How to sow peace?

A value chain approach for environmental peacebuilding in Sierra de la Macarena National Park, Colombia

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Abstract

Ecological rehabilitation projects - as a form of reforestation interventions - are increasing worldwide and present an opportunity for climate change mitigation and supporting local livelihoods. Implemented in post-conflict situations, they are increasingly promoted as solutions for peace. Aiming at understanding their contributions to sustainability and peacebuilding, I examine proposed rehabilitation projects in Sierra de la Macarena National Park in the northern area of the Colombian Amazon by using the value-chain approach of environmental peacebuilding. By combining an analysis of social-environmental tensions around conflicts in the national park and a review of lessons learned from companies working with tree products in Colombia, I answer how value chain considerations can improve rehabilitation projects to address social-ecological tensions. Then, drawing on environmental peacebuilding literature, I discuss the limitations and possibilities of value chain initiatives to address peacebuilding and forest conservation from a short and long-term sustainability perspective.

My findings show that close, long-term and interdependent relationships and a risk-sharing between farmers and partners are essential in creating value chains with tree products. Moreover, it is necessary to find trade-offs between the environmental and economic benefits of specific tree products within the rehabilitation interventions. These projects can contribute to peacebuilding by creating trust and cooperation with different parties and by providing alternative sources of income. However, solutions around land use and land rights must be created to overcome overall tensions within the protected area. Conservation agreements between the National Parks Agency and the farmers can be a first step in providing securities around future land rights and therefore present an incentive for sustainable land use. My thesis identifies that institutional requirements and lacking governmental support for tree product businesses hinder the rehabilitation projects. Thus, political factors need to be simultaneously addressed to create holistic and sustainable solutions for nature and people.

Keywords: *environmental peacebuilding, systems theory, post-conflict, value chain approach, deforestation, non-timber forest products*

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Abbreviations

AFS	Agroforestry Systems
AMEM	Área de Manejo Especial de La Macarena (Engl.: Special Management Area of La Macarena)
FARC	Fuerzas Armadas Revolucionarias de Colombia (Engl.: Revolutionary Armed Forces of Colombia)
NTFP	Non-timber Forest Products
PcC	Parques con Campesinos (Engl.: Parks with Farmers)
PIVAC	Pacto Intergeneracional por la Vida del Amazonas Colombiano (Engl.: Intergenerational Pact for the Live of the Colombian Amazonas)
PNN	Parques Nacionales Naturales de Colombia (Engl.: National Park Agency of Colombia)
PNN-SDLM	Parque Nacional Natural Sierra de la Macarena (Engl.: National Park Sierra de la Macarena)
SES	Social-ecological System
WWF	World Wide Fund for Nature
ZRC	Zonas de Reservas Campesinas (Eng.: Farmers Reserve Zones)

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1. Introduction

*"Conservation efforts are only as sustainable
as the social and political context within
which they take place"*

(Hanson et al., 2009, p. 578)

Ecological Rehabilitation projects[1], including agroforestry systems and reforestation strategies, are associated with many benefits such as carbon sequestration (Kumar & Nair, 2011), increased soil quality (Beuschel, Piepho, Joergensen, & Wachendorf, 2020; Bueno et al., 2018; Nyberg, 2001), biodiversity conservation (Montagnini, 2017; Santos, Crouzeilles, & Sansevero, 2019), and income creation (Montagnini, 2017; Ota, Herbohn, Gregorio, & Harrison, 2020).

Reforestation projects are often implemented in highly biodiverse countries (e.g. IKI, n.d.; Initiative 20x20, n.d.), many of which have experienced armed conflicts (Hanson et al., 2009). These initiatives carried out in post-conflict countries require special attention considering fragile internal institutions and other peacebuilding priorities such as livelihoods creation, governance restoration, trust building and promotion of economic recovery (Environmental Peacebuilding, 2017a; Jensen & Lonergan, 2012; Young & Goldman, 2015).

Colombia is currently in a post-peace-agreement phase and several rehabilitation projects are implemented or planned within the country (e.g. ForestFinest, 2019; tree-nation, 2020; UNFCCC, 2020). After five decades of conflict, a peace agreement between the Revolutionary Armed Forces of Colombia (FARC) and the Colombian state was signed in October 2016 (DNP, 2018; Fernandez-Osorio, 2019; Gobierno de Colombia & FARC-EP, 2016). The current transition phase from armed conflict to security stabilization is characterized by increasing deforestation rates in areas left by the former FARC rebels (Armenteras, Schneider, & Dávalos, 2019; Clerici et al., 2020), struggles around control and power in some areas of the country (Murillo Sandoval, Van Dexter, Van Den Hoek,

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[1] Throughout the thesis I use the term 'rehabilitation projects' to refer to WWF's initiative in the PNN-SDLM. This project mainly entails reforestation activities in the form of agroforestry systems. I employ WWF's terminology to keep consistence between their terms and my thesis. The approach in ecological rehabilitation projects is to re-establish the landscape through partly reforestation with productive purposes in mind (CIFOR, 2003).

Wrathall, & Kennedy, 2020; Van Dexter & Visseren-Hamakers, 2020) and increasing social-environmental tensions around local conflicts (Rosario, 2018).

One case in point of these struggles is the social-ecological consequences of a local conflict over territory in Sierra de la Macarena National Park (PNN-SDLM). Formerly controlled by the FARC (Mignorance, 2016), the area experiences a power vacuum that different legal and illegal actors try to fill, leading to struggles over authority, resources and territory. As now the National Park Agency (PNN) has authority over the national parks, tensions are growing between PNN and farmers. At the same time, deforestation rates are increasing as new actors arrive and formerly inaccessible areas become reachable. This is threatening the environmentally important area, which is a transition zone between the Andes, the Orinoquia's savannas and the Amazon rainforest landscapes, and represents a crucial biological connection for the South American continent (Clerici et al., 2019).

In the context of increasing local conflict, rehabilitation projects through AFS are being introduced in the North of PNN-SDLM by the World Wildlife Fund (WWF) under the project 'Parques y Paz'. Ecological rehabilitation projects are a form of reforestation projects with productive purposes (CIFOR, 2003). The projects are funded by the German Ministry of Environment and planned by WWF Germany and WWF Colombia. The rehabilitation projects, framed as a peacebuilding intervention, are in a planning phase and tend to introduce - limited by the legal restrictions of the PNN - eight different types of tree products as an alternative income for farmers. However, the initiative has not yet considered a long-term development of these agroforestry systems from a value chain perspective.

Drawing on the ongoing debates about employment creation and value chain approaches within the environmental peacebuilding research and practice community, I investigate how these recent initiatives could influence the social-environmental tensions around the local conflict in PNN-SDLM and to what extent they represent a viable long-lasting and self-sufficient option for farmers. Therefore, I first investigate the drivers of the social-ecological tensions in PNN-SDLM to assess how they are leading to increased deforestation and conflict between the farmers and the PNN. Then, I analyse opportunities and challenges experienced by companies working with non-timber forest products (NTFPs) and AFS in Colombia to compile key lessons learned. Following this, I elaborate on how those lessons learned address some of the most pressing structural drivers of conflict. Then, following systems theory, I present possible outcomes of introducing rehabilitation projects within the social-ecological system (SES) of PNN-SDLM and its implications for environmental peacebuilding and forest conservation.

1.1 Research Questions and Aim

Considering the case of the PNN-SDLM, and the initial stage of rehabilitation projects soon to be developed by WWF in the national park, I ask the following questions to guide my research:

RQ.: How to improve ecological rehabilitation projects via a value chain approach to address social-ecological tensions and contribute to environmental peacebuilding?

- Sub-RQ.1: What are the variables influencing the SES and tensions in PNN-SDLM?
- Sub-RQ.2: What are the 'lessons learned' for environmental peacebuilding from companies working with the tree products?

Thereby, I aim first to increase awareness around the social-ecological complexities of deforestation drivers and how rehabilitation projects should take into account structural drivers in their design. Further, my research attempts to discuss the role and scope of value chain creation in environmental peacebuilding discussions by showing possible consequences of rehabilitation projects if market considerations are included in their planning and implementation. Furthermore, I discuss shortcomings associated with a value chain approach and the need for a more holistic approach.

1.2 Relevance and Contribution towards Sustainability Science

My thesis contributes in several ways to sustainability science. It contributes to the global discussion around the consequences of reforestation and rehabilitation projects (Adams, Rodrigues, Calmon, & Kumar, 2016; Mansourian & Vallauri, 2014) and the effectiveness of environmental peacebuilding initiatives (Castro & Stork, 2015; J. Unruh & Williams, 2013). Thereby, I use a specific local case study, thus connecting different spatial scales (Clark & Dickson, 2003; Kates et al., 2001) and I analyse the social-ecological interactions at play (Jerneck et al., 2011; Kates et al., 2001). It is problem-driven, with the challenges of the local conflict in PNN-SDLM in mind (Clark & Dickson, 2003) and by analysing new sustainability challenges and *wicked problems* (Jerneck et al., 2011). The research even goes a step further with the analysis of proposed solutions (Miller, Wiek, Sarewitz, Robinson, & Olsson, 2014).

