

Payment for Ecosystem Services as a tool for forest conservation in Bolivia

Case study of the Indigenous territory Monte Verde



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Key messages:

Our findings suggest that a carefully crafted PES scheme in Monte Verde, Bolivia, could involve the Chiquitano people as providers of biodiversity ecosystem services to international users.

These findings are a starting point for further research, where our recommendations include mapping ecosystem services within the territory, conducting focus group interviews with its residents, performing a market analysis for ecosystem services from Monte Verde and making a thorough risk assessment to enhance the success potential of a PES scheme.

This research emphasizes the intricate considerations needed when creating PES schemes in Indigenous territories and underscores the importance of aligning conservation efforts with local values and interests.

KEY MESSAGES:

Despite the challenges posed by Bolivia's political stance against PES and the Laws of Mother Earth, our findings suggest that a carefully crafted PES scheme could involve the Chiquitano people as providers of biodiversity ecosystem services to international users. Further exploration indicated that an NGO or a regional or national institution could serve as an intermediary organization to facilitate trust and administration of the scheme.

These findings are a starting point for further research, where our recommendations include regarding a PES scheme set in Monte Verde are: a) map the factual provision of ecosystem services in Monte Verde; b) carry out focus group interviews with Monte Verde communities to explore their ES and payment preference; c) conduct a market analysis to determine which ecosystem service has the highest demand and its potential buyers; and lastly d) make a thorough risk assessment to understand possible risks of a PES scheme in Monte Verde. Following these recommendations would increase the success chance of a potential PES scheme and consider the interests and values of the Chiquitano people.

However, it is essential that PES should not be perceived as a stand-alone solution or as a 'silver bullet' to solve deforestation and biodiversity loss but it is nonetheless, under the right conditions, a potential tool in forest conservation. This study does not conclude whether the right conditions are present, but emphasizes the intricate considerations needed when creating PES schemes in Indigenous territories and underscores the importance of aligning conservation efforts with local values and interests.

Bachelor thesis by Rose Benedicte Lawaetz & Daniel Brigsted Bervild

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Abstract

The escalating climate and biodiversity crises, intertwined especially by deforestation, pose unprecedented threats to species diversity, ecosystem health, and human well-being. Bolivia, the 12th most biodiverse country globally, is facing substantial forest loss due to agricultural expansion. This case study takes place in the Indigenous Chiquitano territory of Monte Verde, Bolivia, and is emblematic of the challenges faced by Indigenous communities in preserving the forest, the wildlife and their way of living.

This paper explores Payment for Ecosystem Services (PES) as a tool for forest conservation in Monte Verde. Specifically, the study sets out to: understand the geographic, demographic, and biophysical aspects of Monte Verde and the Chiquitano Indigenous people's perspective on nature via semi-structured interviews, secondary literature and own observations from fieldwork; investigate enabling and restricting factors for a PES scheme in Monte Verde related to a PES value chain; identify ecosystem services and stakeholders for a preliminary PES value chain framework; and lastly design an initial PES framework aligned with the local context, enabling factors, and selected operators.

Despite the challenges posed by Bolivia's political stance against PES and the Laws of Mother Earth, our findings suggest that a carefully crafted PES scheme could involve the Chiquitano people as providers of biodiversity ecosystem services to international users. Recommendations for further research include mapping ecosystem services within the territory, conducting focus group interviews with the local residents, performing a market analysis for ecosystem services from the territory and making a thorough risk assessment to enhance the success potential of a PES scheme.

While our findings offer a starting point for further research, it is crucial to recognize that PES is not a standalone solution but, under suitable conditions, presents a potential tool for forest conservation. While this research does not conclude on the presence of the right conditions, it emphasizes the intricate considerations needed when creating PES schemes in Indigenous territories and underscores the importance of aligning conservation efforts with local values and interests.

Foreword

This bachelor's thesis has been conducted at the Department for Food and Resource Economics (IFRO), University of Copenhagen.

The paper has been written by Natural Resources students, Rose B. Lawaetz with a specialisation in Environmental Economics and Daniel B. Bervild with a specialisation in Nature Management. The paper was developed with counselling from Prof. Jens Friis Lund and Lect. Aske Skovmand Bosselmann, whom we thank deeply for their advice and time.

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Abbreviations

ABT - Autoridad de Fiscalización y Control Social de Bosques y Tierra

APCOB - Apoyo para el Campesino Indígena del Oriente Bolivia

APMT - Plurinational Authority of Mother Earth (Autoridad Plurinacional de la Madre Tierra)

AIOC - Native Indigenous Peasant Campesino Territories (Autonomías Indígenas Originario Campesinas)

BES - Biodiversity Ecosystem Service

CICC - Central Indígena de Comunidades de Concepción

CICOL - Central Indígena de Comunidades Originarias de Lomerío

CIP-SJ - Central Indígena Paikoneka de San Javier

ES - Ecosystem Service

FAN - Fundación Amigos de la Naturaleza

FNB - Fundación Natura Bolivia

PES - Payment for Ecosystem Service

PSA - Pago por Servicio Ambiental

FAN - Fundación Amigos de la Naturaleza

HFLD - High Forest Low Deforestation under the ART TREES framework

NDC - Nationally Determined Contributions under the Paris-agreement

NGO - Non-Governmental Organisation

PES - Payment for Ecosystem Services

PWS - Payment for Watershed Services

PBS - Payment for Biodiversity Services

REDD+ - Reduced Emissions from Deforestation and Degradation

TCO - Tierra Comunitaria de Origen

TIOC - Territorio Indígena Originario Campesino

VC - Value Chain

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1 Introduction

The climate and biodiversity crisis, being increasingly intertwined, are contributing to an unprecedented decline in species diversity, ecosystem conservation and Indigenous livelihoods (Pörtner et al., 2021). Climate change and biodiversity loss are intrinsically linked to deforestation, driven by human activities for purposes such as agriculture, urbanisation, and resource extraction which are leading to the loss of habitat for numerous plant and animal species, disrupting ecological balance and diminishing their ability to survive and thrive (Semper-Pascual et al., 2019). Consequently, the climate and biodiversity crisis intensifies as species struggle to adapt or face extinction due to the loss of suitable habitats (Ibid). Furthermore, biodiversity is crucial for sustaining ecosystem services (ES) that benefit human well-being and livelihood, as different species contribute uniquely to various ecological processes that underpin these services. Intact forests with their complex web of interactions and biodiversity are integral to providing essential ecosystem services (Fangyuan et al., 2022).

This study focuses on deforestation in Bolivia, the 12th most biodiverse country in the World, home to over 2,194 species of amphibians, birds, mammals, and reptiles, with 5.4% being endemic (of the World, 2023) while also being one of the countries with the highest forest loss (Colque Fernández, 2022; Müller et al., 2014). Specifically, this study centres around the Indigenous Chiquitano territory of Monte Verde in the lowland of Bolivia. It is part of the Chiquitano dry forest ecoregion which covers around 24 million hectares across Bolivia, Brazil, and Paraguay, representing one of the largest neotropical seasonal dry tropical forest complexes (Pennington et al., 2006). Despite being one of the most biodiverse forest biomes, potentially supporting more plant species than the Amazon rainforest, the ecoregion is critically endangered (Tabarelli et al., 2024; WWF, 2016). This is due to mechanised industrial farming, extensive cattle farming, subsistence farming, illegal timber harvesting, and the proliferation of new road infrastructure linked to mining and extraction of oil and gas which is diminishing its geographical coverage rapidly, resulting in the highest deforestation growth of any region in Bolivia (of the World, 2023; Potapov et al., 2022). Specifically in South America is deforestation mainly driven by cattle farming for the leather and meat industry as well as small-medium-scale agriculture (jayathilkaka, pendrill). This is connected to the rental of Indigenous land and the exploitation of it which will be addressed.

Indigenous-led community institutions and local governance systems prove to be equally or even more effective than conventional protected areas in preventing deforestation and forest degradation (Fa et al., 2020). However, in Bolivia outside settlers are exerting pressure on Indigenous people's territories (Müller et al., 2014). Specifically in the Bolivian lowland region of Santa Cruz, private cattle ranches and Mennonite colonies surround the Indigenous territory of Monte Verde and pressure the cultural values of the Chiquitano people. This is leading to a slow abandonment of traditional activities, such as small-scale agriculture, hunting, fishing, fruit and medicinal plant collection, towards a more market-oriented view centred on the exploitation of forests, potentially losing the Chiquitano as stewards of the forests (Arrien et al., 2014; Colque Fernández, 2022). Figure 1 shows the deforestation pressure in Monte Verde and the surrounding area. It illustrates how deforestation is most severe in the outskirts of the city of Santa Cruz de la Sierra but also reaches Monte Verde and its surrounding area.

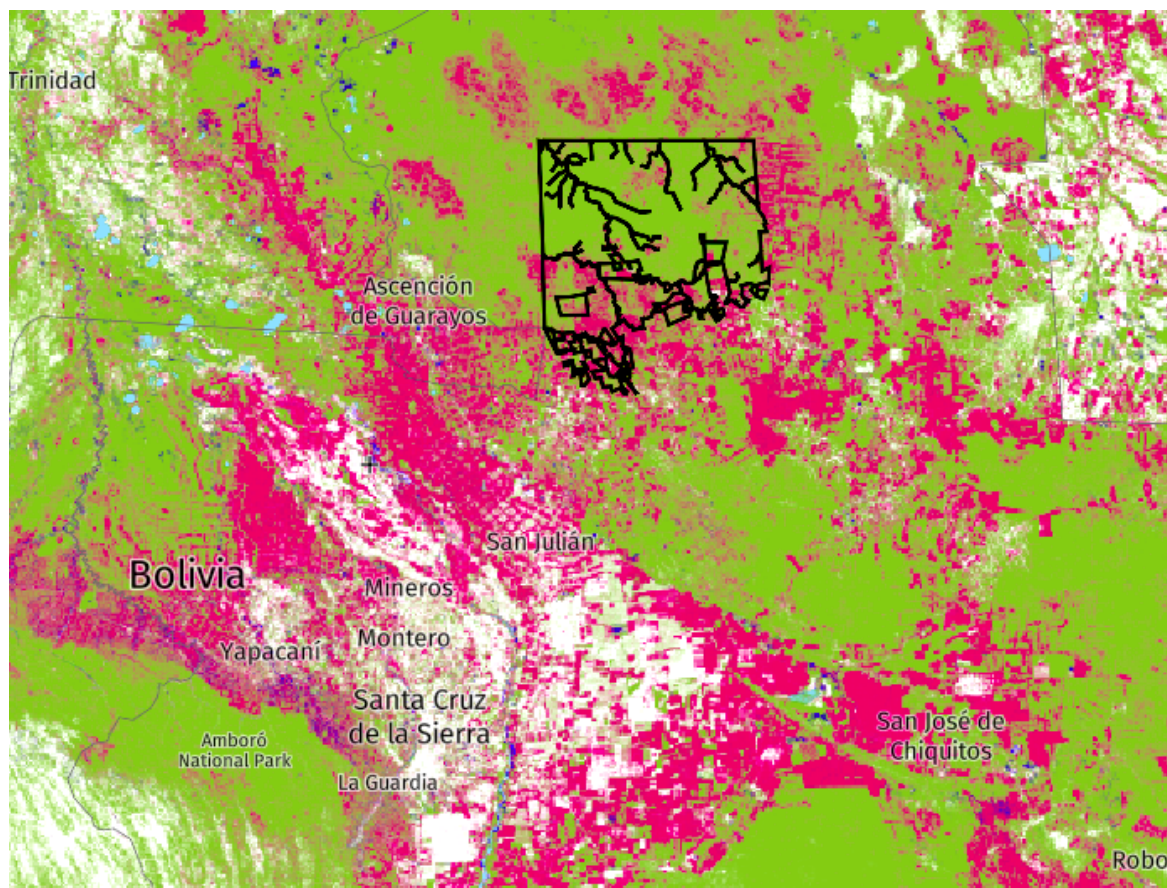


Figure 1: Deforestation (pink) and forest cover (green) from 2001 to 2022 in Monte Verde (black markings) and surrounding area (Global Forest Watch, 2024)

The traditional REDD+ (Reducing Emissions from Deforestation and Forest Degradation) concept incentivises countries to forest conservation by providing compensation for avoiding deforestation and degradation by paying for carbon stocks in forests. The inclusion of “+” expands the focus to include forest management, conservation, and restoration (UNFCCC, n.d.). Critics challenge this approach, arguing that compensation is unlikely to drive a shift toward a more sustainable lifestyle. Additionally, it is criticised for being perceived as the lowest-cost option for highly industrialised economies to offset carbon reductions (Müller et al., 2014). The national government of Bolivia has also taken a critical stance against the carbon market, seeing it as “carbon colonialism” forcing capitalistic models of the Global North onto the people of the Global South (MMAyA, 2022). This political position poses a challenge in providing economic compensation to the Indigenous people residing in and safeguarding the forest. Consequently, it is imperative to devise alternative models for compensating economic efforts of forest conservation. Payment for Ecosystem Services (PES) offers an approach to address biodiversity loss, deforestation, and ecosystem service degradation. PES initiatives create economic incentives for conservation by compensating providers of an ecosystem service for conserving or restoring ecosystems through payments from users of the ecosystem service (Wunder, 2005). By assigning economic value to ecosystem services, PES aims to financially motivate stakeholders to engage in conservation efforts against deforestation and biodiversity loss (Engel et al., 2008; Wunder & Wertz-Kanounnikoff, 2009).

1.1 Research objective

The increased deforestation and forest degradation in the region of Monte Verde threaten both local biodiversity and the traditional customs of the Chiquitano Indigenous people.

Initiatives such as REDD+ face big opposition in Bolivia, being seen as 'carbon colonialism'. This calls for an alternative approach to PES mechanisms, with a focus on the conservation of biodiversity as well as considering the interests of the Chiquitano people and users of the ecosystem services generated in the forests of Monte Verde.

The objective of the study is to examine PES as a tool for forest conservation in Monte Verde, Bolivia. This will be executed by the following investigation:

- What are the geographical, demographic, and biophysical elements in the territory of Monte Verde, and what is the Chiquitano Indigenous people's view of nature in Monte Verde?
- What are the enabling and restricting factors for a PES scheme within the territory of Monte Verde?
- What are the ecosystem services and actors that should be included in a preliminary value chain for a Monte Verde PES?
- How would an initial PES framework be designed to take account of the local context of Monte Verde, enabling factors and the chosen operators of a PES value chain?

1.2 Delimitation

Our focus in this study is to examine PES as a tool for forest conservation in Monte Verde by making a preliminary design of a PES scheme. We have delimited to not present an optimal PES scheme but to examine the potential actors and gather information through observations and interviews to understand the conservation potential of a PES scheme. Furthermore, we have delimited to only focus on elements which occur inside the Bolivian national border, in which the current Bolivian legislation takes place as of this study (18th of January, 2023). We will not address international agreements and deals and only analyse Bolivian laws that we find relevant to the development of PES schemes and rights of the Chiquitano people in Monte Verde. It goes beyond the resources of this study to understand the entirety of the Bolivian political landscape along with foreign diplomacy. However, we will mention partnerships with programs such as REDD+ and the LEAF coalition due to their relevance in our analysis and discussion. Additionally, we have composed a simple value chain for a PES scheme, but we will not address supporters or influencers to the operators of said PES scheme. In addition to this, our focus has been on the providers and the plausible ecosystem services they can provide as well as the PES design in this context. Therefore, focusing less on the potential users and intermediaries but enlightening to some extent the worries and awareness needed to be taken into account in the development of a PES scheme.

Moreover, we will not make thorough risk assessments associated with the introduction of a PES scheme in Indigenous territory. This includes design features that could lead to perverse incentives and eventually a perverse outcome; Risk with monitoring difficulties by the ES providers and hereby of the verification of the deliverance of the ecosystem service to satisfy users; Environmental risk by focusing on a specific ecosystem service and therefore falling to consider other aspects of the environment, consequently leading to an unintended negative impact on the ecosystem; Risk of potential leakage of deforestation to surrounding areas neighbouring Monte Verde.

Finally, We will not address the payment level for a PES scheme due to the fact that it would require a comprehensive livelihood analysis or a focus-group analysis in several Chiquitano communities to understand a satisfactory level of payment for ES provision, which was beyond the resources of this study.

2 Methodology

This study applies the research strategy of case studies to examine PES as a tool for forest conservation in Monte Verde, Bolivia. The unit of analysis, the Indigenous Territory of Monte Verde, tries to enlighten the complex circumstances in which PES is often implemented due to its abundance of forest ecosystem services and complex stakeholder landscape (McAfee, 2016).

The case study of Monte Verde is of exploratory character with corresponding research questions that seek to produce a preliminary diagnosis of relevance and design of PES in the territory (Priya, 2021; Yin, 2018). This case study research adopts a diverse methodological framework, integrating various techniques to investigate the chosen topic and case: literature study, semi-structured interviews and a value chain analysis. Furthermore, a nuanced understanding of the case is sought through qualitative data and secondary sources.

2.1 Case study and value chain analysis

The initial understanding of the case area was achieved through a literature study combined with conducted interviews. The literature study was based on secondary research, employing an approach to synthesize existing scholarly works and reports from the area.

