: <http://geog.ucsb.edu/~carr/wordpress/wp-content/uploads/2012/04/Population-rural-development-and-land-use-among-settler-households-in-an-agricultural-frontier-in-Guatemala%E2%80%99s-Maya-Biosphere-Reserve.pdf>

aims to reinforce the education received in the primary education and make essential concepts of health and welfare available to everyone in the project area. This is done by implementing workshops in the communities and monitoring the households that cannot or do not bring their children to school as well as through investment on increasing the quality of primary education in general. By applying this approach, the project proponents ensure that the vast majority of poorest families will benefit from the education activities. In addition to investments in education, the poorest will also benefit from the overall investments on infrastructures, that it is expected to improve the access to improved health management in the project area.

GL2.1 For the 2009 baseline study, households with financial means equal to or less than \$2 USD per person per day were considered to be below the poverty line, and households with financial means equal to or less than \$1 USD per person per day were considered to be below the line of extreme poverty, according to the most-of used international standard (International Labour Organization).

In the 2009 baseline study, for the cooperative of La Lucha, it was established that the average was Q 10.88 (Guatemalan Quetzal, GTQ) (\$1.30 USD) available daily per person. At the lowest extreme, there were 2.3% of families subsisting on Q 2.43 (\$0.29 USD) per person per day, while at the highest extreme, there were 2.3% of families living on Q 30 (\$3.60 USD) per person per day.

A total of 20.5% of households fell above the poverty line, while the remaining 79.5% fell below the line. Of those below the poverty line, 53.8% fell into the category of extreme poverty. Agriculture was the main source of income for families living below the poverty line.

In the case of La Técnica Agropecuaria, 60.5% of households subsisted on less than Q 16 (\$2 USD) per person per day. Among those households, 23.3% of the total subsisted on less than Q 8 per person per day (\$1 USD). At the lowest extreme were families subsisting on Q 1.90 (\$0.23 USD) per person per day, while at the highest extreme were families living on Q 55 (\$6.88 USD) per person per day. The average was Q 14.32 (\$1.79 USD) per person per day.

Finally, for Unión Maya Itzá, 38.3% of households subsisted on less than Q 1,000 per family per month. 29.8% of households had between Q 1,000 and Q 2,000 per month, and 12.8% had between Q 2,000 and 3,000 per month. At the lowest extreme (2.1%) were families subsisting on Q 3.70 per person per day, while at the highest extreme (2.1%) were families living on Q 25 per person per day. The average was Q 10.27 (\$1.23 USD) per person per day.

While 21.1% of households fell above the poverty line, the remaining 78.9% fell below the poverty line. 36.8% of households were considered to be in extreme poverty.

Overall, we are convinced that the poorest members of the local communities will strongly benefit from our project. The project is building capacity and creating opportunities for linkages to project activities and/or production chains other than logging, including agroforestry arrangements containing products for family consumption.

Barriers to involvement of the poorer households could result from existing social barriers. As a result, poorer parts could be actively excluded from community activities by the remaining sections of the community. Also, poorer parts could be less proactive themselves. During our involvement in the project area, we have not noticed such dynamics. The communities seem relatively heterogeneous. However, as part of our community monitoring system (see section Data and Parameters Monitored (CL4, CM4 & B4)),

we aim to identify such barriers. Should any barrier come to our attention, we will react to it and adapt our policies to address it. This will be part of our adaptive management approach.

As standard practice, the project will monitor household-income class and gender of any direct beneficiary of the project's activities. This can then be compared to the results of the monitoring of indirect benefits, which are based on randomized sampling within the communities (see section Description of the Monitoring Plan (CL4, CM4 & B4)). Cross-comparison of gender and household-income class of direct beneficiaries with all locals will then reveal any bias towards richer sections of the communities. The project proponent intend to distribute direct benefits pro-poor and commit to take corrective action should we discover any bias against the poorest locals.

GL2.2 Through the project activities such as adjustment of land uses and land use rights, sustainable farming and livestock familiar management systems, and diversification and use of communal forestry resources; the communities will increase their incomes and will improve their quality of life. Besides, women participation would increase in REDD+ project activities.

FDN conduct a cultural inventory of the entire protected area and has improved the management and conservation of the sites of Piedras Negras and El Tecolote.

Project activities include:

- Generating economic alternatives through conservation and / or protection of natural resources
- Sustainable management of natural resources
- Strengthening governance in communities
- Access to activities and empowerment of women and youth
- Improving the quality of life of communities

The indicators of well-being impacts on communities will be evaluate through the “Indirect effects monitored - Social impact” described in the Table 53, reflecting the improvement in the quality of life within the communities. Please refer to Section CM4 Community Impact Monitoring for more information.

GL2.3 All negative impacts were explained in the participatory process with communities (evidence available to auditor), among those listed:

- Decreased revenues from illegal activities
- Higher control over the expansion of the agricultural frontier
- Believe that you can live only from project
- Mishandling of the project can generate pollution
- The project promotes individualism

All the REDD+ project activities are designed to ensure that vulnerability is reduced and benefits increase for the most marginalized and vulnerable groups throught strengthening land tenure; developing alternative economic activities to reduce financial vulnerability; protecting natural resources to reduce environmental vulnerability; and increasing governance capacity enhances the relationship and contact with other institutions, which reduces the vulnerability of the community (further information in Section Net Positive Community).

GL2.4 Community groups that are marginalized and/or vulnerable were identified according the land tenure. These communities are Nueva Jerusalén II, Guayacán, El Pital, El Esfuerzo y Nuevo Paraíso 107. The communities are also located within the SLNP and were as well established prior to the establishment of the protected area law. The importance and priority to work with these communities is the proximity to the intangible area of the SLNP and the pressure on forest areas. In addition, if they do not adjust their permanence in the park, they will not be able to benefit from future projects from FDN, CONAP, Municipalities, Guatemala's State and project activities.

For these reason, adjustment of land uses and land use rights and the signing of cooperation agreements is priority in order to reduce the high sensitivity and low adaptive capacity to adjust in response to actual or expected changes. The implementation of the project's strategies will reduce the effect of climate change and help the communities to adapt and to improve their quality of life. Therefore, the project activities will generate net positive impacts on the well-being of these communities.

There are no any risk or barriers identified. CONAP and FDN work currently on obtaining signed cooperation agreements for these communities to adequate their situation according to the legal jurisdiction that is applicable in the areas of the SLNP. CONAP has already expressed the willingness to maintain the settlements with historic land rights if they follow the guidelines considered by the applicable law.

Periodic local consultations are developed as measure to avoid that any vulnerable community member may be negatively affected by the project.

GL2.5 The project is generating net positive impacts on the welfare of women and ensuring that women participate in decision-making. At the date, there is a pilot project which primary purpose is to provide financial services to the communities of influence of the Sierra del Lacandón; so that they create opportunities for development and economic growth of the area, through sustainable and aligned with the goals of environmental conservation alternatives. The first phase of the program has achieved a total of 16 beneficiary families, with women as leaders, who have done business activities (commodity shops, pharmacy, dining, bakery products, crafts and others), with a return rate of 100% and no late payments. In August 2012 began the second phase of the program with 13 beneficiary families included as credit management responsible men and women¹⁰⁸.

GL2.6 / GL2.8 / GL2.9 The project has establish a Governance Committee with legal entity in which representatives of the participating communities with legal land tenure (La Técnica Agropecuaria, La Lucha and Unión Maya Itzá) and FDN have representatives (one regular with voting right and one substitute). The carbon credits will be awarded to this committee, in which the decision of allocating revenues generated through its commercialization will have to be taken by consensus.

GL2.7 The basis of cooperation with the communities are the cooperation agreements signed between the inhabitants and CONAP. An open and transparent communication is established in all activities and regular exchange communication takes place with the communities living in the park. In addition, periodic newsletter were issued and distributed to communities about the process of the project.

The analysis of the net benefits to the communities resulting from the project activity is organized around the Sustainable Livelihoods Approach (SLA). The communities were informed throughout a participatory

¹⁰⁸ Lacandón Bosques para la Vida website. Information online <http://www.bosques-Lacandón.org/es/fortalecer-el-desarrollo/microcreditos.html>

discussion of the pros and cons of developing a REDD+ project including issues such as variability in the carbon market and fulfillment of agreements.

GL2.9 To achieve all the benefits for the communities, exist cooperation agreements established between CONAP and the communities. Organized groups were trained by the FDN and OroVerde to strengthen their work and participation in the project, contributing to stabilize the governance. The continued participation of local people in project activities ensures institutional sustainability, since cooperation agreements recognize the right of residence of local populations and thus ensure their commitment to forest protection. Similarly the project fosters political sustainability by developing national and international policies, so to ensuring the participation of local people and biodiversity conservation permanently. For more information refer to Section 6 Stakeholder Comments.

7 BIODIVERSITY

7.1 Net Positive Biodiversity Impacts (B2)

B2.1 The project does not anticipate any direct and indirect negative impacts on biodiversity, as all of the interventions have been designed to promote improved environmental management, through avoiding deforestation and degradation and fostering the regeneration of already degraded forests.

To evaluate biodiversity, primary project proponent use the Camera Trap Method. The method selected is Bushnell Trophy Cam which is designed for extreme environments of moisture and high temperatures; as well as snow and water resistant. The Trophy Cam is a digital camera designed to be activated by a high sensitivity motion sensor, which uses a passive infrared motion sensor. This tool is use for studies of ecology and wildlife. The areas where this method has been most widely used are:

1. Study of the distribution and range of species where researchers seek to understand the factors that determine the presence of a species in a given location.
2. Metapopulation dynamics where the occupation of the site or patch is related to the specific characteristics of the site. Ultimately, the chances of colonization can be modeled with respect to the characteristics of the patch.

Monitoring patch occupancy may reveal changes in the status of a species over large areas, so it is appropriate for populations of species that exhibit wide fluctuations in short periods of time. Forest conservation will increase

The main wildlife monitored by camera traps are jaguar (*Panthera onca*), tapir (*Tapirus bairdii*) and white-lipped peccary (*Tayassu pecari*); due to the state of ecosystems are known through the presence of these species and are under constant threat and listed on IUCN Red List. These species are closely associated with native and primary forest; therefore; conservation strategies are developed to protect the forest and the threatened species. Further, forest fires and forest cover monitoring are performed by CEMEC through the analysis of satellite images.

B2.2 Among the positive impacts identify for the biodiversity, are those in relation with the interconnection of natural corridors, increases of the populations of endemic and endangered species (this will be proven after monitoring activities), the creation of shelterbelts in waterways with native species and the retention of moisture and restoration of micro fauna. Positive impacts on ecosystems are increases in the biomass and the creation of a favourable environment for fauna and flora communities.

Table 49. Expected impacts

Livelihood Asset		Without Project Scenario	With Project Scenario	Net Effect	Relevant Project Area
Natural Capital	Tools and Technology	No capacity building efforts.	Locals will benefit from the capacity-buildings that refer among others to the improved agriculture, reforestation activities and fire management.	Positive. Increase in forest conservation	Reduction in CO2 emissions from deforestation and degradation forest
	Access to land use	Conflicts and pressure for relocation in communities without legal land tenure	Cooperation agreements	Positive. Increase forest conservation	Conflict resolution
	Biodiversity	Little to no conservation efforts, continuous undamped destruction of habitat leading to loss of biodiversity.	Forests are among the habitats most rich in biodiversity. Reduced deforestation will fight loss of biodiversity at its very root, which is the destruction of habitat.	Positive. Increase forest conservation	Improved biodiversity conservation
	Desertification	Continuously progressing desertification. No meaningful measures against taken. The forest present in Guatemala is not well adapted to the extreme climate conditions present in the project region characterized by droughts and floods.	Consequently, conserving the forest ecosystem will increase resilience and reduces the vulnerability of the project area.	Positive. Increase forest conservation and increased in soil conservation and soil fertility/ productivity	Reduction in CO2 emissions from deforestation and degradation forest

Livelihood Asset		Without Project Scenario	With Project Scenario	Net Effect	Relevant Project Area
	Wildlife	Wildlife protection in the area remains at very low level, established wildlife protection areas are frequently ignored.	Monitoring of key species will be implemented and the indicators will contribute to a better decision-making	Positive. Increase in wildlife populations due to increased forest cover or protection	Improved biodiversity conservation
	Water resources	Low investments in establishment and maintenance of local boreholes.	Maintenance of environmental services water regulation through the conservation of forest cover	Positive. Increase or stabilization of water flows and/or quality for local people	Reduction in CO2 emissions from deforestation and degradation forest

B2.5 The wildlife in the area has suffered strongly from 1992. Furthermore, deforestation and forest degradation destroys fauna and flora and the natural ecosystems that support them. Land use change via agricultural and cattle ranching expansion is the most important driver for loss of biodiversity in Guatemala¹⁰⁹. The “with project” scenario includes several activities directly or indirectly enhancing biodiversity. None of the project activities is foreseen to have a negative effect on biodiversity in the area. Reduced deforestation will fight loss of biodiversity at its very root, which is the destruction of habitat. By doing so, the project area’s function as a reserve for biodiversity is restored. Patrolling is an integral part of our project reducing the pressure on biodiversity caused by diverse illegal practices, thus allowing biodiversity to flourish.

In summary, the project is expected to have a strong positive effect on the area’s biodiversity. As stated in section Measures to Maintain High Conservation Values (CM2 & B2), the identified HCV1 will be strongly enhanced by the project. Reduced forest loss will significantly improve the habitat conditions for threatened wildlife in the project area. The project will use species during its agricultural and forestry activities (see section Description of the Project Activity (G1)). Invasive species will not be used.

Species used in the project include the following:

Table 50. Species used in project activity

Scientific name	Spanish name	English name
<i>Cedrela odorata</i>	Cedro	Spanish Cedar
<i>Swietenia macrophylla</i>	Caoba	Large-leaved Mahogany
<i>Brosimum alicastrum</i>	Ramón	Breadnut
<i>Theobroma cacao</i>	Cacao	Cocoa
<i>Pimenta dioica</i>	Pimienta	Pepper

The project will have a positive impact on biodiversity outside the project area. This positive impact could also include improvement of the habitat conditions for such threatened species as the tapir (*Tapirus bairdii*), of which few individuals are left in the rest of protected areas of Guatemala.

B2.6 As information becomes available, new species could be introduced, taking into account their invasive potential. No species that are likely to have a negative effect will be used. The population of any invasive species will not increase as a result of the project since the project proponent promote the use of native species. No potential negative environmental impacts could result from the use of fertilizers or pesticides due to the species that will be use in the project are mostly native.

B2.7 The activities envisioned by this project do not foresee the utilization of non-native species or Genetically Modified Organisms. Seeds collected in the project area is used to establish tree nurseries.

¹⁰⁹ Loening & Sautter, 2005. Valuation and Conservation of Biodiversity 2005, pp 391-418 Information available online at: http://link.springer.com/chapter/10.1007%2F3-540-27138-4_19

B2.8 Basic grains are the main source of carbohydrates (65%) and protein (71%) in the diet of Guatemalans. The main crop is corn. The contribution of corn in energy and protein per capita is 37.7% and 36.5% respectively; in comparison with the black bean with values of 9.5% and 22.9%. These basic grains ensure food security and survival of the population¹¹⁰. Some persons in the project area use agrochemical in low concentration and green label for corn and bean crops.

The possible adverse effects for the use of fertilizers, chemical pesticides, biological control agents and other inputs used are:

- Fertilization

When using fertilizers, is important to establish the optimum composition, nutrient concentrations and the type of materials used in its production, as certain components can alter the biochemical characteristics of soil and water, accelerate the process of eutrophication in aquatic systems and negatively affect the crop production.

It is important to distinguish between the mere presence of a contaminating substance and its role as a pollutant due to its location, concentration and adverse biological or toxic effects. Nitrate and phosphate, for example, are essential nutrients to plants but may become pollutants if present in excessive quantities¹¹¹.

Sometimes, this excessive use of chemical fertilizers and / or applications at unsuitable times (for both crops and environmental components) may adversely affect the environment, altering the balance of nutrients in the soil, changing the pH, salinity, and pollution of water bodies caused by discharges of chemical waste.

In the process of fertilization, a certain degree of non-reusable waste (plastic containers and agrochemicals etc.) is produced. Project participants should clearly identify this type of material, to proceed with the proper method of storage and disposal.

- Weed control, Pest and diseases

The excessive use of herbicides to eradicate weeds, pollutes natural systems directly influencing the quality of the soil resources, water and air; and indirectly flora and fauna altering biological activity and interactions of many native species. Improper control of pests and handling of chemicals, pollutes soils and areas where they are applied, including water bodies as a result of run-off and movement through the soil from areas where is used in farming.

In agroforestry systems agro-ecological practices are promoted. However, the Strategy 3 of the project activities is to improve the productivity of the family management systems and to invest in the necessary education that leads to lower necessities for deforestation. This is particularly relevant for slash and burn practices commonly applied in the region. It also pursues the study and understanding of current agricultural practices in order to be able to analyse practices that can be improved satisfying basic household needs at lower environmental costs.

¹¹⁰ Fuentes, M. 2002. El Cultivo del Maiz en Guatemala. Una guía para su manejo agronómico. Available at <http://www.icta.gob.gt/maiz/cultivoMaizManejoAgronomico.pdf>

¹¹¹ Van Lynden (1995). Cited by: FAO. 2004. Guiding Principles for the quantitative Assessment of Soil Degradation with a focus on salinization, nutrient decline and soil pollution. Source: <ftp://ftp.fao.org/agl/agll/docs/misc36e.pdf>

B2.9 Mitigation of impacts is based on best prevention practices to avoid ecosystem damages. However, if monitoring records any negative impacts, studies will be conducted to determine the specific sources of pollution, in order to seek alternatives to harmful agrochemicals.

- For handling chemical products, recommendations of the technical data and field technicians should be followed, including the security and safety standards and other procedures determined by Fundación Defensores de la Naturaleza, for the work of handling, mixing and application of agro-inputs.
- Those responsible for handling pesticides, should wear protective equipment, in order to avoid poisoning and health damages.
- The packages and containers of chemicals will be classified and disposed as hazardous waste. Each community present a landfill where any waste product from the project activities are collected.
- The packages and chemical containers should not be reused for any purpose.
- Training on the use and management of agrochemicals complemented with environmental education workshops.

7.2 Negative Offsite Biodiversity Impacts (B3)

B3.1 / B3.2 / B3.3 No potential negative offsite biodiversity impacts have been identified and therefore no measures or activities have been developed. The project also serves as an example of good practices and innovative approaches in the communities regarding to biodiversity (reforestation and enrichment activities, agroforestry systems) that can be adapted by outside communities.