2. Theoretical Considerations

Rehabilitation projects within PNN-SDLM are claiming to contribute, next to sustainable livelihoods and biodiversity conservation, to peacebuilding in the region. In this context, I will approach the topic by using the perspective of environmental peacebuilding (Young & Goldman, 2013) and finally discuss my findings with it. Environmental peacebuilding is becoming increasingly prominent and sees the management of natural resources not necessarily as a threat but as an opportunity to increase cooperation between parties and therefore to create a long-lasting peace (Castro & Stork, 2015). According to environmental peacebuilding, natural resource management can improve the cooperation between parties and the de-escalation of conflict in all stages of the conflict life cycle (Fig. 1). The conflict life cycle provides a model of conflict development, even if a conflict does not always follow it strictly (UN-Environment et al., 2019). Just as the management of resources can provide possibilities for cooperation, it can also fuel conflicts — for example by providing rebel groups with income, such as in cases in Colombia (UN-Environment et al., 2019). My research is situated in a post-conflict peacebuilding phase, where literature has pointed out the need to create employment and livelihood opportunities and to increase cooperation between conflict parties.
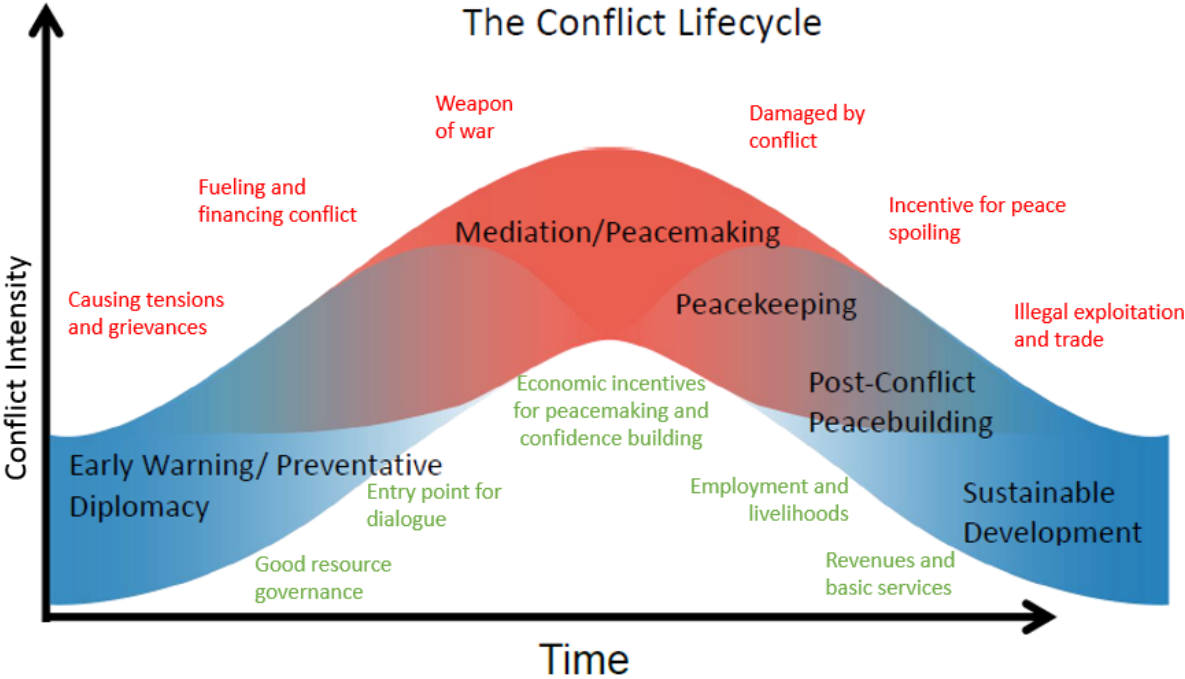
Figure 1. The Conflict Life Cycle (Source: UN-Environment et al., 2019, pp. 17, adapted by the author)

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One approach under the umbrella of environmental peacebuilding is the value chain approach[2]. It is receiving increasing attention to address income necessities in post-conflict situations (Environmental Peacebuilding, 2017b). In the value chain approach, the focus lies on economic recovery, the creation of sustainable value chains in conflict affected regions and alternatives to illicit crops, as well as an increase in cooperation (Castro & Stork, 2015).

To stress the importance of local perspectives in peacebuilding (Leonardsson & Rudd, 2015), I will be focusing on a local case study. The structures and system of PNN-SDLM will be first analysed with the help of the concept of the social-ecological system (McGinnis & Ostrom, 2014; Ostrom, 2009) and by using systems theory and systems thinking (Meadows, 2009). I will use systems theory and the framework of the SES to structure the research design and data collection. The framework of the socio-ecological system was first used to identify relevant variables within the SES, thus allowing me to start structuring the data collection process (Ostrom, 2009) which were then refinded by the use of system theory. Followingly, I use systems theory to analyse the data.

Systems theory is widely used in sustainability sciences (Bryant & Thomson, 2020; Gómez Martín, Giordano, Pagano, van der Keur, & Máñez Costa, 2020; Rehman, Sohaib, Asif, & Pradhan, 2019; Sanneh, 2018). In this perspective, a system is "an interconnected set of elements that is coherently organized in a way that achieves something." (Meadows, 2009, p. 12). In system theory, the interconnections between the different elements of the system are essential. The idea is that there is not only a linear causation between A and B, but that B also has an impact on A. The different elements create a feedback within the system.

Systems theory enables me to integrate variables from different academic perspectives. By setting geographical instead of thematic boundaries, namely the boundaries of PNN-SDLM, an interdisciplinary study becomes possible. Through this, I was able to include and analyse legal, political, social, ecological and economic factors, rather than being limited to only one. However, adequate boundaries of the systems that are being studied need to be chosen carefully (Nabavi, Daniell, & Najafi, 2017). Whereas in the case study, national park boundaries can be easily identified as boundaries of the system, other external influences are affecting the social-ecological situation in PNN-SDLM. Therefore, it is essential to distinguish, in the presentation of the causal-loop diagram, between exogenous and endogenous variables (Haraldsson, 2004).

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2 "The term "value chain" refers to coordinated relationships between actors who are involved directly and indirectly in a productive activity, with the aim of taking a product or service from its supply source and getting it to the customer" (UNCTD, 2009, p. 3)

One systems thinking tool which I use are causal-loop diagrams (CLD) (Haraldsson, 2004; Sarriot et al., 2015). Two kinds of feedback loops exist, reinforcing as well as balancing feedback loops, which consequently influence the system itself (Haraldsson, 2004). With the help of the CLDs, I will be able to map out the consequences the projects will have, as well as understand which mechanisms and flows are at work (Sarriot et al., 2015). Understanding the SES which exists in PNN-SDLM will help to identify problematic behavior that could hinder the success of the intervention.

3. Methodology

3.1 Research Design

For the purpose of an in-depth analysis, my thesis was geographically limited. My research is a case study with its focus on the Northern and Western part of PNN-SDLM. Armed groups continue to influence the Eastern part of PNN-SDLM and different dynamics are at play. Due to Covid restrictions, the research was partly limited to digital sources and observation, which described tendencies in the whole National park. Therefore, a more limited geographical scope was not possible. The case study was chosen due to its historical, political, and ecological importance, as well as due to its ongoing conflict. The boundaries of the PNN-SDLM represent the system boundaries of my analysis; however, external influences such as the market situation of the tree products, current market potentials and legal and political influences were included.

Mainly qualitative data was used, in combination with a geographical analysis through ArcGIS. In order to guide the data collection process, categories and subcategories for data collection were created prior to the research (Table 2). By using potentially relevant subsystems and variables from the framework of the social ecological system (Ostrom, 2009) and by combining these with elements found for this local system following the perspective of systems theory (Meadows, 2009), a range of possible variables which influence the SES were identified and adapted to the case study following an initial literature review (Table 2, RQ. 1). The remaining categories were drawn up using system theory and after an initial literature review in which possible influencing factors were identified. In addition, they have been continuously adapted during the course of the research when factors became superfluous, with new factors also being added when their necessity became apparent.

3.2 Data Collection

As the research is divided into different areas of attention, I used a mixed methods approach for collecting data, such as semi-structured interviews, observations of meetings and discussion groups, and systematic literature and media reviews (Table 2). I conducted interviews with experts and practitioners who work in related fields. In total, I held 13 interviews with nature conservation practitioners (3), think-thank or research institute experts (4), one person working with a social organisation (1), and representatives of companies related to NTFP or AFSs (5). Responses by interviewees are presented using acronyms displaying who they represent, for instance #N1 to #N3 representing interviewees working with nature conservation; #E1 to #E4 interviewees from think-tanks

or research institutes; #SO for the person working with a social organisation and #C1 to #C5 for people working for companies. Complementary, interviews held by WWF with their cooperating small-scale farmers were included in the analysis (#IW)

A list of all interviews and observations is included in Annex 1. Due to privacy reasons, the names of interviewees and organisations or companies are not included. I chose semi-structured interviews in order to be flexible to the answered questions and the upcoming topics (Bryman, 2016). I tried to have a diverse group of interviewees in order to avoid biases in my data sample. However, response rates differed significantly between the fields of the experts. Therefore, I complemented the data with observations of discussion groups and webinars (Calderon, 2011; Guest, Namey, & Mitchell, 2013).