The understanding of the case area is then applied in a value chain framework using PES theory, secondary research and conducted interviews to examine and map out a preliminary PES value chain and its enabling environment. This includes an analysis of the possible actors in the preliminary value chain, an analysis of the legislative framework and policy affecting the viability of a PES scheme and reflections on specific PES design features relevant to a Monte Verde PES value chain. The analysis of the enabling environment was mapped due to information from experts such as the NGO CEJIS (Centro de Estudios de Justicia Social) and a researcher from the Autonomous University of Gabriel René Moreno. We were informed of the jurisdiction of TIOC Monte Verde and its autonomous process as well as laws significant for understanding some of the complex Bolivian political landscape.

Our methodology includes defining precise search criteria, strategically selecting databases, and employing relevant keywords. We have been evaluating the credibility of our sources by using the criteria through the CRAAP test (currency, relevance, authority, accuracy and purpose) (Blakeslee, 2004). The critical evaluation of each source contributes to a comprehensive understanding of the current knowledge landscape in the PES field.

2.2 Semi-structured interviews and interview analysis

The study employed semi-structured interviews as a qualitative research method interviewing local stakeholders such as NGOs, university researchers, political advisors and indigenous people from the territory. The method of semi-structured interviews was chosen as it allows for a balance between a predefined structure and the flexibility needed to delve deeper into participants' perspectives, ensuring comprehensive exploration of the research topics (Brinkmann et al., 2018).

We utilised purposive and snowball sampling techniques to select persons and organisations of interest while also assessing the necessary number of participants given our information needs to avoid burdening individuals unnecessarily. The informants were found from our own research and in cooperation with our host organisations, APCOB and Forests of the World, with the criteria of being able to provide knowledge and in some cases expert knowledge on Monte Verde, the Indigenous Chiquitano people of Monte Verde plus conservation and PES experiences in Bolivia. Several interviews were the result of snowball sampling, where initial informants referred or introduced us to additional informants. Informants were reached by

both official canals sending a formal request for an interview by email and by more unofficial canals such a physical introduction and contact information passed on by other informants and employees in APCOB or Forests of the World. This sampling technique allows for efficient use of time resources and personal connections to reach informants who may not have participated if contacted without a personal referral. It is however a subject of limitations such as potential biases, limited representation, and challenges in generalizing findings to broader populations due to its subjective selection criteria and potential exclusion of diverse perspectives (Brinkmann et al., 2018). Also, there may have been other relevant informants that were not brought to our attention due to a lack of knowledge or bias from the people helping us to map relevant actors to interview.

The interviews were conducted using an interview guide made beforehand from the criteria of using open-ended questions and guiding the conversation onto key topics taking into account the expertise of the informant e.g. diving deeper into the Chiquitano Indigenous people's worldview when interviewing Chiquitanos and diving deeper into the political opinion on PES when interviewing a public policy consultant.

11 interviews were conducted in total of which 10 were conducted in Concepción and Santa Cruz de la Sierra in Bolivia from the 19th of October to the 22nd of November 2023 and 1 was conducted online from Denmark on the 12th of December 2023 (see table 1). They were all conducted in Spanish and audio-recorded with the informed consent and confidentiality of the subjects.

Subsequently, the interview material was transcribed to text for analysis using 'Good Tape' which has high security measures and is a GDPR-compliant software (Tape, n.d.). The data was then analysed using familiarisation by reading the transcripts multiple times to become acquainted with the data. Furthermore, we tried to consider potential bias by both the interviewer and the interviewee. This included trying to ask questions that remained neutral and non-leading, however, this was not always ensured as seen in the example below from the interview with a forest engineer from APCOB (Annex D).

Interviewer: "How do they (Chiquitano) interact with resources? How does their life, their livelihood, depend on natural resources?"

Interviewee: "Mostly, indigenous communities depend heavily on this. They are also the ones who take the utmost care of the forest because, in the event of a fire within the communities, they are the first ones to respond. If there is a fire, it displaces the animals, making hunting impossible, resulting in a lack of meat. Some species extract products like almonds, and if the forest burns, it adversely affects their economy and other aspects. They are mostly engaged in this continuous cycle with the environment. They do not engage in excessive extraction that could deplete resources; instead, they care for it consistently."

The interviewer was leading the question in a certain way by asking "How does their (Chiquitano) life, their livelihood, depend on natural resources?" Consequently, but unintentionally, the question already leads to an answer which would explain the Chiquitano dependence on nature. Cases such as these unfortunately happened due to our inexperience with conducting interviews. Our initial analysis of the interviews afterwards was therefore to identify leading questions and be critical to the answers which followed. Likewise, biases from interviewers were also accounted for by being aware of our own assumptions and Euro-centric viewpoint which could influence our questions. Furthermore, we were aware of the interviewee's bias by being Chiquitano and the possibility of framing the Chiquitano positively. This is seen in the following example: "They (Chiquitano) are also the ones who take the utmost care of the forest". This statement is supported by literature underlining that Indigenous people

Table 1: The interviews used for further analysis

Date	Occupation of informant	Interview Subject	Annex
2023.10.19	FNB - Fundación Natura Bolivia	Experiences working with PWS and perspectives on challenges in La Chiquitania	A
2023.10.23	CEJIS - Centro de Estudios Jurídicos e Investigación Social	Experiences with the titling process and legal structure of Monte Verde	B
2023.10.24	FAN - Fundación Amigos de la Naturaleza	Experiences with ecosystem services in Bolivia and La Chiquitania	C
2023.10.26	Chiquitano forest engineer 1 from APCOB	Own perspective on organisation, challenges and view on nature as an indigenous Chiquitano citizen. Experience working with Chiquitano communities as APCOB employee	D
2023.10.27	Chiquitano forest engineer 2 from APCOB	Own perspective on organisation, challenges and view on nature as an indigenous Chiquitano citizen. Experience working with Chiquitano communities as APCOB employee	E
2023.10.27	Chiquitano citizen from neighbouring territory of Lomerío	Own perspective on organisation, challenges and view on nature as an Indigenous Chiquitano	F
2023.11.22	Researcher from the Autonomous University of Gabriel Rene Moreno	Structural challenges to conservation in Bolivia	G
2023.12.12	Public policy consultant	Knowledge of the political agenda in Bolivia and the government's view on PES	H

Annex will be used to cite interview findings. Transcripts are, however, not provided in this version.

protect the forest (Colque Fernández, 2022; Müller et al., 2014). However, that Chiquitano "take the utmost care of the forest" indicates, that they do not exploit or extract resources from nature at all. This could also be due to the fact that they do not have the resources to cultivate larger areas than "one Ha every year" per family (Annex D). We have tried to follow proper interview etiquette by being respectful and observant of biases. However, due to our lack of experience in this kind of data collection, we experienced obstacles.

The acknowledgement of the asymmetrical power dynamics inherent in the interview scenario and the impact exerted by the interviewer on the elicited information and knowledge was considered in determining the usefulness of the knowledge obtained from the interviews. This aspect becomes even more important when interviewing across cultures where cultural and verbal norms can differ and lead the interviewer or interviewee to misinterpret each other (Ibid). Due to possible bias created by the interview scenario and the interests of the informants (e.g. in attracting finances to the area), the knowledge obtained from the interview was then validated through questioning the interview findings and checking secondary sources (triangulation) (Brinkmann et al., 2018).

Only 8 of the 11 interviews were used in the analysis due to poor relevance of the interview findings. Selecting only 8 interviews for analysis based on relevance can enhance depth and efficiency but risks compromising representativeness and potentially overlooking valuable insights (Ibid).

2.3 Limitations

The thorough use of qualitative methods gives an in-depth understanding of the context in Monte Verde due to insight into the participants' perceptions and their knowledge regarding the political, economic and demographic landscape on multiple levels respectively local, regional and national. However, the lack of quantitative methods affects the scalability of this case study due to the fact that semi-structured interviews usually produce results which are difficult to reproduce and generalise beyond the specific group of participants. Our initial fieldwork idea was to investigate PES funding options and the Chiquitano people's perspective on ecosystem services, PES, and their livelihood, including physical and social capital. The comprehensive time and resources it would require to gather data on demographics, economic frameworks, and viewpoints limited our data collection. A focus group in specific communities would have led to a bigger data collection representing the overall position on relevant topics.

3 Payment for Ecosystem Services

To apply the concept of PES to the Indigenous territory of Monte Verde in the later analysis, it is essential to first understand the theoretical framework as well as relevant literature on the experiences with PES as a conservation mechanism primarily from Latin America. The following section will firstly explain the concept of ecosystem services after which it will elaborate on the definition of PES and key aspects of its design. Lastly, the main critics of the concept will be assessed.

3.1 Ecosystem services

Ecosystem services (ES) is a concept that has gained popularity since the turn of the century for its intent to link ecology, economics and human well-being (Everard, 2022). The concept was defined in 2005 by the Millennium Ecosystem Assessment (MA, 2005) as 'the benefits people obtain from ecosystems' but has been known in the academic world since the 1970s (Dempsey, 2016). The Millennium Ecosystem Assessment from 2005 divided ecosystem services into four categories acknowledging their differences and perceptions of value (MA, 2005):

1. Provisioning services (products) such as food, fuel, freshwater, medicinal substances and energy.
2. Regulating services (regulation of ecosystem processes) such as moderation of climate, air quality, erosion control and pollination.
3. Cultural services (non-material benefits enriching human lives) including aesthetic and spiritual meanings, recreation and tourism.
4. Supporting services (essential processes for functioning and resilience of other services) such as soil formation, habitat for wildlife and the cycling of nutrients.

Several of the provisioning services such as food are traded with a clear market value whereas cultural services such as spiritual inspiration lack market values (Everard, 2022).

3.2 Definition of payment for ecosystem services

The definition of PES has been explored by many and has a variety of academic interpretations even though the principles and concept remain the same since it was first defined by Wunder, 2005 (Everard & McInnes, 2013; Muradian et al., 2013; Smith et al., 2013; Wunder, 2015). The most recent definition from Wunder, 2015 is that PES is:

"A voluntary transaction for generating offsite services of a well-defined ES (or land-use likely to secure that service) between ES users and ES providers that are conditional on agreed rules of natural resource management."

In essence, this concept encapsulates a cooperative and intentional exchange between those who benefit from a specific ecosystem service and those responsible for providing or maintaining that service. The transaction is contingent upon a set of pre-established rules governing the sustainable management of natural resources. Moreover, the term 'voluntary' underscores the consensual nature of the arrangement, implying a joint dedication from stakeholders to cultivate a collaborative relationship. According to Smith et al., 2013 the key actors in a PES scheme are therefore:

- User: beneficiaries or buyers of ecosystem services who are willing to pay for them to be safeguarded, enhanced or restored.

- Provider: seller or suppliers; land and resource managers whose actions can potentially secure supply of the beneficial service.
- Intermediaries: who can serve as agents linking buyers and sellers and can help with scheme design and implementation.

It is crucial to mention that these actors are not locked in their roles and can likely act in another role in different PES schemes. For example, a wildlife charity might: sell ES in its role as a landowner or steward; take on the role of intermediary to facilitate the delivery of a PES scheme; or buy ecosystem services on behalf of its' memberships (Ibid).

The main reason to involve intermediaries is their capacity for trust-building either by having built trust with the providers or users or by being a trustworthy organisation in general. If providers and users are alienated from each other the possibilities of a scheme failing its objectives are increased. However, studies from Africa and Latin America found that increasing the number of intermediaries involved increases transaction costs, delays decision-making and possibly decreases the efficiency of the scheme (Brouwer et al., 2011). A large meta-study on PES in Latin America found that schemes with a closer linkage between actors, i.e. having no intermediaries, had a higher performance on environmental objectives than the programs which had intermediaries (Grima et al., 2016). This further emphasizes the importance of selecting the intermediaries if their participation is deemed useful in the scheme design (Brouwer et al., 2011).

3.3 Types of PES schemes

There are three distinct financed types of PES schemes which Smith et al., 2013 elaborates on:

- Government-financed PES programs where the government is acting on behalf of the wider public. The government pays land or resource managers to enhance ecosystem services. This kind of PES scheme is especially popular in Latin America with examples such as the Mexican Payment for Hydrological Services Program and the Costa Rican Pago por Servicio Ambiental.
- User-financed PES programs where the beneficiaries of the ES contract directly with the ES supplier. These self-organised private deals are often due to the beneficiaries being direct users of an ES e.g. downstream water usage.
- User/government-financed payment schemes that embrace both governmental and private funds in order to give allowance or natural resources to providers for the delivery of ES.

A study comparing PES in developing and developed countries Wunder et al., 2008 found that the user-financed programs were better at targeting ES, more closely designed and related to local circumstances and exigencies, were better at monitoring as well as showed greater willingness to impose conditionality, and lastly had far fewer ambiguous secondary targets than government-financed programs. Wunder et al., 2008 underlies that these user-financed schemes create a stronger relationship between users and providers therefore creating incentives for the users to demand conditionality from the providers and vice versa.

3.4 Scale of PES schemes

Smith et al., 2013 further develops on the different spatial scope of PES schemes which can extend in various scales from local to international schemes.

- **Local:** Agreements between local users paying local providers for the provision of an ES. An example is a scheme whereby residents collectively fund a warden or environmental organisation to manage local green space for biodiversity, landscape and recreational value.
- **Catchment:** Agreements between providers managing a users paying for appropriate watershed management on upstream land. These schemes tend to be private-financed, for example where a water utility pays upland land managers on behalf of its customers to implement certain measures designed to stabilise or improve water quality or quantity.
- **National:** Agreements between entities within a single country, where a government or public entity financially compensates individuals or groups for environmentally friendly practices or conservation efforts. An example is the Payment for Hydrological Environmental Services Program in Mexico, a government-financed scheme to contribute to the sustainable management of forests by providing incentives to agrarian groups, individuals and/or collective legal entities, and individuals interested in a designated and legally representative to contribute to water refilling.
- **International:** Agreements between entities from different countries where one party pays another for maintaining or enhancing certain ecosystem services. An example is REDD+ whereby countries that are willing and able to reduce emissions from deforestation and degradation are paid by developed countries for doing so.

The spatial scope is another factor that has a big influence on a PES success. From experiences with PES in Latin America, Grima et al., 2016 states that when PES is implemented on a local and regional scale it allows communities to better identify actors and intermediaries and also for joint monitoring of costs and benefits. This is further supported by Corbera et al., 2009 in a study on Mexico's carbon forestry programme which states that for PES schemes related to the maintenance of the natural resource essence (i.e. biodiversity, water, etc.), the implementation at a local or regional scale is more efficient than at a national scale. Adding to this a global study on the implementation of PES emphasizes how spatial targeting by making contracts based on hot spots of high ES intensity and threat, increases the chances of making a significant environmental difference (Ezzine-de-Blas et al., 2016).

3.5 Payment configuration and transactional design

Configuration of providers and users

The configuration of the users and providers can vary depending on the objective and the pool of both users and providers (Smith et al., 2013):

- **One-to-one:** a company enters into a contract with a single major landowner to provide enhanced carbon sequestration.
- **One-to-many:** a water utility makes arrangements via a broker to pay many farm businesses for water-sensitive management practices in a key catchment.
- **Many-to-one:** multiple buyers together invest in the development and maintenance of urban green space.
- **Many-to-many:** the government pays farmers for sympathetic land management practices on behalf of the wider public.

Regardless of the configuration of users and providers, the ideal is that payment is made directly from users to providers but in practice, it is often made using an intermediary or broker (Ibid). Especially in the case where multiple providers or beneficiaries are involved, the

intermediary may act on their behalf to arrange the exchange and distribution of payments (Ibid).

Payment packaging

Often a PES scheme focuses on more than one ES hereby being packaged. These packaged ES can be described in three different units (Ibid):

- **Bundling:** A single beneficiary, or a bunch of beneficiaries, pays for the whole package of ES which is being supplied from the same area of land or water (e.g. by paying for the conservation of a hectare generating several ES such as carbon, biodiversity, water filtration etc.)
- **Layering:** Several beneficiaries are independently paying for the ES being supplied from the same area of land or water (e.g. one buyer for carbon and another for biodiversity generated in a PES scheme). Although some examples of layered PES schemes exist, these remain somewhat hypothetical.
- **Piggy-backing:** In this sort of packaging, some ES are not included in the contract between buyers and sellers even though several ES are being provided by the area of land or water. Alternatively, a single ES is sold as an umbrella service, whilst the benefits provided by other ES are being received by beneficiaries free of charge. Hence the users are free riding on some of the ES provided (e.g. only paying for the carbon stored in a conserved hectare that is also generating biodiversity and watershed services).

Payment model

Another key aspect of a PES scheme is the payment model being either output-based or input-based payments:

- **Input-based payments** are contingent upon the implementation of specific land or resource management practices. This mechanism entails compensating stakeholders for activities such as establishing and sustaining buffer strips along watercourses or restoring and maintaining green spaces within residential areas (Ibid).
- **In contrast, output-based payments** are contingent upon the tangible delivery of ES. This compensation model involves remunerating stakeholders based on the quantifiable provision of ES. For instance, payments may be allocated for achieving a predetermined level of carbon sequestration or demonstrating a measured enhancement in biodiversity. The establishment of a PES scheme reliant on input-based payments hinges on the assurance provided to buyers that the designated management practices will effectively yield the desired ecosystem services.