7.3 Exceptional Biodiversity Benefits (GL3)

GL3.1 The project area is included within the Key Biodiversity Area (KBA) Selva Lacandóna and Sierra del Lacandón (Mexico/Guatemala)¹¹². By avoiding deforestation in a KBA the Lacandón - Forests for Life Project generates Exceptional Biodiversity Impacts.

Vulnerable, Endangered or Critically endangered species

The little knowledge available on floristic and fauna present in the project zone suggest that the species records that are currently available in the area could be extended if proper monitoring is developed. The project will monitor fauna and flora following systematic and scientific methods and will collaborate with Universities and other institutions that may bring additional knowledge on the biodiversity present in the project zone.

Many of the areas of the project remain to be explored, and logically there are no records of the biodiversity present. This applies specially for the area of sinkholes. This project has chosen to conservatively apply the classification of IUCN red list¹¹³, which may not describe in detail the biodiversity

¹¹² Critical Ecosystem Partnership Fund. 2010. Assessing Five Years of CEPF Investment in the Mesoamerica Biodiversity Hotspot. Available at http://www.cepf.net/Documents/Final_NMesoamerica_Assessment_Jan2010.pdf

¹¹³ Available at: <http://www.iucnredlist.org/>

present in the project area, nor the locally threatened species, but provides an international classification of the status of species occurring in the project zone.

The fauna and flora species identified at IUCN red list as Vulnerable, Endangered or Critically endangered within the project zone are listed in Table 51.

Table 51. List of Vulnerable, Endangered or Critically Endangered species present in SLNP.

Latin name	English name	Status at IUCN red list
<i>Crocodylus moreletii</i>	Morelet's Crocodile	Least Concern
<i>Crax rubra</i>	Great Curassow	Vulnerable
<i>Electron carinatum</i>	Keel-billed Motmot	Vulnerable
<i>Eleutherodactylus leprus</i>		Vulnerable
<i>Megalops atlanticus</i>	Tarpon	Vulnerable
<i>Agamia agami</i> *		Vulnerable
<i>Alouatta pigra</i> *, ^a	Yucatán Black Howler Monkey	Endangered
<i>Ateles geoffroyi</i> *, ^a	Geoffroy's Spider Monkey	Endangered
<i>Balantiopteryx io</i> *	Thomas's Sac-winged Bat	Vulnerable
<i>Craugastor alfredi</i> *		Vulnerable
<i>Cryptotis griseiventris</i> *	Guatemalan Small Eared Shrew	Vulnerable
<i>Myrmecophaga tridactyla</i> *	Giant Anteater	Vulnerable
<i>Tapirus bairdii</i> *	Baird's Tapir	Endangered
<i>Tayassu pecari</i>	White-lipped peccary	Vulnerable
<i>Cedrela odorata</i>	Spanish Cedar	Vulnerable
<i>Swietenia macrophylla</i>	Large-leaved Mahogany	Vulnerable

*** Species described by IUCN red list to be in the project area but not recorded directly; ^a Species recorded during site visits (videos available for auditors upon request).**

See Appendix I, II and III for a complete list of plants and animals species known in the project zone.

GL3.2 In the intangible area of SLNP, a biodiversity base line was performed, where three items of conservation were selected: The near threatened Jaguar (*Panthera onca*), the largest feline in Latin America and part of the Guatemalan culture for years; the endangered Tapir (*Tapirus bairdii*), largest land mammal in the Neotropics and the only living representative of perissodactyla order, is a species considered nationally endangered and throughout its range, and vulnerable White-lipped Pecari (*Tayassu pecari*), is threatened due to strong illegal hunting. These were identified by the availability of information, expert criteria, viability of the species and if it were present in the lists of species threatened CITES and List of Threatened Species of the CONAP.

According to the 2006-2010 Master Plan, within the park, the jaguar is distributed both in primary forest ("High" or "Medium Forest" of flatlands, mountains, and lowlands) and in regenerating forest. Based on the aforementioned, the estimated distribution area of jaguars within the park is approximately 150,255 hectares (1,502.55 km²). Based on the area of Calakmul, the resulting jaguar home range – the territory occupied by one individual – is estimated to be 15-22 km² per jaguar. Using the most conservative figure, a home range of 22 km² per individual, it is estimated that there are sixty-eight (68) individuals in Sierra del Lacandón National Park (PNSL).

A more conservative estimate of the jaguar population, based on a home range of 30 km² per jaguar as reported by Ceballos (2002), estimates a total jaguar population of 51 in PNSL and 203 in the Lacandón Jungle of Chiapas (state of Mexico) and Petén (department of Guatemala). It is important to mention that previous estimate erroneously assumed a homogenous distribution of jaguar within the park and in the Selva Maya, rather than a distribution based on preferential habitat, as occurs naturally. Within PNSL, Del Valle and Morales (2004), suggest that the conditions within the zone surrounding the Macabiler river make it one of the most important areas for the jaguar, citing the work of MacNab and Soto (2000). This area is characterized as a large, continuous block of forest with little disturbance and contains abundant sources of water and high densities of prey species.

Tapir and White-lipped Pecari distribution in Guatemala have dropped dramatically over the past century, causing populations to be restricted to protected areas of the northeastern region of the country. According to the International Union for Conservation of Nature (IUCN), the tapir is on the Red List of threatened species due to the reduction of their populations. A regional and local level the main threats are loss and habitat degradation, and to a lesser degree hunting. Therefore, it can be deduced the local extinction of the species is associated with land use change and the consequent habitat fragmentation¹¹⁴.

Jaguar are very sensitive to indicators of ecosystem intactness, such as pressure from hunting and changes in habitat and in water sources. In addition, because the jaguar is a predator high in food pyramid, it plays an important role in tropical ecosystems. Its presence indicates that there is sufficient prey to support its feeding requirements, and therefore, it is associated with high levels of biodiversity and ecosystem functioning.

The tapir is also a good indicator of deforestation, because requires large areas to roam; protecting itself in this manner indirectly protects other animals as well, resulting in greater biodiversity over a large extent.

Lastly, the white-lipped peccary helps to disperse plants and forms part of the trophic chain as a top predator, along with the puma and the jaguar. Also, is a good detector of water sources.

¹¹⁴ Garcia, M & Leonardo, R.2016. Classification of the potential habitat of the Central American tapir (*Tapirus bairdii* Gill, 1865) for its conservation in Guatemala. Available at http://www.revistas-conacyt.unam.mx/therya/index.php/THERYA/article/viewFile/345/pdf_114

The baseline was established by placing “camera traps”, motion activated cameras, in the field to obtain species presence data. The majority of mammalian species recorded via this method were present on the Council of National Protected Area’s List of Endangered Species and in CITES (wildlife protection treaty).

Without the project activities, it is expected that the population of these three species reduce dramatically due to land use change and hunting since there is a tendency in reducing coverage and degradation (fragmentation) habitats, highlighting the vulnerability of the species populations in the zone.

GL3.3 These three species require large tracts of continuous forest to maintain viable populations over time, so generating mechanisms or tools for conservation habitat, are protecting other species that share the same habitat type, allowing there a balance of the ecosystem.

By protecting areas of intact forest the habitat of many species is conserved. Furthermore, the previously logged areas are reforested with native species also in IUCN Red list like *Swietenia macrophylla* and *Cedrela odorata* or recover over time so that they can be almost natural forests.

GL3.4 Indicators for the three trigger species are include in the monitoring plan under “Presence of endangered fauna” indicator. The monitoring is performed using the camera trap method. This method is used for multiple purposes, from identify individual specie to assess population size and various aspects of their ecology and behavior. For this reason, using camera traps in one of the most important and versatile methodologies for studies of biological research for conservation purposes. For more information refer to CCBS Section B4.

8 MONITORING

8.1 Description of the Monitoring Plan

8.1.1 Description of the Monitoring Plan (CL4, CM4 & B4)

CL4.1 As this document fulfills the requirements of both VCS and CCBS, the monitoring procedures herewith described fulfill all criteria needed for both standards. After cross-checking in both standards it has been deemed appropriate that the climate section of the CCBS is explained through the monitoring suggested by the VCS Methodology VM0015. Thus, climatic monitoring, community monitoring and biodiversity monitoring are presented separately, while fulfilling all requirements of VCS and CCBS.

Monitoring will be developed by FDN, whereas other governmental and non-governmental institutions may also participate in the process of data gathering on the field. The data generated during monitoring will be stored by FDN. FDN will be responsible for the gathering and process of all necessary data on the field for community and biodiversity monitoring. CEMEC/CONAP will be responsible for the gathering and process of all data for climate monitoring needed for future VCS verification events. A process of quality check and quality control of the information generated by each institution will occur along the time and strengthen before any verification event. Any non-conformity found during the internal auditing exercises will be documented, communicated and solved within 3 months after its detection.

CL4.2 All results will be publicly available on the internet and summaries are communicated to the Communities and Other Stakeholders through appropriate media.

8.1.2 Organization and responsibilities of the parties involved

Carbon monitoring required by VCS will be undertaken by CEMEC/CONAP. All CCBS community and biodiversity monitoring activities will be carried out by FDN, with support from CONAP and the local communities. CCBS Climate monitoring requirements will be fulfilled under the monitoring designed for fulfilling VCS monitoring criteria. Data is stored on local servers using the Excel program. This furthers accuracy and transparency and minimizes data loss.

FDN

Biologist Rebeca Escobar, Coordinator of Research and Monitoring of SLNP / FDN, will be in charge of community and biodiversity monitoring.

CEMEC/CONAP

CEMEC, CONAP's Center for Monitoring and Evaluation, has offices and its own computer lab where all of the monitoring and evaluation data associated with the MBR and the MUZ are housed. This includes remotely sensed imagery, reconnaissance from overflights, the results of ground surveys and other reports. CEMEC has specialists that help design the updated land cover maps and calculate land cover change.

All data is stored in servers at CEMEC's offices within CONAP's headquarters in the Petén. The data is routinely backed up using the institutional policy and procedures of CONAP. This includes raw image files, processed and corrected image files, remote sensing and geospatial analysis software, and all vector files needed to create the land cover map, document land cover changes, and to retrieve these files at future points in time.

8.1.3 General instructions on data collection

Collecting reliable field measurements is an important part of quality assurance (QA). Standard procedures should be followed to collect reliable data to ensure credibility in the estimation of the baseline, project emissions, leakage, and GHG removals. In addition, the data gathered by CEMEC is subject to a rigorous map accuracy assessment that uses higher resolution images to verify the map classification accuracy according to the guidelines in VM0015 v1.1 section 2.5.

During the monitoring process, the senior personnel overseeing the project activity shall verify the data collected by the field personnel. The project entity shall implement procedures that will ensure independent verification. Particular attention shall be paid to monitoring and measurement errors. This issue will be addressed through mandatory data checks and training of field personnel. Additional persons may be included to improve performance of the field crews when conditions require more resources. It is desirable that some in the field crews are hired locally and act as guides in the field.

Data collection in the field

Data storage

The project entity will make necessary arrangements for data entry on the registry forms. The forms will be both in paper and electronic formats to ensure that the information is stored in multiple ways. Further, the project proponent will ensure the transfer of data to the spreadsheet database as outlined in the monitoring methodology at required intervals. The data will be archived using acceptable standards and

stored in compliance with the instructions of the project information management system. The electronic data will be stored securely at multiple locations using backup procedures. All GHG related information is collected and aggregated.

Information (data) management system

The project information management links the operations of the field data collection and spreadsheet database. Further, it outlines responsibilities of staff involved in collecting field data and organization of the spreadsheet database. The supervisory staff overseeing the field data and spreadsheet database must check and certify the data. If any changes occurred in the data collected and processed during the month, the supervisory staff has to provide necessary clarification.

Monitoring and operational procedures

The project participants use Standard Operation Procedures (SOPs)¹¹⁵. All measured and experimental data shall be documented and archived. Operational procedures under this monitoring plan are defined as those that enable measuring and estimating net carbon stock changes associated with avoided deforestation under the project activity, as well as general monitoring of forestry operations. The project participants shall keep records of all activities, like changes in the forest cover and forest management.

8.1.4 Data archiving

The personnel involved in the measurement of carbon pools, community and biodiversity; and other monitoring will be fully trained in field data collection and analysis by the technical manager. SOPs will be developed for each step of the field measurements and followed so that measurements are comparable over time. If different interpretations of the SOPs exist among the sampling teams, they will be jointly revised to ensure clearer guidance.

Proper entry of data is required to produce reliable carbon estimates. Therefore

- Locals servers
- a hand held devices

form for all those data measured in the field required by the methodology will be used.

All data sheets will include a "Data recorded by" field. Communication between all personnel involved in measuring and analysing data will take place to resolve any apparent anomalies before final analysis of the monitoring data can be completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis. Additionally, field data will be reviewed by the technical manager or a team leader of the GIS team to ensure that the data are accurate and analyses are realistic.

Due to the long duration of the project and the speed at which technology changes, data archiving will be an essential component of the project. Data will be archived in several forms: All original field data sheets are saved and in addition copies of the original data sheets are stored in another file as backup. All documents are stored in the office of FDN.

8.1.5 Quality control and Quality Assurance procedures (QA/QC).

The project will follow the IPCC GPG of using two types of procedures in order to ensure that the data are of high quality^{116,117,118}. The plan that describes specific QA/QC procedures is as follows^{119,120}.

¹¹⁵ Márquez, J. 2013. Determinación del carbono secuestrado y liberado en los bosques naturales y sistemas de uso de la tierra del Parque Nacional Sierra del Lacandón, Peten, Guatemala.

¹¹⁶ IPCC GPG for LULUCF; Chapter 5.5 Quality assurance and quality control

- Standard Operating Procedures (SOP) will be used for field data measurements.
- Training courses will be held for all relevant personnel on all data collection and analysis procedures.
- To reduce uncertainty in leakage measurement a field protocol for sampling forest degradation and trainings are implemented.
- Steps will be taken to control for errors in the sampling and data analysis to develop a credible plan for measuring and monitoring carbon stock change in the project context.

FDN is managing the project and will be responsible for the centralized documentation of all project planning and implementation. QA/QC procedures will be implemented to ensure that all materials generated through remote sensing and GIS exercises and biomass and leakage are measured and monitored precisely, credibly, verifiably, and transparently. FDN will coordinate QA/QC activities, and is responsible for documenting QA/QC procedures. For this purpose FDN will designate a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.

VCS Monitoring & CCBS Section CL4 Climate Impact Monitoring

CL4.1 The objective of climate monitoring is to obtain information to estimate the amount of avoided GHG emissions during the crediting period. For this purpose, FDN uses MIRA application and have the support of CONAP/CEMEC which will produce land cover maps that help quantify the effectiveness of the project in terms of the amount of forest cover that remains intact and undisturbed as a result of anthropogenic influence.

The procedures for project monitoring and re-validation of the baseline have been designed according with the requirements of the VCS Methodology VM0015, and focus on

- Calculating carbon stock changes and GHG emissions for periodical verifications within the fixed baseline period; and
- Monitoring key baseline parameters for revisiting the baseline at the end of the fixed baseline period.

Calculating carbon stock changes and GHG emissions for periodical verifications within the fixed baseline period

As per the VCS Methodology VM0015, this section can be monitored fulfilling three main monitoring tasks

1. Task 0: At first verification, confirmation of project area boundaries
2. Task 1: Monitoring of actual carbon stock changes and GHG emissions within the project area
3. Task 2: Monitoring of leakage
4. Task 3: Ex post calculation of net anthropogenic GHG emission reduction

¹¹⁷ IPCC GPG and Uncertainty management in National GHG Inventories; Ch. 8 QA and QC

¹¹⁸ IPCC GPG for LULUCF; Chapter 3.2 Forest land

¹¹⁹ IPCC GPG for LULUCF; Chapter 5.5 Quality assurance and quality control

¹²⁰ IPCC GPG and Uncertainty management in National GHG Inventories; Ch. 8 QA and QC

The project proponents commit to undertake these monitoring tasks immediately after project start according to the Monitoring Plan describing how these tasks will be implemented, including the following sections:

- a) Technical description of the monitoring tasks.
- b) Data to be collected (see appendix 5 of the VCS Methodology VM0015).
- c) Overview of data collection procedures.
- d) Quality control and quality assurance procedures.
- e) Data archiving.
- f) Organization and responsibilities of the parties involved in all the above.

Task 0: At first verification, confirmation of project area boundaries

In case there is any issue with the land ownership of areas including in the project area according to the on hand document, the project commits to revise and adapt the coordinates accordingly.

Task 1: Monitoring of actual carbon stock changes and GHG emissions within the project area

This task involves

1. **Monitoring of project implementation** – in which project activities implemented within the project area will be monitored in order to determine if they are consistent with the management plans of the project area and the PD. All maps and records (including pictures, testimonies, additional specific reports, etc.) generated during project implementation will be stored by FDN and will be made available to VCS verifiers for inspection at verification.
2. **Monitoring of land-use and land-cover change within the project area** – The project will collect data in form of satellite images and develop spatial classification that will offer information about the area of forest-land converted to non-forest land and the area of forest land undergoing carbon stock decrease, per LULC change class, in the entire reference region and leakage belt. For ensuring the quality of the obtained results, the project will double-check on site within the project boundaries the LULC results obtained from the classification. All data will be stored by FDN and will be made available to VCS verifiers at any verification event. These procedures will be done periodically at verification, in one of the two ways:
 - a. If Guatemala or the sub-national region of Petén have developed by then a jurisdictional program or approved MRV system, the project will use the MRV data generated by the jurisdictional program.
 - b. In the contrary, the Project Proponent will keep working with CEMEC/CONAP to complete the Land-Use and Land-Cover change analysis since last verification/ monitoring event. The procedures used will reproduce those used for the validation of for the historical analysis in order to ensure consistency with the completion of the baseline.

3. **Monitoring of carbon stock changes and non-CO2 emissions from forest fires** – In case uncontrolled forests fires or other catastrophic events occur within the project area this project commits to estimate carbon stock losses as soon as possible. If planned and significant carbon stock decrease occurs in leakage management areas in the project scenario, CEMEC/CONAP will be in charge of estimate the change in carbon stocks at least once after the planned event that caused the carbon stock decrease has happened.

In most cases, the ex ante estimated average carbon stocks per LU/LC class (or carbon stock change factors per LU/LC change category) will not change during a fixed baseline period and monitoring of carbon stocks will not be necessary.

However, monitoring of carbon stocks is mandatory in the following cases:

Within the project area:

- a) Areas subject to significant carbon stock decrease in the project scenario according to the ex ante assessment. These will be areas subject to controlled deforestation and planned harvest activities, such as logging, fuel wood collection and charcoal production. In these areas, carbon stock changes must be estimated at least once after each harvest event.