Table 1. Methodology used in the different categories and sub-categories of the research

RQ	Category	Sub-category	Methods used
Sub-RQ.1	Social-environmental variables which influence the local conflict	Legal factors	• Interviews • (Systematic) literature review • Review of media publications
		Historical factors	
		Social factors	
		Environmental factors	
		Political factors	
		Economic factors	
		Geographic factors	• Geospatial analysis using ArcGIS • Interviews • Literature review
Sub-RQ.2	Rehabilitation projects	Legal possibilities & restrictions	• Literature review • Interviews
		Value chain structures	• Mapping of value chains
		Market situation of the products in Colombia and International	• Systematic literature review • Interviews
		Challenges with products	• Systematic literature review • Interviews
RQ.	Contribution to environmental peacebuilding	Identification of points of influence by rehabilitation projects	• Comparison to the before established SES, based on the thematic analysis • Identification of possible leverage points and points of influence

I conducted extensive literature reviews and reviews of media publications. For the systematic literature review, I used the search engine Scopus and followed the steps by Luederitz et al. (2016). I conducted a systematic literature review[3] about deforestation drivers in La Macarena and for each of the following tree products: asaí, cacay, camu-camu, moriche/canangucha, genipa americana, achiote, vanilla, chontaduro. The goal of these was to find opportunities and difficulties associated with the different tree products. The research was accompanied by an extensive review of media publications concerning PNN-SDLM.

3.3 Data Analysis

I used thematic analyses, according to Clarke, Braun, Hayfield, and Terry (2019), for the examination of data from interviews, observations, and literature and media reviews. In a thematic analysis, themes are created from the collected data through different procedural steps. After collecting the data, the interviews, observations, and additional sources were grouped into the pre-existing categories (Table 2), established to facilitate the data collection. The data was then further analysed according to the steps presented by Clarke et al. (2019). First, I familiarised myself with the data. Then, I coded the data and grouped the data into different themes. In this process, the categories and sub-categories developed prior to the data analyses were used as candidate themes (Braun & Clarke, 2019; Clarke et al., 2019) and were further refined or discarded in the process of the thematic analysis.

For the spatial analysis, I used ArcGIS, a geographical analysing tool. I created maps to show deforestation hotspots and the influence of infrastructure. I used deforestation data by Hansen/UMD/Google/USGS/NASA; Hansen et al. (2013); infrastructure data by (INVÍAS, 2019; WFP, 2018), and boundaries of the national parks by ArcGIS Hub (2020). In the last step, I created CLDs as a visualisation of the analyses and to assist with further identifying influences on rehabilitation projects within the SES.

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[3] Search strings, exclusion criteria and number of found sources can be found in Annex 2.

3.4 Limitations

The initial research plan was designed to be executed through on-site field studies and interviews with farmers and other important actors within PNN-SDLM. A first initial field trip took place in February 2020. However, the data collection was planned for the following field trips. Through the increase in local conflict in PNN-SDLM, I was initially not able to go back due to security concerns at the end of February 2020 and March 2020. Afterward, the COVID-19 pandemic hit Colombia and infection cases increased in the country, leading to extensive travel restrictions and the prohibition of the entrance into PNN-SDLM (Parques Nacionales Naturales de Colombia, 2020). Therefore, my analysis was primarily based on interviews via Skype, observations, and extensive literature and media reviews. I could not include local farmers living within PNN-SDLM, which is a potential source of bias in the direction of conservation organizations and businesses. Therefore, I tried to obtain sufficient information through presentations and statements of PcC and newspaper articles.

4. Introduction to the Social-ecological Complexities of PNN-SDLM

4.1 National Context: Colombia: From a Conflict to a Post-peace Agreement Phase

FARC occupied large areas of Colombia for decades. After the signing of the peace agreement in 2016, FARC retreated to reintegration camps, re-shaping the governance structures of several areas completely. Areas that were formerly inaccessible due to FARC's control are now becoming reachable. Through this, people are able to change behavior, new actors arrive, land-use is changing and deforestation is increasing (Murillo Sandoval et al., 2020) - even within national park (Amazon-Conservation, 2019; Clerici et al., 2020). Thereby, drivers of land-use change and deforestation are diverse and highly context-dependent (Castro-Nunez, Mertz, Buritica, Sosa, & Lee, 2017). As a response to increasing deforestation, the Colombian government launched a military strategy named Artemisa in April 2019. By identifying actors of deforestation within national parks and deploying military actions to catch them, the government is trying to halt deforestation. However, this strategy is criticised as it is seen as being primarily focused on small-scale farmers living within the national parks and not on actors behind large-scale land-grabbing (Contagi, 2019; Semana Sostenible, 2020; Volckhausen, 2020a).

The Colombian conflict was and still is long-lasting and rooted in historical reasons such as the unequal distribution of land (Sánchez León, 2017). Therefore, a rural land reform, the promotion of rural development, and alternatives for coca cultivation were essential aspects within the peace agreement (Gobierno de Colombia & FARC-EP, 2016). The most important one for the case study is the Rural Integral Reform. It covers essential aspects such as the access and use of land, national sectoral plans, and development programs with territorial focuses (Gobierno de Colombia & FARC-EP, 2016). Land access and use within the peace agreement encompasses several tools that address the unequal distribution of land in Colombia. One of this are the *zonas de reserva campesina (*Farmers Reserve Zones, ZRC*),* in which they can create their own model of cultivation (Agencia Nacional de Tierras, n.d.; Minagricultura, n.d.; OsejaVarona, Marín Marín, Posada Molina, Sánchez, & Torres Quijano, 2018; PBI Colombia, 2018). Other vital aspects addressed through the peace agreement are, among others, political participation of ex-combatants and the National Integrated Program for the Substitution of Illicit Crops (PNIS). The PNIS focuses in halting coca cultivation through the development of economic alternatives (Gobierno de Colombia & FARC-EP, 2016). According to monitoring carried out by international institutes, a lack of compliance by the government exist more than three years after the signing of the peace agreement. The implementation of essential aspects such as the Rural Integral Reform or PNIS is not in line with the set out targets (Kroc Institute, 2020).

Location of the National Park Sierra de la Macarena

Location of Colombia (pink)

Location of National Parks (dark green), Meta and PNN Sierra de la Macarena (in pink) in Colombia
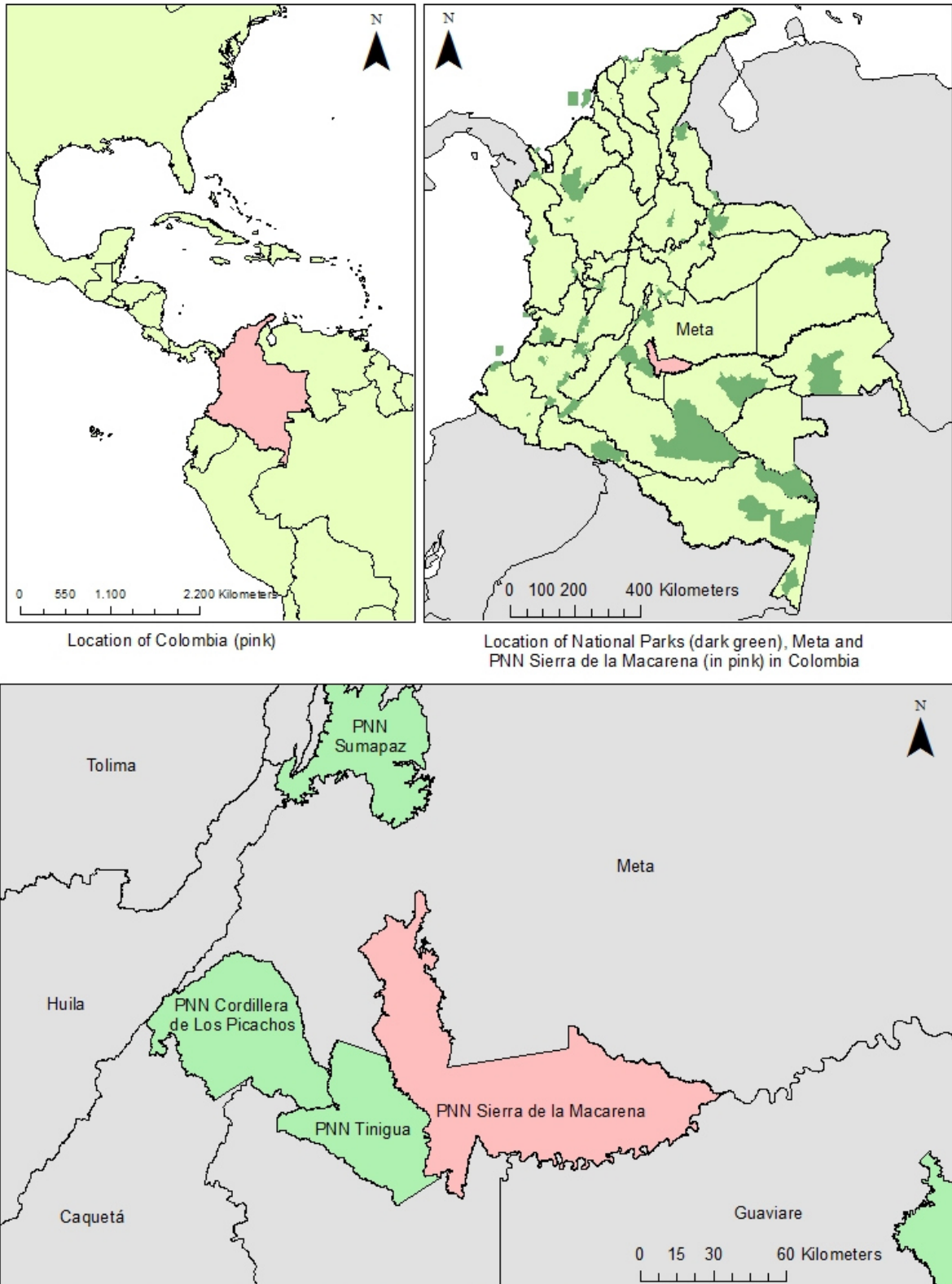
National Parks of the Amem Region with PNN Sumapaz, Cordillera de Los Picachos, Tinigua and Sierra de la Macarena.