The conceptual idea is for output-based payments to serve as the foundational principle for all PES schemes. In practical terms, input-based payments prevail over output-based payments, given that contractual agreements stipulating a predetermined level of ecosystem service provision may prove impractical or objectionable to involved parties (Ibid).

Payment method

The payment method also differs between schemes between cash and in-kind payment and combined use of the two:

- **In-kind payment** refers to compensation provided in the form of goods or services, rather than in the conventional currency or monetary form.

- Cash payments involve compensating providers directly with monetary funds for the environmental services they provide.

Regarding payment methods experiences from PES in Latin America have found that there are risks identified with the distribution of cash payments among providers which can lead to unfairness and the development of corrupt practices. In addition, in-kind payments have helped avoid instances of corruption and unfair distribution of benefits due to the indivisible nature of the payments and the benefits for the whole of the community Grima et al., 2016. Studies on global implementation of PES also found that whenever ES providers have varying profit opportunities due to market access, asset holdings, preferences, technology availability, etc., offering them a varied payment level or variable types of contract results in greater cost efficiency than paying each provider an equal amount per area or family, thus potentially enhancing the scheme's environmental performance Ezzine-de-Blas et al., 2016. A combination of the two payment methods can also prove optimal, as was found in a systematic review of experiences with deforestation PES in the Amazon region (Montero-de-Oliveira et al., 2023). Accordingly, they concluded that a combination of in-kind and cash payment led to a positive PES outcome because it provided both an alternative income source as well as economic motivation for the ES providers (Ibid).

3.6 PES critic and experiences

The rise in popularity of the payment ecosystem services concept as a conservation strategy has given rise to vocal criticism from scholars and conservationists (Dempsey, 2016). The following section will investigate these points of criticism in order to integrate solutions to them in the preliminary design for a Monte Verde PES scheme and discuss the overall suitability of PES as a tool for forest conservation in Monte Verde.

Critics have pointed to several deeply rooted issues such as the reduction of complex ecosystems to market logic, coordinating between actors with very different political and scientific perspectives and forcing Western perspectives onto other cultures (Dempsey, 2016). These problems are among various other methodological issues, including the risk of leakage, non-additionality, impermanence, the creation of perverse incentives, and other forms of moral hazard (McAfee, 2016).

The quantification and monetization of ecosystem services is the concept's strong point and Achilles' heel. The quantification can demonstrate the existence and vulnerability of the ecosystem service while the monetization calculates a monetary value of the service that otherwise would have been indirectly assigned a value of zero in the absence of appropriate taxes and regulation. However in the process of quantification and monetization, one must first reduce immensely complex biological interactions, that are still subject to scientific uncertainty, to numbers and secondly convert this to a monetary amount representing its value to humans using methods with questionable precision. Furthermore, there are concerns that this commodification of nature can lead to additional exploitation and potentially rationalize the loss of biodiversity (Dempsey, 2016).

Another point of concern is how international PES-scheme such as REDD+ involves a very diverse range of actors including governments from different continents, intermediaries such as think tanks, NGO's and local organizations in addition to the service providers often being local farmers or Indigenous communities. Besides the very different political and socio-economic circumstances that the actors in the value chain find themselves in, there are also differences in worldview and relationship to the natural world. The PES concept is formulated by experts in the Global North and builds on Western, capitalistic thought such

as the notion of nature's value as a function of human interest (Dempsey, 2016). Applying this in other cultural contexts, however, might undermine existing conservation initiatives as has been the case for Peru's National Forest Conservation Program (Ravikumar et al., 2023). In the Peruvian national PES scheme, Indigenous communities are paid for deforestation reductions if they invest the funds according to an agreed-upon plan, where a study of the scheme suggests that it has deteriorated local Indigenous systems of conservation (Ibid). Another aspect of this is the perverse incentives that can be created by PES schemes such as 'carbon piracy' where companies speculating in carbon prices enter Indigenous territories and trick them into trading their carbon credits through the company resulting in a minor earning for the community and a profit for the company (Greenfield, 2023a).

In addition to these conceptual and ethical concerns, there are more methodological issues such as leakage where e.g. a forest conservation effort simply moves deforestation from the PES project area to a new site resulting in a lesser or non-existent additional effect from the payment scheme (Albers et al., 2018). Evaluation studies of PES schemes have found a significant amount of leakage and that current practices to address leakage are insufficient (Filewod & McCarney, 2023; Jack & Cardona Santos, 2017).

Another methodological issue is that of non-additionality which occurs when the conservation effort paid for would have occurred without the payment due to the ES provider's own motivation, existing law etc. (Bottazzi et al., 2018; McAfee, 2016). This is especially difficult in avoided deforestation schemes where additionality is relative to the projection of a deforestation rate in a baseline scenario (McAfee, 2016). Aside from the perpetual uncertainty of such projections, there have also been cases of doubtful baseline methodology as in the recent 'Verra' case from January 2023 where the reference area used for the baseline was located close to infrastructure but the actual project site was located further into the forest with a lower deforestation pressure. This faulty methodology created a baseline projecting a higher deforestation indicating a high amount of avoided deforestation in the actual project area (Greenfield, 2023b).

An additional problem is the inadequate enforcement of conditionality, which is a key feature in PES, validating that the payments have resulted in an additional conservation result by monitoring compliance and sanctioning detected non-compliance from ES providers (Bauchet et al., 2020; Wunder et al., 2018). Findings from Brouwer et al., 2011 underline the importance of establishing quantifiable environmental objectives and monitoring progress towards reaching these objectives. In the study, fewer than half of the schemes employed measurable indicators and tracked the schemes' influence on environmental performance. In the majority of these instances, the indicators primarily referred to the endeavours made in implementing the scheme rather than the tangible impacts and results of the scheme. The hypothesis here is that PES schemes which are serious about implementing this quintessential PES feature will also tend to perform better with respect to their environmental outcomes (Ezzine-de-Blas et al., 2016). It was also found that the implementer's combined efforts to monitor and sanction in compliance have a substantial impact on PES outcomes as ES providers perceiving PES schemes as ill-monitored and poorly enforced often results in a widespread non-compliance trend. In such circumstances, opting for PES while maintaining a 'business as usual' approach becomes a more lucrative strategy. (Ezzine-de-Blas et al., 2016).

The impermanence of the conservation results from PES is also a concern as many PES schemes have short contract periods or are vulnerable due to unstable financing (McAfee, 2016). As for many of these methodological issues the risk will differ from project to project but there have been studies showing that even after payments have ended, the environmental

results lasted (Carrilho et al., 2022).

Summing up the critics of PES argue that the concept has inherent problems such as reducing complex ecosystems to a market logic, coordinating among stakeholders with vastly different political and scientific viewpoints, and imposing Western perspectives on other cultures. It is important to be aware of these issues before applying PES schemes to real-world situations to evaluate whether the pursuit of a promising conservation initiative can undermine its overall objective or the integrity of the people involved.

Smith et al., 2013 tries to address some of the more methodological concerns by arguing that a PES scheme should ideally ensure seven key principles:

- Voluntary: stakeholders enter into PES agreements voluntarily
- Beneficiary pays: payments are made by the beneficiaries of ecosystem services (individuals, communities and businesses or governments acting on behalf of various parties)
- Direct payment: payments are made directly to ecosystem service providers (in practice, often via an intermediary or broker)
- Additionality: payments are made for actions over and above those which land or resource managers would generally be expected to undertake (will vary from case to case but must at the very least go beyond regulatory compliance)
- Conditionality: payments are dependent on the delivery of ecosystem service benefits. In practice, payments are more often based on the implementation of management practices which the contracting parties agree are likely to give rise to these benefits
- Ensuring permanence: management interventions paid for by beneficiaries should not be readily reversible, thus providing continued service provision
- Avoiding leakage: PES schemes should be set up to avoid leakage, whereby securing an ecosystem service in one location does not lead to the loss or degradation of ecosystem services elsewhere

The implementation of these principles into complex real-life scenarios has proven difficult however it must be the aim when implementing PES schemes and they will be addressed in the preliminary design of a Monte Verde PES in this study.

4 Case study of Monte Verde, Bolivia

This section will elaborate on the geographical, organisational, demographic and biophysical nature of the TIOC of Monte Verde in order to understand more of the context in which a potential PES scheme would take place. Furthermore, it will showcase the cultural and spiritual values of the Chiquitano in relation to nature and their reliance on natural resources to better understand the Indigenous people living in Monte Verde and their potential as possible ES providers. Lastly, the ecosystem services in Monte Verde will be mapped and showcased to give an overview of potential ecosystem services related to a PES scheme.

4.1 General description of the territory

Monte Verde is located in the Chiquitania region in the department of Santa Cruz de la Sierra of Eastern Bolivia where the Indigenous Chiquitano population consists of approximately 100.000 individuals (APCOB, 2016). Monte Verde is recognized as an original native peasant land (Territorio Indígena Originario Campesino - TIOC, previously TCO), meaning they have rights to a specific territorial area based on their ancestral history in the area. According to the INRA Law (Law no. 1715 of 1996) and the national constitution, this area constitutes collective property that cannot be seized, divided, expired, or transferred (Bolivia, 1996). All residents are collective owners, and no individual villager owns the land separately. The administration of TIOC is led by the Grand General Assembly which represents 138 Chiquitano communities and is composed of the presidents from the three different conclaves in Monte Verde respectively: The central organisation of indigenous communities of Concepción (Central Indígena de Comundades de Concepción - CICC), the central organisation of original indigenous communities of Lomerío (Central Indígena de Comundades Originarias de Lomerío - CICOL) and central organisation of indigenous office of Paiconeca de San Javier (Central Indígena Paikoneka de San Javier - CIP-SJ) (Arrien et al., 2014). The central organisations emerged in the 1980s as instances of the populations that traditionally accessed and inhabited the territory of Monte Verde (CEJIS, 2015).

In 2010 the population belonging to the TIOC was 13,679 persons and only around 10% inhabitants lived inside the TIOC. This leaves a significantly larger part of the corresponding population, 90% in 2010, living outside the borders of the territory in the surrounding towns and villages (Arrien et al., 2014; Chumacero R., 2011). The reason for the majority of the population living outside the TIOC is linked to the access to educational institutions and work opportunity which is difficult to find in the small communities of Monte Verde (Annex E).

4.2 The Chiquitano Indigenous people of Monte Verde

The Chiquitano people are epitomizing the stewards of these territories, engage in sustainable practices deeply rooted in their traditional knowledge as well as their intrinsic ethics originated in their cultural and religious heritage (APCOB, 2016; Arrien, 2008). The "Jichi" has an important role in cultural and spiritual beliefs. Each forest, river, lagoon, spring, and other elements possess their unique "jichi". Besides the guardians of animals and the rulers of the forest, who oversee the fauna and the overall forests, individual animal and plant species (particularly trees) also have their distinct "jichis" (Ibid). This indicates that Chiquitano people feel that nature has an intrinsic value separated from valuation from humankind possibly meaning that nature should be respected on its own. According to our interviews with Chiquitano forest engineers from the NGO 'Apoyo para el Campesino Indígena del Oriente Boliviano' (APCOB), the communities are dependent on nature providing food, medicine and firewood for them (Annex E) and they therefore have a limited extraction of natural resources in order to pass it on to the next generations as heritage (Annex D).

Chiquitano farmers are using traditional eco-friendly farming techniques, ensuring a harmonious coexistence with the ecosystem. Furthermore, our interviews have informed us that most Chiquitano communities are small, have small quantities of land and are not able to cultivate areas larger than one hectare per family due to their manual cultivation practices (Annex D & E).

The Chiquitano acts as caretakers of the forest to ensure a healthy ecosystem and to prevent and react to forest fires because they are so deeply dependent of the forest's resources whether it is for food, medical or commercial output (Annex E). This is also reflected in the naming of the forest which they call 'La Casa Grande' or 'The Great Home' (Annex E). However, a study carried out in the communities settled in the TIOC Monte Verde in 2010 outlined the transition of Chiquitano populations from community-based subsistence economies relying on agriculture, small animal husbandry, hunting, fishing, fruit and medicinal plant collection, raw materials for crafts, construction, etc., to market-based family economies centred around forest exploitation (Arrien et al., 2014). This transition has disorganised cultural, economic, and social spaces based on tradition. In the TIOC Monte Verde, 90% of the population particularly depends on agricultural activities for its subsistence (Ibid). Moreover, the Chiquitano people's perspective on nature is jeopardized by the growing number of non-indigenous individuals marrying into families and communities. Often, these individuals don't hold the same belief in protecting the forest and instead see nature primarily as a resource for extraction (Annex D). However, the main cause of deforestation is not the transition away from the Chiquitano's historical dependence of nature to exploitation but the rental of Chiquitano land to external actors and rise in pasture and small-medium-scale agriculture (Jayathilake et al., 2021; Pendrill et al., 2022). This transition could, however, be a potential future threat for a PES.

4.3 Biophysical description of the territory and its ecosystem services

Of the 947,440.84 Ha that comprise the territory of Monte Verde only 50,900 Ha (5%) is occupied by Chiquitano communities (Arrien et al., 2014). The remaining area corresponds to a forest area with the main biophysical characteristics determined by a sub-humid, seasonal rainfall climate (Arrien et al., 2014; SDBA, 2014; Vides-Almonacid et al., 2012). The territory experiences moderate to high amounts of rainfall in the wet season from November to May (7 months) and extremely little rainfall in the dry season from June to October (5 months). The average temperature is 25,5 °C ($\pm 2,0$) with a maximum temperature of 35.8 °C and a minimum of 15.2 °C (Pinto-Viveros, 2023).

The forest biome is dominated by tropical dry forest but also has a large transition zone between tropical dry forest and tropical rainforest (Pinto-Viveros, 2023). The tropical dry forests contain reddish weathered soils that have high levels of iron and aluminium and minimal mineral nutrient content and can be eroded easily (Bhadouria, 2020). Similarly, the soils of Monte Verde are considered soils of low or very low fertility (SBDA, 2014).

Monte Verde is part of the ecoregion of the Chiquitano dry forest, which covers approximately 24 million Ha in Bolivia, Brazil, and Paraguay, and represents what is probably the largest existing area of neotropical seasonal dry tropical forest complex (Pennington et al., 2006). It is one of the most biodiverse dry forest biomes categorized by significant levels of species endemism among both plants and vertebrates and potentially supports a greater variety of plant species than the Amazon rainforest (Tabarelli et al., 2024).

There have been recent attempts to map ecosystem services in the Chiquitano dry forest in neighbouring areas such as the Municipal Wildlife Reserve of Tucabaca in Roboré and His-

torical and Archaeological National Park of Santa Cruz La Vieja near San José de Chiquitos by Quintanilla, 2021a, 2021b. Here it is emphasised how the mountain ranges alongside the Chiquitano dry forest form water-producing zones that regulate water flows in dry and rainy seasons, generating a positive water balance for the surrounding communities. Secondly, the biodiversity composed of countless animal species and plants supports the maintenance of healthy ecosystems, ensuring the productivity and stability of the soils (Quintanilla, 2021a, 2021b). The studies also identified services within all of four categories:

- Provisioning: wild foods, medicine, energy source, timber and water
- Supporting: soil formation, nutrient recycling, and pollination
- Regulating: sequestration and storage of carbon, temperature control and regulation, regulation and generation of rainfall, moisture regulation in the soil, soil erosion control, regulation of water flows for water supply, pest control and regulation and mitigation of global impacts
- Cultural: cultural identity, traditional and ancestral knowledge, spiritual values, tourism, recreation and aesthetic appreciation

The provisioning of these ecosystem services is affected by human exploitation and climate change such that e.g. reduced forest cover from deforestation is causing higher land surface temperatures and reducing resilience to rising temperatures due to climate change (Maillard et al., 2022). In tropical dry forests, there have been cases where chronic anthropogenic disturbance almost eliminated ecosystem services. Overexploitation of forest resources resulted in diminished nutrient reserves, reduced ecosystem productivity, and decreased rural incomes which consequently drove a cycle where intensified exploitation was pursued to offset income loss, ultimately culminating in land abandonment due to desertification (Tabarelli et al., 2024). This is a rather extreme case of anthropogenic disturbance but it can be reflected in cases in Monte Verde where Chiquitano communities have rented their forested land to private landowners and Mennonite colonies for a few years provided that they return the land cleaned for forest and thereby easier to cultivate. Since the soils of Monte Verde are soils of low or very low fertility, the returned land is very unproductive and possibly hard to afforest once again (Annex D & A).

A study of the state of conservation of the tropical dry forests in the Americas concluded that the forest cover of the Chiquitano dry forest in 2010 was around 14 million Ha primarily in Eastern Bolivia with smaller patches in Brazil (Portillo-Quintero & Sánchez-Azofeifa, 2010) and later studies from 2022 indicate that current forest coverage is only around 8,5 million Ha (Colque Fernández, 2022). The geographical coverage of the Chiquitano forest is diminishing as a result of especially agricultural expansion, burning, and grazing, which has led it to become the area with the highest growth in deforestation in Bolivia (Potapov et al., 2022) and to be considered critically endangered by WWF, 2016. The territory of Monte Verde has nevertheless had an intact forest cover from 2001-2019 while neighbouring areas have experienced a significant loss of forest cover (Maillard et al., 2022) adding to the arguments of the Chiquitano people of Monte Verde as good stewards of nature. However, data from Global Forest Watch show that Monte Verde suffered substantially higher forest cover losses from 2019 to 2022 partially as a result of more severe forest fires (See figure 2).