Within the project activities areas are planned logging representing a reduction in carbon stocks, whereby the monitoring will be:

- Through forest management plans of each community; as well as legal permits for removal. All forest harvest must have permission from the relevant authorities and lead a forest harvesting guide.
 - CONAP is in charge of the harvesting plans are complied with and verify forest harvesting. Annual Operating Plan are made and each cooperative has a regent which is responsible for all these activities.
 - Data will be stored in physical format (field) and then in digital formats.
- b) Areas subject to unplanned and significant carbon stock decrease, e.g. due to uncontrolled forest fires and other catastrophic events. In these areas, carbon stock losses will be estimated as soon as possible after the catastrophic event when significant.

Within leakage management areas:

- a) Areas subject to planned and significant carbon stock decrease in the project scenario according to the ex ante assessment. In these areas, carbon stocks must be estimated at least once after the planned event that caused the carbon stock decrease.

The project does not consider a decrease in carbon stocks and increased emissions resulting from leakage prevention measures. All project proponents have legal land tenure so it is unlikely that a leak occurs.

Monitoring of carbon stocks is optional in the following cases:

Within the project area:

- a) Areas subject to carbon stock increase after planned harvest activities, such as logging, fuel wood collection and charcoal production. In these areas, the carbon stock increase occurring after the harvest event can be measured and accounted, when significant.

The project does not consider an increase in carbon stocks within the project area so this monitoring is not necessary.

- b) Areas recovering after disturbances, such as unplanned forest fires and other catastrophic events. In these areas, the carbon stock increase occurring after the catastrophic event can be measured and accounted, when significant.

The project does not consider the increase in carbon stocks that may occur after catastrophic events so it is not necessary this monitoring.

Within leakage management areas:

- a) Areas subject to carbon stock increase due to leakage prevention measures. In these areas, the carbon stock increase can be measured and accounted only up to the amount necessary to offset any carbon stock decrease caused by leakage prevention measures in other leakage management areas or in previous years.

The project does not consider an increase in carbon stocks within the leakage management areas so it is not necessary this monitoring.

Within the leakage belt:

- a) Areas undergoing significant changes in carbon stock may be measured at the end of each fixed baseline period in order to update carbon stock information for the subsequent period.

The project does not consider an increase in carbon stocks within the leakage belt so it is not necessary this monitoring.

4. **Monitoring of impacts of natural disturbances and other catastrophic events** - Decreases in carbon stocks and increases in GHG emissions will be subject to monitoring and must be accounted under the project scenario, when significant. If the event occurs in areas that have already generated VCUs in past verification the field personnel of FDN and CONAP will develop field measurements in the affected area within 3 months after the event. The measurements will allow estimating the total net change in carbon stocks and GHG emissions in the area and this project will cancel and equivalent amount of VCUs from the VCS buffer.
5. **Total ex post estimated actual net carbon stock changes and GHG emissions in the project area** - All ex-post estimations in the project area will be summarized using Table 29 of the VCS methodology VM0015.

Task 2: Monitoring of leakage

Monitoring of leakage is required. Monitoring of leakage will be done periodically prior to any verification.

This project will monitor the following sources of leakage

1. **Decrease in carbon stocks and increase in GHG emissions associated with leakage prevention activities** - Leakage prevention measures in this project may include tree planting, agricultural intensification, fertilization and/or fodder production, a temporally significant reduction in carbon stocks and/or an increase in GHG emissions may occur compared to the baseline case. If this is the case, this project will account and monitor these sources of leakage emissions.
2. **Decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage**
 - a. Monitoring of carbon stock changes - Deforestation above the baseline in the leakage belt area will be considered activity displacement leakage. Leakage will be calculated as the difference between the ex-ante and the ex-post assessment of the area of forest land converted to non-forest land in the leakage belt. Monitoring will be undertaken following the same approach than in the monitoring of land-use and land-cover change within the project area (please see Monitoring Task 1, point 2). The project will collect data in form of satellite images and develop spatial classification that will offer information about the area of forest-land converted to non-forest land and the area of forest land undergoing carbon stock decrease, per LULC change class, in the leakage belt.
 - b. Monitoring of increases in GHG emissions - emissions from forest fires were not included in the baseline as they were considered not significant.

Task 3: Ex post net anthropogenic GHG emission reductions – This project will generate a map showing Cumulative Areas Credited within the project area which will be updated and presented to VCS verifiers at each verification event. The cumulative area that have been considered for the generation of VCUs will be excluded in future periods.

Revisiting the baseline projections for future fixed baseline period

Baseline will be revisited every ten years.

Update information on agents, drivers and underlying causes of deforestation – the personnel of FDN, in collaboration with other Guatemalan institutions, NGOs and Governmental Organizations will undertake ongoing surveillance and monitoring of deforestation threats, agents and drivers. All relevant information, data, reports, legal documents collected will be kept by FDN. Step 3 of the ex-ante methodology will be reassessed. As this project used a spatial model for locating the risk of future deforestation, new data on the spatial driver variables will be collected and new “Factor Maps” for the subsequent fixed baseline period will be generated. All information collected will be used at each revisiting of the baseline to conduct a complete analysis of agents, drivers, and causes of deforestation, in the same way it was completed for validation.

Adjustment of the land-use and land-cover change component of the baseline - If new VCS requirements on regional baselines are available, the project will use the most recent version. As this project foresees using a sub-national baseline and being included within a jurisdictional scenario at the time in which the baseline would have to be revisited, no further adjustments are needed in this case.

Adjustment of the carbon component of the baseline – If improved carbon stock data have become available over time, this project will use the most updated information.

For Monitoring tasks and associated monitoring activities as required by VCS Methodology VM0015 v.1.1 please refer to the Monitoring Plan.

CCBS Section CM4 Community Impact Monitoring

CM4.1 It is necessary to actively involve local people in sustainable development and management of climate change projects, and to participate fairly in the potential positive effects, not only as an important moral responsibility, but also by be essential for successful long-term.

The local community in the project zone is extremely vulnerable, at least 70% of the population live in poverty and more than 25% in extreme poverty, being located in the route of hurricanes in the Caribbean. Under these conditions, the project aims to strengthen local management of natural resources whence improve the welfare of communities to ensure the success of long-term project.

Regular monitoring of the project's impacts on local communities is undertaken. This is separated into direct and indirect effects of the project. Direct effects are measured by evaluating data reported by the monitoring teams of FDN. Indirect effects are assessed by interviewing people in the project area. A basic questionnaire collects information from all sampled people while two specific questionnaires are tailored toward (a) direct beneficiaries of the project (e.g. people that have participated in workshops) and (b) employees. Monitoring takes place either continuously, or upon verification – at least every five years; the latter in case extra studies like interviews or remote sensing analyses are necessary. The ultimate goal is that all monitoring data is uploaded on an internet platform directly upon data collection.

This evaluation aims to answer three key questions¹²¹:

- What changes have there been in the community since the start of the project?
- Which of these changes are attributable to the project?
- What difference have these changes made to people's lives?

¹²¹ Overview of the PIA approach. Richards, M. 2011. Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 2 – Social Impact Assessment Toolbox. Climate, Community & Biodiversity Alliance and Forest Trends with Rainforest Alliance and Fauna & Flora International. Washington, DC.

Direct effects monitored for the quantification of Social impact of the Lacandón - Forests for Life Project

Table 52. Direct effects monitored - Social impact

Strategy	Project activity	Indicator	Data source	
			Unit measure	Method
Adjustment of land uses and land use rights	Project activity 1: Signature and enforcement of cooperation agreements	Cooperation agreements signed	Number of cooperation agreements signed	Data record
	Project activity 1: Signature and enforcement of cooperation agreements	Communities boundaries	Definition and demarcation of communities boundaries	Data record
	Project activity 1: Signature and enforcement of cooperation agreements	Assessment of compliance of the agreements	Every three years evaluate the progress of the commitments by communities	Data record
Forest protection and biodiversity programs	Project activity 2: Establishment of a program of patrols and surveillance subcommittee for each organization within the park	Patrols conducted and participants	Number of patrols conducted and participants	Data record and MIRA application ¹²²
	Project activity 2: Establishment of a program of patrols and surveillance subcommittee for each organization within the park	Emergencies detected (emergency classes being fire, catastrophic events, biodiversity, social)	Number of emergencies detected (emergency classes being fire, catastrophic events, biodiversity, social)	Data record and MIRA application

¹²² MIRA application methodology is described in Doc Support_Methodology

Strategy	Project activity	Indicator	Data source	
			Unit measure	Method
	Project activity 3: Workshops about fire management in the communities	Fire workshops undertaken at the communities	Number of fire workshops undertaken at the communities	Data record and MIRA application
	Project activity 3: Workshops about fire management in the communities	Forest fire prevention in communities	Early warning system for forest fire prevention in communities	Data record and MIRA application
	Project activity 3: Workshops about fire management in the communities	Cleaning of firebreaks	Number of annual cleaning of firebreaks in communities	Data record
	Project activity 4: Program for conservation of habitats linked to endangered species and development of a plan for conservation of HCV	Reports of biodiversity	Number of endangered species recorded	Data record and MIRA application
Sustainable farming and livestock familiar management systems	Project activity 5: School of agroforestry promoters for enhancing practices sustainable agriculture in the communities	Capacitation workshops for the personnel and professionals of the SLNP in practices for a sustainable agriculture	Number of capacitation workshops for the personnel and professionals of the SLNP in practices for a sustainable agriculture	Data record
	Project activity 5: School of agroforestry promoters for enhancing practices sustainable agriculture in the communities	Farmers trained in conservation agriculture	Number of farmers trained in better practices for sustainable agriculture	Data record and MIRA application

Strategy	Project activity	Indicator	Data source	
			Unit measure	Method
	Project activity 5: School of agroforestry promoters for enhancing practices sustainable agriculture in the communities	Community agricultural plots in which it is effectively implemented	Number of community agricultural plots in which it is effectively implemented	Data record and MIRA application
	Project activity 5: School of agroforestry promoters for enhancing practices sustainable agriculture in the communities	Crops that has been included in the program for sustainable agriculture	Productivity/ha /household of a given crop that has been included in the program for sustainable agriculture	Data record and MIRA application
	Project activity 5: School of agroforestry promoters for enhancing practices sustainable agriculture in the communities	Hectares of deforestation needed per household/year	Number of hectares of deforestation needed per household/year	Data record
Diversification and use of communal forestry resources	Project activity 6: Identification of alternative NTFPs and market study on each case	Alternative NTFPs identified	Number of alternative NTFPs identified	Data record
	Project activity 6: Identification of alternative NTFPs and market study on each case	Forest nurseries and number of used species	Number of forest nurseries and number of used species	Data record
	Project activity 7: Development of a census of populations of species of flora/fauna that have historically been subject to commercial	Communities included in the census of populations of flora/fauna that have historically been subject to commercial	Number of communities included in the census of populations of flora/fauna that have historically	Data record

Strategy	Project activity	Indicator	Data source	
			Unit measure	Method
	extraction and their most common geographical location.	extraction	been subject to commercial extraction	
	Project activity 8: Development of sustainable forest management plans for small holders and communities	Approved sustainable forest management plans	Number of approved sustainable forest management plans	Data record and MIRA application
	Project activity 9: Establishment and reinforcement of a program of micro-credits and the promotion of conservation and forest management	Micro credits awarded	Number of micro credits awarded and number of micro credits re-paid timely	Data record
Improved management of the SLNP	Project activity 10: Human resources plan focusing on contracting personnel at a fix-basis (not seasonal jobs)	Persons contracted by the SLNP at a fix basis (not seasonal jobs)	Number of persons contracted by the SLNP	Contract
	Project activity 10: Human resources plan focusing on contracting personnel at a fix-basis (not seasonal jobs)	Minors participating of the REDD+ project	Number of minors under 15 participating of the project	Data record
	Project activity 10: Human resources plan focusing on contracting personnel at a fix-basis (not seasonal jobs)	Direct women beneficiaries	Number of women beneficiaries	Data record and MIRA application
Community dialog,	Project activity 11: Community	Workshops in communities for the	Number of workshops in	Data record and MIRA application

Strategy	Project activity	Indicator	Data source	
			Unit measure	Method
education and capacitation	empowerment and capacity building	socialization of environmental legislation	communities for the socialization of environmental legislation	
	Project activity 11: Community empowerment and capacity building	Environmental education training and lectures	Number of women/ men/ youth participants	Data record and MIRA application
	Project activity 11: Community empowerment and capacity building	Cases of non-compliance with applicable laws per community (for example: logging without a permit)	Number of penalties	Data record
	Project activity 11: Community empowerment and capacity building	Communities that effectively manage to apply measures in case of non-compliance with applicable laws by any of its members	Number of communities that effectively manage to apply measures in case of non-compliance with applicable laws by any of its members	Data record
Health and welfare of communities	Project activity 12: Workshops about sexual and reproductive health in communities	Workshops about sexual and reproductive knowledge per community	Number of workshops about sexual and reproductive knowledge per community	Data record
	Project activity 13: Workshops water waste management	Workshops on correct use of water, management of human waste and use of latrines	Number of workshops on correct use of water, management of human waste and use of latrines	Data record

The frequency of the monitoring is continuously and the reporting will be at every verification.

Compliance assessment by communities of the project objectives will be through the committee representatives of each cooperative, who will be responsible for giving information to the community about the progress of the project. Additionally, regular meetings between FDN technicians and communities will be made to treat technical issues and the information reaches as clearly as possible to every beneficiary.

Indirect effects monitored for the quantification of Social impact of the Lacandón - Forests for Life Project

Indirect effects will be measured through interviews with the community in the project area. The interviews will be offered in both written and oral form in order to gain the feedback and insights from the many employees who do not read and write.

A sample of households in the project area will be interviewed at least on a five-year basis to gain this information. A general questionnaire is asked to all people interviewed while two specific sections apply to direct beneficiaries of the project, or respectively to employees, only.

The methodology plan and carry out efficient implementation of a household survey to produce reliable and unbiased data (method presented in) will be made according to Richard (2011)¹²³ as is presented below:

- Clarify the key questions or objectives of the survey.
- Define the survey area.
- Obtain a reliable sampling frame.
- Decide the sampling method (according to statistic methods).
- Meet the local leaders to explain objectives and obtain approval.
- Design the questionnaire into local language.
- Recruit and train data collection enumerators.
- Plan the survey logistics.
- Design a data processing format.
- Supervise enumerators during survey.
- Check data in the field on the same day as collected or within 24 hours to allow the chance to return to clarify responses or to discard survey as unreliable.
- Resurvey discarded households.
- Clean and process the data.
- Analyze the data including statistical analysis as required.
- Write draft report and send to key informants for comments.
- Present results to the community in an appropriate form and obtain feedback ('ground-truthing' the results).
- Write and present final report.

¹²³ Richards, M. 2011. Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 2 – Social Impact Assessment Toolbox. Climate, Community & Biodiversity Alliance and Forest Trends with Rainforest Alliance and Fauna & Flora International. Washington, DC.

Table 53. Indirect effects monitored - Social impact

Indicator	Data source	
	Unit measures	Method
Involvement in the project (yes/no)	Number of beneficiaries	Survey
Gender of household head	Female / Male	Survey
Age range of members	Member age	Survey
Level of education of the community	Number of children attending to school and last grade approved	Survey
Level of education of the community	Parents last school grade approved	Survey
Number of children by family	Age range and number of children by family	Survey
Infant mortality rate	Number of infant death	Survey
Economically active population	Person generating economic income in the family	Survey
Monthly family income	Monthly income range per family	Survey
Activity that provides higher incomes	Types of activities that provides higher incomes	Survey
Access to basic services	Types of active services (energy, communication, education, transport, health).	Survey
Sanitary service	Type of sanitary service use	Survey
Frequent diseases	Three most frequent diseases	Survey
Vehicles per family	Type and number of vehicles per family	Survey

Specific monitoring of employees and direct beneficiaries of the project

Basic data of employees are registered upon recruitment. Every fifth year, there will be a more extensive set of questions asked to every employee. Direct beneficiaries are community members that receive direct support.

Table 54. Monitoring for employees or direct beneficiaries hired by the project

Indicator	Frequency	
	Monitoring	Reporting
Age	Continuously	Upon verification
Gender	Continuously	Upon verification
Annual household income	Continuously	Upon verification
Annual household income before the employment	Continuously	Upon verification
Education	Continuously	Upon verification
Did you gain knowledge on sustainable natural resource management? *	5 yearly	Upon verification
Did you receive sufficient training to do your work properly? *	5 yearly	Upon verification
Do you earn more or less money than in previous jobs? *	5 yearly	Upon verification
Are you from the project area? *	5 yearly	Upon verification
Is your work dangerous? *	5 yearly	Upon verification
Did you receive training to prepare you for dangerous situations? *	5 yearly	Upon verification
Do you know who to address for your grievances *	5 yearly	Upon verification

* Note: these questions are only applicable to employees, not to direct beneficiaries.

Monitoring of High Conservation Values (HCV) related to community well-being

CM2.2 / CM2.4 / CM4.2 The forest conservation includes the protection and maintenance of HCVs areas including the protection of non-timber forest resources (medicinal plants, seeds, food, construction, clothes). Through project activities focused on reducing degradation and deforestation will be achieved protect community HCVs.

Assessment of maintenance and enhancement of High Conservation Values (HCVs) will be included as part of the project's standard monitoring procedure. More specifically, it will be covered in the monitoring of indirect project effects, which is scheduled on a 5 yearly basis.

The two identified HCVs related to community well-being are:

- HCV5: Areas fundamental to meeting basic needs of local communities (e.g. subsistence, health), and
- HCV6: Areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

To cover these two HCVs, the following questions will be included into the interviews as part of the community monitoring:

Table 55. Monitoring of High Conservation Value 5

HCV 5
"Are you or members of your household restricted in sourcing from forest products including commercial goods (timber, xate, etc.), firewood and subsistence hunting?"
"Did you get alternatives offered to collecting these products in natural forests"? (For commercial goods, firewood and subsistence hunting separately)
"Are these alternatives attractive to you?" (For commercial goods, firewood and subsistence hunting separately)

Table 56. Monitoring of High Conservation Value 6

HCV6
"Are you or members of your household restricted in using the forest to fulfil your cultural needs?"

CM4.3 All results will be publicly available on the internet and summaries are communicated to the Communities and Other Stakeholders through appropriate media. Additionally, all documents and information about the results of the monitoring and verification of this project will be published in the platforms of the VCS and CCB standards as usual.