Figure 2. Location of PNN-SDLM within Colombia, Meta and the AMEM Region (Source: Own illustration)

4.2 National Park Sierra de la Macarena

PNN-SDLM belongs to the Área de Manejo Especial de La Macarena (Special Management Area of La Macarena, AMEM), which consists of four national parks: Sumapaz, Tinigua, Cordillera de Los Picachos, and Sierra de la Macarena (FCDS, 2018). The AMEM represents a vital biodiversity hotspot as the national parks connect different landscapes and ecosystems such as the Andes and its páramo landscapes[4] in Sumapaz; the open savannas and flood areas of the Orinoquia landscape in the North of PNN-SDLM; and the transition to tropical rainforests through PNN-SDLM, Tinigua and Cordillera de Los Picachos. The four national parks create an Anden-Amazon corridor together with the national park Chiribiquete (Clerici et al., 2019). The biological connection of these is highly important as different species are able to genetically interchange and therefore increase their resilience and adaptability to changing environments (Clerici et al., 2019). The natural ecosystems in these four protected areas are currently being lost at a fast pace, deforestation rates are rising and tensions between farmers and PNN increase.

4.2.1 Deforestation within Sierra de la Macarena

During the FARC occupation, forests were preserved as the environmental code of conduct by FARC prohibited deforestation due to strategic reasons (Cubides et al., 1989). PNN-SDLM and the whole region of La Macarena with San Vicente del Caguán was a stronghold of the FARC (Moreno Rodríguez & Díaz, 2018). After the peace agreement was signed and the majority of FARC rebels retreated into reintegration camps (ARN, n.d.), a power vacuum appeared which other armed groups and criminal gangs are seeking to fill. In this critical time, the state did not step in to fill this gap, partly because of the politics of the in 2018 newly elected President Iván Duque (BBC, 2018) from a party which did not support the peace agreement (López Morales, 2019; Ocampo, 2018). The shift from the FARC occupation gave space for other armed actors to arrive who are no longer bound to the strict rules of FARC. As a result, deforestation rates are increasing within and around PNN-SDLM (Amazon-Conservation, 2019; Murillo Sandoval et al., 2020). Thereby, deforestation actors are newly arriving landgrabbers, FARC-dissidents, and small-scale farmers (who have the lowest impact) (#OO4; Duzán, 2020; Semana Sostenible, 2020). Figure 5 shows the deforestation from 2012 to 2019 and the current hotspots of it within PNN-SDLM, namely *trocha ganadera* (gravel road for cattle ranching), Puerto Rico, Puerto Concordia, and Rio Guayabero.

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[4] Páramo landscapes are high-altitude mountain wetlands.
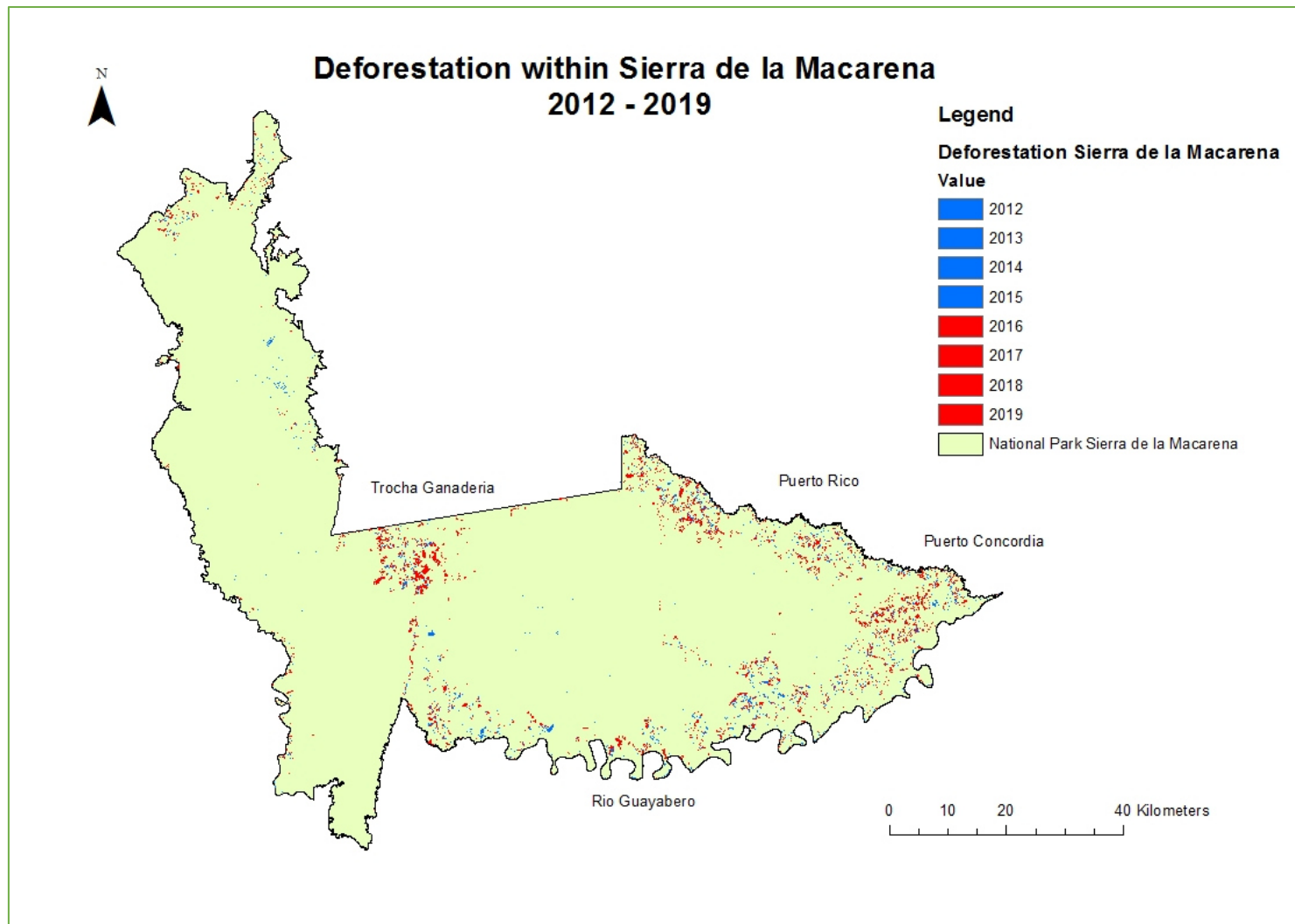
Figure 3. Deforestation in National park Sierra de la Macarena 2012 - 2019. The red areas represent deforestation within PNN-SDLM between 2016 and 2019. The blue areas represent (as a time comparison) deforestation between 2012 and 2015. (Source: Own illustration, forest loss data used by Hansen/UMD/Google/USGS/NASA; Hansen et al., 2013).

4.2.2 Development of the Conflict

The first biological reserve in the area of La Macarena was founded in 1948 (FCDS, 2018; PNN, 2020). However, when farmers arrived in the following decades (Leal León, 2019; Ruiz Serna, 2003), the national park authorities were not able to enforce environmental regulations due to FARC occupation. Therefore, several farmers claim that they were not aware of the national park boundaries (#IW). Just as the peace agreement led to an increase in deforestation in PNN-SDLM, it also enabled the environmental authorities of PNN-SDLM to come back to the area and enforce its environmental rules. According to those rules, farmers are not allowed to live on or cultivate land within PNN-SDLM. This has led and is leading to increasing disputes, violent events, and conflicts between the government (in the form of the PNN) and the farmers living within the national park. Underlying factors which increase tensions around the conflict are addressed in the following chapter.

Figure 4. Logo of the farmer communities within the National parks of La Macarena (Source: Parques con Campesinos, 2020)

Tensions between farmers and PNN peaked at the end of February 2020, following forest fires and strong governmental actions via Artemisa. Several meetings were held between farmers and PNN. For these meetings, *Parques con Campesinos* (Parks with Farmers, PcC), a farmer's organisation which represents farmers living inside protected area, published demands to the government. The farmers showed themselves to be disappointed by the actions of the national government for not entering into agreements with them (Parques con Campesinos, 2020). They argue that the deforestation is a problem of missing land titles and that they are not the main drivers of deforestation in the region, nor have they any connections with armed groups. Rather, on the contrary: they are the ones preserving the area and are willing to continue to do so. They agree to leave 40% of their farms in preservation if the government takes the following actions (Parques con Campesinos, 2020)[5]:

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[5] The demands by PcC will be used in the analysis of the underlying factors of the local conflict.