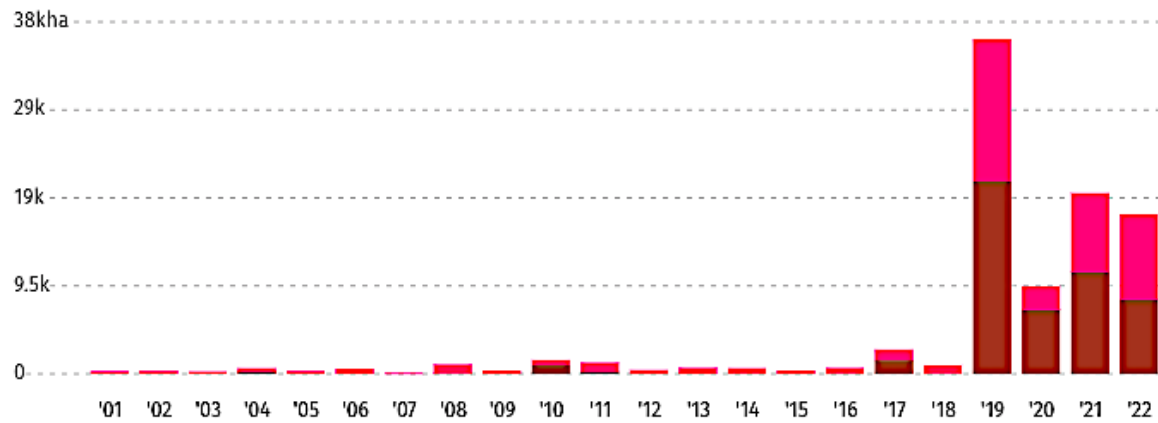


Figure 2: Tree cover loss in Monte Verde (ha/year) due to deforestation (pink) and forest fires (brown) (Global Forest Watch)

The direct causes of the deforestation in Monte Verde and whether the forest fires are caused by human activity have not been uncovered in this study, however, a cautious interpretation could be that the peak in forest cover loss are the result of the prolonged exerted pressure on the territory, starting to have a more direct impact (Colque Fernández, 2022; Müller et al., 2014). In further research of a Monte Verde PES scheme, it would be essential to perform an investigation of these causes to determine the ability of PES to address them.

5 Preliminary PES design for Monte Verde

Building on the PES theory of section 3.2 and the information gathered in the case study section 4 this section will explore different aspects of a PES value chain in Monte Verde. First, the enabling environment will be investigated to determine whether there are conditions for developing a PES scheme. Subsequently, a preliminary value chain will be mapped with possible operators following the PES terminology of provider, user and intermediary organisations. This in combination will suggest a possible PES scheme, taking into consideration the legislative and political space that can be navigated and possible actors in the design of a Monte Verde PES scheme.

5.1 Enabling environment for PES in Monte Verde

The enabling environment of a value chain refers to the broader external factors that create a conducive backdrop to activities within the value chain such as regulatory frameworks, market access, access to resources, and institutional support (Konig et al., 2013). This section assesses the enabling environment for a PES scheme in Monte Verde by analysing selected Bolivian legislative frameworks and the political position on PES as these are fundamental enabling factors for the effective functioning and development of a Monte Verde PES value chain (Ibid).

5.1.1 Legislative framework

There are several national laws in Bolivia affecting the prospects of creating a PES scheme in Monte Verde (see table 2) which are mainly influencing two key aspects: Firstly, tenure rights and the ability of Indigenous territories to manage the natural resources within their territory; and secondly the ability to create a market-based scheme for transfers between users and providers of ecosystem services.

Tenure rights and autonomy

We first investigate what autonomy Indigenous communities such as Monte Verde have over their territories and natural resources through an analysis of tenure rights legislation.

- The INRA Law (Law no. 1715 of 1996) is a fundamental tenure legislation in Bolivia that clarified property rights in 1996 through a redistribution of unproductive and underutilised land through a process of regularisation of land tenure. The land was distributed to several groups including Indigenous communities in the form of Indigenous Communal Territories (TCOs - Tierra Comunitaria de Origen) (Bolivia, 1996; Müller et al., 2014). The central organisations of the Chiquitano communities around Monte Verde (CICC, CICOL and CIP-SJ) used this opportunity to reiterate previous demands to the territory of Monte Verde. They demanded an area of 1,159,173 Ha but after a conflicting 11-year titling process, they were granted 947,441 Ha on July 3, 2006 (Arrien et al., 2014). Due to a high number of third parties in the region (e.g. private landowners), the granted territory of Monte Verde has a high territorial discontinuity (Chumacero R., 2011). As can be seen in figure 3 It consists of one large area some gaps inside the larger square and several smaller patches in the southern part that are disconnected from the large area.

Table 2: Legal framework relevant to prospects of PES in Monte Verde (Modification of Müller et al., 2014, p. 28 adding information from Augsburg and Haber, 2018; Bolivia, 1996)

Law	Name and Year Passed	Explanation
1715	National Institute of Agrarian Reform Law (INRA) passed in 1996	Fundamental property right law that addresses land distribution, ownership, and tenure issues by among other thing redistributing unproductive or underutilised land to indigenous communities and regularise land titles to provide legal recognition and security to landholders.
1700	The Forestry Law passed in 1996	Implementing a stronger regulation and management of forest resources within the country and essentially clarifying rights over forests.
3545	Law of Community Redirection of the Agrarian Reform passed in 2007	A modification to the INRA Law that accelerates the collective land titling and establishes that all available public lands should be provided preferentially in favor of indigenous peoples and communities or peasants that have no or insufficient lands.
3760	Law on The Rights of Indigenous Peoples passed in 2007	Raises the United Nations Declaration on the Rights of Indigenous Peoples to the rank of law.
031	Change to the constitution passed in 2009 and subsequent Framework Law on Autonomies and Decentralisation passed in 2010	Significant change in the constitution, including renaming the country to "the Plurinational State of Bolivia" and recognising the collective indigenous right to self-governance and provided guidelines for the creation of Indigenous Autonomies and Native Indigenous Peasant Campesino Territories (AIOCs - Autonomías Indígenas Originario Campesinas).
071	Law of The Rights of Mother Earth passed in 2010	Legally recognising Mother Earth's rights, as well as the obligations and duties of the Plurinational State and society to ensure respect for these rights including the prohibition of mercantilisation of nature and it's services.
300	Framework Law of Mother Earth and Integral Development for Living Well passed in 2012	Promotes articulation of rights, establishes sectoral bases, technical instruments and guarantees for the rights of Mother Earth. It bans the marketisation of livelihoods and the processes that support them. It also establishes the Plurinational Authority of Mother Earth, mitigation and adaptation mechanisms and a financial mechanism for the implementation of the climate and environmental agenda in Bolivia.

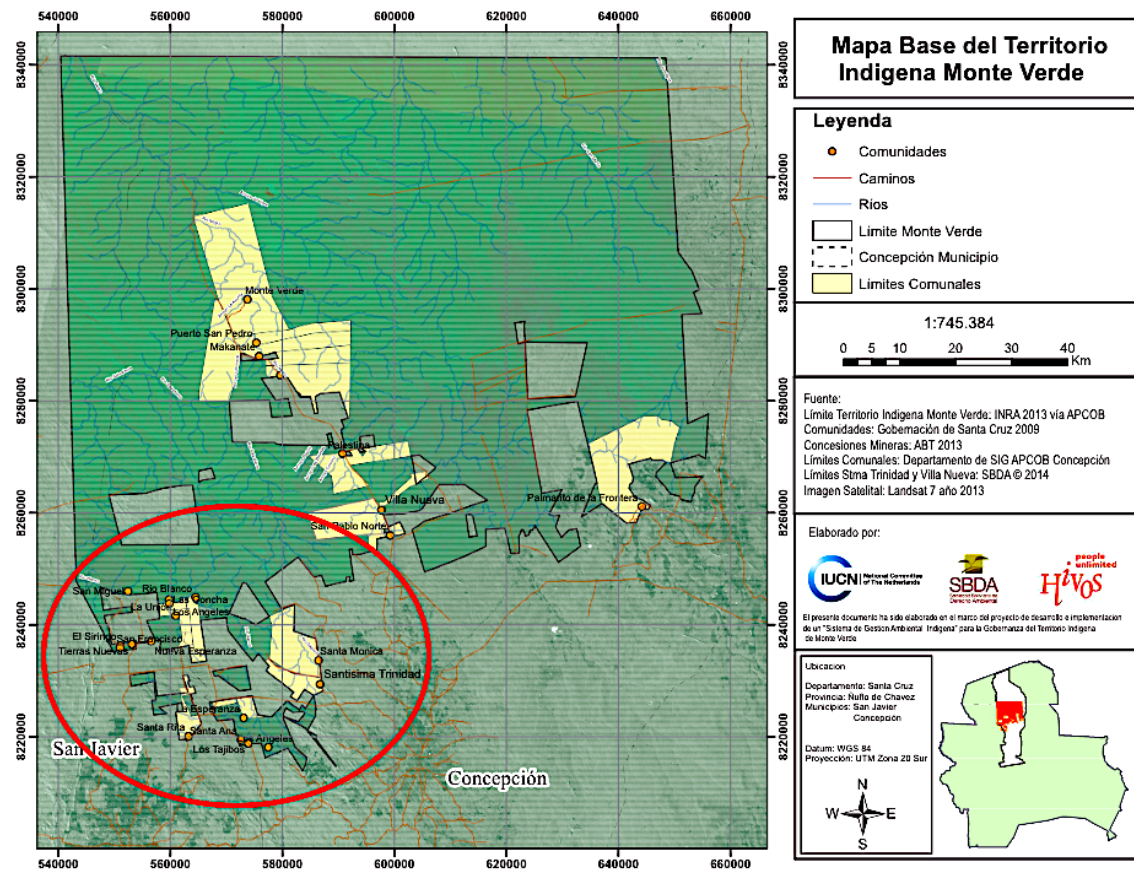


Figure 3: Map of Monte Verde illustrating smaller patches (marked by a red circle) in the southern part of the territory separated from the main larger area (Mod: SBDA, 2014)

- The Forestry Law (Law no. 1700 of 1996) assigns TCOs rights over the forest resources within their respective territories, granting them certain rights and control over the use, management, and sustainable exploitation of forest resources found within their TCOs (Müller et al., 2014).
- The Law of Community Redirection of the Agrarian Reform (Law no. 3545 of 2007) further enforces that areas identified as public forests should be allocated to indigenous and native or rural communities, with or without lands. This affects the success rates of territorial claims from Indigenous groups (Ibid).
- The Law of Rights of Indigenous Peoples (Law no. 3760 of 2007) enforces Indigenous land ownership and use by recognising the right of Indigenous peoples to own, use, develop, and control their traditional lands, territories, and resources (Ibid).
- The 2009 Constitution marked a change in the national policy, changing the name of the country to the Plurinational State of Bolivia and the name of Indigenous Communal Territory (TCO) to Indigenous Native Peasant Territory (TIOC - Territorio Indígena Originario Campesino). Furthermore, the Constitution recognised the collective indigenous right to self-governance and provided guidelines for the creation of Indigenous Autonomies and Native Indigenous Peasant Campesino Territories (AIOCs - Autonomías Indígenas Originario Campesinas). The conversion process involves the establishment of autonomous regions or entities with greater self-governance powers. AIOCs have the authority to create their own laws, manage resources, and govern

themselves within the framework of the national constitution. They have a more significant degree of political and administrative control compared to TIOCs which only provide indigenous communities with some degree of land rights, self-governance, and the ability to manage their territories. The Law on Autonomies and Decentralisation (Law no. 031 of 2010) elaborated on the specific requirements for the creation and operation of AIOC. A key factor is that the AIOCs have control over renewable natural resources such as forests, but not over nonrenewable natural resources such as minerals and hydrocarbons that are ascribed to the central state (Augsburger & Haber, 2018; Doyle, 2021; Tockman & Cameron, 2014).

From the enactment of the legislation in 2010 to present day, 18 TIOCs have engaged in the conversion to Indigenous autonomy but only one TIOC has managed to convert into AIOC (Raquaypampa, Cochabamba) (Cameron & Plata, 2023). The TIOC of Monte Verde also engaged in the process of becoming an AIOC with the inherent challenges of fulfilling the criteria of a continuous territory and the possible location of the AIOC being limited to one municipality. Another essential challenge was that the large population living outside the territory would not be considered part of the AIOC and receive the same rights (Chumacero R., 2011). The AIOC process is currently frozen in the application process, having received the Certificate of Ancestral Territory but awaiting the Certificate of Governmental Viability and Population Base. This certificate approves their management capacity and that their population is at least one thousand individuals (Cameron & Plata, 2023). According to our interview with legal experts from CEJIS who have aided Monte Verde in the conversion process, the process is currently suspended due to internal conflicts and there are no existing plans of resuming it (Annex B). The conversion of Monte Verde to an AIOC would direct financial resources from the state to the territory, strengthen its institutional capacity, and give more political autonomy over resources, facilitating more favourable conditions to participate in a potential PES scheme. The status of TIOC, however, still provides them with certain autonomy over resources and resource management that we consider sufficient to begin maturing a preliminary PES scheme.

Rights of Mother Earth

The ability to create a market-based scheme for transfers between users and providers of ecosystem services is also affected by local legislation, namely the laws stating the rights of Mother Earth. The Law of the Rights of Mother Earths (Law no. 071 of 2010) and the Framework Law of Mother Earth and Integral Development for Living Well (Law no. 300 of 2012) define land rights as a collective matter of public concern, outlining both the collective and individual rights of indigenous nations, rural communities, and intercultural groups to these lands. This is set within a holistic development framework for the sustainable utilisation of natural resources. Furthermore, it establishes the Plurinational Authority of Mother Earth (Autoridad Plurinacional de la Madre Tierra, APMT), climate change mitigation and adaptation mechanisms, and a financial mechanism for the implementation of the climate and environmental agenda (Müller et al., 2014). A significant paragraph for the implementation of PES schemes is Article 2.5 of The Law of the Rights of Mother Earths:

”No mercantilización. Por el que no pueden ser mercantilizados los sistemas de vida, ni los procesos que sustentan, ni formar parte del patrimonio privado de nadie” (Bolivia, 2010)

This article states the mandatory compliance principle of non-commercialisation: Neither living systems nor processes that sustain them may be commercialised, nor serve anyone’s private property. The contents of this article serve as a massive barrier to the prospects of

PES in Monte Verde. However, there are current PES-like schemes in the form of payment for watershed services (PWS) operating in Bolivia which serves to illustrate the elasticity of enforcement of article 2.5 (N. Asquith, 2016; Bauchet et al., 2020). Furthermore several of the rights of Mother Earth are in contradiction to public policy objectives to support food production and extractive industry development further highlighting the inconsistency in implementation of the law (Colque Fernández, 2022; Müller et al., 2014). An example of this is the emphasis in the Laws of Mother Earth on preventing or minimising the expansion of the agricultural frontier (Article 24.2 in Law no. 300 of 2012), while other laws and policies have a direct objective to promote the expansion of the agricultural frontier, such as the Law on Support to Food Production and Forest Restoration (Law no. 337 of 2013) and the national development plan 'The Patriotic Agenda 2025' (Colque Fernández, 2022; Müller et al., 2014).

Conclusively, the legislation on tenure rights of Indigenous territories promotes the prospects of PES whereas legislation on the rights of Mother Earth demote the prospect. The implementation of the laws of Mother Earth, however, seems faulty, which might allow for certain PES or PES-like schemes to develop in Bolivia.

5.1.2 Political position

The latest Bolivian Nationally Determined Contribution (NDC) from 2022 encompassed the same opinions as articulated in the Laws of Mother Earth (Law no. 071 of 2010 and Law no. 300 of 2012) and the critical stance that Bolivia has taken against international carbon PES schemes since Evo Morales' government started in 2006 (MMAyA, 2022; Müller et al., 2014). The 2021-2030 NDC calls for an "eradication of the commodification of the environmental functions of nature, of carbon markets and nature-based solutions that promote millionaire climate business and do not solve the problem of the climate crisis" and "confronting models of 'carbon colonialism' to combat the climate crisis that impose models of the countries of the North on the countries and peoples of the South" (MMAyA, 2022, p. 3). These statements underline the government's long-standing rejection of carbon markets and commercialisation of nature as part of a neo-colonialist and capitalistic approach to climate change mitigation presented by developed countries not assuming responsibility for their historical emissions (Müller et al., 2014).