FDN has extensive experience with dissemination of the project to communities. The most effective medium agreed with communities is the dissemination of periodic newsletter reporting the progress of the project in all its phases. The project considers the translation of important documents to Q'eqchi language. The monitoring plan and monitoring result will be disclosed through the governance committee and workshops with communities.

CCBS Section B4 Biodiversity Impact Monitoring

B4.1 & GL3.4 The biodiversity monitoring plan is based on guidelines published by different institutions like CCBS, UNEP and The King Mahendra Trust for Nature Conservation in Nepal.¹²⁴

The framework of pressure, state and response of biodiversity has been adapted to develop a monitoring system that is both effective and efficient. This project will reduce the pressure on the wildlife in the project area by reducing the deforestation rates – thus conserving habitat – and relieving fauna and wildlife from illegal extraction and hunting through the project's patrolling efforts. Additionally, the Lacandón - Forests for Life Project will develop a program for conservation of habitats linked to endangered species and development of a plan for conservation of biodiversity-linked HCVs identified.

To monitor these anticipated impacts, the monitoring plan includes indicators that represent the illegal activities of extracting flora species and wildlife, the prevalent biodiversity in flora and fauna and the project's efforts to reduce the expansion of subsistence agricultural frontier and cattle ranching activities at different levels. This set of indicators will give a holistic picture of the state of the biodiversity over time in the project area, as well as the pressure on the wildlife and the project's efforts to reduce these pressures. Monitoring report will be done at least every five years.

Monitoring variables are directly linked to the project's biodiversity objective and activities described in Section 2.2. Among the outcomes and positive impacts identified are those in relation with the interconnection of natural corridors, increases of the populations of endemic and endangered species (this will be proven after monitoring activities), the creation of shelterbelts in waterways with native species and the retention of moisture and restoration of micro fauna. Positive impacts on ecosystems are increases in the biomass and the creation of a favourable environment for fauna and flora communities.

As biodiversity monitoring is in progress, it will be improved taking into account the technologies available and previous results, to make it more effective and efficient. The following variables are foreseen to be monitored during the project at every verification period:

Table 57. Effects monitored - Biodiversity impact

Strategy	Indicator / areas to be monitored	Data source	
		Unit measure	Method
Biodiversity conservation	Illegal settlements in the project area and leakage belt	Number of hectares usurped by illegal settlements	GIS analysis and monitoring overflights
	Illegal settlements in the project area and leakage belt	Number of irregular camps detected for illegal extraction of flora, timber and wildlife	GIS analysis
	Community biodiversity in the project area	Hectares of forest conservation in community polygons	GIS analysis

¹²⁴Tucker, G., et al. (2005), Guidelines for Biodiversity Assessment and Monitoring for Protected Areas. King Mahendra Trust for Nature Conservation and UNEP WCMC. Cambridge, UK.

Strategy	Indicator / areas to be monitored	Data source	
		Unit measure	Method
	Community biodiversity in the project area	Number of hectares loss per forest strata	GIS analysis
	Community biodiversity in the project area	Number of hectares of forest loss habitats for HC1	GIS analysis
	Community biodiversity in the project area	Reforestation hectares in community polygons	GIS analysis
	Community biodiversity in the project area	Hectares with forestry enrichment	GIS analysis
	Community biodiversity in the project area	Hectares with agroforestry system	GIS analysis
	Frequency and intensity of forest fires in the project zone	Hectares affected by forest fires per community per year	GIS analysis and monitoring overflights
	Presence of endangered fauna in the project area	Number of times Jaguar, Tapir and White lipped pecari were observed in the project area	Camera traps and direct observation (MIRA application)
	Presence of fauna in the project area	Number of times additional species were observed	Camera traps and direct observation (MIRA application)
	Habitat available for Jaguar in the project area	Percentage of the project area occupied by Jaguar	Camera traps and direct observation (MIRA application)
	Illegal activities in the project zone	Number of people caught carrying xate extraction within the project area	Report per patrol and MIRA application
	Illegal activities in the project zone	Number of people caught carrying hunting within the project area	Report per patrol and MIRA application
	Illegal activities in the project zone	Number of people caught carrying illegal logging within the project area	Report per patrol and MIRA application
	Illegal activities in the project zone	Number of people caught carrying illegal fishing within the project area	Report per patrol and MIRA application

Strategy	Indicator / areas to be monitored	Data source	
		Unit measure	Method
	Illegal activities in the project zone	Number of people caught carrying illegal wildlife trafficking	Report per patrol and MIRA application

MIRA application – Monitoring via Smartphones

The development and introduction of a smart-phone App provides an innovative method to monitor the activities in the Sierra del Lacandon National Park. It is used to collect data in the field which shall proactively be forwarded to a central database. The App make it more convenient to document and transfer information, for the implementation of project activities, sightings of key animals such as the jaguar or detection of illegal activities. The camera traps and MIRA application methodologies are in the Doc Support_Methodology.

Monitoring and reporting will be done at least every five years.

Monitoring of High Conservation Values (HCV) related to biodiversity

B4.2 The identified High Conservation Values HCV1 is covered by the standard monitoring procedure to assess the effectiveness of measures to maintain biodiversity. The approach described includes monitoring of all endangered species that qualify the project area as being of HCV 1 (Refer to Table 57). The main wildlife monitored by camera traps are jaguar (*Panthera onca*), tapir (*Tapirus bairdii*) and white-lipped peccary (*Tayassu pecari*); as the state of ecosystems are known through the presence of these species and are under constant threat and listed on IUCN Red List.

B2.3 / B2.4 Conservation of threatened species—those with identified natural high conservation value (HCV1)—lies at the core of the project's activities. The recovery of ecological niches for endemic, vulnerable or threatened species is favored. The HCV are not expected to be negatively affected by the project. By reducing the deforestation rate in the project area, the project will preserve the habitat for endangered and vulnerable species. Different institutional patrols will monitor its boundaries and areas of influence.

B4.3 All results will be publicly available on the internet and summaries are communicated to the Communities and Other Stakeholders through appropriate medios. Additionally, all documents and information about the results of the monitoring and verification of this project will be published in the platforms of the VCS and CCB standards as usual.

FND has extensive experience with dissemination of the project to communities. The most effective medium agreed with communities is the dissemination of periodic newsletter reporting the progress of the project in all its phases. The project considers the translation of important documents to Q'eqchi language. The monitoring plan and monitoring result will be disclosed through the governance committee and workshops with communities.

8.2 Data and Parameters Available at Validation (CL4)

Data Unit / Parameter:	i
Data unit:	Dimensionless
Description:	1, 2, 3 .. IRR A stratum within the reference region
Source of data:	Section 4.1 Anexo VCS
Value applied:	Estrato 1 - Reserva de la Biosfera Maya (RBM) (con exclusiones) Estrato 2 - Zona de Amortiguamiento (ZA) Estrato 3 - Tierras bajas del Norte
Justification of choice of data or description of measurement methods and procedures applied:	Anexo VCS
Any comment:	To divide the RR into strata with specific characteristics

Data Unit / Parameter:	Thrp
Data unit:	yr
Description:	Duration of the historical reference period
Source of data:	Section 2 Anexo VCS
Value applied:	10
Justification of choice of data or description of measurement methods and procedures applied:	Section 2 Anexo VCS
Any comment:	Historical emissions and forest cover change

Data Unit / Parameter:	f(t)
Data unit:	Dimensionless
Description:	Time function equation, Approach b.
Source of data:	Mapa de Cambios 1986 – 2009 CEMEC
Value applied:	$[ABSLRR]_{(i,t)} = 1,225.37x - 2,447,617.33$
Justification of choice of data or description of measurement methods and procedures applied:	Anexo VCS
Any comment:	Developing the project baseline

Data Unit / Parameter:	ABSLK
Data unit:	ha
Description:	Cumulative area of baseline deforestation within the leakage belt at year t
Source of data:	Calculated, see Anexo VCS Section 1.1.3 and 4.1.2.2
Value applied:	Table 9c, 11c, 13c of VM0015.
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 by dividing ABSLRR (t) of stratum 1 of the RR by the leakage belt polygon.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLK_(fcl,t)
Data unit:	ha
Description:	Area of final (post-deforestation) forest class fcl deforested at time t within the leakage belt in the baseline case
Source of data:	Calculated, see Anexo VCS section 4.1.2.2
Value applied:	Table 13c of VM0015.
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 by dividing ABSLRR (t) of stratum 1 of the RR by the leakage belt polygon.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLK_(i,t)
Data unit:	ha
Description:	Annual area of baseline deforestation in stratum (i) within the leakage belt at year t
Source of data:	Calculated, see Anexo VCS section 4.1.2.2
Value applied:	Table 9c, 11c, 13c of VM0015.
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 by applying the time function regression (with constraints) to stratum 1 of the RR and dividing it by the project area and leakage belt polygons.

Any comment:	Activity data for calculating GHG emissions in the baseline scenario
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Data Unit / Parameter:	ABSLLK_(icl,t)
Data unit:	ha
Description:	Area of initial (post-deforestation) forest class fcl deforested at time t within the leakage belt in the baseline case
Source of data:	
Value applied:	Table 11c of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 , 5.1 by applying land cover map to the result of Table 9c
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLLK_(t)
Data unit:	ha
Description:	Annual area of baseline deforestation within the leakage belt at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9c, 11c, 13c of VM0015.
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 , 4.1.2.2 by dividing ABSLRR (t) of stratum 1 of the RR by the leakage belt polygon.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	Annual area of baseline deforestation in stratum (i) within the RR at year t
Data unit:	ha
Description:	Cumulative area of baseline deforestation within the project area at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9b, Table 11b, Table 13b of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 , 4.1.2.2 by dividing ABSLRR (t) of stratum 1

applied:	of the RR by the project area polygon.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLPA_(i,t)
Data unit:	ha
Description:	Annual area of baseline deforestation within stratum (i) of the project area at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9b, 11b, 13b of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 , 4.1.2.2 by dividing ABSLRR (t) of stratum 1 of the RR by the project area polygon.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLPA_(icl,t)
Data unit:	ha
Description:	Area of initial (pre-deforestation) forest class icl deforested at time t within the project area in the baseline
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 11b of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Calculated according to requirements of VM0015 v1.1 , 5.1 by applying land cover map to the result of Table 9b
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLPA_(t)
Data unit:	ha
Description:	Annual area of baseline deforestation in the project area at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9b, 11b, 13b of VM0015
Justification of choice of data or description of measurement methods and procedures	Calculated according to requirements of VM0015 v1.1 , 4.1.2.2 by dividing ABSLRR (t) of stratum 1

applied:	of the RR by the project area polygon.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLPAz_(t)
Data unit:	ha
Description:	Area of the zone z “deforested” at time t within the project area in the baseline case; ha
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 13b of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Methodology deviation applied. Equal to values of Table 11b.
Any comment:	Calculating net GHG emissions via post-deforestation C-stocks

Data Unit / Parameter:	ABSLRR
Data unit:	ha
Description:	Cumulative area of baseline deforestation in the reference region at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9a,11a VM0015
Justification of choice of data or description of measurement methods and procedures applied:	The reference area meets three of the four criteria in section 1.1.1 and then calculated according to 4.1.2.1 , option b with constraints applied.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLRR_(i,t)
Data unit:	ha
Description:	Annual area of baseline deforestation in stratum (i) within the RR at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9a,11a VM0015
Justification of choice of data or description of measurement methods and procedures	The reference area meets three of the four criteria in section 1.1.1 and then calculated

applied:	according to 4.1.2.1 , option b with constraints applied.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ABSLRR_(t)
Data unit:	ha
Description:	Annual area of baseline deforestation within the RR at year t
Source of data:	Calculated, see Anexo VCS
Value applied:	Table 9a,11a VM0015
Justification of choice of data or description of measurement methods and procedures applied:	The reference area meets three of the four criteria in section 1.1.1 and then calculated according to 4.1.2.1 , option b with constraints applied.
Any comment:	Activity data for calculating GHG emissions in the baseline scenario

Data Unit / Parameter:	ARR_(i)
Data unit:	ha
Description:	Total forest area in stratum i within the reference region at the project start date
Source of data:	Calculated, see Anexo VCS
Value applied:	Stratum 1: 1,248,936.12 Stratum 2: 110,828.16 Stratum 3: 531,726.48
Justification of choice of data or description of measurement methods and procedures applied:	Based on the results of satellite image processing as described in Annex section 4.1.1. and 2.4.3.
Any comment:	Benchmark forest cover used to assess emissions reductions.

Data Unit / Parameter:	Cab_(fcl)
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl

Source of data:	Calculated, see Anexo VCS 6.1.1
Value applied:	Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl
Justification of choice of data or description of measurement methods and procedures applied:	Agropecuario-No Bosque - Guamiles: 17.7 Palma Africana / húmedo: 123.3 Regeneración de bosque secundario: 11.3
Any comment:	Calculate GHG emissions from deforestation

Data Unit / Parameter:	Cab_(cl)
Data unit:	t CO ₂ e ha-1
Description:	Average carbon stock per hectare in the above-ground biomass carbon pool of LU/LC class cl
Source of data:	Calculated, see Anexo VCS 6.1.1
Value applied:	Forest class: BB-SH: 263.9 BMA-H: 343.8 BMA-SH: 314.7
Justification of choice of data or description of measurement methods and procedures applied:	Derived from various forest inventory data. See section 6.1.1.
Any comment:	Emissions factors for estimating GHG emissions from deforestation.

Data Unit / Parameter:	Cab_(fcl)
Data unit:	t CO ₂ e ha-1
Description:	Average carbon stock per hectare in the above-ground biomass carbon pool per zone z
Source of data:	Calculated, see Anexo VCS 6.1.1
Value applied:	Zone 1 (BB-SH): 16.7 Zone 2 (BMA): 25.4
Justification of choice of data or description of measurement methods and procedures applied:	Derived from a combination of sources. See section 6.1.1
Any comment:	Growth factors in post-deforestation classes used for calculating net GHG emissions.

Data Unit / Parameter:	Cbb_(fcl)
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Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock per hectare in the below-ground biomass carbon pool per zone z
Source of data:	Calculated, see Anexo VCS 6.1.1
Value applied:	Zone 1 (BB-SH): 26.8 Zone 2 (BMA): 22.6
Justification of choice of data or description of measurement methods and procedures applied:	Derived from a combination of sources. See section 6.1.1
Any comment:	Growth factors in post-deforestation classes used for calculating net GHG emissions.

Data Unit / Parameter:	Ctotz
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock of all accounted carbon pools per zone z
Source of data:	Tabla 17 VM0015
Value applied:	Zone 1 (BB-SH): 43.5 Zone 2 (BMA): 48.0
Justification of choice of data or description of measurement methods and procedures applied:	Calculated, see Anexo VCS Section 6.1.1
Any comment:	Estimate net GHG emissions

Data Unit / Parameter:	R _(j)
Data unit:	%
Description:	Root:shoot ratio
Source of data:	IPCC/Literature value
Value applied:	0.24
Justification of choice of data or description of measurement methods and procedures applied:	Default value of 0.24 from IPCC/Mokany 2006
Any comment:	Belowground biomass estimation

Data Unit / Parameter:	Cbb _(cl)
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock per hectare in the below-

	ground biomass carbon pool of LU/LC class cl
Source of data:	Calculated, see Anexo VCS 6.1.1
Value applied:	Forest class: BB-SH: 63.3 BMA-H: 82.5 BMA-SH: 75.5
Justification of choice of data or description of measurement methods and procedures applied:	Default value of 0.24 from IPCC/Mokany 2006
Any comment:	Emissions factors for estimating GHG emissions from deforestation.

Data Unit / Parameter:	CF_(j)
Data unit:	Dimensionless
Description:	Carbon fraction for tree tr, of species, group of species or forest type j
Source of data:	Arreaga 2002, IPCC GPG 2006 Chapter 6, Sec. 6.3.1.4
Value applied:	Forest classes: 0.5 Post-deforestation classes: 0.47
Justification of choice of data or description of measurement methods and procedures applied:	See section 6.1.1. of the Anexo VCS Forest Classes: Arreaga 2002, local measurements Post-Deforestation classes: default values IPCC GPG 2006, Chapter 6, Sec. 6.3.1.4
Any comment:	Conversion from biomass to CO ₂ e

Data Unit / Parameter:	C _p
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock per hectare in the carbon pool p
Source of data:	Table 20.a
Value applied:	Table 20.a. VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Requirements of VM0015 sec. 6.1.2.
Any comment:	Baseline GHG emissions estimates

Data Unit / Parameter:	Ctot_(fcl, t)
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock of all accounted carbon pools in non-forest class fcl at time t;
Source of data:	n.a.
Value applied:	n.a.
Justification of choice of data or description of measurement methods and procedures applied:	Sec. 8.1.1 Anexo VCS. Leakage management activities do not decrease carbon stocks.
Any comment:	n.a.

Data Unit / Parameter:	Ctot_(icl)
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock per hectare in all accounted carbon pools of LU/LC class cl
Source of data:	Calculated, see Anexo VCS 6.1.1
Value applied:	Forest class: BB-SH: 325.9 BMA-H: 425.03 BMA-SH: 388.9
Justification of choice of data or description of measurement methods and procedures applied:	Derived from various forest inventory data. See section 6.1.1.
Any comment:	Emissions factors for estimating GHG emissions from deforestation.

Data Unit / Parameter:	Ctot_(icl, t)
Data unit:	t CO ₂ e ha ⁻¹
Description:	Average carbon stock of all accounted carbon pools in forest class icl at time t
Source of data:	Calculated, see Anexo VCS Section 9.1
Value applied:	Deemed de-minimus
Justification of choice of data or description of measurement methods and procedures applied:	Significance analysis. Table "Significancia" in "Tablas de VM0015 Lacandon_5areas"
Any comment:	n.a.