- *Stop the military actions against the farmers and guarantee the human rights of the communities*
- *Stop the penalties against the farmers who were imprisoned*
- *Constitute three zones as reserves for farmers at the next board of directors meeting of the National Agency for Land*
- *Implement productive alternatives for the farmers within the park*
- *Put the PNIS Strategic Direction Board into operation*
- *Reverse the order of implementation of STC4360 of 2018[6].*
- *Installation of a Regional Coordination Table*

4.3 Rehabilitation Projects

In this context of the local conflict and increasing deforestation rates in PNN-SDLM, efforts by WWF emerge, who are planning to implement rehabilitation projects in cooperation with fifty small-scale farmers. Rehabilitation projects are supposed to tackle social and environmental challenges simultaneously. The approach in ecological rehabilitation projects is to re-establish the landscape through partly reforestation with human purposes in mind (CIFOR, 2003). In the projects by WWF, the area is reforested but its land-use is oriented towards the cultivation of agricultural products. This is diversifying the income of the farmers and increasing resilience of the systems. The established area can be compared to complex AFS. In comparison to a natural forest, AFS are rather oriented towards the production of certain products, while more advanced AFS keep the main structure of a forest with trees and shrubs of different sizes (Fig. 5). This makes the system in itself more resilient and biodiverse than a single crop monoculture plantation (World Agroforestry, 2014).

In the region in Meta and other parts of Colombia, different projects exist with tree products such as cacao, rubber, or palm oil (INCAS, 2020). However, only certain products in rehabilitation projects are allowed within the restriction of PNN. An exact list does not exist, and officials from the PNN (#N1; other informal talks) could not specify which species are allowed and which are not. However, products such as cocoa and rubber are seen as being too close to commercial production. Therefore, they are prohibited as their cultivation stands in contrast to PNN's conservation approach. The projects by WWF, decided after an analysis of the biological contributions of different

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[6] The STC4360 of 2018 is a decision by the Supreme court in which it commands the immediate protection of the Amazonas as the governmental actions were not sufficient.

tree products, are to use vanilla, cacay, asaí, camu-camu, canangucha, genipa americana, achiote, chontaduro (Table 3). The authorities of the PNN-SDLM follows the same strategy as WWF and are trying to promote the cultivation of different tree products, due to the limited possibilities within a national park (#N1).
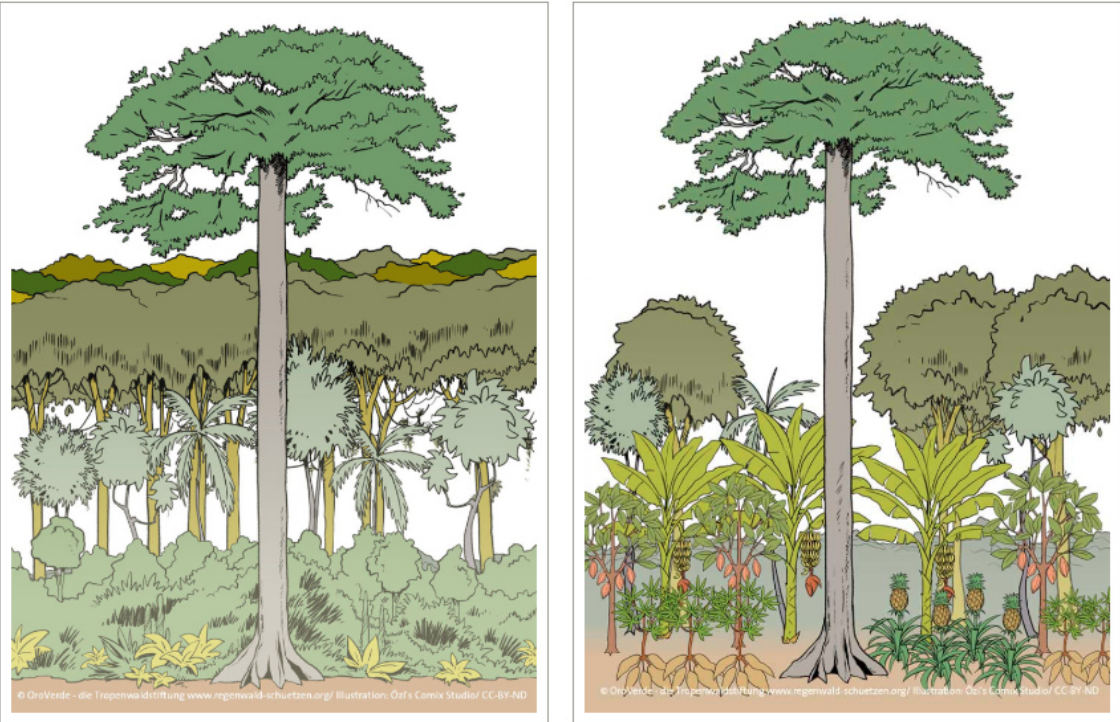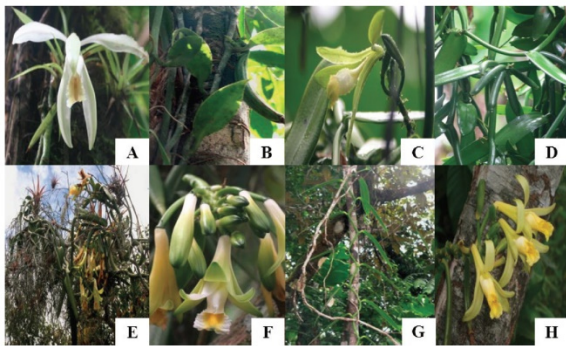
Figure 5. Comparison between natural tropical forest and an agroforestry system. Whereas natural forests (left picture) have five layers of vegetation, AFSs (right picture) are oriented towards the cultivation of agricultural products, for instance fruit, cereal, vegetables, nuts, but also timber (Source: OroVerde, 2020)

Table 2. Introduction of tree products used in rehabilitation projects by WWF

Name	Parts of the plant used	Use
Asaí (*Euterpe oleracea*)	*Photo of the fruit of the asaí tree (Source: Pepper & De Freitas Navegantes Alves, 2017, p. 217)*	Consumption
Camu-camu - *Myrciaria dubia*	*Camu-camu fruits (Source: Bellver, 2017)*	Consumption
Cacay – *Caryodendron orinocense*	*Photos of the cacay fruit. On the left picture it is dried and in the right picture it is a fresh fruit cut open (Source: KAHAI, 2018)*	Production of Oils; limited consumption
Canangucha - *Mauritia flexuosa*	*Fruits of canangucha (Source: Garcia et al., 2018, p. p.2)*	Consumption

Genipa Americana - *Genipa Americana*	 *Fruits of genipa americana (Source: Mercandante, 2010)*	Colouring (for example for tatoos, etc.)
Chontaduro – Bactris gasipaes	 *Chontaduro. On the left the fruit itself is observable and on the right the boiled fruit is cut and salted, ready to consume (Source: Calero, 2015)*	Consumption
Vanilla	 FIGURE 1. Native species of *Vanilla* in natural habitat in Colombia: *Vanilla trigonocarpa* - A. Flower, B. Developing fruit; *Vanilla phaeantha* - C. Flower D. Developing fruit; *Vanilla calyculata* - E., habit, association with bromelias in subxerophytic shrubland. F. flower. *Vanilla rivasii* G. growth habit in tropical humid forest. H. inflorescence with three flowers opens simultaneously, and developing fruits. (Photos: A–G: Flanagan, 2009-2015; H: Molineros-Hurtado, 2011). *Different forms of native species of vanilla (Source: Nicola Flanagan & Mosquera-Espinosa, 2016, p. 204)*	Spices
Achiote - *Bixa Orellana*	Fruit *Photo of the fruit of achiote (Source: Cardona, 2018)*	Colouring of food and cosmetic

5. Results and Analysis Part 1 : The Social-ecological Situation of Sierra de la Macarena

I identified the main influencing factors behind the SES (Table 3) in four themes. With help these themes and through systems theory I structured the SES of the PNN-SDLM (Fig. 8, p.29). In the second part of the analysis, I present the lessons learned by companies working with tree products. Finally, I present the considerations by taking the SES into account and discuss the findings with environmental peacebuilding literature. The analyses together reveal that considerations around the created income, the structure of the value chain, power asymmetries in possible cooperation, land tenure security and infrastructure are essential to consider when implementing rehabilitation projects through a value chain approach. Further, political considerations such as governmental actions and institutional support for business with tree products will be decisive in the coming years and will largely influence which consequences rehabilitation projects will have.

5.1 Underlying Factors behind Deforestation and the Conflict

5.1.1 Land Tenure and Land Accumulation as Driving Force

A main deforestation driver is land-grabbing (Amazon-Conservation, 2019) and thereby increasing national and international pressures for the government to act (Volckhausen, 2020a). Hereby, large areas are deforested and used for cattle ranching to obtain land titles in the future. Richani (2012) explains that land speculations are already increasing since 1987. Law 160 of 1994 ("Ley 160 de 1994," 1994) further simplified the purchase of land and land-grabbing through a market-assisted land reform and the exclusion of the government from land transactions (Gruszczynski & Felipe Jaramillo, 2002; land portal, 2019; Pereira, 2021). However, the extent of the current development is faster and stronger than before (Guereña & Burgos, 2017; Murillo Sandoval et al., 2020)[7], leading to an even more unequal land distribution.