The very explicit character of the statements can be compared to the rhetoric used by Bolivia regarding REDD+, which at times has been perceived as contradictory (Müller et al., 2014). Firstly, Bolivia was one of the first countries to apply a carbon credit mechanism through the Climate Action Plan at Noel Kempff Mercado National Park in the 1990s. Carbon credits were sold to US companies stemming from extensions of the national park, suspended forest concessions and compensating timber companies (Ibid). Likewise, they were a part of the Coalition for Rainforest Nations in 2006 demanding a compensation mechanism for reduced deforestation, participated in preparatory programs for REDD+ mechanisms in 2007-2008 and were allocated US \$ 4.7 million for a REDD+ readiness preparation program in 2010. These funds were however allowed for use in alternative policies to REDD+ in 2012 (Ibid). The period up to 2012 was characterised by substantial contradictions between different areas of the executive body, especially the Ministry of Environment and Water and the Ministry of Foreign Relations (Ibid). There were also contradictions within the organisations of Indigenous people where the largest organisation, the Confederation of Indigenous Peoples in Bolivia (Confederación de Pueblos Indígenas de Bolivia, CIDOB) in 2011 choose to support REDD+ programmes between CIDOB and the World Bank or other international organisations. At the same time smaller Indigenous peoples organisations released statements completely rejecting carbon market and marketization of forests (Ibid). In the following period, the COMSERBO project (Strategic Conservation and Sustainable Management of

the Forest Resource) worked to develop mechanisms of payment for forest conservation with no success (2016-2017) while Fundación Natura Bolivia (FNB) continued to create PWS-like schemes (N. Asquith, 2016; Müller et al., 2014; Strategy, n.d.).

The PWS schemes by FNB are the only current operating PES-like schemes in Bolivia, which covered 623,604 Ha in 2019 and are characterised by the use of in-kind payments and a name consciously distinctive from PES and PWS, namely "Reciprocal Water Agreement" (Acuerdo Recíproco por Agua, ARA) (Bauchet et al., 2020; F. N. Bolivia, 2019). For FNB, it has been an active strategy to focus on water rather than carbon, to avoid familiarity with the PES concept consciously using a different name, not quantifying the ES but paying in-kind for changed practices, conserved land and predominantly being financed by Bolivian citizens, companies and organisations (Annex A).

In April 2023, Bolivia joined the international LEAF Coalition, having initial proposals approved to supply high integrity jurisdictional REDD+ credits (ART TREES) (LEAF, 2023). The proposal covers an area of 12.5 million Ha of forest across the departments of Pando and the Indigenous Territory (AIOC) of Charagua Iyambae and was created in collaboration with the Bolivian national government. It contains two types of ART TREES credits: High Forest Low Deforestation (HFLD) in Pando and REDD+ in the AIOC of Charagua (LEAF, 2023, Annex H).

According to our interview with a Bolivian public policy consultant, the participation of Bolivia in the LEAF Coalition is an expression of financial difficulty that has allowed high-level politicians to pursue other mechanisms to finance conservation, protected areas, or forested areas (Annex H). There is still a wing of the government that is sceptical of this type of initiative and the LEAF participation is therefore a type of pilot project (Ibid).

To stay within the scope of Bolivia's opposition to the commodification of nature, the LEAF proposals only contain credits for results-based payments where the purchase of the credits doesn't compensate the buyer's emissions but simply serves as a contribution to achieving national NDC commitments. However, the very REDD+ nature of the LEAF initiative demonstrates a possible political opening for other financial mechanisms such as PES (Ibid).

Similarly Bolivia has joined a sustainable forest management project called Territorio Indígena Originario Campesino, covering 3.5 million hectares, set to be the world's largest REDD+ initiative. The project currently spans over five TIOCs and is therefore conducted in close partnership with the Confederation of Indigenous Peoples in Bolivia (CIDOB) (GCFTF, 2023). This emerging project along with the participation of the AIOC Charagua Iyambae in the LEAF-coalition shows that the political Indigenous organisations in parallel to the national Bolivian government are opening up to other financial mechanisms such as PES.

Conclusively, the PWS schemes from FNB and the participation in the LEAF Coalition have evolved alongside the very critical political opinion to commercialization of nature and convey the impression of a certain action range to develop PES and PES-like schemes in Bolivia, navigating around the legislation and political hostile environment for PES. This in combination with the legislative analysis demonstrates a limited enabling environment, allowing for some extent of PES, if it avoids carbon ES or at least offsetting mechanisms and carbon markets. The political environment is also assessed to be relatively unstable, facing the risk of shifts in the political position. However, if a PES scheme considers these obstacles and demonstrates PES features not related to offsetting but a focus on philanthropic investment in the conservation of forests and inherent ecosystem services, a plausible PES

scheme could be developed.

5.2 PES value chain and actors in Monte Verde

Having analysed the enabling environment for a PES scheme in the last section, this section will examine the possible operators in a Monte Verde PES value chain to identify relevant providers, ecosystem services, beneficiaries and intermediaries (Smith et al., 2013).

5.2.1 Providers and ecosystem service in Monte Verde

As mentioned earlier in section 4.1 the TIOC of Monte Verde is owned and managed by the Chiquitano people and the three Chiquitano Central Organisations, CICC, CICOL and CIP-SJ. As ES providers mostly are landowners and resource managers of the given areas, it seems obvious that providers in the PES scheme should be the Chiquitano communities and the three different central organisations of the region (Smith et al., 2013). As mentioned in section 5 external stakeholders do not have management rights of the TIOC Monte Verde and would therefore be excluded from any influence regarding administrative questions related to a plausible PES scheme. The role of the provider should be to ensure an increase in the ecosystem service in the territory or at least maintain status-quo and it is, therefore, important to assess whether the Chiquitano is in a position to achieve this through changed management practices or has the interest to do so (Ibid). Part of this is determined by the ecosystem service chosen in the PES scheme.

PES is influenced by both demand and the perceived scarcity of ecosystem services. Scarcity may pertain to water quality, flood protection, climate stability, or biodiversity loss. If a service is not scarce or is taken for granted, there is no apparent necessity to make a payment for it (Salzman et al., 2018). The ecosystem service in a PES can either be a directly measurable service (e.g. purity of water) or resource management activities that increase the ecosystem service (e.g. practices that would improve water quality) (Smith et al., 2013). In some instances, the delivery of ecosystem services may be less clear and more abstract, such as in the case of biodiversity, where users might be willing to accept a certain level of uncertainty regarding cause-and-effect relationships if the overall evidence indicates potential benefits. However, if the scientific foundation for a prospective PES scheme is lacking, it would become challenging to attract users (Ibid).

The ecosystem services mentioned in section 4.3 are all present in Monte Verde, but not all are measurable or explicitly demanded from users. The most commonly studied and quantified ecosystem services in neotropical dry forests are those related to water, carbon, soils and biodiversity (Calvo-Rodriguez et al., 2017). These services (with the exception of biodiversity) are often considered the most tangible in terms of familiarity, measurability as well as identification and delineation of both beneficiaries and providers (Pagiola et al., 2005; Salzman et al., 2018; Wunder & Wertz-Kanounnikoff, 2009). Furthermore, conservation of ecosystem services is often correlated so that e.g. protecting carbon stocks by protecting standing forests will also contribute to biodiversity by providing habitats for a variety of plant and animal species (i.e. piggy-backing) (Calvo-Rodriguez et al., 2017; Quijas et al., 2019). There are however consequences of focusing on certain ecosystem services e.g. the scope of carbon in REDD+ has failed to protect larger mammal populations within forests from unsustainable hunting and thereby reduced biodiversity and vital forest ecosystem functions performed by forest fauna like seed dispersal and pollination (Krause & Nielsen, 2019). During our fieldwork and via our interviews with Chiquitano forest engineers we noted that the Chiquitano often value the ecosystem service of water highly (Annex D & E). This is mainly due to the fact that Ingenious communities in Monte Verde are experiencing the

consequences of climate change with the work in the fields becoming more labour intense and exhausting (Annex D) through an increase in temperatures as well as with higher concentration of precipitation within a shorter period of the year resulting in longer dry seasons (Vides-Almonacid et al., 2012). From our interviews with Chiquitano forest engineers, we noted that several communities were experiencing water shortages due to the longer dry seasons which furthermore were increased by deforestation and forest fires (Annex D). Adding to this studies from sites of the Bolivian Chiquitano dry forest showed that forest cover gave an additional purification and water availability of between 865 and 539 mm/year in the studied sites (Quintanilla, 2021a, 2021b). Water as an ecosystem service is dependent on the maintenance of forest cover to prevent degradation and ultimately degrees of desertification (Vides-Almonacid et al., 2012). The Chiquitano understands the importance of water and its relation to cultivation and forest conservation, as well as how the forest helps lower temperatures and retain water. They try not to damage the forest unnecessarily by e.g. maintaining manual labour which is more gentle to the environment according to our interviews with Chiquitano forest engineers (Annex E) showing their appreciation and valuation of water as an ecosystem service. However, the lack of mechanical labour could also stem from lack of capital to introduce heavy machinery. The continuation of manual labour and adaptation of biodiversity initiatives such as agroforestry and intercropping leads to labour trade-offs (e.i. physical burden, productivity, time consumption ect.). Whereas the introduction of labour-saving techniques would lead to certain trade-offs in relation to biodiversity such as soil erosion and crop diversity (Daum et al., 2023).

Another ecosystem service, in which the Chiquitano showed an interest, was biodiversity, understanding the link between the abundance of flora and fauna and a healthy forest and ecosystem. Adding to this, the sustaining of ecosystem services relies significantly on biodiversity, as diverse species make distinct contributions to various ecological processes essential for these services (Calvo-Rodriguez et al., 2017; Fangyuan et al., 2022; Quijas et al., 2019). Likewise, intact forests with their intricate network of interactions and biodiversity play a crucial role in providing essential services that bolster human well-being and livelihoods (Ibid). The potential of biodiversity as an ecosystem service for a PES scheme set in Monte Verde is supported by the increased global efforts and interest in specifically biodiversity loss in the last decades with international agreements such as the Kunming-Montreal Global Biodiversity Framework and recent COP28 commitments to halt and reverse deforestation by 2030 (Canopy, n.d.; CBD, n.d.) showing global political will to conserve the forests of the world and the biodiversity which it holds. This growing international interest is supported by the understanding of the economic value of biodiversity with the World Economic Forum (WEF) estimating that US\$ 44 trillion of global GDP is highly or moderately dependent on nature (Deutz, A. et al., 2020). A biodiversity-ecosystem service (BES) therefore has a high international demand due to the aforementioned agreements and a PES scheme focused on BES would therefore have a larger pool of users to choose from in contrast to PWS schemes that often operate on a regional or national level (N. Asquith, 2016; N. M. Asquith et al., 2008; F. N. Bolivia, 2019). Several of our interviewees also saw biodiversity as a possibility to attract payment mechanisms such as PES to Bolivia without challenging the critical stance of the government (Annex G & C).

For this reason, the PES value chain proposed in this study will have biodiversity as its main ecosystem service product.

The following will investigate the Chiquitano's inherent interest in providing an increase or protection of biodiversity and the relation between the Chiquitano and the surrounding natural environment.

As discussed in section 4.2 the Chiquitano people have a strong cultural and spiritual con-

nection with the forest believing that the "jichi" exists in every living being (APCOB, 2016). Furthermore, the Chiquitano rely on the natural resources from the forest in their way of living to ensure food, medicine and commercial goods. With this strong dependence on the forest, it is therefore indisputable that the degradation of the forests and its ecosystems would have a big impact on the Chiquitano both on their livelihood but also their cultural and spiritual relation with the forest (APCOB, 2016).

The understanding of this holistic relationship to nature is based on sources such as APCOB, 2016; Arrien, 2008; Arrien et al., 2014 and conducted interviews in this study (Annex D, E & F) that stem from indigenous people as well as anthropologists working as consultants for APCOB which could have a bias to frame the Chiquitano people in a certain way - most likely in a positive one. There are nevertheless other sources that confirm that Indigenous people are often the best caretakers of natural resources having similar rates of deforestation to protected areas despite not having the same conservation regulation (Colque Fernández, 2022; Müller et al., 2014; Annex A, C & H). This supports the case of the Chiquitanos as potential trustworthy providers

Certain factors could reduce the dependence on nature which has been a big part of the incitement to take care of the natural environment. These factors include the size of the communities, distance from infrastructure and bigger cities and part of the population living outside the territory. Communities with easier access to buying products from outside or finding employment in cities would have a lesser reliance on natural resources from the forest. As mentioned earlier in section 4.2 the majority of the Chiquitano population with affiliation to TIOC Monte Verde lives outside the TIOC. The implications of this distribution could be that the smaller population living inside the TIOC would have a heavier working load in providing the ecosystem service and monitoring thereby creating unfairly distributed ES provision efforts within the Chiquitano population of Monte Verde (Daum et al., 2023). Furthermore, the Chiquitano population consist of approximately 100.000 individuals spread over the Chiquitania region (APCOB, 2016; Colque Fernández, 2022). It is therefore uncertain whether every community and person have the same relation and connection to the forest that can be affected by consumerist lifestyle and capitalistic trends (Annex C & A). This is noted during our interview with FNB:

"Ese es un desafío grande para los Chiquitanos de Monte Verde. Cada vez ellos ven más cercano al modelo de desarrollo de las haciendas ganaderas de criollos y de menonitas. Entonces es un modelo muy tentador para seguir aunque los suelos de la Chiquitania no pueden sostenerse. Son suelos pobres. Aptos para la forestación."(Annex A)

The quote underlines how the Chiquitanos view on nature can be challenged by the tempting prosperity of nearby cattle ranches and affect traditional views on land-use and connectivity. Additionally, this view on nature is threatened by the increased proportions of non-indigenous people marrying into families and communities, which often do not share the same belief as the Chiquitano to protect the forest and see the nature more as a resource to be extracted (Annex D).

There can also be certain considerations that overrule the protection of the natural world and its fauna. An example of this, that we noted during our fieldwork, is the practice of killing jaguars if they kill the livestock of the Indigenous communities. Projects with local NGOs have however been able to change this practice in some communities by implementing initiatives to reduce human-wildlife interactions such as a hunting ban in dry periods, so that the jaguars have better feeding opportunities and are less likely to approach community livestock. Other initiatives have been to strengthen the knowledge and identification with local fauna such as the jaguar. An example of this is the community of Palmarito de

la Frontera which had previous high amounts of human-wildlife conflicts. Since 2022 they have cooperated with WWF Bolivia to learn to preserve and coexist with jaguars and other wildlife with great advancements (WWF, n.d.). This is also an example of how sustainable management practices can increase and protect local biodiversity.

An important factor to determining the probability of compliance is the provider's interest in providing an increase or protection of ecosystem service. There are other factors such as livelihood concerns, occurrence of corruption and monitoring frequency that can affect this aspect. These will not be elaborated further in this section, as it leads to an immense analysis that goes beyond the scope of this project, but it should be taken into account in the design of a PES scheme.

This analysis showcases the diverse and contrasting aspects of the Chiquitano people's relationship with nature. Empiric data through interviews and observations tell us that the Chiquitano have a fundamental dependence on the forest's natural resources and a low impact on nature. However, it is uncertain whether their cultural and spiritual connection with nature as well as their history in the region would result in full compliance in a PBES scheme as more factors should be investigated to fully understand the complexity of their situation. This uncertainty needs to be taken into account in the development of a PES scheme.

5.2.2 Users

The phase of identification of the providers and users includes an assessment of the demand for the service and whether it is economically valuable to potential users (Smith et al., 2013). However, this presents challenges in scenarios where biodiversity conservation is the primary ES, as pinpointing and charging the specific beneficiaries of this service proves challenging (Fedele et al., 2017; Pagiola et al., 2005; Quijas et al., 2019). This is due to the fact that the majority of biodiversity services are public and non-excludable goods meaning numerous individuals benefit from the BES simultaneously. This creates a significant motivation for free-riding on BES provision, leading to an overall tendency to underpay and fall short of the desired level of service provision (Wunder & Wertz-Kanounnikoff, 2009). This is in contrast to PWS where the recipients of clean water and flood protection are clear and localized, biodiversity beneficiaries are frequently dispersed, and the associated benefits are often indirect or intangible (Salzman et al., 2018). Unlike water utilities, there are no corresponding institutions capable of collecting fees on behalf of numerous beneficiaries, and establishing common metrics for assessment proves challenging (Salzman et al., 2018). These factors make targeting users of BES challenging compared to other ES (Wunder & Wertz-Kanounnikoff, 2009).

It has not been within the resources of this study to conduct a market analysis for ES and the following will therefore present some initial reflections.

Assessing an increasing global interest in biodiversity as mentioned in the selection of biodiversity as the main ES, we make the assumption that there would be an international market for BES from NGOs, private companies, international organisations and citizens. However, a more concrete proposal of a potential buyer could be international conservation organisations such as The Global Biodiversity Framework Fund (GBFF) (GEF, 2023) that could act as 'buyers' for users interested in investing in biodiversity (Wunder & Wertz-Kanounnikoff, 2009).

The GBFF aims to help countries achieve the Global Environment Facility's goals and targets with a strategic focus on strengthening national-level biodiversity management, planning, policy, governance, and finance approaches (GEF, 2023).

The funding to the GBFF will enhance support for biodiversity and Indigenous Peoples (Ibid). Likewise, conservation organisations could contribute to the development of a PES scheme and ensure payment on behalf of the beneficiaries of the BES if donors continue their funding. However, it is important to understand that certain kinds of international funding for conservation efforts could be ambiguous due to the focus on biodiversity offsetting in contrast to biodiversity conservation. Organisations such as WEF have planned a voluntary biodiversity credit market as a biodiversity offsetting function (WEF, n.d.). This kind of mitigation credits will let companies, agriculture and likewise continue to decrease biodiversity in one site while supporting biodiversity in another. These mechanisms can therefore be contrary to a PES scheme which focuses on conserving or increasing biodiversity on a global scale (Maron et al., 2015).

