Extended Essay

Geography IB

Effects of voluntary carbon offset projects in the Amazon region on biodiversity and local communities.

RQ: To what extent has the Alto Mayo Protected Forest REDD+ Project been successful in conserving biodiversity and promoting sustainable livelihoods for local communities in the Amazonial department of San Martín, northern Peru?

Word Count: 3,996

Candidate Number: jry723

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Abbreviations

Alto Mayo Conservation International	AMCI
Alto Mayo Protected Forest	AMPF
Conservation Agreement	CA
Conservation International	CI
Greenhouse Gases	GHG
One tonne of carbon dioxide equivalent	tCO2-e
Progress of Poverty Index or Poverty Probability Index	PPI
Reducing Emissions from Deforestation and forest Degradation	REDD+
Simpson's Diversity Index	SDI
Verified Carbon Standard	VCS
Voluntary Carbon Unit	VCU, 1 VCU = 1 tCO2-e

Introduction

Deforestation in the Amazon is a critical problem affecting local communities, the environment and the climate. It's estimated that globally, deforestation and forest degradation account for around 11% of CO2 emissions (FAO).

REDD+ aims at Reducing Emissions from Deforestation and forest Degradation in developing countries which includes additional (+) activities namely sustainable forest management as well as the conservation and enhancement of forest carbon stocks ("What Is REDD+?").

The REDD+ frameworks were developed under the United Nations Framework Convention on Climate Change (UNFCCC), ("REDD and REDD+"). REDD+ was refined during the 19th Conference of the Parties (COP 19) in Warsaw and is often referred to as the Warsaw Framework for REDD+. These frameworks provide guidelines and funding aspects for the implementation of REDD+ activities ("What Is REDD+?").

Peru has registered a large number of REDD+ projects to reduce deforestation in the Amazon (Atmadja et al). The Alto Mayo Conservation Initiative is a voluntary carbon offset project that is reducing tropical deforestation by protecting and restoring tropical rainforest in the Peruvian Amazon (Greenfield 1). It's supported by Conservation International (CI), a US-based private non-profit organization in partnership with local communities and the Peruvian government ("Conservation International").

This study focuses on the project's reduction of GHG emissions through avoidance of deforestation, evaluates how significantly the rate of deforestation changes and whether biodiversity can be preserved. Additionally, this work investigates whether the project's

educational activities, benefits and revenues from the sale of carbon credits provide long-term sustainable support to settlers and local indigenous communities in the Alto Mayo Protected Forest (AMPF) region.

Research Question

To what extent has the Alto Mayo Protected Forest REDD+ Project been successful in conserving biodiversity and promoting sustainable livelihoods for local communities in the Amazonial department of San Martín, northern Peru?

Geographical context

The AMPF is situated in the San Martin region, northwest of Peru, in the upper drainage basin of the Mayo River. It consists of the Rioja and Moyobmaba provinces (Figure 1).

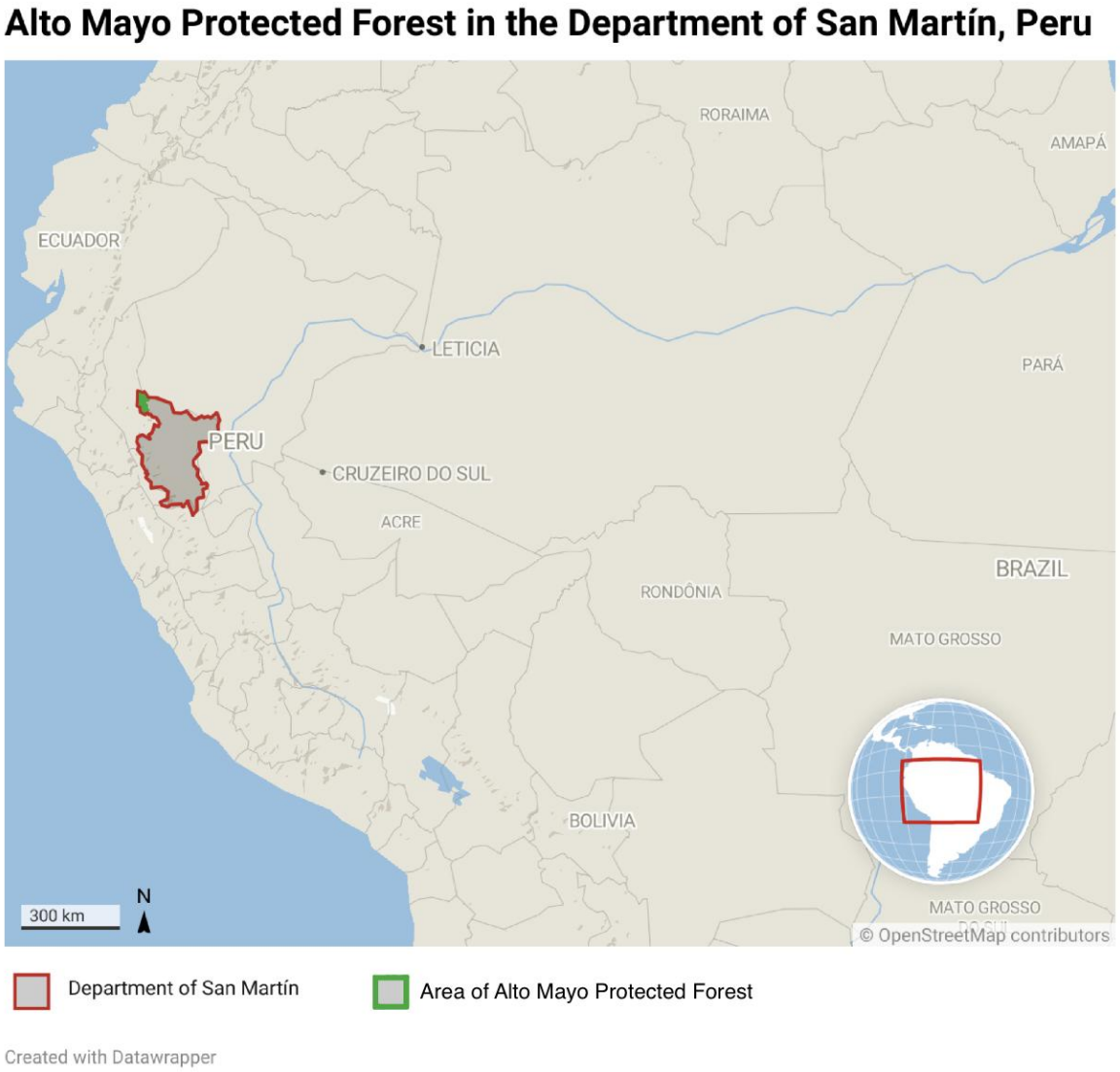


Figure 1: Location of the Alto Mato Protected Forest within San Martin Department in Peru. Map created by author using Datawrapper.

The project comprises an area of 182,000 hectares in the northern Peruvian Amazon (Figure 2). The area contains the district of Moyobamba in the province of Moyobamba. It also includes the districts of Yorongos, Rioja, Elías Soplín Vargas, Nuevo Cajamarca and Pardo Miguel in the province of Rioja ("Alto Mayo Protection Forest").