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[7] Guereña and Burgos (2017) show that the number of UPAs, which are areas cultivated through the same means, are increasing in size and occupy an increasing percentage of area. Whereas in the 1980's UPAs of over 500 ha were only occupying 29 % of the area, in 2014, UPAs of over 500 ha occupy more than 68,2% of the available area in which was included into the agricultural consensus.

Table 3. Identified variables influencing the social-ecological context of PNN-SDLM

Themes	Summary
Land titles and land accumulation	• Unequal distribution of land in Colombia is one of the reasons why farmers are living within the PNN-SDLM. • Due to PNN restrictions, farmers do not have official land titles within PNN-SDLM • Large-scale land-grabbing and speculations to obtain land titles in the future is the main driver of deforestation.
Income creation	• Farmers living within PNN-SDLM are in a difficult economic situation, influenced by governmental policies and actions • Missing economic alternatives to deforestation and coca production are increasing the conflict and deforestation and worsening the livelihood of farmers within PNN-SDLM • Large scale land-grabbing, especially through cattle ranching, is economical only viable because the land will be sold in the future
Governmental actions	• Governmental actions, such as the strategy Artemisa, focuses primarily on small-scale farmers as driver of deforestation, and do not address deforestation through large-scale land-grabbing • Governmental actions are leading to increased stigmatisation of farmers and are through this increasing the potential for conflict
Infrastructural development	• Road development improves the conditions for alternative income projects in PNN-SDLM • Through increased accessibility, road development is driving deforestation

The historical development of land accumulation, together with political processes and violence by different actors, let to an increase in migration (Salgado Ruiz, 2020). Through this, farmers were pushed to expand the agricultural frontier (#OE4, Salgado Ruiz, 2020). The agricultural frontier are areas which are converted e.g. from natural forest, to another land use such as cattle ranching. The farmers arrived in protected areas such as the PNN-SDLM without being aware of its land-use restrictions. Within PNNs, farmers are not able to receive official land titles due to PNN restrictions. Farmers described how after they arrived at the North of PNN-SDLM, pressures and conflicts with different actors increased, such as from rebel groups and the government over territory (#IW).

Specific mechanisms from within the peace agreement, such as the land fund and the land cadastre, are supposed to counteract the unequal land distribution in Colombia. However, the progress of implementation is slow (Kroc Institute, 2020). One of those mechanisms in the peace agreement is the creation of *Zonas de Reserva de Campesina*. Introduced in 1994 by Law 160, these are areas in which farmers are given the space and the right to develop their own farming model (OsejaVarona et al., 2018). It stands in contrast to large-scale agricultural developments (Agencia Nacional de Tierras, n.d.; Minagricultura, n.d.; OsejaVarona et al., 2018; PBI Colombia, 2018). In their position paper, PcC demand to constitute three ZRC at the next board of directors meeting of the National Agency for Land, the agency responsible for the constitution of ZRCs (Parques con Campesinos, 2020). Establishing such a farmer reserve zone would give the farmers recognition and security as, among others, no mining rights or private land titles would be able to be obtained (PBI Colombia, 2018). Currently, farmers have no official rights to cultivate or live within PNN-SDLM, which is leading to increasing tensions between PNN and farmers.

5.1.2 Situation of Income Creation

Currently, areas which are deforested are mostly used for cattle ranching. Even though it is pointed out that cattle ranching is unprofitable on cleared forest lands (#OO6), it is still largely practiced. Reasons for this are that it is used to obtain land, promoted by the government (#OE3; #N2), and that having a cow presents a certain level of economic security (#OO2). The extraction of wood only plays a minor role in deforestation decisions (#OE1; Semana Sostenible, 2020). The most profitable land use remains the cooperation with rebel groups to cultivate coca and deforest areas for them (Semana Sostenible, 2020).

As cattle ranching is not profitable and coca production is risk-laden, alternatives for the region need to be found and are demanded by PcC (Parques con Campesinos, 2020). However, real alternative economically-viable options are missing in PNN-SDLM (#OE6; #ON1; #OO2; Salgado Ruiz, 2020), leading to non-compliance with conservation agreements (#OO1) and, in combination with conservation restrictions, there is an increasing risk of escalating violence and conflict (#OE6). The lack of economically-viable alternatives was named as a consequence of agricultural policies, missing support for small-scale agriculture, non-compliance in PNIS, and the spraying of coca cultivation:

- Pérez Forero *(2020)* describes how, at the end of the 20th century, agricultural products had a guaranteed market by the state. Today the cultivation of agricultural consumable goods is only oriented towards self-sufficiency and economic opportunities are limited due to prolonged traditions of policies in favor of large-scale agriculture (such as Law 135 of 1961), missing support for small-scale agricultures, *bonanzas* (booms or trends - for example, for leather, marijuana and coca) and an unequal transfer of technology (#OE4; Pérez Forero, 2020).

- The non-compliance by the government in PNIS is presented as another reason why deforestation and coca cultivation has not yet stopped. PNIS is supposed to create alternative sources of income for farmers and is part of the peace agreement (Gobierno de Colombia, **n.d.;** Pérez Forero, 2020). However, farmers complain about a lack of cooperation from the Colombian government (Duzán, 2020), forcing them to start deforestation again in order to generate an income.

- Castro and Stork (2015) point out that the fumigation of coca profoundly impacted agricultural production in the Amazon, as agricultural fields and ecosystems surrounding coca plantations were impacted as well. Experiences from farmers within PNN-SDLM affirm this assumption. During the last decades, many farmers started coca cultivation as revenues were high or as they were pressured into it. However, in 2006 the government launched strong actions against the production of coca, which left the farmers with no choice other than cattle ranching (#IW; #N2).

5.1.3 Governmental Actions

Governmental actions are conducive to specific deforestation drivers, and through this are partly increasing the conflict. As explained previously, the non-compliance by the government in their PNIS agreements is one such driver, which is argued to increase the necessity for deforestation by small-scale farmers. Several other governmental actions were found to be reinforcing the conflict and increasing deforestation.

One action is a governmental strategy against deforestation, namely Artemisa. Since the beginning of the strategy, several mostly small-scale farmers were detained due to their actions within PNNs (Semana Sostenible, 2020). The governor of Meta, where PNN-SDLM is located, sees Artemisa as a success, as otherwise there would be more coca production in the South of Meta (Semana Sostenible, 2020). However, there is criticism that the government, by focusing on small-scale farmers, is not addressing the largest drivers of deforestation, namely large-scale land-grabbing - with some claiming a governmental interest in cattle ranching and the cultivation of palm oil (#OO6, Duzán, 2020; Volckhausen, 2020a).

Two of the farmers' demands[8] (Parques con Campesinos, 2020) were the ceasing of military actions against them and the guarantee of human rights for communities. Another demand is the end of the penalties for those who are imprisoned. These demands go back to the one-sided focus of the Artemisa strategy mentioned before. This perceived one-sided focus by the government is leading to an increased conflict through the perceived stigmatisation of small-scale farmers. Experts call for a stop of the overall stigmatisation of farmers in the region (#OE5; #OF1; Salgado Ruiz, 2020). They claim that farmers have been for decades stigmatised as being the main drivers of deforestation, as well as belonging to either guerillas or drug traffickers (#OE5; #OE4) – which has let to a loss of trust in the government (#OE5; Volckhausen, 2020b)

In addition to the end of stigmatisation, the farmers demand, in their writing to the government, an increase in their active participation (Parques con Campesinos, 2020). One of their demands is to reverse the order of implementation of STC4360 of 2018[9] (Parques con Campesinos, 2020). The farmers request to start with the Intergenerational Pact for the Life in the Colombian

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[8] Demands were presented at page 17.

[9] The STC4360 of 2018 is a decision by the Supreme court which commands the immediate protection of the Amazonas, as governmental actions were not sufficient.

Amazon (Pacto Intergeneracional por la vida del Amazonas Colombiano, PIVAC) (Parques con Campesinos, 2020). The PIVAS was supposed to be constructed with affected communities and other key actors within five months after the court decision (Corte Suprema de Justicia, 2018). However, one year later, the government did not yet comply effectively, even after repeated requests by the Supreme Court (Garavito et al., 2019).

Another demand by PcC is the installation of a Regional Coordination Board, as well as the Strategic Direction Board of PNIS (Parques con Campesinos, 2020). These demands demonstrate the aim of achieving active participation and recognition by the farmers. This perceived lack of participation is even observable around the location of meetings between PNN and farmers in the peak of the tensions in February 2020. Whereas the farmers wanted to negotiate in their territory, the authorities of the PNNs want to solve the conflict in Bogotá due to security concerns. This is fostering a perception among the farmers that decisions are taken far away from their reality and without considering their opinion (7:40, 2020; Macarena, 2020; ViveElMeta, 2020; Zuluaga, 2020).

5.1.4 Infrastructural Factors

Another underlying factor that leads to deforestation is the development of road infrastructure (Ahmed Sadia, Ewers Robert, & Smith Matthew, 2014; Laurance, Goosem, & Laurance, 2009) through increased accessibility of formerly inaccessible regions (Baraloto et al., 2015; Walker et al., 2013). However, at the same time, a better connection to cities and markets increases the possibility of economic development in PNN-SDLM. Therefore, infrastructural development is a factor which involves environmental or social trade-offs. Around PNN-SDLM, several roads have been constructed during the last few years in order to connect rural areas in Guaviare, Meta, and Caquetá (Agencia Nacional de Infraestructura, n.d.-c). Besides the larger asphalt roads, smaller gravel roads are also increasing the connectivity of the PNNs and, therefore, cause deforestation (#ON3). Fig. 6 shows main governmental roads and gravel roads, which are partly going through PNN-SDLM. In particular, the *trocha ganadera,* which is cutting through PNN-SDLM in the middle-western part of the National park, is leading to increased deforestation.