If a more direct link is preferred between the ES providers and the user, it is possible to establish a kind of package deal by selling certain conservation practices along with products opened for purchase. Products with a clear market value, such as shade-grown coffee, could be used as the marketing object of biodiversity (Wunder & Wertz-Kanounnikoff, 2009). The product becomes a payment vehicle, where consumers then pay for the ES as a “green premium” on top of the price of the product (Bishop & Pagiola, 2012). APCOB, FNB, FAN and FSC Bolivia have some initial investigations and projects with these types of incentives in areas of the Chiquitano region and Monte Verde using both non-timber products such as coffee, copaibo products and honey and timber products receiving an ecosystem service certification as payment vehicles (Annex A & C).

5.2.3 Intermediaries

There are often intermediaries involved in PES schemes bridging potential gaps between providers and users and facilitating the development of the schemes (Smith et al., 2013). According to the specific needs, they can have different functions such as technical and capacity assistance to providers and facilitating contact between providers and users. However, some of the more successful PES schemes have concluded that trust-building through an intermediary institution was an essential factor to success (Everard, 2022; Smith et al., 2013).

During our fieldwork, we have observed the same necessity in the case of Monte Verde as their contact with outsiders has not always been positive or productive for them. Therefore, a crucial attribute of an intermediary organisation is to build trust with the communities e.g. by spending time with them, understanding their needs, assisting with issues unrelated to the specific project, and delivering on promises (Own observations & Brouwer et al., 2011). According to this, we recommend that an NGO which already has a connection with the Chiquitano communities and has gained their trust through cooperation and multiple projects could act as an intermediary between providers and users of the provided BES.

However local or regional institutional agencies could also act as intermediaries due to their mandate from the government. Governmental agencies could bridge the gap between the Chiquitano central organisations and the international market or community by facilitating the development and implementation of PES schemes. This intermediary role could be taken by 'The Authority for Supervision and Social Control of Forests and Land' (Autoridad de Fiscalización y Control Social de Bosques y Tierra - ABT) which already works in the region and knows the area (ABT, n.d.). ABT is a governmental entity responsible for monitoring and regulating various activities related to the management of forests and land in Bolivia (ABT, n.d.). ABT possesses the institutional capacity to monitor and enforce compliance with agricultural and forest legislation.

"The operational units of ABT allocate, monitor, and control usage rights for forests and land in their areas" (ABT, n.d.).

Some of its primary functions include: Controlling forest operations and sustainable management of forest resources in Bolivia; regulating and monitoring land ownership to ensure that agricultural and livestock activities develop sustainably and respect property rights; preventing and controlling forest fires, especially in areas prone to such events; promotion of the conservation of biodiversity and forest ecosystems by advocating for sustainable management and protection of areas with high ecological value; combating deforestation and illegal logging by implementing control measures and sanctions against those violating environmental laws; and lastly promote the sustainable use of natural resources and ensure that economic development aligns with environmental protection (ABT, n.d.). These tasks indicate that ABT has an interest in the sustainable management of natural resources and the conservation of forest ecosystems and biodiversity. However, as shown in the figure 1 there has been an increase in deforestation surrounding Monte Verde so it is questionable what ABT's definition of "sustainable management" means and how they act to prevent the increase of deforestation in the future. Müller et al., 2014 also point to ABT as being a 'weak institution' underlining their low capacity and funds to actually investigate and monitor (Annex G).

Furthermore, ABT works as the government enforcer and therefore is obligated to act out the government's political agenda. As the political situation is volatile in relation to shifts in the ruling political party's agenda it is relevant to take into account whether ABT can function as a stable and trustworthy intermediary for the development of a PES scheme when the political will for forest and biodiversity conservation can change.

Conclusively our analysis of possible operators in a PES value chain leads us to recommend of a PES scheme where the Chiquitano are the providers of a biodiversity ecosystem service (See figure 4). Possible users are international citizens and conservation organisations, however, this would need to be investigated further in the elaboration of an actual PES scheme. Lastly, several considerations concerning intermediaries lead us to recommend organisations of confidence with the Chiquitanos such as local NGOs or institutional agencies.

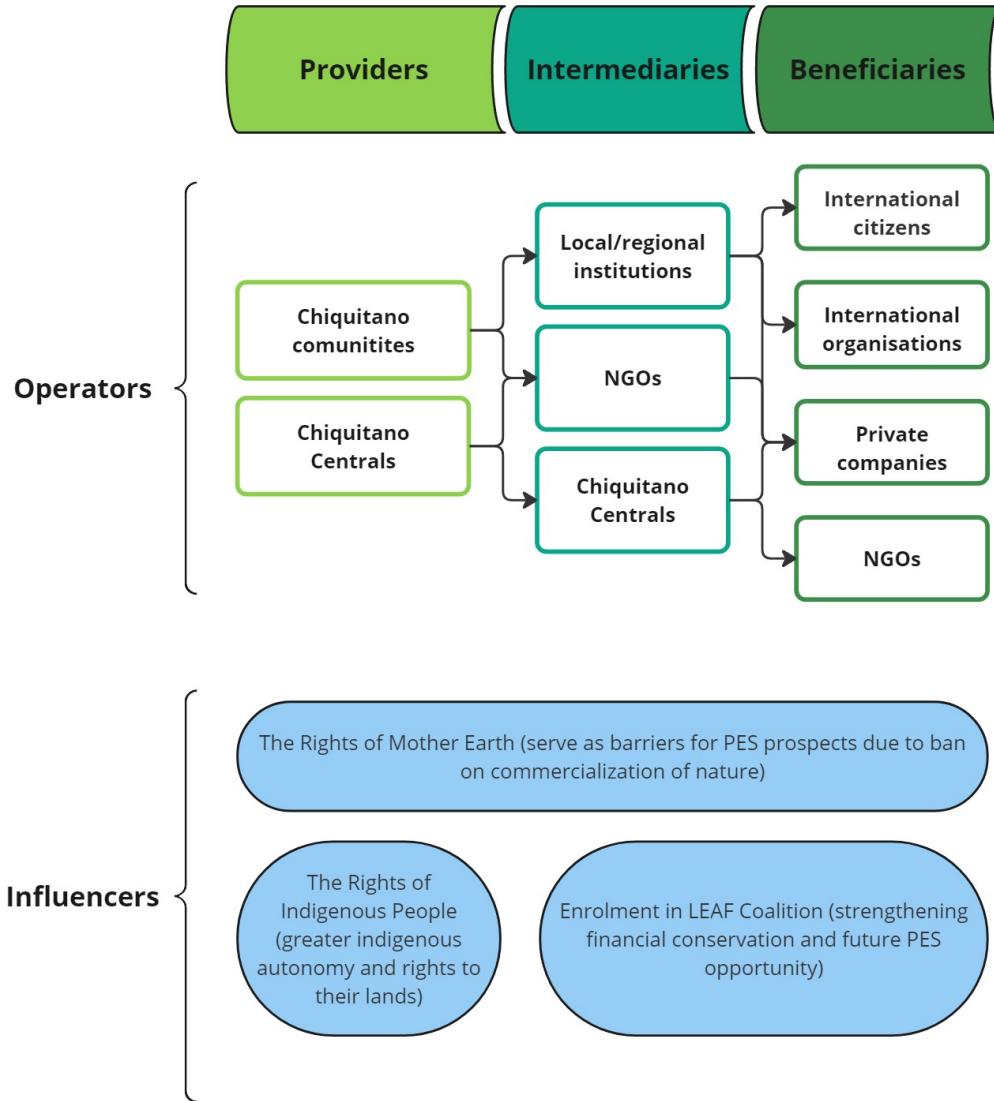


Figure 4: Preliminary value chain of a biodiversity PES scheme in Monte Verde (Own production, 2024).

5.3 Design features of PES in Monte Verde

The section will reflect upon key design aspects of a possible Monte Verde PES scheme, drawing upon the theoretical framework of PES and the experiences and critics it has awakened from section 3, the contextual situation of Monte Verde as described in section 4 and the value chain analysis from the previous sections.

As illustrated in figure 4, the proposed scheme will be based on a biodiversity-ecosystem service being provided by the Chiquitano communities of Monte Verde to international users, e.g. through conservation organisations.

Type of PES scheme

When choosing an international market, the scheme is designed to be a user-financed scheme, where the international user (citizen, organisation or country) is contracting directly with

Chiquitano BES providers (potentially through an intermediary organisation facilitating contact). Due to the sceptical political position of the Bolivian government towards PES and the financially challenging situation, it is not considered likely that a government or user/government-payment scheme would be possible at the moment (as described in section 3.3). In the PWS created by FNB, subnational units such as governing organs of cities or towns have participated in the funding. However, as noted previously, the beneficiaries of watershed services are more easily defined than those of biodiversity services, which is why this funding option seems less likely for a biodiversity scheme. A user-financed scheme has been found to be more effective in considering local circumstances in the design of the scheme (Wunder et al., 2008). Because of the complex stakeholder landscape in Monte Verde, it is essential to incorporate the local context in PES scheme development.

Scale of PES scheme

Due to the factors listed above, the spatial scale of the scheme would address the international market for user funding rather than national and local users. This could potentially decrease the chances of success as it requires more intermediaries due to the distance between providers and users, which could dilute the payment by increasing transaction cost and lessen the effect of the monetary incentive (Brouwer et al., 2011). However, it may increase funding options, which possibly outweighs the negative impact of the distance-linkage between actors. These considerations emphasise how the development of a plausible PES scheme would require careful analysis of intermediaries to select the ideal amount of them and which possible intermediaries to use.

Configuration of users and providers

The configuration of users and providers could take varying forms depending on the user design. Addressing the communities of Monte Verde as one unit would create possibilities for entering a contract with a large company or organisation, which would become the sole buyer forming a sponsor-like relationship between Monte Verde and the buyer (one-to-one). Another option would be for several buyers to fund the provision of BES in Monte Verde (many-to-one). It would be difficult to use a one-to-many or many-to-many configuration, where the communities or central organisations would be viewed as individual providers. Due to the nature of BES, it would be problematic to separate Monte Verde as a unit, as it can be hard to distinguish the impacts of one community's actions from those undertaken on neighbouring communities (Wunder et al., 2008). The participation of all communities of Monte Verde can also have a positive effect on the environmental outcome and facilitate compliance due to social norm reinforcement (Brouwer et al., 2011). However, another important aspect for scheme success is the voluntary character of the participation, which could be limited if the entire territory is included as it may result in larger groups being unwillingly subject to the scheme because of a deciding majority (Sattler et al., 2013).

Payment model

Another important question in the payment model is whether the payment should be conditional upon an amount of delivered service (output-based) or an implemented land practice estimated to deliver the service (input-based). Many PES schemes, including the FNB PWS, are input-based as this gives higher security for the providers, who are not able to control all factors affecting the ecosystem service (e.g. naturally occurring forest fires) (Smith et al., 2013, Annex A). In the case of FNB, they calculate the payment as a function of inputs: the amount of land reserved for conservation, the time this will be dedicated to conservation and the amounts of families in the community providing the ecosystem service (Annex A). Paying for input complicates the question of additionality, as it becomes harder to prove

that the payments are creating an increase or additional protection of the ES (Wunder et al., 2018). This is generally a point where the conceptual idea of PES crashes with the reality of the world (Smith et al., 2013). Based on these arguments, we recommend an input-based payment approach in a PES scheme set in Monte Verde.

Payment packaging

Of the many ecosystem services present in Monte Verde, biodiversity was deemed most suitable in a PES scheme in the previous analysis. However, there will possibly be an increase in other ecosystem services as well, when conservation efforts for biodiversity are made. These ecosystem services could potentially be packaged in the form of 'bundling', being sold as a package of ES or 'piggy-backing' where solely the BES is paid for (as explained in section 3.5).

Due to the intangible nature of biodiversity, it could be advantageous to bundle it with a more tangible ecosystem service such as carbon or water (Wunder & Wertz-Kanounnikoff, 2009). The layered packaging, where the ecosystem services are paid for separately, is not commonly used and would also be complicated to execute in the case of Monte Verde, as it would make the scheme unnecessarily complex in terms of estimating the values of the layered ES and encountering different users (Smith et al., 2013). Which of these packaging options to use will depend on the final design and number of buyers. We recommend bundling several ES with biodiversity to make the provision more valuable but not too complex.

Payment method

In terms of payment method, the payment of the BES provision can be delivered in cash or as an in-kind payment (paying with a good instead of cash). In the case of the PWS created by FNB, the communities can choose between several packages that are targeted at different threats such as cattle ranching, deforestation, or wasteful usage of the water resource (Annex A). Once the value has been determined, they negotiate which in-kind payment package will be most useful for the community. In our interview with FNB, they elaborate on their choice of in-kind payment and specific packages:

"No les damos hospitales, no les damos escuelas. Hemos hecho ese experimento, te cuento: Elijan lo que quieran. Nos pidieron iglesia, nos pidieron cementerio. Bancos. Nos pidieron la plaza. Y ahí nos pusimos a pensar en qué medida va a sumar esto. Bueno, es una cuestión de ahí. Hemos hecho algunos experimentos. Pero no hemos dado efectivo, para nada (Ibid)."

In their experiments with the contents of the in-kind payment packages, they asked the participating communities to choose freely but were startled at the request that included churches, cemeteries, banks and public squares, as they were not sure how much those would contribute to their livelihoods and development (Ibid).

FNB prefer using what they consider more useful in-kind payments that can possibly increase providers' productivity and subsistence e.g. beehives, fruit tree seedlings and irrigation tubes along with capacity building on how to use them (N. Asquith, 2016). As an argument, FNB points to the fact that in order to make their PWS economically sustainable, they will never be able to fully compensate the providers for the opportunity cost related to dedicating land to conservation. For this reason, it is important for FNB to choose initiatives that have the potential to create long-lasting economic benefits for the providers and possibly enforce intrinsic motivation for conservation in the absence of stronger economic motivation (Annex A).

An evaluation of in-kind payments in an FNB PWS scheme from 2008 similarly found that some providers also preferred in-kind payments with the argument that cash would be

spent fast and these initiatives (beehives in the evaluated study) would give a long-lasting income source (N. M. Asquith et al., 2008). Moreover, a large meta-study of PES in Latin America addresses how in-kind payment increases the distribution of benefits to whole communities rather than individuals due to its inherent indivisible nature (Grima et al., 2016). The same study points to how institutional weakness in several Latin American countries can enforce the risk of unfair distribution of cash payment and the development of corrupt practices (Ibid).

Mimicking these considerations and applying it to the case of Monte Verde and the Chiquitano region, product-and-BES packages could strengthen communities livelihoods and subsistence by focusing on non-timber forest products such as coffee, Chiquitano almonds, açai, honey and other products that have an established economic value (Annex A).

In our workshop on preliminary findings of our fieldwork with the technical team of APCOB Concepción, these subjects were discussed, and a member of the team pointed to the patronising aspect of in-kind payments. The member furthermore underlined that the communities were seeking real capital that would enable them to further participate in a market-based society. At the moment, Chiquitano inhabitants of far-away communities depend heavily on the presence of NGOs and few private transport vehicles to reach markets to sell their products, buy medicine or education beyond the elementary or high school level (APCOB technical staff, personal communication, 2023). Receiving cash payments to extend their physical capital, in the form of motorbikes, cars, etc. allows the Chiquitano communities to be less dependent on outsiders for transportation and selling of their products.

The final transaction design could contain a combination of in-kind and cash payment, both stimulating conservation efforts through an economic incentive and providing an alternative income source with either low or possibly even positive impact on conservation (Montero-de-Oliveira et al., 2023). Deciding the final transaction design would also require that the preference of the Chiquitano communities of Monte Verde be studied further. A suggestion to find the optimal solution for a transaction design for Chiquitano would be to interview a focus group to investigate their wishes in relation to payment. However, based on the weak institutional capacity and cases of corruption in the territory, an initial recommendation would be to use in-kind payments that are of value to the communities in combination with cash (Arrien et al., 2014, Annex C).

Payment duration

Another aspect of payment design is whether to pay the communities through a one-off payment or a continuous payment scheme. There are several aspects to this such as the similarity to an employer-employee relationship. As discussed in section 3.6 there have been cases, where PES schemes have negatively affected Indigenous' inherent conservation motivations by imposing a view of nature adherent to this employer-employee structure (Ravikumar et al., 2023). FNB has consciously tried to avoid this structure and instead stimulate the participants' intrinsic motivation for conservation by using one-off in-kind payments (Annex A). Avoiding an employer-employee structure can nevertheless result in a factual smaller payment to the providers and a distance to the conceptual principle of granting the providers a payment equivalent to the value of the ES they are providing. A continuous payment could also be more efficient in actually improving livelihoods and thereby relieving the economic pressure that in some cases can be the driver of unsustainable resource management practices even among groups that are traditionally sustainable stewards of nature. A product-based scheme layering biodiversity with payment vehicles such as coffee could prove a viable option to provide a continuous and just economic incentive.