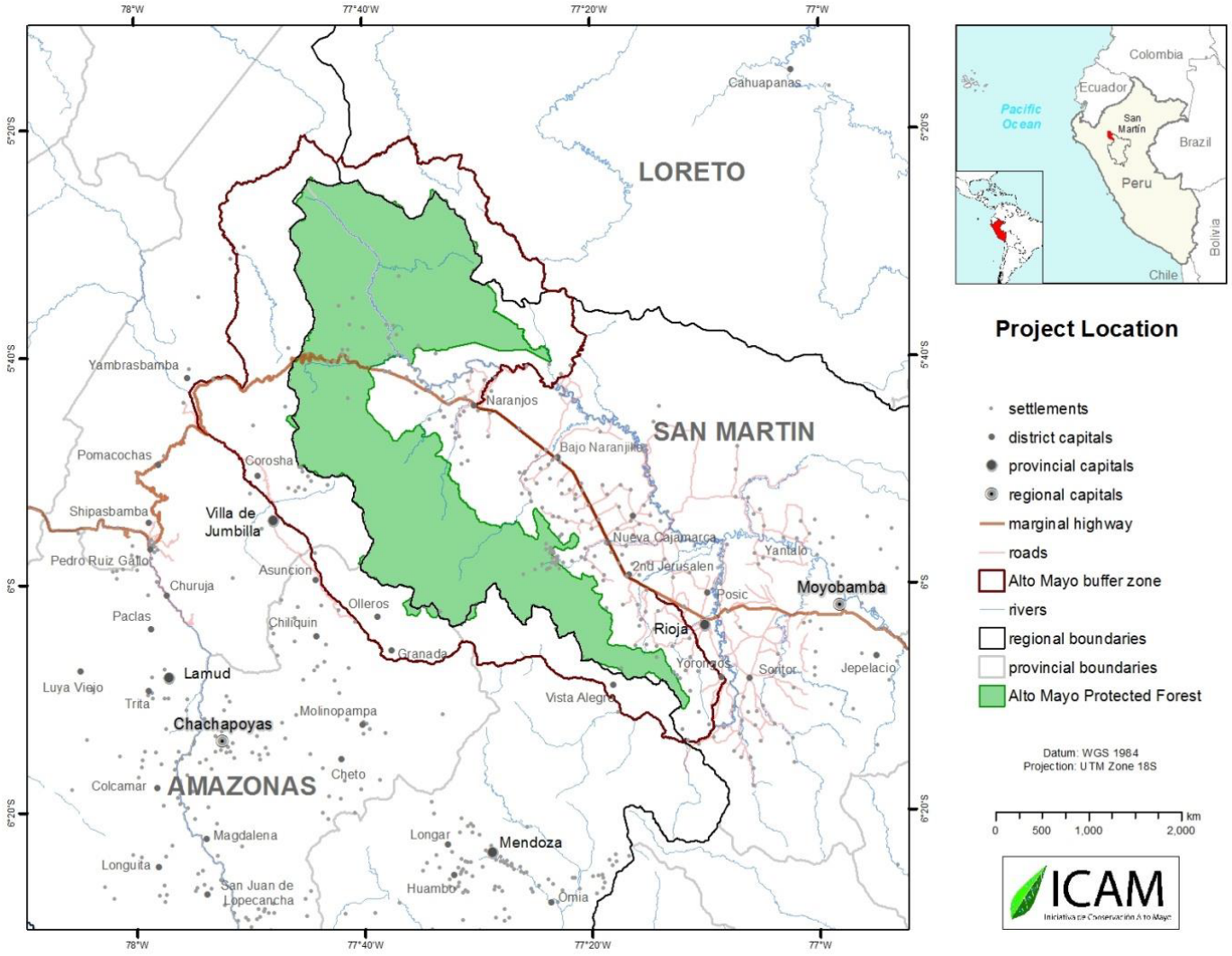


Figure 2: Location of the Alto Mayo Protected Forest (Conservation International - Peru, 2015)

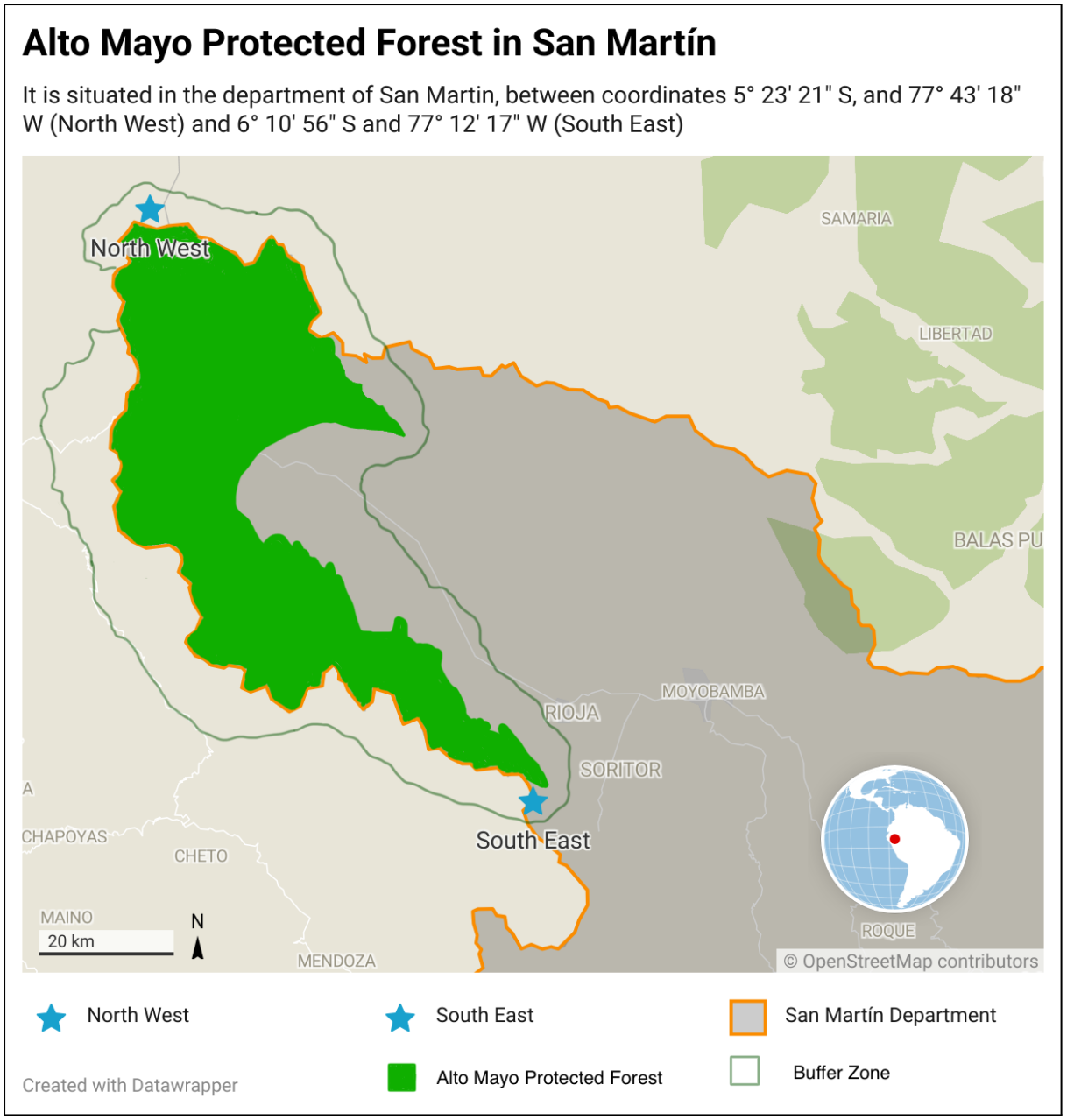


Figure 3: Alto Mayo Forest Area within San Martin Department (Local Scale). Map created by author using Datawrapper.

In total, 14 settlements and nine rural sectors were identified in the AMPF in 2008 (INRENA). The population within the AMPF was estimated at 3,000 to 4,000 families, not including the population in the buffer zone (Conservation International - Peru, 2015). A buffer zone is a region "outside the boundaries of and immediately adjacent to designated

protected areas that needs special development control to minimize harm to the protected area" ("Glossary of Terms - Buffer Zone").

Agriculture has historically been the main economic activity in the Alto Mayo. Livestock and rice are produced to supply the national market whereas coffee, cocoa, palm oil, cotton, tobacco and peach-palm act as commercial crops and are used for export and domestic consumption (INRENA).

The Peruvian government granted protection to the Alto Mayo National Forest in 1963, however many people began to clear the forest for settlements and road workers hunted yellow-tailed woolly monkeys for meat. The forest was declared protected by decree in 1987 after several research projects concluded that the local fauna and forest ecology should be prioritized for conservation ("Alto Mayo Protection Forest").

The Co-benefits Model

REDD+ projects offer a range of co-benefits beyond its primary goal of reducing GHG emissions (Figure 4).

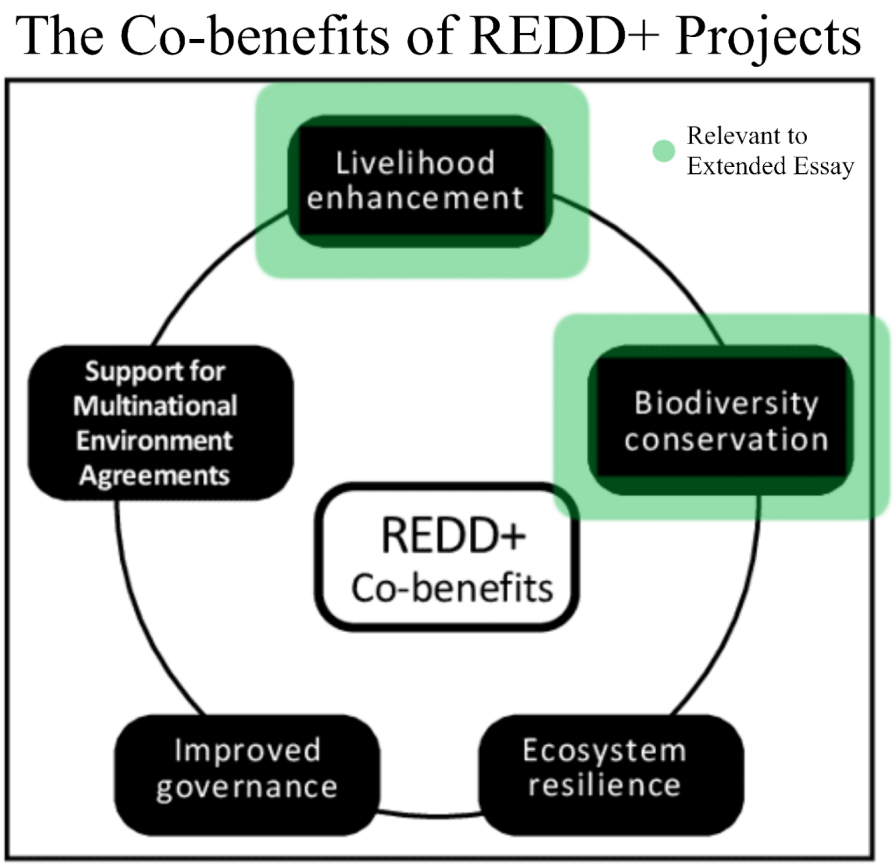


Figure 4: Adapted by author, Co-benefits of REDD+ Projects (Joshi et al.)