The government is planning to connect several regions in the future. A map of the plans for 2035 shows that San José del Guaviare is planned to be connected with San Vincente de Caguán, creating a road alongside the Southern border of PNN-SDLM (Agencia Nacional de Infraestructura, n.d.-a; n.d.-b, Fig. 6). This road is identified as one of the planned infrastructural projects outside of Brazil with the worst environmental impact (Vilela et al., 2020). The resulting connectivity might increase the pace of deforestation in PNN-SDLM drastically.

Deforestation and Road Infrastructure - National park Sierra de la Macarena
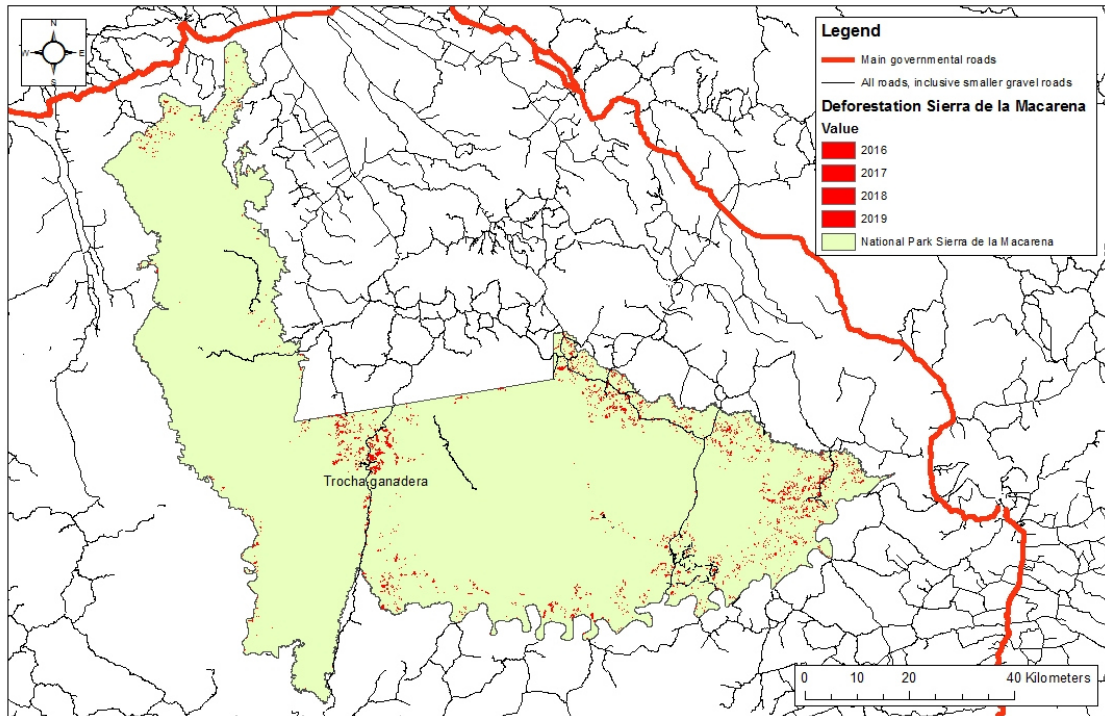
Figure 6. Deforestation and road infrastructure in national park Sierra de la Macarena. The red spots inside PNN-SDLM present deforestation from 2016 – 2019. The red streets present major governmental streets, and the smaller black streets present smaller gravel roads. Especially the trocha ganadera is increasing deforestation within the National park (Source: Own illustration, forest loss data used by Hansen/UMD/Google/USGS/NASA; Hansen et al., 2013; INVÍAS, 2019; data for road infrastructure used by WFP, 2018)

Figure 7. Planned road infrastructure for 2035. The planned road between San José del Guaviare and San Vincente de Caguán (located inside the red circle) is expected to accentuate deforestation in the Southern region of PNN-SDLM (Source: Agencia Nacional de Infraestructura, n.d.-b; red circle added by author)

5.2 Systems Perspective on the Local Conflict of Sierra de la Macarena

Fig. 8 shows a causal-loop diagram, derived from the presented analysis. The actions and policies of the Colombian government are influencing the SES in several ways. First are policies (14), which are described as being in favor of large-scale agricultural projects and cattle ranching (#OE4; Pérez Forero, 2020)*,* affecting deforestation rates (1) through the promotion of land accumulation (15) which is further increased through neglecting large-scale deforestation driver (16). Second is the described missing support for agricultural activities of small-scale farmers (8), together with the non-compliance in PNIS (7), leading to the worsening of the economic situation of small-scale farmers (6) which is then affecting the necessity for additional income (10), leading to more coca production (12) and deforestation (1).

Third, with increasing deforestation (1), the necessity for governmental responses is increasing through national and international pressures (2). This is leading to increased governmental actions against small-scale farmers due to a scapegoating of the farmers by governmental bodies. Through this, the stigmatisation of farmers is increasing (3), leading to an increased conflict potential (4). Further, increasing governmental actions against small-scale farmers (5) decreases the economic income of them (6) as experiences presented before showed that the spraying of coca fields can have tremendous impacts on surrounding ecosystems and agriculture and thus worsen economic conditions (6).

The economic income of farmers (6) then becomes an influence, as new sources of income have to be found (10). Increased through the unavailability of alternative income sources (11), this necessity is increasing, leading to more deforestation (1) through the cultivation of coca (12) or food production. Some elements, such as the development of road infrastructure (13) can influence deforestation (1) as well as living conditions (6), creating a trade-off between social and environmental elements.

When we look at the loops, we can see one essential reinforcing loop between the elements: deforestation (1) – necessity for governmental response (2) – military actions against small-scale farmers (5) – economic situation of small-scale farmers (6) – additional income necessities (10) – deforestation (1). This loop goes back to experiences within PNN-SDLM (Chapter 5.3.2) about the negative economic consequences of military strategies against e.g. coca cultivation in PNN-SDLM.
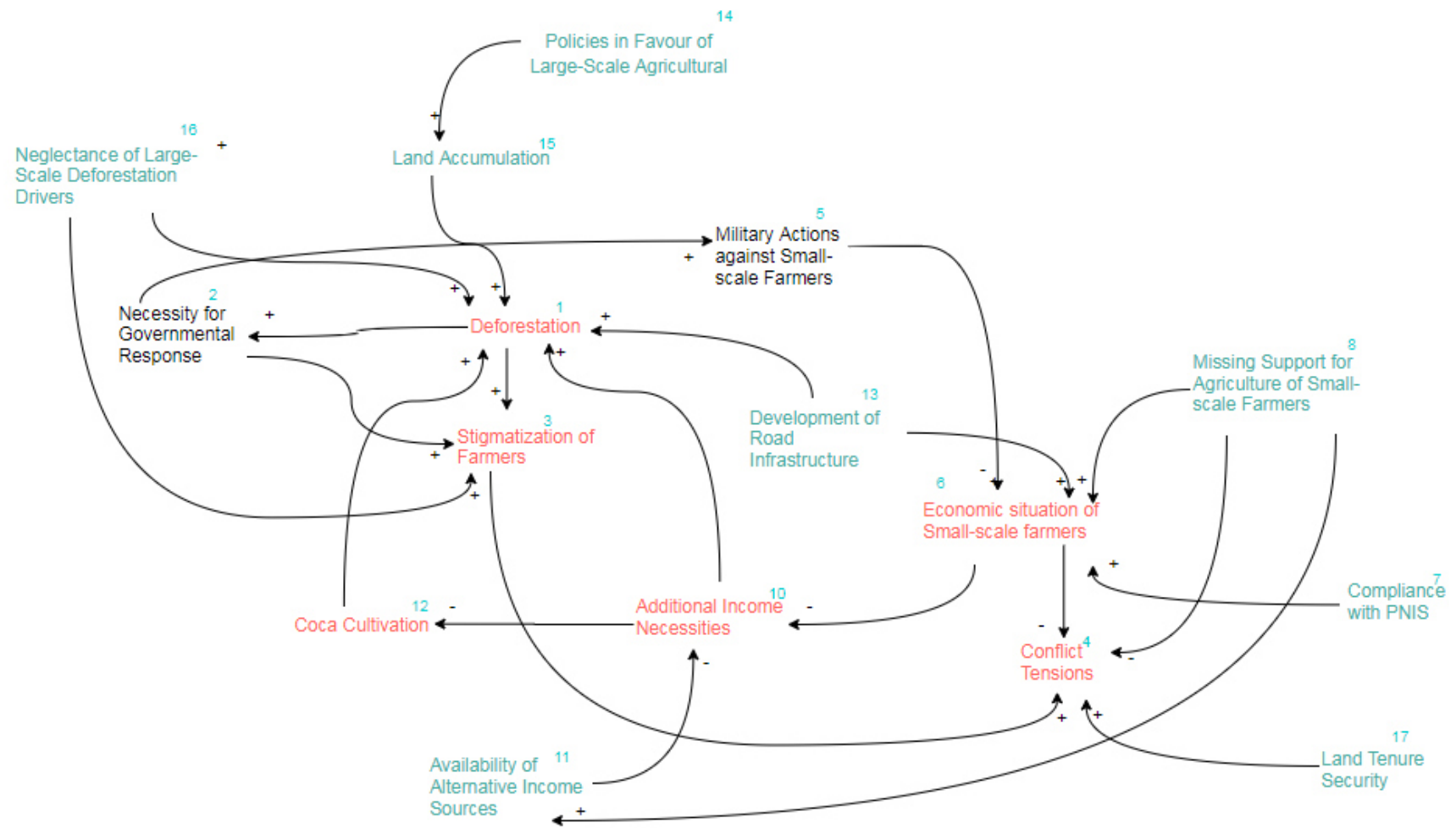
**Figure 8.** Social-ecological system in PNN-SDLM. Numbers (1-17) are added to guide the reading of the causal-loop analysis. (-) present opposite relationships and (+) present same relationships. Endogenous elements are red and exogenous elements are blue. Elements which are not clearly distinguishable are black (Source: Own illustration, based on literature reviews, observations and interviews)