Data Unit / Parameter:	a1,a2
Data unit:	ha
Description:	Sample plot size
Source of data:	Various field plot types from: • Inventarios forestales de Concesiones en la RBM (IFCRBM)• Parcelas permanentes de monitoreo forestal (PPMF)• Inventarios de carbono de la UVG-CEA del área protegida Lachuá (ICUVG)• Inventario de carbono en el Parque Nacional Sierra del Lacandón (ICPNSL)
Value applied:	IFCRBM = >24.99 cm DAP 1ha (500mx20m), >9.99 cm DAP <25 cm DAP (0.2ha) PPMF = 0.25 ha (50mx50m) ICUVG = 0.1 ha (circular) ICPNSL = 0.1 ha (50mx20m)
Justification of choice of data or description of measurement methods and procedures applied:	Carrera, F. 1996; Castellanos, E. et al, 2010; Castellanos, E. et al, 2011; Márquez, J. 2013, Pinelo 2000, Pinelo 2004
Any comment:	Estimate of aboveground biomass

Data Unit / Parameter:	Cwp_(icl)
Data unit:	t CO ₂ -e ha ⁻¹
Description:	Average carbon stock per hectare in the harvested wood products carbon pool of initial forest class icl.
Source of data:	Historical harvest data 2000-2013 from CONAP.
Value applied:	1.3
Justification of choice of data or description of measurement methods and procedures applied:	CONAP has historical harvest data for the MBR, and Bamaca's local harvesting efficiency study is one of the few that exist on the subject. Approximately 25% of a whole tree is converted into commercially viable wood. Guatecarbon project estimates that milled wood equates to harvested wood products (conservative), and that they are long-lived (no decay) because of the lack of data, which is also conservative.
Any comment:	To account for biomass losses due to harvest and to determine whether the harvested wood pool is significant. Finally, the significance analysis shows that the Hwp from legal and

	illegal harvests are insignificant and account for less than 1% of emissions.
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Data Unit / Parameter:	$\Delta\text{CabABSLKK}$
Data unit:	t CO ₂ -e
Description:	Cumulative baseline carbon stock changes for the above-ground biomass pool in the leakage belt
Source of data:	Table 21.c.1 of VM0015
Value applied:	See Table 21.c.1 of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	GHG accounting in the leakage belt.
Any comment:	n.a.

Data Unit / Parameter:	$\Delta\text{CbbABSLKK}$
Data unit:	t CO ₂ -e
Description:	Cumulative baseline carbon stock changes for the below-ground biomass pool in the leakage belt
Source of data:	Table 21.c.1 of VM0015
Value applied:	See Table 21.c.1 of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	GHG accounting in the leakage belt.
Any comment:	n.a.

Data Unit / Parameter:	$\Delta\text{CabBSLPA}$
Data unit:	t CO ₂ -e
Description:	Cumulative baseline carbon stock changes for the above-ground biomass pool in the project area
Source of data:	Table 21.b.1 of VM0015
Value applied:	See Table 21.b.1 of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	GHG accounting in the project area.

Any comment:	n.a.
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Data Unit / Parameter:	$\Delta C_{bbBSLPA}$
Data unit:	t CO ₂ -e
Description:	Cumulative baseline carbon stock changes for the below-ground biomass pool in the project area
Source of data:	Table 21.b.1 of VM0015
Value applied:	See Table 21.b.1 of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	GHG accounting in the project area.
Any comment:	n.a.

Data Unit / Parameter:	$\Delta CADLK$
Data unit:	t CO ₂ -e
Description:	Cumulative total decrease in carbon stocks due to displaced deforestation
Source of data:	Table 34, 35 of VM0015
Value applied:	See Table 34, 35 of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	GHG accounting from displaced leakage
Any comment:	n.a.

Data Unit / Parameter:	ΔC_{BSLPA}
Data unit:	t CO ₂ -e
Description:	Total baseline carbon stock changes in the project area
Source of data:	Table 36 of VM0015
Value applied:	See Table 36 of VM0015
Justification of choice of data or description of measurement methods and procedures applied:	GHG accounting in the project area
Any comment:	n.a.

Data Unit / Parameter:	ΔCPLdPA
Data unit:	t CO ₂ -e
Description:	Cumulative decrease in carbon stock due to planned logging activities at year t in the project area
Source of data:	Table 25b, 25d VM0015 Historical harvest data 2000-2013 from CONAP. See "Extracción_madera_Lacandon_I instancia.xlsx".
Value applied:	1.3 tCO ₂ e ha ⁻¹ yr ⁻¹ , but deemed de-minimis
Justification of choice of data or description of measurement methods and procedures applied:	To account for biomass losses due to harvest and to determine whether the harvested wood pool is significant.
Any comment:	The significance analysis shows that legal and illegal harvests are insignificant and account for less than 1% of emissions.

Data Unit / Parameter:	ΔCPSPA
Data unit:	t CO ₂ -e
Description:	Cumulative project carbon stock change within the project area at year t
Source of data:	Table 27, 36 VM0015
Value applied:	Table 27, 36 VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Calculation of net GHG emissions reductions
Any comment:	n.a.

Data Unit / Parameter:	fj(DBH,H)_(ab)
Data unit:	kg arbol-1
Description:	Allometric equation linking biomass to a biometric variable (D).
Source of data:	Arreaga 2002
Value applied:	$\text{Log}_{10}(\text{Bt}) = -4.09992 + 2.57782 * \text{Log}_{10}(\text{DAP})$.
Justification of choice of data or description of measurement methods and procedures applied:	See Anexo VCS section 6.1.1, N=139, R ² = .95
Any comment:	Estimate biomass to calculate GHG equivalents

Data Unit / Parameter:	ΔCUDdPA
Data unit:	t CO ₂ -e
Description:	Cumulative actual carbon stock change due to unavoided unplanned deforestation at year t in the project area
Source of data:	Table 27 VM0015. Section 7.1.2 Anexo VCS
Value applied:	Effectiveness index: 45%
Justification of choice of data or description of measurement methods and procedures applied:	Measure of project effectiveness
Any comment:	n.a.

Data Unit / Parameter:	ΔREDD_(t)
Data unit:	t CO ₂ -e
Description:	Net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t
Source of data:	T36 VM0015
Value applied:	T36 VM0015
Justification of choice of data or description of measurement methods and procedures applied:	The cumulative result of applying the VM0015 methodology, see section 9.2 of Anexo VCS
Any comment:	Final GHG calculations

Data Unit / Parameter:	DLF
Data unit:	%
Description:	Displacement leakage factor
Source of data:	%
Value applied:	5
Justification of choice of data or description of measurement methods and procedures applied:	Ex ante leakage
Any comment:	n.a

Data Unit / Parameter:	EI
Data unit:	%

Description:	Ex ante estimated Effectiveness Index
Source of data:	Estimate generated by the project
Value applied:	0.45
Justification of choice of data or description of measurement methods and procedures applied:	Estimate generated by the project
Any comment:	n.a.

Data Unit / Parameter:	ELK
Data unit:	t CO ₂ -e
Description:	Cumulative sum of ex ante estimated leakage emissions at year t
Source of data:	Table 35,36 VM0015 Anexo VCS
Value applied:	Table 35,36 VM0015 Anexo VCS
Justification of choice of data or description of measurement methods and procedures applied:	The cumulative result of applying the VM0015 methodology, see section 8 of Anexo VCS
Any comment:	n.a.

Data Unit / Parameter:	RF_(t)
Data unit:	%
Description:	Risk factor used to calculate VCS buffer credits
Source of data:	VCS Non Permanence Risk analysis
Value applied:	10
Justification of choice of data or description of measurement methods and procedures applied:	see VCS Non-Permanence Risk Analysis
Any comment:	n.a.

Data Unit / Parameter:	VBC_(t)
Data unit:	t CO ₂ -e
Description:	Number of Buffer Credits deposited in the VCS Buffer at time t;
Source of data:	Table 36 VM0015
Value applied:	Table 36 VM0015
Justification of choice of data or description of measurement methods and procedures applied:	Calculated. Section 9.3

applied:	
Any comment:	Buffer calculation

8.3 Data and Parameters Monitored (CL4, CM4 & B4)

Climate Parameters

Data Unit / Parameter:	ABSLK
Data unit:	ha
Description:	Cumulative area of deforestation within the leakage belt at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 9c, 11c, 13c of VM0015.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions. Calculated according to requirements of VM0015 v1.1.
Any comment:	n.a.

Data Unit / Parameter:	ABSLK_(i,t)
Data unit:	ha
Description:	Annual area of deforestation in stratum (i) within the leakage belt at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 9c, 11c, 13c of VM0015.
Frequency of monitoring/recording:	At each verification period

Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions. Calculated according to requirements of VM0015 v1.1.
Any comment:	n.a.

Data Unit / Parameter:	ABSLK_(t)
Data unit:	ha
Description:	Annual area of deforestation within the leakage belt at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 9c, 11c, 13c of VM0015.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions. Calculated according to requirements of VM0015 v1.1.
Any comment:	n.a.

Data Unit / Parameter:	ABSLPA
Data unit:	ha

Description:	Cumulative area of deforestation within the project area at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 9b, 11b, 13b of VM0015.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions. Calculated according to requirements of VM0015 v1.1.
Any comment:	n.a.

Data Unit / Parameter:	ABSLPA_(i,t)
Data unit:	ha
Description:	Annual area of deforestation within stratum (i) of the project area at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 9b, 11b, 13b of VM0015.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions.

	Calculated according to requirements of VM0015 v1.1.
Any comment:	n.a.

Data Unit / Parameter:	ABSLPA_(t)
Data unit:	ha
Description:	Annual area of deforestation in the project area at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 9b, 11b, 13b of VM0015.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions. Calculated according to requirements of VM0015 v1.1.
Any comment:	n.a.

Data Unit / Parameter:	AUFPA_(icl,t)
Data unit:	ha
Description:	Areas affected by forest fires in class icl in which carbon stock decrease occurs at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software

QA/QC procedures to be applied:	n.a.
Calculation method:	GHG emissions from extreme events. Calculated according to requirements of VM0015 v1.1.
Any comment:	Measure carbon stock decreases from natural disturbance/catastrophic events

Data Unit / Parameter:	ΔCFCdPA
Data unit:	t CO ₂ -e
Description:	Cumulative decrease in carbon stock due to forest fires and catastrophic events in the project area
Source of data:	Fire monitoring reports from CEMEC
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.
Calculation method:	GHG emissions from extreme events. Calculated according to requirements of VM0015 v1.1.
Any comment:	No large fires or events were detected in the project area

Data Unit / Parameter:	$\Delta\text{CFCdPA}_t(t)$
Data unit:	t CO ₂ -e
Description:	Total decrease in carbon stock due to forest fires and catastrophic events at year t in the project area
Source of data:	Fire monitoring reports from CEMEC
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.
Calculation method:	GHG emissions from extreme events. Calculated according to requirements of VM0015 v1.1.

Any comment:	No large fires or events were detected in the project area
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Data Unit / Parameter:	Δ CPSPA
Data unit:	t CO ₂ -e
Description:	Cumulative project carbon stock change within the project area at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 27 and Table 36.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions reductions.
Any comment:	n.a.

Data Unit / Parameter:	Δ CPSPA_(t)
Data unit:	t CO ₂ -e
Description:	Annual project carbon stock change within the project area at year t
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 27 and Table 36.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
n.a.	n.a.
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon.

	In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions reductions.
Any comment:	n.a.

Data Unit / Parameter:	ΔCUCdPA
Data unit:	t CO ₂ -e
Description:	Cumulative decrease in carbon stock due to catastrophic events at year t in the project area
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 25f, 25g.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions reductions.
Any comment:	Measure carbon stock decreases from natural disturbance/catastrophic events

Data Unit / Parameter:	ΔCUCdPA_(t)
Data unit:	t CO ₂ -e
Description:	Total decrease in carbon stock due to catastrophic events at year t in the project area
Source of data:	Satellite images
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 25f, 25g.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.

QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures will be performed by CEMEC/CONAP according to the guidelines in Anexo PD VCS Guatecarbon. In addition, FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Activity data for calculating GHG emissions reductions.
Any comment:	Measure carbon stock decreases from natural disturbance/catastrophic events

Data Unit / Parameter:	ΔCUCiPA
Data unit:	t CO ₂ -e
Description:	Cumulative increase in carbon stock in areas affected by catastrophic events (after such events) at year t in the project area
Source of data:	TBD
Description of measurement methods and procedures to be applied:	n.a.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.
Calculation method:	Measure carbon stock increases from natural disturbance/catastrophic events
Any comment:	n.a.

Data Unit / Parameter:	$\Delta\text{CUCiPA}_{(t)}$
Data unit:	t CO ₂ -e
Description:	Total increase in carbon stock in areas affected by catastrophic events (after such events) at year t in the project area
Source of data:	TBD
Description of measurement methods and procedures to be applied:	n.a.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.

Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.
Calculation method:	Measure carbon stock increases from natural disturbance/catastrophic events
Any comment:	n.a.

Data Unit / Parameter:	ΔCUFdPA
Data unit:	t CO ₂ -e
Description:	Cumulative total decrease in carbon stock due to unplanned (and planned – where applicable) forest fires in the project area
Source of data:	Subsequent activity data
Description of measurement methods and procedures to be applied:	CEMEC will be in charged for the climate monitoring according to methodology VM0015 v1.1. Table 25e, 25g.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Measure net GHG emissions
Any comment:	n.a

Data Unit / Parameter:	$\Delta\text{CUFdPA}_{(t)}$
Data unit:	t CO ₂ -e
Description:	Total decrease in carbon stock due to unplanned (and planned – where applicable) forest fires at year t in the project area
Source of data:	Subsequent activity data
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 25e, 25g.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Measure net GHG emissions
Any comment:	n.a

Data Unit / Parameter:	ΔCUFiPA
Data unit:	t CO ₂ -e
Description:	Cumulative total increase in carbon stock due to unplanned (and planned – where applicable) forest fires in the project area
Source of data:	Subsequent activity data and growth modeling
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 26e, 26g.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Measure net GHG emissions
Any comment:	n.a.

Data Unit / Parameter:	ΔCUFiPA_(t)
Data unit:	t CO ₂ -e
Description:	Total increase in carbon stock due to unplanned (and planned – where applicable) forest fires at year t in the project area
Source of data:	subsequent activity data and growth modeling
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 26e, 26g.
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	GIS software
QA/QC procedures to be applied:	FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Measure net GHG emissions
Any comment:	n.a

Data Unit / Parameter:	ΔREDD
Data unit:	t CO ₂ -e
Description:	Cumulative net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity

Source of data:	Methodology VM0015 v1.1. Table 36
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 36
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Final GHG calculations
Any comment:	n.a.

Data Unit / Parameter:	ΔREDD_t
Data unit:	t CO ₂ -e
Description:	Net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t
Source of data:	Methodology VM0015 v1.1. Table 36
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 36
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	FDN has designated a QA/QC coordinator; for the first verification is Biologist Rebeca Escobar.
Calculation method:	Final GHG calculations
Any comment:	n.a.

Data Unit / Parameter:	RF _t
Data unit:	%
Description:	Risk factor used to calculate VCS buffer credits
Source of data:	VCS Non Permanence Risk analysis
Description of measurement methods and procedures to be applied:	AFOLU Non permanence Risk Tool v.3.2
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.

Calculation method:	n.a.
Any comment:	Buffer calculation

Data Unit / Parameter:	VBC_(t)
Data unit:	t CO2-e
Description:	Number of Buffer Credits deposited in the VCS Buffer at time t;
Source of data:	Methodology VM0015 v1.1. Table 36
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 36
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.
Calculation method:	n.a.
Any comment:	Buffer calculation

Data Unit / Parameter:	VCU_(t)
Data unit:	t CO2-e
Description:	Number of Verified Carbon Units (VCUs) to be made available for trade at time t
Source of data:	Methodology VM0015 v1.1. Table 36
Description of measurement methods and procedures to be applied:	According to methodology VM0015 v1.1. Table 36
Frequency of monitoring/recording:	At each verification period
Value applied:	n.a.
Monitoring equipment:	n.a.
QA/QC procedures to be applied:	n.a.
Calculation method:	n.a.
Any comment:	Buffer calculation

Community Parameters

Data / Parameter	Cooperation agreements signed
Data unit	Number of cooperation agreements signed
Description	Cooperation agreements signed with communities for the conservation of the Park
Method	Data record

Data / Parameter	Communities boundaries
Data unit	Definition and demarcation of communities boundaries
Description	Georeference and define communities boundaries
Method	Data record

Data / Parameter	Assessment of compliance of the agreements
Data unit	Percentage of progress of activities
Description	Every three years evaluate the progress of the commitments by communities
Method	Data record

Data / Parameter	Patrols conducted and participants
Data unit	Number of patrols conducted and participants
Description	Biodiversity monitoring and surveillance patrols
Method	Data record and MIRA application

Data / Parameter	Emergencies detected
Data unit	Number of emergencies detected
Description	Emergencies could be fire, catastrophic events, biodiversity, social
Method	Data record and MIRA application

Data / Parameter	Fire workshops undertaken at the communities
Data unit	Number of fire workshops undertaken at the communities
Description	Train communities in fire management
Method	Data record and MIRA application

Data / Parameter	Forest fire prevention in communities
Data unit	Early warning system for forest fire prevention in communities
Description	Train communities in fire management

Method	Data record and MIRA application
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Data / Parameter	Cleaning of firebreaks
Data unit	Number of annual cleaning of firebreaks in communities
Description	Train communities in fire management
Method	Data record

Data / Parameter	Reports of biodiversity
Data unit	Number of endangered species recorded
Description	Management of endangered species
Method	Data record and MIRA application

Data / Parameter	Capacitation workshops for the personnel and professionals of the SLNP in practices for a sustainable agriculture
Data unit	Number of capacitation workshops
Description	Capacitation workshops for the personnel and professionals of the SLNP in practices for a sustainable agriculture
Method	Data record

Data / Parameter	Farmers trained in conservation agriculture
Data unit	Number of community agricultural plots
Description	Number of community agricultural plots in which it is effectively implemented
Method	Data record and MIRA application

Data / Parameter	Crops that has been included in the program for sustainable agriculture
Data unit	Productivity/ha/household
Description	Productivity/ha/household of a given crop that has been included in the program for sustainable agriculture
Method	Data record and MIRA application

Data / Parameter	Hectares of deforestation needed per household/year
Data unit	Number of hectares of deforestation needed per household/ year
Description	Quantify deforested hectares
Method	Data record

Data / Parameter	Alternative NTFPs identified
Data unit	Number of alternative NTFPs identified
Description	Non timber forest products identified to increase the value chain
Method	Data record

Data / Parameter	Forest nurseries and number of used species
Data unit	Number of forest nurseries and number of used species
Description	Quantify production plants
Method	Data record

Data / Parameter	Communities included in the census of populations of flora/fauna that have historically been subject to commercial extraction
Data unit	Number of communities included in the census of populations of flora/fauna that have historically been subject to commercial extraction
Description	Community participation
Method	Data record

Data / Parameter	Approved sustainable forest management plans
Data unit	Number of approved sustainable forest management plans
Description	Community management plans
Method	Data record and MIRA application

Data / Parameter	Micro credits awarded
Data unit	Number of micro credits awarded and number of micro credits re-paid timely
Description	Micro credits for inhabitants
Method	Data record