The Global Forest Coalition (2010) has identified underlying causes of deforestation and forest degradation, including poverty, lack of alternative livelihood options and lack of employment and education. REDD+ projects aim to mitigate these causes by providing mechanisms for financial rewards and other benefits to forest users who contribute to the reduction of GHG emissions. These so-called benefit-sharing mechanisms are created for the poorest forest-dependent populations, tackling the main deforestation drivers. Ensuring fair and efficient benefit sharing is essential for motivating changes in behavior, leading to a

reduction in GHG emissions (Wong et al. 2022). It's crucial for the long-term success of a project (World Bank Group).

This model in the context of carbon offset projects refers to the additional benefits that these projects provide for the people beyond the reduction of GHG emissions. Although REDD+'s primary objective is to combat climate change, it can also help to create other environmental and socioeconomic advantages ("Safeguards & Multiple Benefits"). These benefits can be monetary and non-monetary, can include educational opportunities for local communities, social engagement, generating employment, conservation of biodiversity and reduction of deforestation and forest degradation. Technical support, legal assistance, livelihood improvements and alleviating poverty are additional co-benefits.

Study Purpose

This study's purpose is to assess to what extent the AMPF REDD+ Project has been successful in reducing GHG emissions, conserving biodiversity and promoting sustainable livelihoods for local communities in the Amazonial department of San Martín, northern Peru. This relates to *IB Geography Unit 2 Climate Change* and is an extension of the *Carbon Offsetting* and *Carbon Credits* subtopic. Multinational companies such as Disney and Shell invest in REDD+ projects, such as Alto Mayo, in order to offset their GHG emissions (Greenfield 2). This topic was chosen due to family ties in the oil industry, which sparked my interest in carbon offset projects. However, it's crucial to recognize that this connection may introduce personal bias into my research.

Hypotheses

Hypothesis 1

The AMPF REDD+ Project contributes to the sustainable conservation of biodiversity in the Amazon rainforest in the department of San Martín, northern Peru. This is due to the mitigation activities that are implemented, including the establishment of Conservation Agreements (CAs) with local families and the implementation of afforestation initiatives.

Hypothesis 2

The AMPF REDD+ Project promotes sustainable livelihoods and social benefits for local communities. This can be based on the Co-benefits model which shows a trend in additional benefits that these projects provide for the people beyond the reduction of GHG emissions.

Sustainable Livelihoods

A livelihood encompasses the skills, resources, and activities necessary for sustaining a person's means of living. A livelihood is sustainable when it's resilient to stresses, maintains or enhances its capabilities and resources, isn't reliant on external assistance, and doesn't deplete the natural resource base ("Sustainable Livelihoods Guidance Sheets").

The approach to sustainable livelihoods focuses on people, increasing the effectiveness of development assistance. It's a way of thinking about development's goals, scope, and priorities ("Sustainable Livelihoods Guidance Sheets"). This study focuses on the environmental, social and economic aspects of sustainability.

Methodology

Hypothesis 1

For measuring the conservation of biodiversity and the available species in the AMPF, Monitoring and Implementation reports from 2014-2020 (Figure 5) were used to evaluate the process of the project. The report showcases the type and number of primate species (including monkeys and bears) and individuals that were reported and found in the AMPF as well as their threat status (critically endangered, endangered, vulnerable).

These Monitoring and Implementation reports were chosen because the AMPF project was developed and verified according to internationally-recognised standards. The project applied the Verified Carbon Standard (VCS) Methodology for Avoided Unplanned Deforestation (Pedroni). Verra, a non-profit organization, introduced the VCS to standardize performance benchmarks on the voluntary carbon market. The project proponent CI established an approved monitoring plan to systematically monitor the project implementation, its GHG emission reductions and the project's impacts on local communities and biodiversity.
Third-party verifiers validated the project, the actual deforestation, GHG emission reductions and biodiversity data for the crediting periods which ensures high quality data. The Monitoring and Implementation reports (Conservation International - Peru, 2012, 2014, 2016, 2018, 2020) are representative of the project's impact on biodiversity and are used as research sources in this study.

In order to assess and quantify the biodiversity of the different habitats in the AMPF, the Simpson's Diversity Index (SDI) was calculated based on primate monitoring data (Figure 6). The SDI, developed by Simpson (1949), is a measure of species diversity in a specific area. It quantifies the degree of concentration or evenness of different species within that area. The

index takes into account the number of species present and their relative abundance. The SDI is a measure of probability; a higher index indicates greater diversity and a higher probability that two randomly selected individuals are of different species (Pappas).

The formula of SDI is as follows:

$$D = 1 - \Sigma \left(\frac{n}{N}\right)^2$$

where

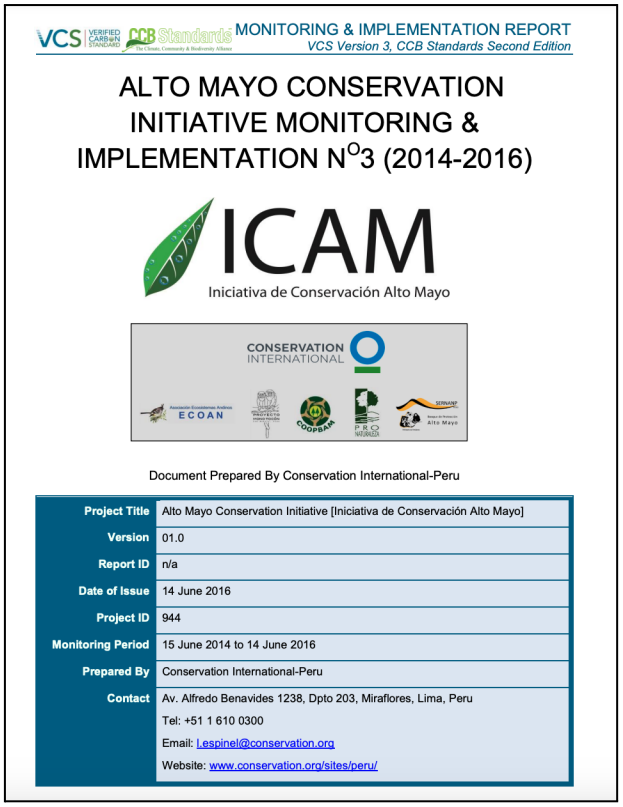
$D = Simpon's\ Diversity\ Index$

$N = total\ number\ of\ individuals$

$n = number\ of\ individuals\ per\ species$

$\Sigma = sum\ of$

The SDI ranges from 0 to 1, with higher values indicating greater diversity more evenly distributed in the area (Wilson and Gownaris). The AMPF was sectioned into five sub-basins, Naranjos, Naranjillo, Yuracyacu, Río Negro, and Huasta, where CAs were signed. There is data available on a number of different primate species and individuals sighted in the AMPF per sub-basin in the baseline study from 2011-2013. In addition, monitoring of the primates species occurred between 2013 and 2015 and data was collected in the same sub-basins. Using this, it was possible to compare the number of species from different time periods to assess changes in biodiversity.