Conclusively, these reflections lead us to recommend an international user-financed scheme

using the payment configuration of addressing Monte Verde as one unit selling its biodiversity-ecosystem service to one or several buyers. The payments should be contingent on input and bundle the biodiversity service with several other ecosystem services, using a combination of a one-off in-kind and continuous cash payment as the payment method. Further research would be needed to determine the input (intervention) from providers, which in-kind payment that would be most desirable and suitable for the communities in Monte Verde and the amount and duration of both in-kind and continuous cash payments.

6 Discussion

The initial analysis of ecosystem services (ES) in the Chiquitano dry forests, along with an understanding of the local appreciation of these services by the Chiquitano people, and an exploration of political limitations related to certain ES, formed the basis of our preliminary ES analysis. Subsequently, we identified water and biodiversity as the most relevant ES for a potential Payments for Ecosystem Services (PES) scheme.

The geographical, demographic, and biophysical elements of the Chiquitano dry forest were thoroughly examined to better comprehend the ecological and societal systems that a PES scheme would impact.

In our investigation of ecosystem services related to the Chiquitano dry forest, we uncovered various provisioning, supporting, regulating, and cultural services. However, these findings were based on ecosystem service mapping conducted in the southeast region of the Chiquitano dry forest (Quintanilla, 2021a, 2021b). It is essential to map the ecosystem services specific to Monte Verde to ensure accurate targeting and inclusion of potential bundled ecosystem services. Additionally, such mapping could unveil specific scarce ecosystem services in the Monte Verde region, potentially increasing the market desirability of these services (Salzman et al., 2018). While we selected water and biodiversity based on Chiquitano conservation preferences, further research is needed to confirm their representativeness for the entire Monte Verde community. Establishing a focus group in the case of a PES scheme would provide more comprehensive insights into the preferred ecosystem services of the Monte Verde communities.

Our choice of water and biodiversity as potential ecosystem services was influenced by the Chiquitano conservation preferences, the broader political considerations, and the increasing international interests in especially biodiversity (CBD, n.d.; MMAyA, 2022). Protection of biodiversity will entail conservation of forest - especially if the ES provisions of the PES scheme are bundled so that ES such as carbon and water are included. Depending of the type of chosen input/output design forest cover is an essential factor for carbon sequestration, water quality and biodiversity conservation (Nunez et al., 2020). There are cases where increasing biodiversity (such as abstaining from killing jaguars who have killed livestock) does not include conserving forest, however, decreasing forest cover will always affect biodiversity as lack of habitat is a serious disturbance to ecosystem well-being.

However, a market analysis to investigate regional or international interests in PES financing for selected ecosystem services is lacking. Therefore, it is recommended that an eventual PES scheme should consider mapping the global market for potential investors or ecosystem service users, aligning with the increasing global interest in forest conservation and biodiversity protection.

While our study primarily focused on analyzing the Chiquitano people's way of life, values, culture, and spirituality to gauge potential compliance and stability as ES providers in a PES scheme, it failed to adequately address potential impacts on their way of life. Neglecting the potential influences of a PES scheme on Chiquitano conservation efforts, as seen in Peru, could lead to unintended consequences (Ravikumar et al., 2023). Our study examined the Chiquitano people's present style of living with the forest as a harmonious co-existence, showing a cultural and spiritual connection with nature. However, we only conducted a few interviews and several of our sources were more than 10 years old, and due to the dynamic nature of people and cultures, a bigger investigation could have taken place addressing the impact of globalisation, capitalistic pressure etc. on their way of living. Adapting the design of PES to correspond with Indigenous peoples' values and concepts leads to bigger engagement of participants and identification of specific conservation roles in their respective communities (Lliso et al., 2020). Furthermore, the transaction designs

should focus on the reciprocal and dynamic connections between humans and the environment, where they mutually 'serve' each other. Although this approach might render certain PES scheme advantages less appealing to users, it is crucial to endorse these benefits. The vital role the designs play in maintaining the well-being of Indigenous cultures and their land, reflects a shared responsibility for environmental sustainability, both presently and in the future. Adaptation of these factors would prevent PES from being perceived as a capitalistic-coloniser tool to commercialize nature which contradicts the perception and values of Chiquitano on nature (APCOB, 2016; Lliso et al., 2020). Furthermore, prioritizing indigenous sovereignty and self-determination during program implementation has played a significant role in generating wide socio-environmental benefits (Denham, 2017). Failing to acknowledge the unique Chiquitano circumstance would potentially lead to widespread non-compliance or even rejection of a PES scheme as seen with REDD+ in Latin America by Indigenous peoples (Lliso et al., 2020). Future studies should consider a more comprehensive examination of the social sustainability of Indigenous people and the potential alterations in their conservation efforts due to PES schemes.

Our analysis of the enabling environment revealed a complex political landscape in Bolivia, with laws both protecting nature and encouraging agricultural expansion (Müller et al., 2014). The contradiction in legislation, along with Bolivia's historical opposition to certain PES schemes, necessitates a cautious approach to navigating the enabling environment. Our study suggested that a PES scheme in Monte Verde could be feasible, albeit with limitations and the need to avoid carbon-related PES or offsetting mechanisms. However, it is important to acknowledge our potential biases in the analysis and the very real challenges in implementing a PES scheme in the context of Bolivia's political and legislative dynamics.

Additionally, our study did not adequately address the issue of leakage in relation to the protection and conservation of forests in Monte Verde. The potential leakage of deforestation to surrounding areas poses a significant challenge that must be considered in the development of a successful PES scheme. Future studies should carefully evaluate the broader impacts of PES interventions, addressing potential leakage issues and ensuring a comprehensive understanding of the environmental and social achievements of such schemes.

Finally, the methodological limitations of our study, including the small sample size in interviews with Chiquitano individuals and the lack of anthropological expertise, call for a more robust approach to data collection and analysis in future investigations. Conducting focus groups in Monte Verde communities and engaging in a more in-depth exploration of values, preferences, and human-nature relationships is recommended for a more comprehensive understanding of the potential success and challenges of a PES scheme in the region.

This case study had the objective of designing a preliminary PES scheme for Monte Verde, Bolivia. However, the findings in this study should be considered starting points or initial recommendations for further investigation in the case of the development of a PES scheme.

7 Conclusion

In conclusion, this research has delved into the use of PES as a tool for forest conservation in Bolivia, shedding light on the challenges and prospects of applying the conceptual framework and PES experiences to the real-world case of Monte Verde. The study began by making a case study of the Indigenous territory of Monte Verde to understand both the Chiquitano Indigenous people as stewards of nature as well as the complex forest biome and the ecosystem services that characterise the territory. Through literature, observations, and

semi-structured interviews we gained a comprehension of the Chiquitano people and their holistic bond with the natural environment that is under pressure from outside settlers, consumerist ideals and integration of outsiders into the communities through marriages. We also gained an understanding of the Chiquitano dry forest which is a highly biodiverse biome providing numerous ecosystem services though it is diminishing quickly due to expansion of the agricultural sector. This reduction in forest cover has also reached Monte Verde which has had an increase in deforestation and forest fires in recent years.

Secondly, we constructed a value chain framework of a preliminary PES scheme in Monte Verde and analysed potential operators within the VC. The analysis contained an examination of the enabling environment for a PES scheme, exploring relevant legislative frameworks and the political position on PES in Bolivia to determine the viability of a PES scheme in Monte Verde. It was found that the current legislation and political position demote the prospect of PES, especially the laws on Mother Earth and the critical position of the Bolivian government on PES. However, It was noted that creating a PES in Monte Verde could be possible if certain factors were avoided, such as carbon offsetting.

Additionally, we assessed the relevant ecosystem services and operators of a PES value chain set in Monte Verde. We found that a PES scheme building on the findings from the case study and the enabling environment, could have the Chiquitano people of Monte Verde as providers of a biodiversity-ecosystem service to international users. Further exploration indicated that an NGO or a regional or national institution could serve as an intermediary organisation to facilitate trust and administration of the scheme.

Lastly, a preliminary design was explored by reflecting on key design aspects such as PES type, scale and payment configuration. The reflections led us to recommend an international user-financed scheme using the payment configuration of addressing Monte Verde as one unit selling its biodiversity-ecosystem service to one or several buyers. The payments should be contingent on input and bundle the biodiversity service with several other ecosystem services, using in-kind payment as the payment method.

The findings are preliminary and should only serve as a starting point for further research on how a PES scheme could look in Monte Verde. However, they underscore the complexities that must be considered when using PES for forest conservation in an Indigenous territory such as Monte Verde. In this regard, our initial recommendations for future research regarding a PES scheme set in Monte Verde should be: a) map the factual provision of ecosystem services in Monte Verde; b) carry out focus group interviews with Monte Verde communities to explore their ES and payment preference; c) conduct a market analysis to determine which ecosystem service has the highest demand and its potential buyers; and lastly d) make a thorough risk assessment to understand possible risks of a PES scheme in Monte Verde. Following these recommendations would increase the success chance of a potential PES scheme and consider the interests and values of the Chiquitano people.

However, it is essential that PES should not be perceived as a stand-alone solution or as a 'silver bullet' to solve deforestation and biodiversity loss but it is nonetheless, under the right conditions, a potential tool in forest conservation. In our preliminary analysis there are both conditions that demote and promote the potential of PES. We can therefore not conclude at this point, whether the right conditions are present in Monte Verde. The analysis nevertheless emphasizes the intricate considerations needed when creating PES schemes in Indigenous territories and underscores the importance of aligning conservation efforts with local values and interests.

Literature

- ABT. (n.d.). *La autoridad de fiscalización y control social de bosques y tierra* [La autoridad de fiscalización y control social de bosques y tierra]. Retrieved January 9, 2024, from <https://www.abt.gob.bo/>
- Albers, H., Lee, K., & Robinson, E. (2018). Economics of reducing emissions from deforestation and forest degradation: Incentives to change forest use behavior. In *Encyclopedia of the anthropocene* (pp. 61–65). Elsevier. <https://doi.org/10.1016/B978-0-12-809665-9.09764-0>
- APCOB. (2016). “ya no queda nada, el jichi se ha ido”: Cosmovisión, conocimientos y prácticas del pueblo chiquitano en relación al cambio climático.
- Arrien, M. (2008). *Sistemas de subsistencia y cosmovisión de los chiquitanos*. Santa Cruz de la Sierra, Bolivia.
- Arrien, M., Rosso, C., & Fernández, E. (2014). *Diagnóstico integral e identificación de los nuevos escenarios futuros en el territorio indígena monte verde (chiquitanos)*. APCOB. Santa Cruz de la Sierra, Bolivia. https://www.academia.edu/33783799/Diagn%C3%B3stico_integral_e_identificaci%C3%B3n_de_los_nuevos_escenarios_futuros_en_el_territorio_ind%C3%ADgena_Monte_Verde_Chiquitanos_?fbclid=IwAR3zvOgDBllrZxx6VN1H125owo7QBV2kmxZxwpCER1GjzgouzM-XW4F-ch4
- Asquith, N. (2016). *Watershared: Adaptation, mitigation, watershed protection and economic development in latin america*. Fundación Natura Bolivia. <https://www.naturabolivia.org/wp-content/uploads/2020/08/CDKN-Bolivia-watershared.pdf>
- Asquith, N. M., Vargas, M. T., & Wunder, S. (2008). Selling two environmental services: In-kind payments for bird habitat and watershed protection in los negros, bolivia. *Ecological Economics*, 65(4), 675–684. <https://doi.org/10.1016/j.ecolecon.2007.12.014>
- Augsburger, A., & Haber, P. (2018). Constructing indigenous autonomy in plurinational bolivia: Possibilities and ambiguities. *Latin American Perspectives*, 45(6), 53–67. <https://doi.org/10.1177/0094582X18791970>
- Bauchet, J., Asquith, N., Ma, Z., Radel, C., Godoy, R., Zanotti, L., Steele, D., Gramig, B. M., & Chong, A. E. (2020). The practice of payments for ecosystem services (PES) in the tropical andes: Evidence from program administrators. *Ecosystem Services*, 45, 101175. <https://doi.org/10.1016/j.ecoser.2020.101175>
- Bhadouria, R. (Ed.). (2020). *Handbook of research on the conservation and restoration of tropical dry forests*. Engineering Science Reference.
- Bishop, J., & Pagiola, S. (Eds.). (2012, April 27). *Selling forest environmental services* (0th ed.). Routledge. <https://doi.org/10.4324/9781849772501>
- Blakeslee, S. (2004). The CRAAP test. *LOEX Quarterly*, 31(3). <https://commons.emich.edu/loexquarterly/vol31/iss3/4>
- Ley N° 1715 del Servicio Nacional de Reforma Agraria (1996, October 18). https://www.tribunalagroambiental.bo/wp-content/uploads/2021/01/ley_1715gaceta.pdf
- Ley N° 071 Derechos de la Madre Tierra (2010, December 10). <http://www.planificacion.gob.bo/uploads/marco-legal/Ley%20N%C2%B0%20071%20DERECHOS%20DE%20LA%20MADRE%20TIERRA.pdf>
- Bolivia, F. N. (2019). *Establecer acuerdos recíprocos por agua*. Retrieved January 13, 2024, from <https://www.naturabolivia.org/acuerdos-reciproc-os-agua/>
- Bottazzi, P., Wiik, E., Crespo, D., & Jones, J. P. (2018). Payment for environmental “self-service”: Exploring the links between farmers’ motivation and additionality in a conservation incentive programme in the bolivian andes. *Ecological Economics*, 150, 11–23. <https://doi.org/10.1016/j.ecolecon.2018.03.032>
- Brinkmann, S., Kvale, S., & Flick, U. (2018). *Doing interviews* (Second edition) [OCLC: ocn994533578]. SAGE.

- Brouwer, R., Tesfaye, A., & Pauw, P. (2011). Meta-analysis of institutional-economic factors explaining the environmental performance of payments for watershed services. *Environmental Conservation*, 38(4), 380–392. <https://doi.org/10.1017/S0376892911000543>
- Calvo-Rodriguez, S., Sanchez-Azofeifa, A. G., Duran, S. M., & Espírito-Santo, M. M. (2017). Assessing ecosystem services in neotropical dry forests: A systematic review. *Environmental Conservation*, 44(1), 34–43. <https://doi.org/10.1017/S0376892916000400>
- Cameron, J., & Plata, W. (2023). Indigenous autonomy in bolivia: From great expectations to faded dreams. In *Indigenous territorial autonomy and self-government in the diverse americas*. University of Calgary Press. <https://doi.org/10.2307/jj.4163716>
- Canopy, G. (n.d.). *For the first time halting and reversing deforestation makes it into the final text of a COP deal* [Global canopy: Insights]. Retrieved December 28, 2023, from <https://globalcanopy.org/insights/insight/for-the-first-time-halting-and-reversing-deforestation-makes-it-into-the-final-text-of-a-cop-deal/>
- Carrilho, C. D., Demarchi, G., Duchelle, A. E., Wunder, S., & Morsello, C. (2022). Permanence of avoided deforestation in a transamazon REDD+ project (pará, brazil). *Ecological Economics*, 201, 107568. <https://doi.org/10.1016/j.ecolecon.2022.107568>
- CBD. (n.d.). *Kunming-montreal global biodiversity framework* [The biodiversity plan for life on earth]. Retrieved December 28, 2023, from <https://www.cbd.int/gbf/>
- CEJIS. (2015, April 30). *El Territorio Indígena de Monte Verde*. Retrieved December 8, 2023, from <https://www.cejis.sinnerrsite.com/noticias/el-territorio-indigena-de-monte-verde/>
- Chumacero R., J. P. (2011). *Informe 2010: Territorios indígena originario campesinos en bolivia entre la loma santa y la pachamama* [OCLC: ocn781687599]. Fundación TIERRA. <https://ftierra.org/index.php/publicacion/libro/attachment/2/52>
- Colque Fernández, G. (2022). *Deforestación 2016-2021: El pragmatismo irresponsable de la "agenda patriótica 2025"* (Primera edición). TIERRA.
- Corbera, E., Soberanis, C. G., & Brown, K. (2009). Institutional dimensions of payments for ecosystem services: An analysis of mexico's carbon forestry programme. *Ecological Economics*, 68(3), 743–761. <https://doi.org/10.1016/j.ecolecon.2008.06.008>
- Daum, T., Baudron, F., Birner, R., Qaim, M., & Grass, I. (2023). Addressing agricultural labour issues is key to biodiversity-smart farming. *Biological Conservation*, 284, 110165. <https://doi.org/10.1016/j.biocon.2023.110165>
- Dempsey, J. (2016). *Enterprising nature: Economics, markets, and finance in global biodiversity politics* (1st ed.). John Wiley & Sons, Ltd.
- Denham, D. (2017). Community forest owners evaluate a decade of payments for ecosystem services in the mexican cloud forest: The importance of attention to indigenous sovereignty in conservation. *Society & Natural Resources*, 30(9), 1064–1079. <https://doi.org/10.1080/08941920.2017.1295495>
- Deutz, A., Heal, G. M., Niu, R., Swanson, E., Townshend, T., Zhu, L., Delmar, A., Meghji, A., Sethi, S. A., & Tobinde la Puente, J. (2020). *Financing nature: Closing the global biodiversity financing gap*. The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability.
- Doyle, M. (2021). The paths to autonomy: Plurinational reform and indigenous governance in contemporary bolivia. *Latin American and Caribbean Ethnic Studies*, 16(4), 352–373. <https://doi.org/10.1080/17442222.2020.1821444>
- Engel, S., Pagiola, S., & Wunder, S. (2008). Designing payments for environmental services in theory and practice: An overview of the issues. *Ecological Economics*, 65(4), 663–674. <https://doi.org/10.1016/j.ecolecon.2008.03.011>
- Everard, M. (2022). *Ecosystem services: Key issues* (2nd ed.). Routledge.