Data / Parameter	Persons contracted by the SLNP at a fix basis (not seasonal jobs)
Data unit	Number of persons contracted by the SLNP
Description	Persons working for SLNP
Method	Contract

Data / Parameter	Minors participating of the REDD+ project
Data unit	Number of minors under 15 participating of the project
Description	Minors benefiting from the project
Method	Data record

Data / Parameter	Direct women beneficiaries
Data unit	Number of women beneficiaries
Description	Women benefiting from the project
Method	Data record and MIRA application

Data / Parameter	Workshops in communities for the socialization of environmental legislation
Data unit	Number of workshops in communities for the socialization of environmental legislation
Description	Communities with knowledge of environmental legislation
Method	Data record and MIRA application

Data / Parameter	Environmental education training and lectures
Data unit	Number of women/ men/ youth participants
Description	Communities with knowledge of environmental education
Method	Data record and MIRA application

Data / Parameter	Cases of non-compliance with applicable laws per community (for example: logging without a permit)
Data unit	Number of penalties
Description	Activities not regulated by law
Method	Data record

Data / Parameter	Communities that effectively manage to apply measures in case of non-compliance with applicable laws by any of its members
Data unit	Number of communities that effectively manage to apply measures in case of non-compliance with applicable laws by any of its members
Description	Management of non-compliance
Method	Data record

Data / Parameter	Workshops about sexual and reproductive knowledge per community
Data unit	Number of workshops about sexual and reproductive knowledge per community
Description	Communities inform and with knowledge about sexual and reproductive education
Method	Data record

Data / Parameter	Workshops on correct use of water, management of human waste and use of latrines
Data unit	Number of workshops on correct use of water, management of human waste and use of latrines
Description	Improving health care
Method	Data record

Biodiversity Parameters

Data / Parameter	Illegal settlements in the project area and leakage belt
Data unit	Number of hectares usurped by illegal settlements
Description	Monitoring of illegal settlements
Method	GIS analysis and monitoring overflights

Data / Parameter	Illegal settlements in the project area and leakage belt
Data unit	Number of irregular camps detected for illegal extraction of flora, timber and wildlife
Description	Monitoring of illegal settlements
Method	GIS analysis

Data / Parameter	Community biodiversity
Data unit	Hectares of forest conservation in community polygons
Description	Monitoring management plans
Method	GIS analysis

Data / Parameter	Community biodiversity
Data unit	Number of hectares loss per forest strata
Description	Monitoring deforestation
Method	GIS analysis

Data / Parameter	Community biodiversity
Data unit	Number of hectares of forest loss habitats for HC1
Description	Monitoring area of threatened species
Method	GIS analysis

Data / Parameter	Community biodiversity
Data unit	Reforestation hectares in community polygons
Description	Monitoring management plans
Method	GIS analysis

Data / Parameter	Community biodiversity
Data unit	Hectares with forestry enrichment
Description	Monitoring management plans
Method	GIS analysis

Data / Parameter	Community biodiversity
Data unit	Hectares affected by forest fires per community per year
Description	Monitoring management plans
Method	GIS analysis

Data / Parameter	Frequency and intensity of forest fires
Data unit	Hectares affected by forest fires per community per year
Description	Monitoring management plans
Method	GIS analysis and monitoring overflights

Data / Parameter	Presence of endangered fauna
Data unit	Number of times Jaguar, Tapir and Pecarí labio blanco were observed in the project area
Description	Monitoring HCV1
Method	Camera traps and direct observation (MIRA application)

Data / Parameter	Presence of fauna
Data unit	Number of times additional species were observed
Description	Monitoring biodiversity fauna
Method	Camera traps and direct observation (MIRA application)

Data / Parameter	Habitat available for Jaguar
Data unit	Percentage of the project area occupied by Jaguar
Description	Monitoring biodiversity fauna
Method	Camera traps and direct observation (MIRA application)

Data / Parameter	Illegal activities in the project zone
Data unit	Number of people caught carrying xate extraction within the project area
Description	Monitoring biodiversity flora
Method	Report per patrol and MIRA application

Data / Parameter	Illegal activities in the project zone
Data unit	Number of people caught carrying hunting within the project area
Description	Monitoring illegal hunting
Method	Report per patrol and MIRA application

Data / Parameter	Illegal activities in the project zone
Data unit	Number of people caught carrying illegal logging within the project area
Description	Monitoring illegal logging
Method	Report per patrol and MIRA application

Data / Parameter	Illegal activities in the project zone
Data unit	Number of people caught carrying illegal fishing within the project area
Description	Monitoring illegal fishing
Method	Report per patrol and MIRA application

Data / Parameter	Illegal activities in the project zone
Data unit	Number of people caught carrying illegal wildlife trafficking
Description	Monitoring illegal wildlife trafficking
Method	Report per patrol and MIRA application

APPENDIX I. LIST OF VEGETAL SPECIES OF NATIONAL PARK SIERRA DEL LACANDÓN

NUMBER	FAMILY	SPECIES	SPANISH NAME
1	Acantaceae	<i>Justicia sp.</i>	Julup
2	Anacardiaceae	<i>Astronium graveolens Jacq.</i>	Jobillo
3	Anacardiaceae	<i>Metopium brownei (Jacq) Urban.</i>	chechén negro
4	Anacardiaceae	<i>Spondias mombin L.</i>	Jobo
5	Anacardiaceae	<i>Spondias purpurea L.</i>	Quinim
6	Annonaceae	<i>Annona sp.</i>	anona
7	Annonaceae	<i>Cymbopetalum mayanum Lundell.</i>	anona de montaña, muc
8	Annonaceae	<i>Malmea depressa (Baill) R.E. Fries.</i>	Sufricay
9	Annonaceae	<i>Malmea sp.</i>	yaya
10	Apocynaceae	<i>Aspidosperma megalocarpon Muell-Arg.</i>	chichique colorado, mallerio colorado
11	Apocynaceae	<i>Aspidosperma stegomeris Woodson.</i>	chichique blanco, mallerio blanco
12	Apocynaceae	<i>Stemadenia donell-smithii (Rose) Woodson.</i>	cojón
13	Apocynaceae	<i>Thevetia ahovai (L) A. DC. in DC.</i>	huevo de chucho
14	Araliaceae	<i>Oreopanax liebmannii Marchal Bull.</i>	mano de león
15	Araliaceae	<i>Oreopanax obtusifolius L.</i>	hoja tronadora
16	Arecaceae	<i>Cryosophila argentea Bartlett.</i>	escobo
17	Arecaceae	<i>Chamaedorea neurochlamis Burret.</i>	chapana

NUMBER	FAMILY	SPECIES	SPANISH NAME
18	Arecaceae	<i>Chamaedorea elegans</i> . <i>Martius</i> .	xate hembra
19	Arecaceae	<i>Chamaedorea ernestii-agustii</i> Wendl.	cola de pescado
20	Arecaceae	<i>Chamaedorea tepejilote</i> <i>Liemb</i> .	pacaya
21	Arecaceae	<i>Chamaedorea oblongata</i> Martius.	xate jade, xate macho
22	Arecaceae	<i>Geonoma interrupta</i> (Ruiz & Pav) Mart.	capuca
23	Arecaceae	<i>Orbignya cohune</i> (Mart.) Dahlgren ex Standl	corozo
24	Arecaceae	<i>Sabal morriciana</i> <i>Bartlett</i> .	guano,
25	Bignoniaceae	<i>Amphitecna donnell-smithii</i> (Sprague) L.	Morro
26	Bignoniaceae	<i>Parmentiera aculeata</i> (HBK) L.	cuajilote
27	Bignoniaceae	<i>Tabebuia rosea</i> (Bertol.) D.C.	maqueliz, maculiz, matilisguate
28	Bombacaceae	<i>Ceiba aesculifolia</i> (HBK) Britt & Baker.	chuum
29	Bombacaceae	<i>Ceiba pentandra</i> (L) Gaertn.	ceiba
30	Bombacaceae	<i>Pachira aquatica</i> Aubl.	zapote bobo, zapotón
31	Bombacaceae	<i>Pseudobombax ellipticum</i> HBK.	amapola
32	Bombacaceae	<i>Quararibea funebris</i> (Llave) Vischer, Bull.	molinillo
33	Boraginaceae	<i>Bourreria oxyphylla</i> Standl.	sacuché
34	Boraginaceae	<i>Cordia stellifera</i>	bojón blanco, laurel

NUMBER	FAMILY	SPECIES	SPANISH NAME
		<i>I.M. Johnston.</i>	
35	Boraginaceae	<i>Tournefortia elongata D. Gibson.</i>	----
36	Bromeliaceae	<i>Bromelia sp.</i>	pita floja
37	Burseraceae	<i>Bursera graveolens (HBK) Triana & Planch.</i>	chacaj blanco
38	Burseraceae	<i>Bursera simaruba (L) Sarg. Gard. & Ford.</i>	chacaj colorado, palo jiote
39	Burseraceae	<i>Protium copal (Schlecht & Cham) Engler.</i>	copal, pom
40	Caesalpinaceae	<i>Bauhinia gigas Lundell.</i>	pata de vaca, pata de venado
41	Caesalpinaceae	<i>Caesalpinia sp.</i>	chaltecoco
42	Caesalpinaceae	<i>Dialium guianense (Aubl.) Sandwith.</i>	tamarindo, tamarindillo, guaparque, lacandón
43	Caesalpinaceae	<i>Haematoxylon campechianum L.</i>	tinto
44	Caesalpinaceae	<i>Phyllocarpus septentrionalis Donn. Smith.</i>	guacamaya
45	Caesalpinaceae	<i>Schizolobium parahybum (Vell) Blake.</i>	plumajillo, plumillo
46	Caesalpinaceae	<i>Swartzia cubensis (Britt & Wills) Standl.</i>	llora sangre
47	Caesalpinaceae	<i>Swartzia sp.</i>	catalox
48	Cecropiaceae	<i>Cecropia peltata L.</i>	guarumo
49	Celastraceae	<i>Rhacoma eucymosa (Loes & Pitt) Standl.</i>	chilonché hoja grande
50	Celastraceae	<i>Wimmeria concolor Schl & Cham.</i>	chintoc blanco
51	Clusiaceae	<i>Calophyllum brasiliense var. reko Standl.</i>	marío, Santa María, barillo

NUMBER	FAMILY	SPECIES	SPANISH NAME
52	Clusiaceae	<i>Clusia belizensis</i> Standl.	hoja vidriosa, palo de piedra
53	Clusiaceae	<i>Rheedia intermedia</i> Pittier.	mulacté, manguillo, crucetillo
54	Combretaceae	<i>Bucida buceras</i> L.	pucté
55	Combretaceae	<i>Terminalia amazonia</i> (J.F. Gmel) Exell. in Pulle.	canxán, canchán
56	Costaceae	<i>Costus</i> sp.	caña de Cristo
57	Chrysobalanaceae	<i>Licania platypus</i> (Hems) Fritsch, Ann.	zunza
58	Euphorbiaceae	<i>Astrocasia phyllanthoides</i> Rob & Millsp.	pixtonsil
59	Moraceae	<i>Castilla elastica</i> Cervantes.	hule
60	Euphorbiaceae	<i>Gymnanthes lucida</i> Swartz.	pij
61	Euphorbiaceae	<i>Sebastiania longicuspis</i> Standl.	chechén blanco
62	Euphorbiaceae	<i>Tetrorchidium rotundatum</i> Standl.	-----
63	Fabaceae	<i>Ateleia cubensis</i> Griseb.	cuero de sapo
64	Fabaceae	<i>Diphysa robinoides</i> Benth.	stunstula
65	Fabaceae	<i>Diphysa</i> sp.	palo amarillo
66	Fabaceae	<i>Erythrina folkersii</i> Krukoff & Moldenke.	pito
67	Fabaceae	<i>Gliricidia sepium</i> (Jacq) Steud	canté, madre cacao
68	Fabaceae	<i>Lonchocarpus guatemalensis</i> Benth.	yaxmojén

NUMBER	FAMILY	SPECIES	SPANISH NAME
69	Fabaceae	<i>Lonchocarpus hondurensis</i> Benth.	chaperno, gusano
70	Fabaceae	<i>Lonchocarpus rugosus</i> Benth.	frijolillo
71	Fabaceae	<i>Lonchocarpus</i> sp.	manchiche
72	Fabaceae	<i>Myroxylon balsamum</i> var. <i>pereirae</i> (Royle) Harms, Notizbl.	bálsamo
73	Fabaceae	<i>Piscidia piscipula</i> (L) Sarg. Gard & For.	jabín
74	Fabaceae	<i>Vatairea lundellii</i> (Standl) Killip.	danto, medallo
75	Fabaceae		Santa Marta
76	Flaucortiaceae	<i>Casearia</i> sp.	yaaxjochoc
77	Flaucortiaceae	<i>Laetia thamnia</i> L.	baquelac
78	Flaucortiaceae	<i>Zuelania guidonia</i> (Swartz) Britton & Millsp.	tamay
79	Heliconiaceae	<i>Heliconia psittacorum</i> L.	eucadena
80	Lauraceae	<i>Licaria campechiana</i> (Standl) Kosterm. Rec. Trav	Sootzni
81	Lauraceae	<i>Licaria capitata</i> (Cham & Schlecht) Costerm.	aguacatillo
82	Lauraceae	<i>Licaria caudata</i> (Lundell) Kosterm.	laurel aguacatillo
83	Lauraceae	<i>Nectandra saliciflora</i> (Kunth) Nees	eqtit
84	Lauraceae	<i>Ocotea lundellii</i> Standl	sootzni
85	Liliaceae	<i>Dracaena americana</i> Donn. Smith.	isote de montaña
86	Malpigiaceae	<i>Bunchosia swartziana</i>	-----

NUMBER	FAMILY	SPECIES	SPANISH NAME
		<i>Griseb.</i>	
87	Malvaceae	<i>Hampea stipitata</i> <i>Watson.</i>	Baquemán, majagua.
88	Melastomataceae	<i>Miconia</i> sp.	hoja de queso
89	Melastomataceae	<i>Mouriri parvifolia</i> Benth.	chintoc negro
90	Meliaceae	<i>Cedrella mexicana</i> M. <i>Roem.</i>	cedro
91	Meliaceae	<i>Guarea excelsa</i> HBK.	cedrillo hoja ancha
92	Meliaceae	<i>Guarea glabra</i> Vahl.	cedrillo hoja fina
93	Meliaceae	<i>Swietenia macrophylla</i> G.	caoba
94	Meliaceae	<i>Trichilia montana</i> HBK.	chile chachalaca
95	Meliaceae	<i>Trichilia</i> sp.	palo diente
96	Mimosaceae	<i>Acacia cornigera</i> (L) <i>Willdenow.</i>	subín colorado
97	Mimosaceae	<i>Acacia dolichostachya</i> <i>Blake.</i>	jesmó
98	Mimosaceae	<i>Acacia glomerosa</i> <i>Benth.</i>	palo espinudo
99	Mimosaceae	<i>Acacia</i> sp.	subín blanco
100	Mimosaceae	<i>Inga paterna</i> Harms.	paterna
101	Mimosaceae	<i>Inga spurea</i> Humn & <i>Bonpl.</i>	cuje, cushín
102	Mimosaceae	<i>Lysiloma bahamense</i> <i>Benth.</i>	tzalam curtidor
103	Mimosaceae	<i>Pithecolobium</i> <i>arboreum</i> (L) Urban.	cola de coche
104	Moraceae	<i>Brosimum alicastrum</i> <i>Swartz.</i>	ramón blanco
105	Moraceae	<i>Brosimum panamense</i> (Pittier) Standl y	ramón negro

NUMBER	FAMILY	SPECIES	SPANISH NAME
		<i>Steyerm.</i>	
106	Moraceae	<i>Coussapoa oligocephala</i> Don Smith.	copó aguacatillo
107	Moraceae	<i>Chlorophora tinctoria</i> (L) Gaud.	palo de mora
108	Moraceae	<i>Ficus costarricana</i> (Liem) Miq.	mata palo
109	Moraceae	<i>Ficus cotinifolia</i> HBK.	copo hoja fina
110	Moraceae	<i>Ficus glabrata</i> HBK.	chile amate
111	Moraceae	<i>Ficus radula</i> Willd.	chimón
112	Moraceae	<i>Ficus</i> sp.	amate
113	Moraceae	<i>Ficus</i> sp.	copó mata palo
114	Moraceae	<i>Poulsenia armata</i> (Miq.) Standl.	copó hoja ancha
115	Moraceae	<i>Pseudomelia spuria</i> (Swartz) Griseb.	manax
116	Moraceae	<i>Trophis racemosa</i> (L) Hurb.	ramón colorado
117	Moraceae		copó frente de toro
118	Myrsinaceae	<i>Ardisia paschalis</i> Donn-Sm.	chile malache
119	Myrtaceae	<i>Eugenia capuli</i> (Schlecht & Cham) Breg.	chilonché
120	Myrtaceae	<i>Pimenta dioica</i> (L) Merrill.	pimienta
121	Nictaginaceae	<i>Neea psychotrioides</i> Donn Smith.	-----
122	Ochnaceae	<i>Ouratea lucens</i> (HBK) Engler in Mart.	-----

NUMBER	FAMILY	SPECIES	SPANISH NAME
123	Piperaceae	<i>Piper donell-smithii</i> C. DC.	cordoncillo hoja pequeña
124	Piperaceae	<i>Piper perlongipedunculum</i> Trelease & Standley.	cordoncillo hoja mediana
125	Piperaceae	<i>Piper scabrum</i> Swartz.	cordoncillo hoja grande
126	Poligonaceae	<i>Coccoloba browniana</i> Standl.	papaturrito
127	Poligonaceae	<i>Coccoloba laurifolia</i> Jacq.	guayabillo
128	Poligonaceae	<i>Coccoloba</i> sp.	papaturro
129	Rhamnaceae	<i>Colubrina ferruginosa</i> Brongn.	aceituno simple
130	Rosaceae	<i>Hirtella americana</i> L.	aceituno peludo
131	Rubiaceae	<i>Alseis hondurensis</i> Standl.	son
132	Rubiaceae	<i>Alseis yucatanensis</i> Standl.	son
133	Rubiaceae	<i>Exostema</i> sp.	quina
134	Rubiaceae	<i>Faramea occidentalis</i> (L) A. Rich.	puxikil
135	Rubiaceae	<i>Guettarda combsii</i> Urban.	testap
136	Rubiaceae	<i>Psychotria yunckeri</i> Standl.	julup verde
137	Rubiaceae	<i>Psychotria</i> sp.	palo de gas
138	Rubiaceae	<i>Sickingia salvadorensis</i> Standl.	puntero, saltemuche
139	Sapindaceae	<i>Talisia floresii</i> Standl	kolok
140	Rutaceae	<i>Zanthoxylum belizense</i> Lundell.	lagarto