VCS | CCB Standards MONITORING & IMPLEMENTATION REPORT
VCS Version 3, CCB Standards Second Edition

ALTO MAYO CONSERVATION INITIATIVE MONITORING & IMPLEMENTATION N°3 (2014-2016)

ICAM
Iniciativa de Conservación Alto Mayo

CONSERVATION INTERNATIONAL
ECOAN COOPBAM PRO NATURA

Document Prepared By Conservation International-Peru

Project Title	Alto Mayo Conservation Initiative [Iniciativa de Conservación Alto Mayo]
Version	01.0
Report ID	n/a
Date of Issue	14 June 2016
Project ID	944
Monitoring Period	15 June 2014 to 14 June 2016
Prepared By	Conservation International-Peru
Contact	Av. Alfredo Benavides 1238, Dpto 203, Miraflores, Lima, Peru Tel: +51 1 610 0300 Email: l.espinel@conservation.org Website: www.conservation.org/sites/peru/

Figure 5: Cover Page of the 2014-2016 Monitoring and Implementation Report

Hypothesis 2

The project's Monitoring and Implementation Reports provide descriptions of positive community impacts of the project activities. Within the scope of this study it was assessed how the project has improved living conditions of the local population in harmony with the objectives of the AMPF (Conservation International - Peru, 2014), including improved access to primary schools, health care centers and drinking water. Socioeconomic indicators of the project such as improved well-being, livelihoods, education and employment, provided in sections 1 and 4 of the Monitoring and Implementation reports, were used in the analysis. The data provided in the Monitoring and Implementation reports and analyzed in this study was subject to external verification. This included site visits, interviews with local community representatives, document reviews and other audit techniques carried out by

independent experts. For instance, independent verification reports confirmed the validity of reported data and results (AENOR INTERNACIONAL).

A variety of indicators were investigated. Firstly, CAs are legally binding deals between a community and a conservation project funder, where the community commits to specific conservation actions in exchange for benefits like training, tools, or wages (Kane). CAs ensure that traditional ways of life are preserved while promoting responsible resource management. The number of signed CAs was analyzed due their impact on sustainable livelihoods.

Secondly, the project assessed poverty using the Progress of Poverty Index (PPI) from the 2014-2016 monitoring period onwards. The PPI is constructed from ten standardized questions administered to project beneficiaries as part of the socio-economic survey. It quantifies the likelihood that the household is living below the poverty line (Innovations for Poverty Action, 2023). Results were systematized according to the PPI metrics and the index was reported in the Monitoring and Implementation Reports. The trend of the PPI across monitoring periods was analyzed to see whether poverty has truly decreased. A reduction in poverty is linked to the sustainability of livelihoods as it empowers people to invest in long-term economic and environmental resources which decreases the need for unsustainable practices. Hence, the PPI can be used as an indicator that assesses the improvements of sustainable livelihoods of local communities.

Thirdly, the project's annual emission reductions from avoided deforestation and forest degradation are reported in the Monitoring and Implementation reports. These are subject to third-party verification. The VCS Program allows certified projects to turn their GHG

emission reductions into tradable carbon credits (Voluntary Carbon Units, VCUs). VCS Projects need to be registered in the Verra Registry ("Verra Search Page") to receive and trade carbon credits. For the AMPF the number of issued VCUs until 2020 was obtained and used to assess the validity of carbon price assumptions used in the project's financial analysis (Conservation International - Peru, 2020a). The data served as the basis for the evaluation of the project's financial viability. This becomes crucial when assessing the poverty among local communities, as the financial support they receive through the sale of carbon credits has a direct effect on their socioeconomic well-being. Again, reducing poverty is the foundation for successfully promoting sustainable livelihoods.

Analysis

The purpose of this analysis is to find a relationship between reduction of deforestation, GHG emissions, changes of biodiversity and improvements in the sustainable livelihoods for local communities as a result of project related activities. The scope of the analysis comprises the data published in Monitoring and Implementation Reports for the crediting periods from 2008-2020. The data analysis includes deforestation rates, GHG emission reductions, different parameters for biodiversity changes inside the project area and indicators for assessing positive socioeconomic impacts.

Conservation of Biodiversity

The AMPF project had a major positive impact on biodiversity conservation, which was evaluated and analyzed employing Monitoring and Implementation reports and using SDI (Table 1).

Settlement (sub-basin)	Species (Primates)	Number of individuals (Baseline study)	Number of individuals (Monitoring)	Simpson's Diversity Index - Baseline (2011-2013)	Simpson's Diversity Index - Monitoring (2013-2015)
Naranjos	Cebus albifrons	10	7		
	Aotus miconax	3	5		
	Lagothrix flavicauda	1	27		
		14	**39**	**0.44**	**0.47**
Naranjillo	Saguinus fuscicollis	10	N/a		
	Cebus albifrons	0	6		
	Aotus miconax	N/a	6		
	Lagothrix flavicauda	N/a	5		
		10	**17**	**0.00**	**0.66**
Yuracyacu	Saguinus fuscicollis	10	N/a		
	Lagothrix flavicauda	15	3		
	Cebus albifrons	N/a	3		
		25	**6**	**0.48**	**0.66**
Río Negro	Cebus albifrons	11	0		
	Lagothrix flavicauda	2	2		
	Saguinus fuscicollis	1	N/a		
	Aotus miconax	N/a	5		
		14	**7**	**0.36**	**0.41**
Huasta	Lagothrix flavicauda	20	N/a		
	Cebus albifrons	6	N/a		
	Cebus apella	4	N/a		
				0.50	**-**

Table 1: Number of primate species and individuals reported in the AMPF per sub-basin and the calculated SDI in the baseline study 2011-2013 and monitoring 2013-2015 (Conservation International - Peru, 2016)

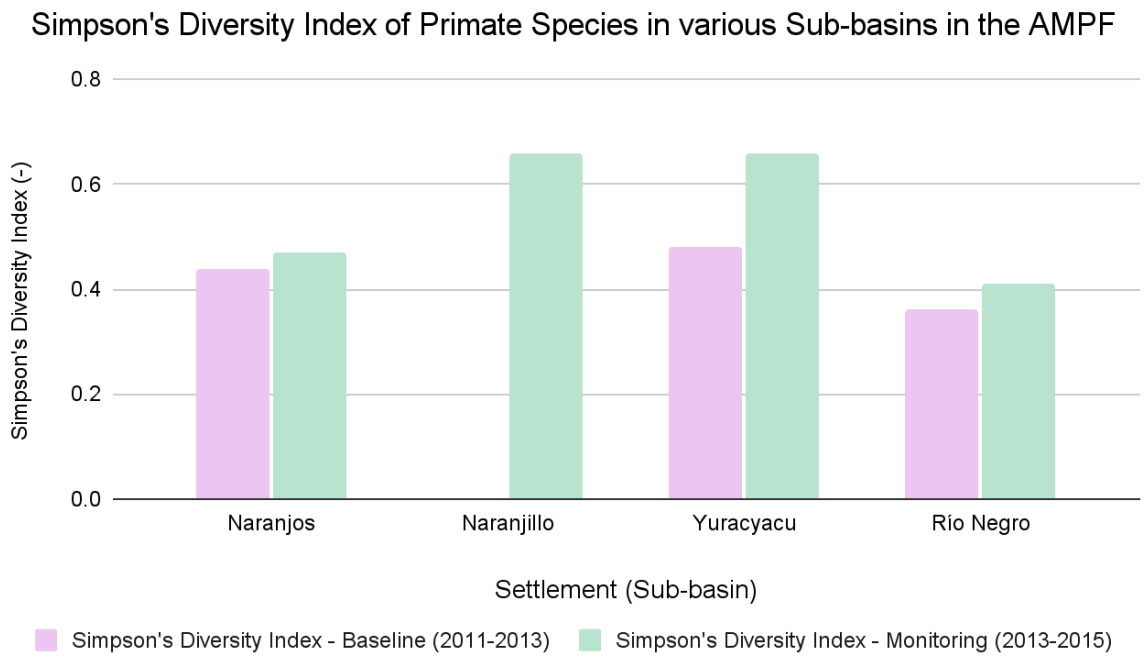


Figure 6: Simpson's Diversity Index of Primate Species (Monkey Species) in Naranjos, Naranjillo, Yuracyacu and Río Negro in the AMPF

The data shown in Figure 6 shows the calculated SDI of the different sub-basins in the AMPF during the baseline study 2011-2013 (Conservation International - Peru, 2016) and the monitoring period 2013-2015 (Conservation International - Peru, 2016). The graph shows a slight increase in biodiversity in four out of five sub-basins, with an average increase of 23%. The sub-basin Naranjillo experienced the highest increase with 66%. This resulted from a diversity index of 0 in the baseline study in Naranjillo, as only one of the two included species was present, indicating no diversity. The sub-basin Naranjos had the lowest increase, just 3%, due to a significant difference in the distribution of the number of individuals per species. Furthermore, no data for the Huasta sub-basin was acquired during the monitoring period, hence it's not represented in the graph.

The value of biodiversity extends to the habitats of various species. These habitats are frequently threatened, with deforestation being a major concern. Deforestation can disrupt the delicate balance of ecosystems and result in the loss of critical habitat for species. To address this issue, initiatives such as the AMPF have been implemented to reduce deforestation and preserve these habitats, thereby protecting the rich biodiversity they support.

To preserve this biodiversity of the Alto Mayo region, deforestation is addressed in regions of exceptional biodiversity significance, prioritizing habitats based on the threat levels to key species. Consequently, deforestation is monitored within habitats critical to the conservation of biodiversity in the AMPF, focusing on species of utmost importance, including the night monkey (Aotus miconax), the yellow-tailed woolly monkey (Lagothrix flavicauda), the titi monkey (Callicebus oenanthe), and the spectacled bear (Tremarctos ornatus) (Figures 7-10).