- Everard, M., & McInnes, R. (2013). Systemic solutions for multi-benefit water and environmental management. *Science of The Total Environment*, 461-462, 170–179. <https://doi.org/10.1016/j.scitotenv.2013.05.010>
- Ezzine-de-Blas, D., Wunder, S., Ruiz-Pérez, M., & Moreno-Sanchez, R. D. P. (2016). Global patterns in the implementation of payments for environmental services (A. García-Gallego, Ed.). *PLOS ONE*, 11(3), e0149847. <https://doi.org/10.1371/journal.pone.0149847>
- Fa, J. E., Watson, J. E., Leiper, I., Potapov, P., Evans, T. D., Burgess, N. D., Molnár, Z., Fernández-Llamazares, Á., Duncan, T., Wang, S., Austin, B. J., Jonas, H., Robinson, C. J., Malmer, P., Zander, K. K., Jackson, M. V., Ellis, E., Brondizio, E. S., & Garnett, S. T. (2020). Importance of indigenous peoples’ lands for the conservation of intact forest landscapes. *Frontiers in Ecology and the Environment*, 18(3), 135–140. <https://doi.org/10.1002/fee.2148>
- Fangyuan, H., Bruijnzeel, L. A., Meli, P., Martin, P. A., Zhang, J., Nakagawa, S., Miao, X., Wang, W., McEvoy, C., Peña-Arancibia, J. L., Brancalion, P. H. S., Smith, P., Edwards, D. P., & Balmford, A. (2022). The biodiversity and ecosystem service contributions and trade-offs of forest restoration approaches. *Science*, 376(6595), 839–844. <https://doi.org/10.1126/science.abl4649>
- Fedele, G., Locatelli, B., & Djoudi, H. (2017). Mechanisms mediating the contribution of ecosystem services to human well-being and resilience. *Ecosystem Services*, 28, 43–54. <https://doi.org/10.1016/j.ecoser.2017.09.011>
- Filewod, B., & McCarney, G. (2023). Avoiding carbon leakage from nature-based offsets by design. *One Earth*, 6(7), 790–802. <https://doi.org/10.1016/j.oneear.2023.05.024>
- GCFTF. (2023). *Bolivia’s bold step: Unveiling the world’s largest REDD+ project for sustainable forest management* [Governor’s climate and forests task force]. <https://www.gcftf.org/bolivia-jredd/>
- GEF. (2023, August 4). *Global biodiversity framework fund* [Global environment facility]. Retrieved January 14, 2024, from <https://www.thegef.org/what-we-do/topics/global-biodiversity-framework-fund>
- Greenfield, P. (2023a). The ‘carbon pirates’ preying on amazon’s indigenous communities. *The Guardian*. <https://www.theguardian.com/environment/2023/jan/21/amazon-indigenous-communities-carbon-offsetting-pirates-aoe>
- Greenfield, P. (2023b). Revealed: More than 90% of rainforest carbon offsets by biggest certifier are worthless, analysis shows. *The Guardian*. <https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe>
- Grima, N., Singh, S. J., Smetschka, B., & Ringhofer, L. (2016). Payment for ecosystem services (PES) in latin america: Analysing the performance of 40 case studies. *Ecosystem Services*, 17, 24–32. <https://doi.org/10.1016/j.ecoser.2015.11.010>
- Jack, B. K., & Cardona Santos, E. (2017). The leakage and livelihood impacts of PES contracts: A targeting experiment in malawi. *Land Use Policy*, 63, 645–658. <https://doi.org/10.1016/j.landusepol.2016.03.028>
- Jayathilake, H. M., Prescott, G. W., Carrasco, L. R., Rao, M., & Symes, W. S. (2021). Drivers of deforestation and degradation for 28 tropical conservation landscapes. *Ambio*, 50(1), 215–228. <https://doi.org/10.1007/s13280-020-01325-9>
- Konig, G., Da Silva, C. A., & Mhlanga, N. (2013). *Enabling environments for agribusiness and agro-industries development: Regional and country perspectives*. Food; Agriculture Organization of the United Nations.
- Krause, T., & Nielsen, M. R. (2019). Not seeing the forest for the trees: The oversight of defaunation in REDD+ and global forest governance. *Forests*, 10(4), 344. <https://doi.org/10.3390/f10040344>

- LEAF. (2023). Bolivia and colombian department of chocó receive green light on LEAF coalition proposals as new window for submissions opens. <https://resources.leafcoalition.org/wp-content/uploads/2023/04/Upd-LEAF-announcement-April-2023-1-1.pdf>
- Lliso, B., Pascual, U., Engel, S., & Mariel, P. (2020). Payments for ecosystem services or collective stewardship of mother earth? applying deliberative valuation in an indigenous community in colombia. *Ecological Economics*, 169, 106499. <https://doi.org/10.1016/j.ecolecon.2019.106499>
- MA. (2005). *Ecosystems and human well-being: Synthesis*. Island Press. Washington, DC.
- Maillard, O., Vides-Almonacid, R., Salazar, Á., & Larrea-Alcazar, D. M. (2022). Effect of deforestation on land surface temperature in the chiquitania region, bolivia. *Land*, 12(1), 2. <https://doi.org/10.3390/land12010002>
- Maron, M., Gordon, A., Mackey, B. G., Possingham, H. P., & Watson, J. E. M. (2015). Conservation: Stop misuse of biodiversity offsets. *Nature*, 523(7561), 401–403. <https://doi.org/10.1038/523401a>
- McAfee, K. (2016). Green economy and carbon markets for conservation and development: A critical view. *International Environmental Agreements: Politics, Law and Economics*, 16(3), 333–353. <https://doi.org/10.1007/s10784-015-9295-4>
- MMAyA. (2022). *Nationally determined contribution (NDC) of the plurinational state of bolivia 2021-2030* (NDC Update). Bolivias Ministry of Environment and Water. https://unfccc.int/sites/default/files/NDC/2022-06/NDC_Bolivia-2021-2030_UNFCCC-en.pdf
- Montero-de-Oliveira, F.-E., Blundo-Canto, G., & Ezzine-de-Blas, D. (2023). Under what conditions do payments for environmental services enable forest conservation in the amazon? a realist synthesis. *Ecological Economics*, 205, 107697. <https://doi.org/10.1016/j.ecolecon.2022.107697>
- Müller, R., Pacheco, P., & Montero, J. C. (2014). *The context of deforestation and forest degradation in bolivia: Drivers, agents and institutions*. Center for International Forestry Research (CIFOR). <https://www.cifor.org/knowledge/publication/4600/>
- Muradian, R., Arsel, M., Pellegrini, L., Adaman, F., Aguilar, B., Agarwal, B., Corbera, E., Ezzine De Blas, D., Farley, J., Froger, G., Garcia-Frapolli, E., Gómez-Baggethun, E., Gowdy, J., Kosoy, N., Le Coq, J., Leroy, P., May, P., Méral, P., Mibielli, P., ... Urama, K. (2013). Payments for ecosystem services and the fatal attraction of win-win solutions. *Conservation Letters*, 6(4), 274–279. <https://doi.org/10.1111/j.1755-263X.2012.00309.x>
- Nunez, S., Verboom, J., & Alkemade, R. (2020). Assessing land-based mitigation implications for biodiversity. *Environmental Science & Policy*, 106, 68–76. <https://doi.org/10.1016/j.envsci.2020.01.006>
- of the World, F. (2023). *Bolivia*. <https://www.forestsoftheworld.org/programme/bolivia>
- Pagiola, S., Agostini, P., Gobbi, J., De Haan, C., Ibrahim, M., Murgueitio, E., Ramírez, E., Rosales, M., & Ruíz, J. P. (2005). Paying for biodiversity conservation services: Experience in colombia, costa rica, and nicaragua. *Mountain Research and Development*, 25(3), 206–211. [https://doi.org/10.1659/0276-4741\(2005\)025\[0206:PFBCS\]2.0.CO;2](https://doi.org/10.1659/0276-4741(2005)025[0206:PFBCS]2.0.CO;2)
- Pendrill, F., Gardner, T. A., Meyfroidt, P., Persson, U. M., Adams, J., Azevedo, T., Bastos Lima, M. G., Baumann, M., Curtis, P. G., De Sy, V., Garrett, R., Godar, J., Goldman, E. D., Hansen, M. C., Heilmayr, R., Herold, M., Kuemmerle, T., Lathuillière, M. J., Ribeiro, V., ... West, C. (2022). Disentangling the numbers behind agriculture-driven tropical deforestation. *Science*, 377(6611), eabm9267. <https://doi.org/10.1126/science.abm9267>
- Pennington, R. T., Lewis, G. P., & Ratter, J. A. (2006). *Neotropical savannas and seasonally dry forests: Plant diversity, biogeography, and conservation*. CRC press.

- Pinto-Viveros, M. A. (2023). Propuesta de sistema de monitoreo comunitario de biodiversidad en dos comunidades indígenas del TIOC monte verde.
- Portillo-Quintero, C., & Sánchez-Azofeifa, G. (2010). Extent and conservation of tropical dry forests in the americas. *Biological Conservation*, 143(1), 144–155. <https://doi.org/10.1016/j.biocon.2009.09.020>
- Pörtner, H.-O., Scholes, R. J., Agard, J., Archer, E., Arneth, A., Bai, X., Barnes, D., Burrows, M., Chan, L., Cheung, W. L. (, Diamond, S., Donatti, C., Duarte, C., Eisenhauer, N., Foden, W., Gasalla, M. A., Handa, C., Hickler, T., Hoegh-Guldberg, O., ... Ngo, H. (2021, June 24). *Scientific outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change* (Version Number: 5). Zenodo. <https://doi.org/10.5281/ZENODO.5101125>
- Potapov, P., Hansen, M. C., Pickens, A., Hernandez-Serna, A., Tyukavina, A., Turubanova, S., Zalles, V., Li, X., Khan, A., Stolle, F., Harris, N., Song, X.-P., Baggett, A., Kommareddy, I., & Kommareddy, A. (2022). The global 2000-2020 land cover and land use change dataset derived from the landsat archive: First results. *Frontiers in Remote Sensing*, 3, 856903. <https://doi.org/10.3389/frsen.2022.856903>
- Priya, A. (2021). Case study methodology of qualitative research: Key attributes and navigating the conundrums in its application. *Sociological Bulletin*, 70(1), 94–110. <https://doi.org/10.1177/0038022920970318>
- Quijas, S., Romero-Duque, L. P., Trilleras, J. M., Conti, G., Kolb, M., Brignone, E., & Dellafiore, C. (2019). Linking biodiversity, ecosystem services, and beneficiaries of tropical dry forests of latin america: Review and new perspectives. *Ecosystem Services*, 36, 100909. <https://doi.org/10.1016/j.ecoser.2019.100909>
- Quintanilla, M. (2021a). *Servicios y beneficios ecosistémicos de la unidad de conservación y patrimonio natural y reserva municipal de vida silvestre santa cruz la vieja*. Fundación Amigos de la Naturaleza (FAN). Santa Cruz de la Sierra.
- Quintanilla, M. (2021b). *Servicios y beneficios ecosistémicos de la unidad de conservación y patrimonio natural y reserva municipal de vida silvestre tucabaca*. Fundación Amigos de la Naturaleza (FAN). Santa Cruz de la Sierra. <https://www.fan-bo.org/wp-content/uploads/2023/04/Tucabaca-.pdf>
- Ravikumar, A., Chairez Uriarte, E., Lizano, D., Muñoz Ledo Farré, A., & Montero, M. (2023). How payments for ecosystem services can undermine indigenous institutions: The case of peru’s ampiyacu-apayacu watershed. *Ecological Economics*, 205, 107723. <https://doi.org/10.1016/j.ecolecon.2022.107723>
- Salzman, J., Bennett, G., Carroll, N., Goldstein, A., & Jenkins, M. (2018). The global status and trends of payments for ecosystem services. *Nature Sustainability*, 1(3), 136–144. <https://doi.org/10.1038/s41893-018-0033-0>
- Sattler, C., Trampnau, S., Schomers, S., Meyer, C., & Matzdorf, B. (2013). Multi-classification of payments for ecosystem services: How do classification characteristics relate to overall PES success? *Ecosystem Services*, 6, 31–45. <https://doi.org/10.1016/j.ecoser.2013.09.007>
- SBDA. (2014). Mapas tematicos de la TCO monte verde.
- SDBA. (2014). *DIAGNÓSTICO ORGANIZACIONES, ESTRUCTURA y APRENDIZAJE DIRIGENCIALES EN EL TERRITORIO INDÍGENA DE MONTE VERDE*. Sociedad Boliviana de Derecho Ambiental. Santa Cruz de la Sierra, Bolivia. <https://www.sbda.org.bo/publicaciones/221250148-Diagnostico-Organizacion-Estructura-y-Aprendizajes-en-el-Territorio-Indigena-de-Monte-Verde.pdf>
- Semper-Pascual, A., Decarre, J., Baumann, M., Busso, J. M., Camino, M., Gómez-Valencia, B., & Kuemmerle, T. (2019). Biodiversity loss in deforestation frontiers: Linking occupancy modelling and physiological stress indicators to understand local extinctions. *Biological Conservation*, 236, 281–288. <https://doi.org/10.1016/j.biocon.2019.05.050>

- Smith, S., Rowcroft, P., Rogers, H., Quick, T., Eves, C., White, C., Everard, M., Couldrick, L., & Reed, M. (2013). *Payments for ecosystem services: A best practice guide*. DE-FRA UK. London. grima
- Strategy, C. (n.d.). *Economic incentives in the north of the amazon* [Conservation strategy]. Retrieved January 13, 2024, from <https://www.conservation-strategy.org/project/economic-incentives-north-amazon>
- Tabarelli, M., Filgueiras, B. K., Ribeiro, E. M., Lopes, A. V., & Leal, I. R. (2024). Tropical dry forests. In *Encyclopedia of biodiversity* (pp. 294–312). Elsevier. <https://doi.org/10.1016/B978-0-12-822562-2.00090-6>
- Tape, G. (n.d.). *Security* [Good tape]. Retrieved December 30, 2023, from <https://goodtape.io/security>
- Tockman, J., & Cameron, J. (2014). Indigenous autonomy and the contradictions of plurinationalism in bolivia. *Latin American Politics and Society*, 56(3), 46–69. <https://doi.org/10.1111/j.1548-2456.2014.00239.x>
- UNFCCC. (n.d.). *Fact sheets / REDD+* [REDD+]. Retrieved January 16, 2024, from <https://redd.unfccc.int/fact-sheets.html>
- Vides-Almonacid, R., Justiniano, H., & Pacheco, N. (2012). *Conservación y desarrollo forestal en el bosque seco chiquitano: Una ventana de oportunidades para el futuro*. Santa Cruz de la Sierra, Bolivia. <https://www.fcbo.org.bo/wp-content/uploads/2021/07/MEMORIA-FINAL.pdf>
- WEF. (n.d.). *World economic forum to launch buyers club for biodiversity credits ■ carbon pulse*. Retrieved January 14, 2024, from <https://carbon-pulse.com/228828/>
- Wunder, S., Brouwer, R., Engel, S., Ezzine-de-Blas, D., Muradian, R., Pascual, U., & Pinto, R. (2018). From principles to practice in paying for nature’s services. *Nature Sustainability*, 1(3), 145–150. <https://doi.org/10.1038/s41893-018-0036-x>
- Wunder, S. (2005). *Payments for environmental services: Some nuts and bolts* (No. 42). Center for International Forestry Research. Jakarta, Indonesia. https://www.cifor.org/publications/pdf_files/OccPapers/OP-42.pdf
- Wunder, S. (2015). Revisiting the concept of payments for environmental services. *Ecological Economics*, 117, 234–243. <https://doi.org/10.1016/j.ecolecon.2014.08.016>
- Wunder, S., Engel, S., & Pagiola, S. (2008). Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries. *Ecological Economics*, 65(4), 834–852. <https://doi.org/10.1016/j.ecolecon.2008.03.010>
- Wunder, S., & Wertz-Kanounnikoff, S. (2009). Payments for ecosystem services: A new way of conserving biodiversity in forests. *Journal of Sustainable Forestry*, 28(3), 576–596. <https://doi.org/10.1080/10549810902905669>
- WWF. (n.d.). *Following the jaguar’s footprints* | WWF. Retrieved January 13, 2024, from <https://www.wwf.org.bo/jaguars.footprints/>
- WWF. (2016). *Chiquitano dry forests* [About our ecoregions]. Retrieved December 21, 2023, from https://web.archive.org/web/20161207031153/http://wwf.panda.org/about_our_earth/ecoregions/chiquitano_dry_forests.cfm
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (Sixth edition). SAGE.