NUMBER	FAMILY	SPECIES	SPANISH NAME
141	Rutaceae	<i>Zanthoxylum procerum</i> Donn. Smith.	naranjillo
142	Sapindaceae	<i>Blomia prisca</i> (Standl) Aguilar.	tzol
143	Sapindaceae	<i>Cupania auriculata</i> Standl.	chonté
144	Sapindaceae	<i>Cupania macrophylla</i> A. Rich	chonté
145	Sapindaceae	<i>Eupatorium</i> sp.	carboncillo
146	Sapindaceae	<i>Matayba oppositifolia</i> (A Rich) Britton.	sacuayum
147	Sapindaceae	<i>Sapindus saponaria</i> L.	jaboncillo
148	Sapindaceae	<i>Talisia olivaeformis</i> (HBK) Radlk.	guaya
149	Sapindaceae	<i>Thouinia paucidentata</i> Radlk.	canchunup
150	Sapotaceae	<i>Chrysophyllum mexicanum</i> Brandegees ex Standl	caimito de montaña
151	Sapotaceae	<i>Manilkara chicle</i> (Pittier) Gilly.	chico, chiquibul
152	Sapotaceae	<i>Manilkara staminodella</i> Gilly, Trop.	chicle de segunda
153	Sapotaceae	<i>Pouteria amygdalina</i> (Standley) Baehni.	silión, silillón, samago morado
154	Sapotaceae	<i>Pouteria campechiana</i> (Kunth in Humboldt, Bonpland & Kunth.) Baehni.	zapotillo hoja grande
155	Sapotaceae	<i>Pouteria reticulata</i> (Engler) Eyma.	zapotillo hoja fina
156	Sapotaceae	<i>Pouteria sapota</i> (Jacquin) H.E. Moore &	zapote

NUMBER	FAMILY	SPECIES	SPANISH NAME
		<i>Stearn.</i>	
157	Sapotaceae	<i>Sideroxylon persimile</i> (Hemsley) Pennigton.	avalo
158	Simarubaceae	<i>Simarouba amara</i> Aubl.	Aceituno, pasaque
159	Solanaceae	<i>Solanum</i> sp.	ixcampuluc
160	Solanaceae	<i>Witheringia meiantha</i> (Donn-Sm) A. T. Hunziker.	chilar
161	Sterculiaceae	<i>Guazuma ulmifolia</i>	tapa culo, caulote
162	Tiliaceae	<i>Belotia camphellii</i> Sprague, Kew, Bull.	jolol
163	Tiliaceae	<i>Heliocarpus</i> <i>appendiculatus</i> Turez. Bull.	majagua
164	Tiliaceae	<i>Muntingia calabura</i> L.	capulín
165	Turneraceae	<i>Erblichia odorata</i> Seem.	colorín
166	Ulmaceae	<i>Ampelocera Hottlei</i> Standl.	luín
167	Ulmaceae	<i>Celtis</i> sp.	huesillo, palo hueso
168	Urticaceae	<i>Myriocarpa</i> <i>heterostachya</i> Don Smith.	-----
169	Verbenaceae	<i>Vitex gaumeri</i> Greenm.	yaxnic
170	Violaceae	<i>Hybanthus</i> sp.	-----
171	Violaceae	<i>Rinorea guatemalensis</i> (Wats) Bartlett.	cafecillo, baquelac
172	Violaceae	<i>Rinorea hummelii</i> Sprague, Kew, Bull.	sootzni
173	Vochysiaceae	<i>Vochysia guatemalensis</i> Donn. Smith.	San Juan

Source: Castañeda, C. 1998. "Clasificación ecológica del Parque Nacional Sierra del Lacandón". The Nature Conservancy, Petén. 66 pp. + anexos., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón.

APPENDIX II. LIST OF BIRD SPECIES OF NATIONAL PARK SIERRA DEL LACANDÓN.

Species with (*) meaning migratory birds.

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
	ORDER TINAMIFORMES	
	FAMILY TINAMIDAE	
1	<i>Tinamus major</i>	Tinamú mayor, Mancolola grande
2	<i>Cryptorellus boucardi</i>	T. jamuey, M. morena, Vale,
3	<i>Crypturellus soui</i>	Tinamú menor
4	<i>Podilymbus podiceps</i>	Zambullidor piquigrueso.
5	<i>Tachyobatus dominicus</i>	Zambullidor menor
6	<i>Phalacrocorax brasilianus</i>	Pato coche, Cormorán
	FAMILIA ANHINGIDAE	
7	<i>Anhinga anhinga</i>	Anhinga americana
8	<i>Trigrisoma mexicanum</i>	Garza tigre
9	<i>Ardea herodias</i> *	Garzón cenizo
10	<i>Egretta alba egretta</i> *	Garza blanca
11	<i>Egretta thula</i> *	Garza patas doradas
12	<i>Egretta caerulea</i> *	Garza azul
13	<i>Bubulcus ibis</i>	Garcita ganadera
14	<i>Butorides virescens</i>	Garza verde
15	<i>Agami agami</i>	Garza agami
16	<i>Cochlearius cochlearius</i>	Garza cucharón
	ORDEN ANSERIFORMES	
	FAMILIA ANATIDAE	
17	<i>Dendrocygna autumnalis</i>	Pijije común, P. aliblanco
	ORDEN FALCONIFORMES	
	FAMILIA CATHARTIDAE	
18	<i>Coragyps atratus</i>	Zopilote negro
19	<i>Cathartes aura</i>	Viuda, Aura cabeza roja
20	<i>Sarcoramphus papa</i>	Rey zope
	FAMILIA ACCIPITRIDAE	
21	<i>Pandion haliaetus</i> *	Águila pescadora
22	<i>Leptodon cayanensis</i>	Milano cabecigris
23	<i>Chondrohierax uncinatus</i>	Milano picoganchudo
24	<i>Elanoides forficatus</i>	Gavilán o Milano tijereta
25	<i>Rostramus sociabilis</i>	Milano caracolero
26	<i>Harpagus bidentatus</i>	Milano bidentado
27	<i>Ictinea plúmbea</i>	Gavilán plomizo

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
28	<i>Geranospiza caerulescens</i>	Gavilán Zancudo
29	<i>Leucopternis albigollis</i>	Gavilán blanco
30	<i>Buteogallus urubitinga ridwayi</i>	Aguililla negra
31	<i>Buteo nitidus</i>	Gavilán gris
32	<i>Buteo magnirostris</i> *	Gavilán del camino
33	<i>Spizaetus tyrannus serus</i>	Aguilucho negro
34	<i>Spizaetus ornatus vicarius</i>	Aguilucho penachudo
	FAMILIA FALCONIDAE	
35	<i>Herpetotheres cachinans</i>	Halcón guaco
36	<i>Micrastur ruficollis</i>	Halcón selvático menor
37	<i>Micrastur semitorquatus naso</i>	Halcón selvático mayor, Collarejo
38	<i>Falco femoralis</i>	Halcón aplomado
39	<i>Falco ruficularis</i>	Halcón murcielaguero
40	<i>Falco peregrinus</i>	Halcón peregrino
	ORDEN GALLIFORMES	
	FAMILIA CRACIDAE	
41	<i>Ortalis vetula</i>	Chachalaca común
42	<i>Penelope purpurascens</i>	Corolita
43	<i>Crax rubra</i>	Faisán, Pajuil
	FAMILIA PHASIANIDAE	
44	<i>Meleagris ocellata</i>	Pavo ocelado, Pavo petenero
45	<i>Odontophorus guttatus</i>	Codorniz bolonchaco
46	<i>Dactylortyx thoracicus</i>	Codorniz silbadora
	ORDEN CHARADRIIFORMES	
	FAMILIA JACANIDAE	
47	<i>Jacana espinosa</i>	Jacana
	FAMILIA SCOLOPACIDAE	
48	<i>Actitis macularia</i> *	Playerito
	ORDEN COLUMBIFORMES	
	FAMILIA COLUMBIDAE	
49	<i>Columba speciosa</i>	Paloma escamosa
50	<i>Columba flavirostris</i>	Paloma morada
51	<i>Columba nigrirostris</i>	Paloma piquicorto
52	<i>Columbina talpacoti</i>	Tortolita rojiza
53	<i>Leptotila verreauxi</i>	Paloma perdiz
54	<i>Claravis pretiosa</i>	Tortola azul
55	<i>Geotrygon montana</i>	Paloma perdiz rojiza
	ORDEN PSITTACIFORMES	
	FAMILIA PSITTACIDAE	
56	<i>Aratinga ASTEC</i>	Perico grande pechisucio
57	<i>Ara macao</i>	Guacamaya roja
58	<i>Pionopsitta haematotis</i>	Loro orejinegro

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
59	<i>Pionus senilis</i>	Loro coroniblanco yucateco
60	<i>Amazona autumnalis</i>	Loro Cachete-amarillo
61	<i>Amazona farinosa</i>	Loro real, loro cabeza azul
	ORDEN CUCULIFORMES	
	FAMILIA CUCULIDAE	
62	<i>Piaya cayana excellens</i>	Pájaro ardilla
63	<i>Tapera naevia</i>	Cuculillo rayado
64	<i>Dromococys phasianellus</i>	Cuculillo coliblanco
65	<i>Crotophaga sulcirostris</i>	Garrapatero, Pijuy
	ORDEN STRIGIFORMES	
	FAMILIA TYTONIDAE	
66	<i>Tyto alba</i>	Lechuza del campanario
	FAMILIA STRIGIDAE	
67	<i>Otus guatemalae</i>	Tecolote crescendo
68	<i>Lophotrix cristata stricklandi</i>	Búho corniblanco
69	<i>Strix virgata</i>	Búho tropical
70	<i>Strix nigrolineata</i>	Búho blanquinegro
	ORDEN CAPRIMULGIFORMES	
	FAMILIA CAPRIMULGIDAE	
71	<i>Lurocalis semitorquatus</i>	Chotacabras colicorta
72	<i>Nyctidromus albicollis</i>	Tapacaminos
	ORDEN APODIFORMES	
	FAMILIA APODIDAE	
73	<i>Streptoprocne zonaris</i>	Vencejo cuelliblanco
74	<i>Panyptila cayennensis</i>	Vencejo tijereta
	FAMILIA TROCHILIDAE	
75	<i>Phaetornis superciliosus</i>	Ermitaño común colilargo
76	<i>Pygmornis longuemareus</i>	Ermitaño pequeño
77	<i>Phaeochroa cuvierii</i>	Fandango prechiescamoso
78	<i>Campylopterus curvipennis</i>	Chupaflor fandanguero
79	<i>Florisuga mellivora</i>	Chupaflor nuquiblanca jacabino
80	<i>Anthracothonax prevostii</i>	Colibrí pechiverde
81	<i>Amazilia candida</i>	C. esmeralda vientre blanco
82	<i>Amazilia tzacatl</i>	Colibrí colirrufo
	ORDEN TROGONIFORMES	
	FAMILIA TROGONIDAE	
83	<i>Trogon melanocephalus</i>	Trogón cabecinegro
84	<i>Trogon violaceus braccatus</i>	Trogón colibarrado
85	<i>Trogon collaris</i>	Trogón collarejo
86	<i>Trogon massena</i>	Trogón colioscuro
	ORDEN CORACIFORMES	
	FAMILIA MOMOTIDAE	
87	<i>Hylomanes momotula</i>	Motmot enano

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
88	<i>Momotus momota</i>	Tolobojo coroniazul
89	<i>Electron carinatum</i>	Momoto piquianillado
	FAMILIA ALCEDINIDAE	
90	<i>Ceryle torquata</i>	Martín pescador grande
91	<i>Chloroceryle americana</i>	Martín pescador enano
92	<i>Chloroceryle aenea strictoptera</i>	Martín pescador pigmeo
	ORDEN PICIFORMES	
	FAMILIA BUCCONIDAE	
93	<i>Notharchus macrorhynchos</i>	Buco collarejo
94	<i>Malacoptila panamensis inornata</i>	Buco barbón
	FAMILIA GALBULIDAE	
95	<i>Galbula ruficauda melanogenia</i>	Martín gorrión, Jacamar colirrufo
	FAMILIA RAMPHSTIDAE	
96	<i>Pteroglossus torquatus</i>	Tucancillo collarejo
97	<i>Ramphastos sulfuratus</i>	Tucán real, pico multicolor
	FAMILIA PICIDAE	
98	<i>Centurus pucherani</i>	Carpintero cachetinegro
99	<i>Centurus aurifrons</i>	Carpintero común
100	<i>Venileornis fumigatus</i>	Carpinterillo café
101	<i>Piculus rubiginosus</i>	Carpintero verde tropical
102	<i>Celeus castaneus</i>	Carpintero castaño
103	<i>Dryocopus lineatus</i>	Carpintero grande
104	<i>Campephilus guatemalensis</i>	Carpintero real piquiclaro
	ORDEN PASSERIFORMES	
	FAMILIA FURNARIIDAE	
105	<i>Automolus ochrolaemus</i>	Furnárido gorjipálido
106	<i>Xenops minutus mexicanus</i>	Picolenza
107	<i>Sclerurus guatemalensis</i>	Rascahojas oscuro
	FAMILIA DENDROCOLAPTIDAE	
108	<i>Dendrocincla anabatina</i>	Trepador sepia alileonado
109	<i>Dendrocincla homocroa</i>	Trepador rojizo
110	<i>Sittasomus griseicapillus</i>	Trepador oliváceo
111	<i>Glyphorhynchus spirurus</i>	Trepador piquicorto
112	<i>Dendrocolaptes certhia</i>	Trepador barrado
113	<i>Xiphorhynchus flavigaster</i>	Trepador dorsirrayado
114	<i>Lepidocolaptes souleyetti</i>	Trepador gorjiblanco coronirrayada
	FAMILIA FORMICARIIDAE	
115	<i>Thamnophilus doliatus</i>	Batará rayado
116	<i>Dysithamnus mentales</i>	Hormiguerito sencillo
117	<i>Microrhopias quixensis</i>	Hormiguerito alipunteado
118	<i>Cercomacra tyrannina</i>	Hormiguero negruzco

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
119	<i>Formicarius moniliger</i>	Hormiguero carinegro
	FAMILIA TYRANNIDAE	
120	<i>Myopagis viridicata</i>	Elaenia verdosa
121	<i>Mionectes oleagineus</i>	Mosquerito ventriocre
122	<i>Leptogon amaurocephalus</i>	Mosquerito gorripardo
123	<i>Todirostrum cinereum</i>	Mosquerito espatulilla
124	<i>Rhynchocyclus brevirostris</i>	Mosquerito de anteojos
125	<i>Tolmomyias sulphureus</i>	Mosquerito ojiblanco
126	<i>Platyrinchus cancrominus</i>	Mosquerito piquichato
127	<i>Onychorhynchus coronatus</i>	Mosquerito real
128	<i>Terentotriccus erythrurus</i>	Mosquerito colirrufo
129	<i>Myiobius sulphureipygius</i>	Mosquerito cola amarilla
130	<i>Contopus cinereus</i>	Contopus tropical
131	<i>Myiozetetes similis</i>	Luis gregario
132	<i>Myiarchus tuberculifer</i>	Mosquero común
133	<i>Myiarchus tyrannulus</i>	Papamoscas copetón común
134	<i>Pitangus sulphuratus</i>	Kiskadi
135	<i>Pyrocephalus rubinus</i>	Mosquero cardinal
136	<i>Myiodynastes luteiventris</i>	Papamoscas Vientre-amarillo
137	<i>Rhytipterna holerythra</i>	Papamoscas Alazán
138	<i>Attila spadiceus</i>	Atila
139	<i>Tyrannus melancholicus</i>	Tirano tropical
140	<i>Tyrannus savana</i>	Tirano tijereta
	FAMILIA COTINGIDAE	
141	<i>Shiffornis turdinus</i>	Tontillo
142	<i>Pachyramphus cinnamomeus</i>	Cabezón canelo
143	<i>Pachyramphus major</i>	Cabezón cuelligris
144	<i>Tityra semifasciata</i>	Titira enmascarada
145	<i>Cotinga amabilis</i>	Cotinga linda
	FAMILIA PIPRIDAE	
146	<i>Manacus candei</i>	Señorita, Saltarín cuelliblanco
147	<i>Pipra mentalis</i>	Sargento, Saltarín cabecirroja
	FAMILIA HIRUNDINIDAE	
148	<i>Tachycineta albilinea</i>	Golondrina manglera
150	<i>Stelgidopteryx ridgwayi</i>	Golondrina yucateca
151	<i>Hirundo pyrrhonota</i>	Golondrina risquera
	FAMILIA CORVIDAE	
152	<i>Cyanocorax morio</i>	Chara parada, Pea
	FAMILIA TROGLODYTIDAE	
153	<i>Thryothorus maculipectus</i>	Chinchirivín pinto
154	<i>Uropsila leucogastra</i>	Troglodita ventriblanco
155	<i>Henicorhina leucosticta</i>	Chinchirivín, Troglodita selvático
	FAMILIA SILVIIDAE	