The size of the deforested area in a scenario with and without the Alto Mayo Initiative as well as the area of avoided deforestation is shown in Figures 7-10 for habitat specific locations. This data was collected from the Monitoring and Implementation Reports from 2012-2020 and summarized in Appendix 1. For all monitoring periods (2012-2020) in Figures 7-10, the baseline deforestation (scenario without the project, red bar) was significantly higher than actual deforestation (scenario with project, blue bar). No data was available before 2012.

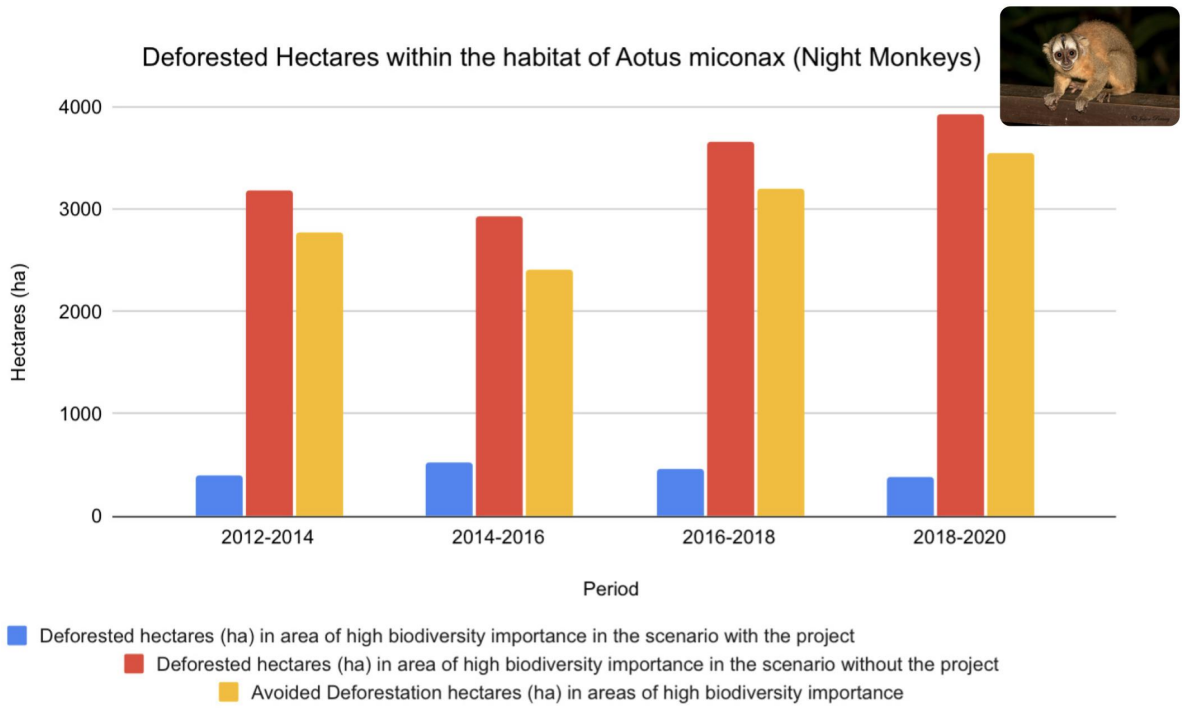


Figure 7: Number of deforested hectares within the habitat of Aotus miconax

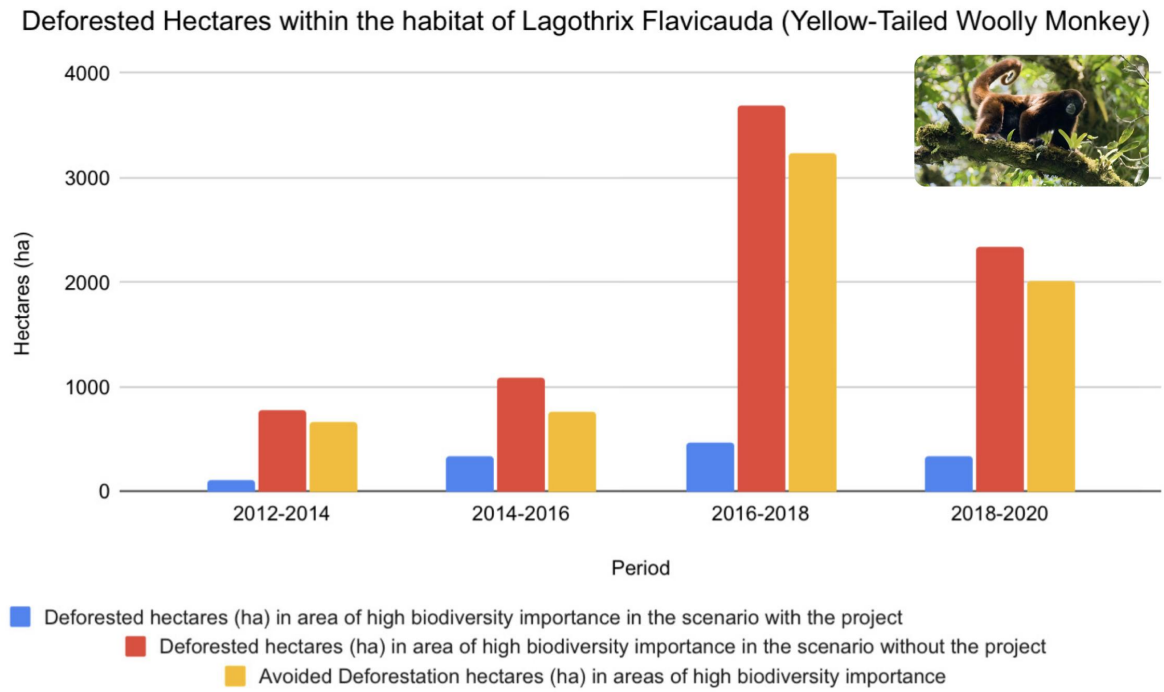


Figure 8: Number of the deforested hectares within the habitat of Lagothrix flavicauda

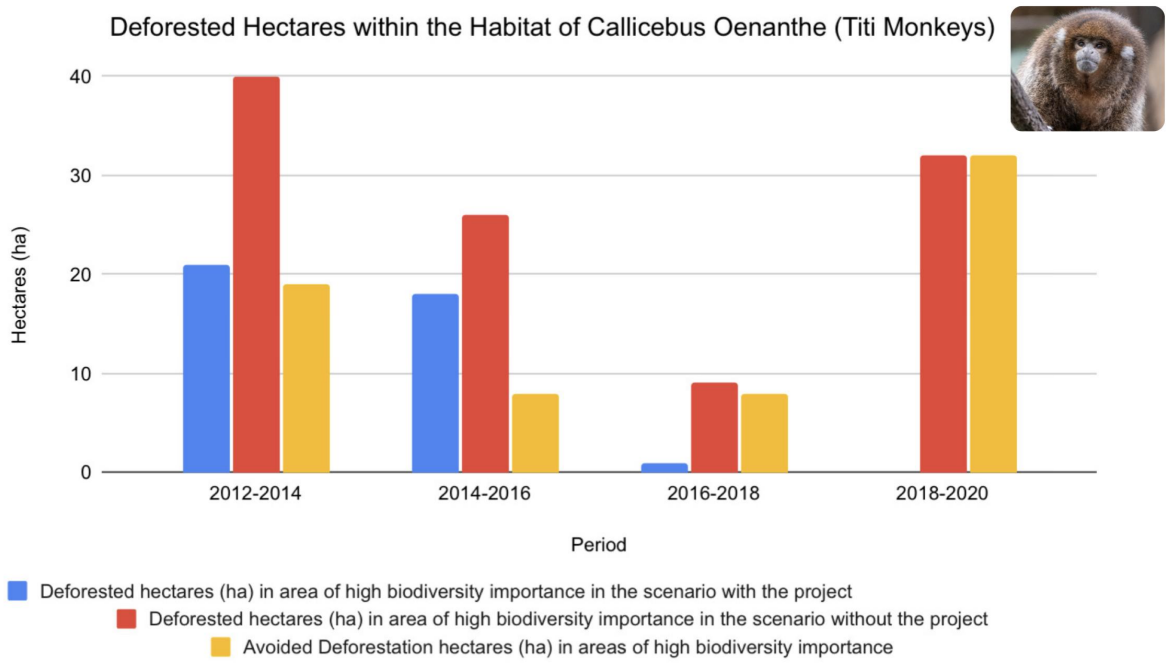


Figure 9: Number of the deforested hectares within the habitat of Callicebus oenanthe