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
156	<i>Polioptila plumbea</i>	Perlita tropical
157	<i>Ramphocaenus melanurus</i>	Silbido picudo
	FAMILIA TURDIDAE	
158	<i>Catharus ustulatus</i> *	Zorzalito de Swainson
159	<i>Catharus mustelinus</i> *	Zorzalito maculado
160	<i>Turdus grayi</i>	Cenzontle
161	<i>Turdus assimilis</i>	Zorzal gorgiblanco
	FAMILIA MIMIDAE	
162	<i>Dumetela carolinensis</i> *	Pájaro gato gris
	FAMILIA VIREONIDAE	
163	<i>Vireo olivaceus</i>	Viero ojo rojo
164	<i>Hylophilus ochraceiceps</i> <i>ochraceiceps</i>	Vireocillo leonado
165	<i>Hilophilus decurtatus decurtatus</i>	Vireocillo verde
166	<i>Vireolanius pulchellus</i>	Vierón esmeralado
	FAMILIA EMBERIZIDAE	
	SUBFAMILIA PARULINAE	
167	<i>Vermivora pinus</i> *	Chipe aliazul
168	<i>Dendroica magnolia</i> *	Chipe colifajado
169	<i>Mniotilta varia</i> *	Chipe zebritita o trepador
170	<i>Setophaga ruticilla</i> *	Pavito migratorio
171	<i>Protonotaria citrea</i> *	Chipe protonotario
172	<i>Helmiteros vermivorus</i> *	Chipe gusanero cabecirrayada
173	<i>Seiurus aurocapillus</i> *	Chipe suelero coronado
174	<i>Seiurus noveboracensis</i> *	Chipe suelero charquero
175	<i>Oporornis formosus</i> *	Chipe cachetinegro
176	<i>Geothlypis trichas</i> *	Chipe mascarita común
177	<i>Geothlypis poliocephala</i>	Chipe mascarita piquigruesa
178	<i>Wilsonia citrina</i> *	Chipe encapuchado
179	<i>Wilsonia pusilla</i> *	Chipe de Wilson
180	<i>Basileuterus culicivorus</i>	Chipe corona dorada
181	<i>Icteria virens</i> *	Chipe piquigrueso
	SUBFAMILIA THRAUPINAE	
182	<i>Tangara larvata</i>	Tángara enmascarada
183	<i>Chlorophanes spiza</i> <i>guatemalensis</i>	Mielero verde
184	<i>Cyanerpes cyaneus carneipes</i>	Mielero patirrojo
185	<i>Euphonia affinis</i>	Eufonia gargantinegra
186	<i>Euphonia gouldi gouldi</i>	Eufonia selvática olivácea
187	<i>Euphonia hirundinacea</i>	Eufonia gargantiamarilla
188	<i>Thraupis episcopus cana</i>	Tángara azul gris
189	<i>Thraupis Abbas</i>	Tángara aliamarilla
190	<i>Eucometis penicillata</i>	Tángara cabecigris

No.	ORDER FAMILY SPECIES	NOMBRE COMUN
191	<i>Lanio aurantius</i>	Tángara gorjinegra
192	<i>Habia rubica</i>	Tángara rúbrica hormiguera
193	<i>Habia fuscicauda</i>	Tángara fuscicauda
194	<i>Piranga rubra *</i>	Tángara roja
195	<i>Phlogothraupis sanguinolentus</i>	Tángara rojinegra tropical
196	<i>Ramphocelus passerinii</i> <i>passerinii</i>	Tángara grupirroja terciopelo
	SUBFAMILIA EMBERIZINAE	
197	<i>Arremon aurantirostris</i>	Rascadorcito piconaranja
198	<i>Arremonops chlorontus</i>	Rascadorcito gorrión dorsiverde
	SUBFAMILIA CARDINALINAE	
199	<i>Saltator atriceps</i>	Saltador cabecinegro
200	<i>Caryothraustes polioaster</i>	Piquigrueso carinegro
201	<i>Cyanocompsa parellina</i>	Colorín azul negro
202	<i>Cyanocompsa cyanoidea</i> <i>concreta</i>	Piquigrueso negro
203	<i>Passerina cyanea</i>	Colorín azul
204	<i>Sporophila aurita cervina</i>	Semillerito aurito
205	<i>Sporophila torqueola</i>	Semillerito collarejo
	FAMILIA ICTERIDAE	
206	<i>Agelaius phoeniceus</i>	Tordo sargento
207	<i>Sturnella magna</i>	Pradero común
208	<i>Quiscalus mexicanus</i>	Zanate mayor
209	<i>Dives dives</i>	Tordo cantor
210	<i>Icterus dominicensis</i> <i>prothemelas</i>	Oriol, Bolsero capuchanegra
211	<i>Icterus mesomelas mesomelas</i>	Bolsero coliamarilla
212	<i>Icterus galbula</i>	Bolsero de Baltimore
213	<i>Amblycercus holosericeus</i>	Tordo piquiclaro
214	<i>Psarocolius montezuma</i>	Oropéndula gigante

Source: Castañeda, C. 1998. "Clasificación ecológica del Parque Nacional Sierra del Lacandón". The Nature Conservancy, Petén. 66 pp. + anexos., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón.

APPENDIX III. LIST OF REPTILE SPECIES OF NATIONAL PARK SIERRA DEL LACANDÓN.

No.	FAMILY SCIENTIFIC NAME	SPANISH NAME	STATUS (R, rare) (C, common) (A, abundant)
	CROCODYLIDAE		
1	<i>Crocodylus acutus</i>	Cocodrilo, lagarto	
2	<i>C. moreletii</i>	Cocodrilo, lagarto	C
	KINOSTERNIDE		
3	<i>Kinosternon acutun</i>	Tortuga casquito	C
4	<i>K. leucostomun</i>	Tortuga casquito	
	EMYDIDAE		
5	<i>Trachemys scripta</i>	Tortuga jicotea	C
	EUBLEPHARIDAE		
6	<i>Coleonyx elegans</i>	Gueko, escorpión	R
	GEKKONIDAE		
7	<i>Sphaerodactylus glaucus</i>	Gueko, escorpión	R
8	<i>S. millepunctatus</i>	Gueko, escorpión	
9	<i>Thecadactylus rapicauda</i>	Gueko, escorpión	R
	CORYTOPHANIDAE		
10	<i>Basiliscos vittatus</i>	Lagartija, turipache	A
11	<i>Corytophanes cristatus</i>	Lagartija, pierde gente	A
12	<i>C. hernandezii</i>	Lagartija, pierde gente	A
	IGUANIDAE		
13	<i>Iguana iguana</i>	Iguana verde	A
	PHRYNOSOMATIDAE		
14	<i>Sceloporus serrifer</i>	Lagartija escamosa	R
15	<i>Sc. Teapensis</i>	Lagartija escamosa	A
	POLYCHROTIDAE		
16	<i>Norops biporcatus</i>	Iguanita, lagartija	C
17	<i>N. lemurinus</i>	Iguanita	C
18	<i>N. rodriguezii</i>	Iguanita	
19	<i>N. humilis</i>	Iguanita	R
20	<i>N. uniformis</i>	Iguanita	
	SCINCIDAE		
21	<i>Eumeces schwartzei</i>	Lagartija	R
22	<i>E. sumichrasti</i>	Lagartija	
23	<i>Cabuya sp.</i>	Lagartija	R
24	<i>Sphenomorphus cherriei</i>	Lagartija	C

No.	FAMILY SCIENTIFIC NAME	SPANISH NAME	STATUS (R, rare) (C, common) (A, abundant)
	TEIIDAE		
25	<i>Ameiva festiva</i>	Lagartija	C
26	<i>A. undulada</i>	Lagartija	C
	XANTUSIIDAE		
27	<i>Lepidophyma flavimaculatum</i>	Lagartija	R
	ANGUIDAE		
28	<i>Celestus rozellae</i>	Lagartija	
	BOIDAE		
29	<i>Boa constrictor</i>	Mazacuata	C
	COLUBRIDAE		
30	<i>Adelphicos quadrivirgatus</i>	Culebra	R
31	<i>Clelia Clélia</i>	Sumbadora	R
32	<i>Coniophanes bipunctatus</i>	Culebra	
33	<i>C. fissidens</i>	Culebra	
34	<i>C. imperialis</i>	Culebra	R
35	<i>Dendrophidion vinitor</i>	Culebra	
36	<i>Drymarchon corais</i>	Culebra	R
37	<i>Drymobius margaritiferus</i>	Culebra, tapetillo	A
38	<i>Ficimia publia</i>	Culebra	
39	<i>Imantodes cenchoa</i>	Culebra	R
40	<i>Lampropeltis triangulum</i>	Falso coral	C
41	<i>Leptodeira septentrionalis</i>	Ojo de gato, falsa barba amarilla	
42	<i>Leptophis ahaetulla</i>	Ranera	C
43	<i>L. mexicanus</i>	Ranera	A
44	<i>Ninia diademata</i>	Culebra	
45	<i>N. sebae</i>	Falsa coral	C
46	<i>Oxybelis aeneus</i>	Bejuquillo	R
47	<i>Pseustes poecilonotus</i>	Culebra	
48	<i>Scaphiodontophis annulatus</i>	Falsa coralilla	R
49	<i>Sbon dimidiata</i>	Culebra	C
50	<i>Spilotes pullatus</i>	Culebra	R
51	<i>Tatillita lintoni</i>	Culebra	
52	<i>Xenodon rabdocephalus</i>	Falsa barba amarila	R
	ELAPIDAE		
53	<i>Micrurus diastema</i>	Coral, coralillo	R
	VIPERIDAE		
54	<i>Atropoides nummifer</i>	Mano de piedra	R
55	<i>Bothrops asper</i>	Barba amarilla	R
56	<i>Porthidium nasutum</i>	Xalpate	A

Source: García, R.A. 2001. “Estudio Preliminar sobre la Herpetofauna encontrada dentro de los cenotes de la región de Macabillero, Parque Nacional Sierra de Lacandón.” Fundación Defensores de la Naturaleza. Guatemala. 13pp., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón.

APPENDIX IV. LIST OF AMPHIBIAN SPECIES OF NATIONAL PARK SIERRA DEL LACANDÓN.

No.	FAMILY SCIENTIFIC NAME	SPANISH NAME
	PLETHODONTIDAE	
1	<i>Bolitoglossa rufescens</i>	Salamandra
2	<i>B. mexicana</i>	Salamandra
	RHINOPHRYNIDAE	
3	<i>Rhinophrynus dorsalis</i>	Sapo borracho
	LEPTODACTYLIDAE	
4	<i>Eleutherodactylus Alfredi</i>	
5	<i>E. leprus</i>	
6	<i>E. rhodopis</i>	
7	<i>Leptodactylus melanonotus</i>	
	BUFONIDAE	
8	<i>Bufo marinus</i>	
9	<i>B. valliceps</i>	
	HYLIDAE	
10	<i>Agalychnis callidryas</i>	
11	<i>Hyla ebraccata</i>	
12	<i>H. loquax</i>	
13	<i>H. microcephala</i>	
14	<i>H. picta</i>	
15	<i>Smilisca baudinii</i>	
16	<i>S. cyanosticta</i>	
17	<i>Tripion petasatus</i>	
	MICROHYLIDAE	
18	<i>Gastrophryne elegans</i>	
	RANIDAE	
19	<i>Rana vaillanti</i>	

Source: García, R.A. 2001. "Estudio Preliminar sobre la Herpetofauna encontrada dentro de los cenotes de la región de Macabiler, Parque Nacional Sierra de Lacandón." Fundación Defensores de la Naturaleza. Guatemala. 13pp., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón.

APPENDIX V. LIST OF FISH SPECIES OF NATIONAL PARK SIERRA DEL LACANDÓN.

No.	SCIENTIFIC NAME
1	<i>Atractosteus tropicus</i>
2	<i>Megalops atlanticus</i>
3	<i>Dorosoma sp.</i>
4	<i>Ctenopharyngodon idella</i>
5	<i>Astyanax aeneus</i>
6	<i>Brycon guatemalensis</i>
7	<i>Hyphessobrycon compressus</i>
8	<i>Ariopsis sp.</i>
9	<i>Cathorops aguadulce</i>
10	<i>Ictalurus furcatus</i>
11	<i>Rhamdia guatemalensis</i>
12	<i>Atherinella sp.</i>
13	<i>Poecilia mexicana</i>
14	<i>Gambusia sexradiata</i>
15	<i>Heterandria bimaculata</i>
16	<i>Hyporhamphus mexicanus</i>
17	<i>Strongylura hubssi</i>
18	<i>Centropomus undecimalis</i>
19	<i>Eugerres mexicanus</i>
20	<i>Aplodinotus grunniens</i>
21	<i>Theraps synspilum</i>
22	<i>Theraps bifasciatum</i>
23	<i>Theraps heterospilum</i>
24	<i>Theraps argenteum</i>
25	<i>Theraps lentiginosum</i>
26	<i>Herichthys pearsei</i>
27	<i>Astateros robertsoni</i>
28	<i>Cichlasoma salvini</i>
29	<i>Thorichthys meeki</i>
30	<i>Thorichthys helleri</i>
31	<i>Thorichthys pasionis</i>
32	<i>Petenia friedrichsthalii</i>
33	<i>Petenia splendida</i>
34	<i>Gobiomorus dormitor</i>

Source: Kihn, P. 2001. Ictiofauna de las dolinas de la Sierra del Lacandón, Petén, Guatemala. Fundación Defensores de la Naturaleza, Parque Nacional Sierra del Lacandón. 29 pp + anexos., cited in Plan Maestro 2011-2015 Parque Nacional Sierra del Lacandón.

APPENDIX VI. LIST OF MAMMALS SPECIES OF NATIONAL PARK SIERRA DEL LACANDÓN

No.	FAMILY SCIENTIFIC NAME	SPANISH NAME
	DIDELPHIMORPHIA	
1	<i>Didelphidae</i>	
2	<i>Didelphis marsupialis</i> Lennaeus	Tacuazín común
	<i>Didelphis virginianan</i> Kerr	Tacuazín blanco
	XENARTHRA	
3	<i>Dasypodide</i>	
4	<i>Dasypus novemcinctus</i> Linnaeus	Armadio de nueve cintas
5	<i>Mymecophagidae</i>	
6	<i>Tamandua mexicana</i> (Saussure)	Oso hormiguera, tamandúa norteño
	CHIROPTERA	
7	<i>Emballonuridae</i>	
8	<i>Peropteryx macrotis</i> (Wagner)	Murciélago perro menor
9	<i>Mormoopidae</i>	
10	<i>Pteronotus parnelli</i> (Gray)	Murciélago bigotudo de Parnell
11	<i>Phyllostomidae</i>	
12	<i>Phyllostominae</i>	
13	<i>Micronycteris brachyotis</i> (Dobson)	Murciélago orejón carganta amarilla
14	<i>Lonchorina aurita</i> Tomes	Murciélago espada de Tomes
15	<i>Tonatia bidens</i> (Spix)	Murciélago oreja redonda de coronilla blanca
16	<i>Mimon bennetti</i> (Gray)	Murciélago lanza grande
17	<i>Trachops cirrhosus</i> (Spix)	Murciélago labio verrugoso
18	<i>Glossophaginae</i>	
19	<i>Glossophaga commissarisi</i> (Gardner)	Murciélago lengüetón de Comisarisi
20	<i>Glossophaga soricina</i> (Pallas)	Murciélago lengüetón de Pallas
21	<i>Carollinae</i>	
22	<i>Carollia brevicauda</i> (Schniz)	Murciélago cola corta sedosa
23	<i>Carollia perspicillata</i> (Linnaeus)	Murciélago cola corta de Seba
24	<i>Stenodermatinae</i>	
25	<i>Sturnira liliun</i> (Geoffroy)	Murciélago de charreteras menor
26	<i>Uroderma bilobatum</i> Peters	Murciélago acampador oscuro
27	<i>Platyrrhinus helleri</i> (Peters)	Murciélago listado de Heller
28	<i>Vampyressa pusilla</i> (Wagner)	Murciélago oreja amarilla menor
29	<i>Artibeus intermedius</i> Allen	Murciélago frutero de Allen

No.	FAMILY SCIENTIFIC NAME	SPANISH NAME
30	<i>Artibeus jamaicensis</i> Leach	Murciélago frutero de Jamaica
31	<i>Artibeus lituratus</i> (Olfers)	Murciélago frutero gigante
32	<i>Dermanura photis</i> Miller	Murciélago frutero pigmeo
33	<i>Dermanura watsoni</i> (Thomas)	Murciélago frutero de Thomas
34	<i>Centurio senex</i> Gray	Murciélago cara arrugada
35	<i>Desmodontinae</i>	
36	<i>Desmodus rotundus</i> (Geoffroyi)	Vampiro común
37	<i>Natalidae</i>	
38	<i>Natalus stramineus</i> Gray	Murciélago oreja embudo mexicano
39	<i>Vespertilionidae</i>	
40	<i>Myotis keaysi</i> Allen	Miotis cola peluda
41	<i>Myotis sp.</i>	Miotis cola peluda
	PRYMATES	
42	<i>Cebidae</i>	
43	<i>Alouatta pigra</i> Lawrance	Saraguato, mono aullador negro
44	<i>Ateles geoffroyi</i> Kuhl	Mono araña centroamericano
	RODENTIA	
45	<i>Sciuridae</i>	
46	<i>Sciurus yacatanensis</i> Allen	Ardilla de Yucatán
47	<i>Sciurus deppei</i> Peters	Ardilla de Deppe
48	<i>Geomyidae</i>	
49	<i>Orthogeomys hispidus</i> (Le Conte)	Taltuza, tuza, topo hispido de bolas
50	<i>Herteromyidae</i>	
51	<i>Herteromys desmarestianus</i> Gray	Ratón espinoso de bolas de bosque
52	<i>Muridae</i>	
53	<i>Ototylomys phyllotis</i> Merriam	Rata trepadora de orejas grandes
54	<i>Erethizontidae</i>	
55	<i>Coendou mexicanus</i> (Kerr)	Puercoespín mexicano
56	<i>Dasyproctidae</i>	
57	<i>Dasyprocta punctata</i> Gray	Cotuza, aguti centroamericano
58	<i>Agoutidae</i>	
59	<i>Agouti paca</i> (Linnaeus)	Tepezcuintle, paca
	CARNIVORA	
60	<i>Procyonidae</i>	
61	<i>Procyon lotor</i> (Linnaeus)	Mapache nortño
62	<i>Nasua narica</i> (Linnaeus)	Pizote, coatí de nariz blanca
63	<i>Potos flavus</i> (Schreber)	Micoleón, kinkajou
64	<i>Mustelidae</i>	

No.	FAMILY SCIENTIFIC NAME	SPANISH NAME
65	<i>Conepatus semistriatus (Boddaert)</i>	Zorrillo rallado nariz de cerdo
66	<i>Lutra longicaudis (Olfers)</i>	Nutria neotropical de río
67	<i>Eira barbara (Linnaeus)</i>	Perico ligero, tayra
68	<i>Felidae</i>	
69	<i>Panthera onca (Linnaeus)</i>	Jaguar
70	<i>Leopardus pardalis (Linnaeus)</i>	Ocelote
71	<i>Puma concolor (Linnaeus)</i>	Puma
72	<i>Canidae</i>	
73	<i>Urocyon cinereoargenteus (Schreber)</i>	Zorro gris, gato de monto
	PERISSIDACTYLA	
74	<i>Tapiridade</i>	
75	<i>Tapitus bairdii (Gill)</i>	Tapir, danta
	ARTIODACTYLA	
76	<i>Tayassuidae</i>	
77	<i>Dicotyles pecari (Linnaeus)</i>	Coche de monte, pecarí de collar
78	<i>Tayassu tajacu</i>	Jabalí, pecarí de labio blanco
79	<i>Cervidae</i>	
80	<i>Odocoileus virginianus (Zimmerman)</i>	Venado cola blanca
81	<i>Mazama americana (Erxleben)</i>	Cabrito, huitzivil