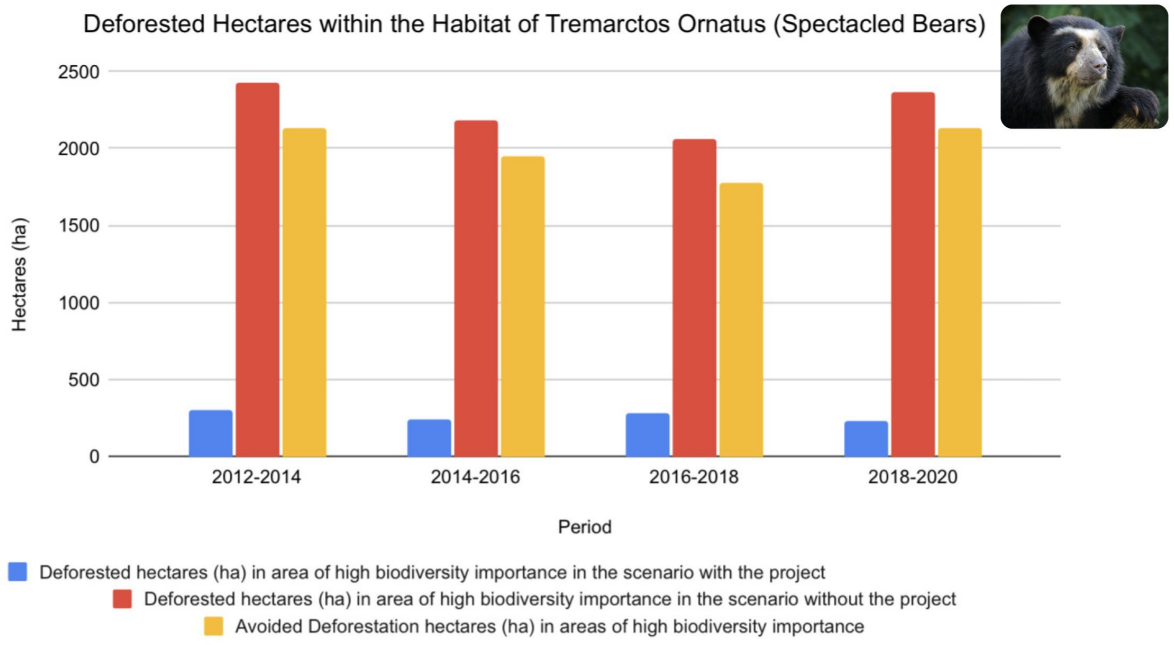


Figure 10: Number of the deforested hectares within the habitat of Tremarctos ornatus

This data demonstrates that project activities have managed to retain high value forests for biodiversity conservation. It's visible that the implementation of mitigation activities has been successful at preventing large areas of deforestation. Specifically within the habitat of Tremarctos ornatus, the highest average of avoided deforested hectares, reaching 88.2% during the period from 2012 to 2022, is seen. In contrast, within the habitat of Callicebus oenanthe, the average deforestation avoidance was 66.7%, the lowest out of the four. The average of avoidance in the Lagothrix flavicauda habitat was 82.3% and in the Aotus miconax habitat was 86.8%.

The graph of the Aotus Miconax habitat and the Tremarctos ornatus showcases a relatively consistent stability over the examined period. Within the Callicebus oenanthe habitat, however, the average avoidance of deforested hectares was 47.5% in 2012-2014, which then decreased to 30.7% before experiencing an increase to 100%. This is due to no deforestation occurring during 2018-2020. On the other hand, in the Lagothrix flavicauda habitat, the avoidance of deforested hectares showed an initial average of 69.7% during 2012-2014, followed by a rapid escalation to 87.5% in the subsequent years of 2016-2018. Overall, the implementation of the project prevented the deforestation of an average of 1,927 hectares of rainforest across all four habitats of high biodiversity importance.

The primary goal of the AMPF is to reduce deforestation, while providing benefits to local communities and biodiversity conservation. Comparing actual vs. baseline deforestation rates over the period from 2009 - 2018 shows actual deforestation rates between 11-16% of the baseline deforestation rates. Actual deforestation rates decrease by 42% from 339 ha/y (2008-2012) to 195 ha/y (2018-2020). The project was able to substantially reduce deforestation inside the AMPF when compared to the baseline (Figure 11).

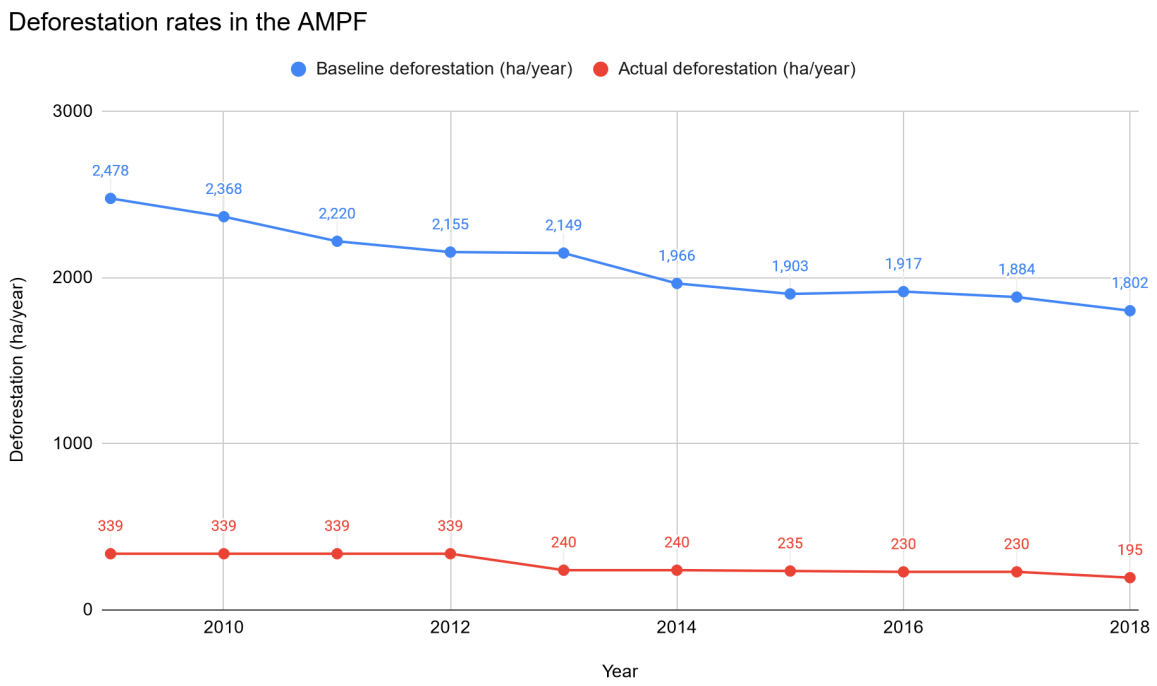


Figure 11: Baseline vs actual deforestation rates in the project area between 2009 and 2018 (Conservation International - Peru, 2014; Conservation International - Peru, 2015; Conservation International - Peru, 2016; Conservation International - Peru, 2018)

Sustainable livelihoods

The AMPF has a significant positive impact on the livelihoods of local communities. By engaging in CAs with these communities, the initiative ensures that traditional ways of life are preserved while promoting responsible resource management.

Upon signing CAs, families commit to engage in practices that include refraining from tree cutting, embracing sustainable agricultural methods, and actively participating in conservation initiatives. Communities receive incentives in exchange for their commitment to specific conservation responsibilities. These include resources like organic fertilizers and

tools to enhance their coffee farms, and training and wages for forest patrols to fight illegal logging (Conservation International - Peru, 2018).

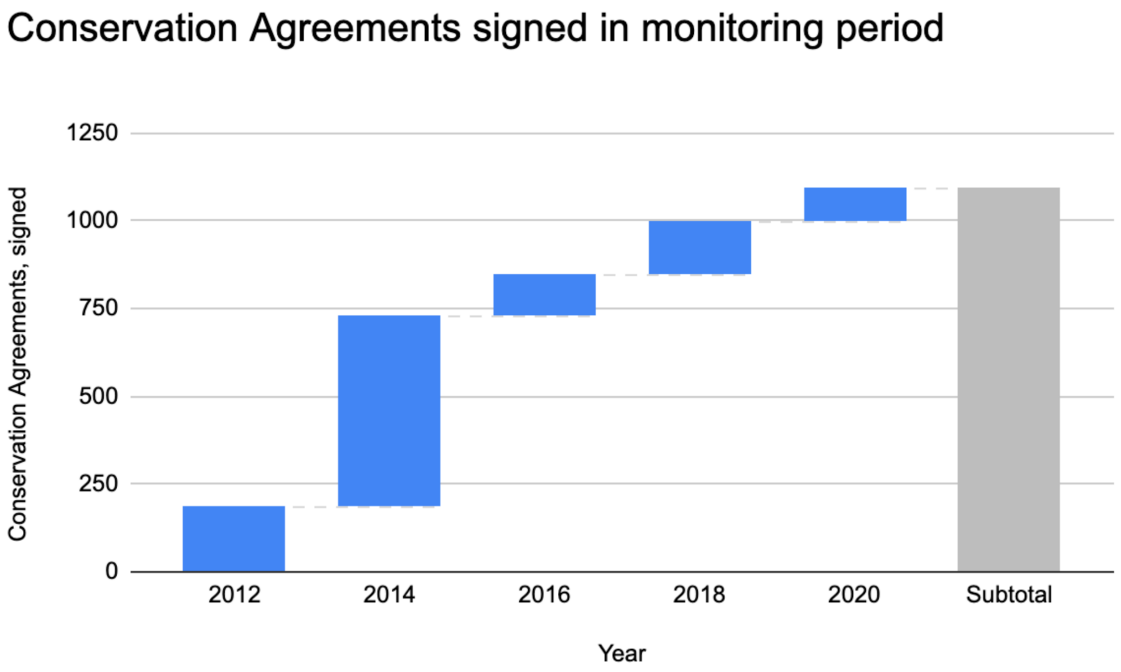


Figure 12: Number of Conservation Agreements signed in the period 2012-2020

Figure 12 shows a notable upward trend in the number of CAs forged with local communities. A rapid increase of 546 CAs is visible between 2012 and 2014. In the subsequent period, spanning 2014 to 2016, the agreements signed reached 848, with a slower increase of only 117 agreements. By the end of the last monitoring period 1096 CAs were signed.

The AMPF Initiative has generated many employment opportunities for the AMPF Head Office and for the various partners of the Administration Contract. Out of the total number of personnel hired during the evaluation period for the REDD project, 73% come from San Martín and adjoining regions such as Amazonas and Loreto.

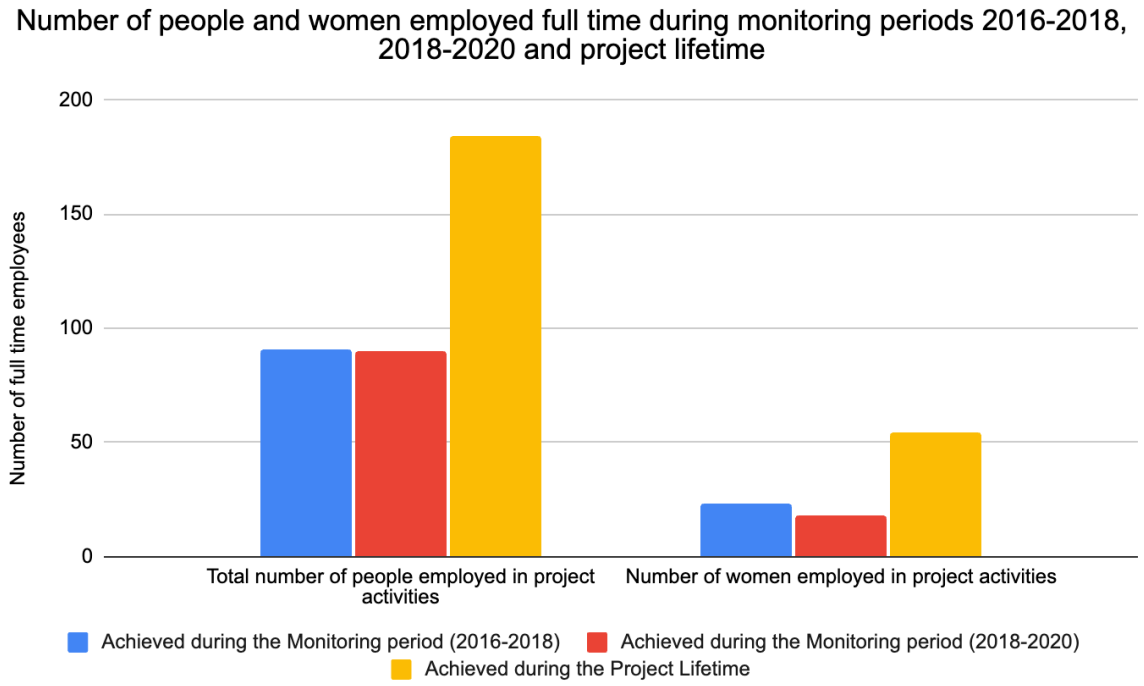


Figure 13: Total number of people and number of women that were employed full time during monitoring periods 2016-2018, 2018-2020 and project lifetime Sep 2020

Figure 13 shows that a significant number of people have been employed in project activities. The total number employed during both monitoring periods remains consistent and stable. However, the number of women employed shows a decline from 23 to 18 in the second monitoring period. Possible reasons for this decline could be the COVID-19 pandemic. The implementation of restrictions, lockdowns, and strict safety measures likely contributed to these employment trends.

The AMPF aims to reduce economic poverty among local communities through financial support generated from the sale of carbon credits. The financial viability of the project during and beyond its lifetime is crucial for achieving this goal. It depends on the actual project

expenses, the carbon pricing and the number of VCUs that can be marketed during the crediting period.

In the non-permanence risk report (Conservation International - Peru, 2020a) four future carbon price scenarios were analyzed: $3, $5, $7, and $9 per one tonne of carbon dioxide equivalent (tCO2-e). This is a standard unit for measuring GHG emissions ("Climate Neutral Certified | FAQ"). The project remains cash flow positive at all scenarios, except the $3 per tCO2-e scenario, until 2036. For the $5 , $7 and $9 scenarios it's stated that the project is able to build a surplus at the end of the crediting period so that it can provide long term funding to local communities (Conservation International- Peru, 2020a).

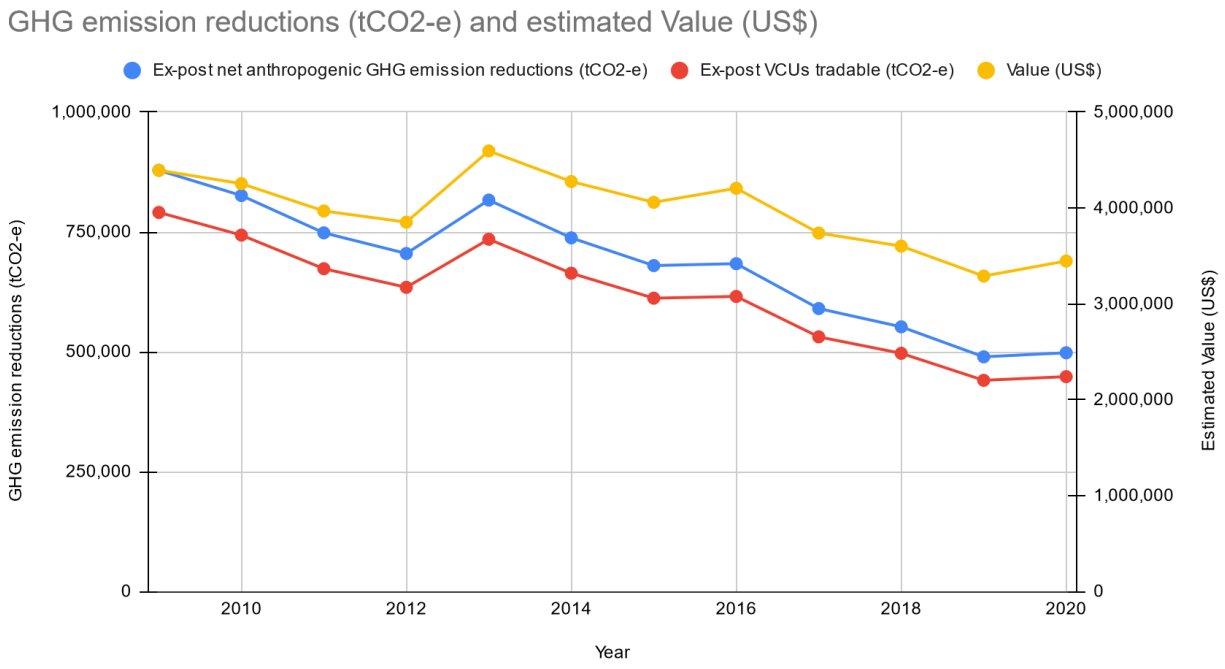


Figure 14: Verified GHG emission reductions and estimated value of tradable VCUs for a 5 US$/VCU price scenario and 3% inflation per year.

Based on the data available from the Verra Registry, 4,251,423 VCUs from the AMPF were issued by September 2020. CI has generated US$ 32 million from the sale of carbon credits (Conservation International - Peru, 2020a). The calculated mean price of 7.53 US$/VCU shows that the price assumptions in the scenarios above are reasonable for the period until 2020 and suggest the economic viability of the project. However, the data in Figure 14 show a decreasing trend in the emission reductions and the estimated value over time. The decrease in emission reductions is possibly caused by a decrease in the baseline deforestation rates after 2013 while the actual deforestation rates remained relatively constant (Figure 11). Baseline deforestation rates were modeled by (Conservation International - Peru, 2015). Observed trends were not further explained.

The Progress out Poverty Index (PPI) was used as a parameter to quantify the improvement of living conditions of the AMPF settlers. The Monitoring & Implementation Reports (Conservation International - Peru 2016, CI 2018, CI 2020b) contained the PPI and noted a slight decrease in the number of people living below the poverty line from 2014 to 2020 (Table 2).

				Access to		
Monitoring Period	**Progress out Poverty Index (PPI)**	**Well-being improved**	**Improvement due to CAs**	**Primary schools**	**Health center**	**Drinking water**
	(%)	(%)	(%)	(%)	(%)	(%)
2014-2016	44	n/a	n/a	n/a	n/a	n/a
2016-2018	47	54	98	99	70	2
2018-2020	41	46	75	88	81	8
TREND	★★☆	★☆☆	★☆☆	★☆☆	★★☆	★☆☆

Table 2: Change in the living conditions of the local population in the AMPF area. Green = improvement, Red = deterioration, number of solid stars indicate the impact (1-low, 2-medium, 3-high)

Table 2 shows that access to health centers has increased by 11%, and access to drinking water has increased by 6%. The PPI decreased by 6% from 2016-2018 to 2018-2020, indicating a lower likelihood that households are living below the poverty line. However, the most significant change was in the improvements due to CAs which shows a decline of 23%. The 10% decrease in access to primary schools could be attributed to the COVID-19 pandemic, which reduced access to schooling and educational resources.

Achieved until end of monitoring period	**2014-2016**	**2016-2018**	**2018-2020**	**TREND**
Livelihoods: Total number of people with improved livelihoods or income generated as a result of project activities	n/a	1,992	2,897	★★☆ **+45%**
Education: Total number of community members who have improved skills and/or knowledge resulting from training provided as part of project activities	n/a	3,689	6,540	★★☆ **+77%**
Employment: Total number of people employed in of project activities, expressed as number of full time employees	n/a	160	184	★☆☆ **+15%**
Source: Conservation International - Peru	(2016)	(2018)	(2020)	

Table 3: Change in the sustainable livelihoods, education and employment as a result of AMPF project activities.

Table 3 shows that the overall socioeconomic impacts in the project area can be considered positive. However, the trend varies greatly between these key indicators. Education had the most notable increase of 77%, while livelihoods increased by 45%, and employment only by 15%.

The successful implementation of CAs in the AMPF has enabled a transition to more sustainable practices and livelihoods. Interviews with local stakeholder representatives carried out as part of the verification confirmed that the AMPF improved sustainable livelihoods (e.g. higher income) and social benefits (e.g. employment) for local communities (AENOR INTERNACIONAL).

Conclusion

The AMPF REDD+ Project has significantly reduced deforestation and contributed to retain high value forests for biodiversity conservation. The project methodology (Pedroni) quantifies GHG emissions in areas subject to uncontrolled deforestation and calculates the emission reductions resulting from avoided deforestation as a result of project activities.

Greenhouse gas emission reductions of 8.2 million tCO2-e have been achieved until 2020. The observed deforestation decreased 42% from 2008 to 2020. Avoided deforestation (19,777 ha over lifetime until 2020) had a positive measurable effect on biodiversity conservation in habitats of species of high biodiversity significance. Monitoring of primate species showed an increase of 23% in the SDI in all four sub-basins of the AMPF.

The AMPF project evidently provides socioeconomic benefits to the local communities living within the project boundaries. Such benefits comprise creation of employment opportunities, improved professional skills by providing training, access to health care and education. A slight positive trend in poverty reduction could be observed in the reported PPI from 44% (2014-2016) to 41% (2018-2020). During the project lifetime (until 2020), there was a total number of 184 people employed in project activities.

Some indicators also show negative trends. For example, in the period 2018-2020 46% project beneficiaries perceive that their economic well-being has improved and 75% of them associate this to the signing of CAs whereas in the previous monitoring period the percentages were 54% and 98%, respectively. According to Tapping's (2020) study on AMPF and a project in Tanzania, carbon offset schemes can benefit locals in the long run if certain precautions are taken by the project's developers. Other research has shown that the implementation of REDD+ or conservation projects doesn't necessarily result in lower poverty levels (Blom et al.,).

Based on the analysis of the available data from Monitoring and Implementation reports and verification reports the author concludes that the AMPF contributes to the conservation of biodiversity, improves and creates sustainable livelihoods for local communities and reduces GHG emissions from avoided deforestation. With this, both hypotheses are accepted.

Despite the many positive indications, there are still risks that could negatively impact local communities after 2028, the end of the crediting period. Unpredictable changes in the voluntary carbon market could impact the economic viability of the project.

Evaluation

The data collection methodology has provided evidence to answer my research question and revealed that the REDD+ project in the AMPF has conserved biodiversity and promoted sustainable livelihoods in local communities.

The findings of this study are based on the analysis of secondary data reported by the project proponent and verified by an external verification company through document reviews, site visits, and interviews with project participants and members of the local communities. However, there are limitations of the study which are due to the following aspects:

1) The lack of continuous primate monitoring data beyond June 2017 does not allow one to assess the long-term effects on biodiversity conservation.
2) Shortcomings of the satellite imagery-based forest cover change method to calculate actual deforestation (e.g. cloud cover) introduces uncertainty.
3) The method to calculate the baseline deforestation and baseline GHG emissions, against which the emission reductions are credited, is currently under debate (Greenfield 2).
4) The subjective nature of socioeconomic surveys introduces sampling bias, response bias etc. A consistent dataset over a longer monitoring period would be more representative.
5) Data gaps, for example in reported socioeconomic parameters, reduced the quality of the analysis.

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Appendix

Appendix 1: Created by author, The number of deforested hectares with and without the project (Conservation International- Peru, 2012-2020)

Species (Specific Name/Common Name)	Years	Deforested hectares (ha) in area of high biodiversity importance in the scenario with the project	Deforested hectares (ha) in area of high biodiversity importance in the scenario without the project	Avoided Deforestation hectares (ha) in areas of high biodiversity importance
Aotus miconax (Night Monkey)	2012-2014	402	3,177	2,775
	2014-2016	520	2,930	2,410
	2016-2018	457	3,658	3,201
	2018-2020	381	3,924	3,543
Flavicauda Lagothrix (yellow-tailed wolly monkey)	2012-2014	105	770	665
	2014-2016	330	1089	759
	2016-2018	459	3,686	3,227
	2018-2020	329	2,333	2,004
Callicebus oenanthe (Titi Monkey)	2012-2014	21	40	19
	2014-2016	18	26	8
	2016-2018	1	9	8
	2018-2020	0	32	32
Tremarctos ornatus(Spectacled Bear)	2012-2014	297	2,430	2,133
	2014-2016	242	2,187	1,945
	2016-2018	285	2,060	1,775
	2018-2020	235	2,364	2,129

Appendix 2: Created and calculated by author, Number of primate species and individuals reported in the AMPF per sub-basin and the calculated SDI in the baseline study 2011-2013 and monitoring 2013-2015 (Conservation International- Peru, 2016)

Settlement (sub-basin)	Species	Number of individuals (Baseline study 2011-2013)	Number of individuals (Monitoring Study 2013-2015)	Simpson's Diversity Index (Baseline Study 2011-2013)	Simpson's Diversity Index (Monitoring Study 2013-2015)
Naranjos	Cebus albifrons	10	7	0.51	0.03
	Aotus miconax	3	5	0.05	0.02
	Lagothrix flavicauda	1	27	0.01	0.48
		14	**39**	**0.44**	**0.47**
Naranjillo	Saguinus fuscicollis	10	N/a	1.00	N/a
	Cebus albifrons	0	6		0.12
	Aotus miconax	N/a	6		0.12
	Lagothrix flavicauda	N/a	5		0.09
		10	**17**	**0.00**	**0.66**
Aguas Verdes	Lagothrix flavicauda	0	4	0.00	0.16
Yuracyacu	Saguinus fuscicollis	10	N/a	0.16	N/a
	Lagothrix flavicauda	15	3	0.36	0.09
	Cebus albifrons	N/a	3	N/a	0.09
		25	**10**	**0.48**	**0.66**
Río Negro	Cebus albifrons	11	0	0.62	0.00
	Lagothrix flavicauda	2	2	0.02	0.08
	Saguinus fuscicollis	1	N/a	0.01	N/a
	Aotus miconax	N/a	5	N/a	0.51
		14	**7**	**0.36**	**0.41**
Huasta	Lagothrix flavicauda	20	N/a	0.44	
	Cebus albifrons	6	N/a	0.04	
	Cebus apella	4	N/a	0.02	
		30		**0.50**	**-**