6. Results and Analysis Part 2: Value-chain Considerations

The rehabilitation projects will be implemented into the SES in PNN-SDLM, analysed in the previous chapter. In PNN-SDLM, WWF is working together with small-scale farmers to incentivise fifty local farmers to make better land-use decisions which benefit both the farmers themselves and the ecosystem. As the products in the project by WWF are only to be planted and as no further information is yet available about the future outlook of the value chain of the project, the following sub-chapters summarises the lessons learned for environmental peacebuilding by different Colombian projects and companies working with tree products in order to investigate which considerations need to be taken into account when creating value chains in complex post-conflict situations in Colombia.

To obtain lessons learned, I interviewed several companies working with NTFP or AFS. The systematic literature review around the different tree products created further lessons learned - depending on the cultivated products (Table 4). It showed that knowledge around some products is limited (e.g. cacay, genipa americana) whereas other products are widely studied (e.g. asaí, camu-camu). The market demands are also highly different, with products such as asaí having an increasing demand and others being almost unknown. Whereas asaí, vanilla, and camu-camu are widely known, information about products such as genipa americana is still limited.

6.1 Value-Chain Structures

How the value chain is organised and how the benefits are shared is essential in obtaining and keeping farmers support in the creation of rehabilitation projects. It determines the benefits that farmers can receive and the cooperation that they can create. Therefore, the value chain must be inclusive and participatory (Castro & Stork, 2015). This inclusivity is highly dependent on the partner of the projects. Therefore, according to #E3, a private-public partnership is important to create, especially in such as challenging environment as PNN-SDLM. An inclusive cooperation between buyers and sellers should be created. Risks and benefits must be shared, services such as technical know-how and investments have to be provided, and all should take place in a transparent way (Lundy et al., 2014).

The majority of companies were directly working together with at least some of their producers (#C1; #C4; #C2; #C5). Only a few companies worked with an intermediary (#C2) and only one company cooperated with a partner who receives the fruits from forest collector and processes them (#C3). Some projects working with AFS and NTFP (#N3; Castro & Stock, 2015) are selling their products directly at local markets. Fig. 9 shows four typologies of value chains named in the interviews.

Table 4. Summary of main opportunities and challenges of the different tree products.

	Asaí	Cacay	Camu-Camu	Chontaduro
Challenges	• Difficult situation of transportation as oxidation starts after only 8 hours (García Botina et al., 2018) • Economic advantage over the other products could contribute to biodiversity loss and loss of diverse pollinators due to an increasing planting of only asaí (**Pepper**, 2016) • Increasing dependency of small-scale farmers in floodplains in Brazil on the production of asaí (Campbell et al., 2018) • Informal working conditions within the value chain (Pepper & De Freitas Navegantes Alves, 2017) • Increasing profit margins between the stakeholders of the value chain in Brazil (Pepper, 2016).	• Growing competition with monocultural plantations in Caquetá (Colombia Sostenible, 2020) • Almost monopoly-like situation in the more commercialized market – dependency on the company KAHAI • There was little information to be found which was not linked to KAHAI	• Difficult transportation and the need to process it quickly • In Colombia, Selva Nevada is one of the only larger buyers of camu-camu (Agroindustria, 2019) from a processing company in Tarapacá (Vanguardia, 2013; Pardo, 2015; Agroindustria, 2019). • Challenges experienced in Peru: problems with the quality, sanitary standards; processing and restrictions to market access in the EU; limited national demand (Blare & Donovan, 2018) dependency on exporting to Japan led to negative consequences for the farmers when the market broke down (Orr & Donovan, 2018) • Farmers began cutting down trees in Peru in order to cultivate camu-camu (Penn Jr., 2008).	• It already came to an oversupply in the past in Colombia (Graefe, Dufour, van Zonneveld, Rodriguez, & Gonzalez, 2013) • Needs to be processed within 3 to 5 days after harvest (Graefe et al., 2013) • No strong links between farmers and industries (Graefe et al., 2013) • Strong supply from the pacific coast and many people are already depending on its production (Graefe et al., 2013)
Opportunities	• Increasing demand in Colombia as well as worldwide (García Botina et al., 2018; **Pepper**, 2016) • Increase of local consumption • Currently secured and good incomes in Brazil (Pegler, 2015) • Certification could differentiate the cultivation on plantations with the cultivation from traditional farmers (Pepper & De Freitas Navegantes Alves, 2017) • Used in stores & Restaurants in Colombia such as Wok, Selva Nevada & Mini Mal	• Increasing international demand which is bigger than supply (Agricultures, 2020) • Demand and cultivation by the company KAHAI (KAHAI, 2018) • Declared as one of the most promising tree products (García Botina et al., 2018) • Promoted as being an successful alternative for deforestation and income creation (World Bank Group, 2019)	• High vitamin C content (Penn Jr, 2008; Martin, Peters & Ashton, 2017) • Experiences from Peru: the establishment of local and international markets for camu-camu has been partially successful • Use in drinks and ice-creams in restaurants such as Wok, Selva Nevada and Mini Mal in Bogotá (Selva Nevada, 2020; Wok, n.d.) • Increasing demand in Colombia • Highly productive tree (Penn Jr, 2008) • Easy harvest (Penn Jr, 2008) • First processing plant in Colombia in Putumayo (Bernal, 2013) • Ability to withstand high harvest demands (Martin, Peter & Ashton, 2014)	• Main demand coming from Cali but also from Bogotá • Important for food security (Mesa & Galeano, 2013) (Graefe et al., 2013) • Palm not very demanding – very adaptable to different situations (Galluzzi et al., 2015) (Graefe et al., 2013) • Stable market price (Graefe et al., 2013) • Most cultivation in agroforestry systems (Graefe et al., 2013) • Very productive palms (Graefe et al., 2013)

	Canangucha	Achiote	Vanilla	Genipa Americana
Challenges	• Not yet highly demanded in Colombia and so far mostly used as animal food (Garcia et al., 2018) • Prices not high enough to create sufficient income alone in Colombia (Garcia et al., 2018) but higher prices in Peru (Horn, Vargas Paredes, Gilmore, & Endress, 2018) • Threat for palm population due to destructive harvest (felling the tree) (Horn et al., 2018)	• Not yet sufficiently demanded (Raddatz-Mota et al., 2017) • Low demand and plantations in Chocó already produce it (Cardona, 2018)	• Demand in Colombia is relatively low as more synthetic vanilla is used (Nicola Flanagan & Mosquera-Espinosa, 2016) • Fluctuations of the world market price (Nicola Flanagan & Mosquera-Espinosa, 2016) (Llopis et al., 2020) • Working with native vanilla requires special knowledge (Nicola Flanagan & Mosquera-Espinosa, 2016) • More the areas around the Cauca river and Magdalena river and in the pacific region are ideal for vanilla cultivation (Unimedios, 2012)	• Not well known • No extensive experiences to learn from • No information about demand and commercial usage in Colombia were found
Opportunities	• Possibility that the demand for human use might increase and therefore also the price • Higher demand in Peru or Brazil (Garcia et al., 2018) • High distribution in the Amazonas (Horn et al., 2018) • Population growth maintained even under intensive non-destructive harvest methods (Horn et al., 2018) • Important food source for many endangered species (Horn et al., 2018) • Creation of local livelihoods through handcrafting bags, etc. with spear leaves (Castellanos, Buitrago, & Aranguren, 2017) • Relatively low prices (Garcia et al., 2018) especially in comparison to e.g. asaí	• In Colombia it is used as a food color by companies such as Colorquímica (Cardona, 2018) and Colorganics (Medio Ambiente, 2017) • There is the potential of increasing international demand in the future (Raddatz-Mota et al., 2017)	• 22 different vanilla species are reported in Colombia, some of which have the potential to be used in agroforestry systems (Nicola Flanagan & Mosquera-Espinosa, 2016) • Problems with genetic diversity of vanilla crops and disease affection in commercial crops (N. Flanagan, Chavarriaga, & Mosquera-Espinosa, 2018) (Watteyn et al., 2020) • Natural pollination of plants is very probable in Colombia due to species richness of bees (N. Flanagan et al., 2018) and alternative to hand pollination on plantations in e.g. China (Watteyn et al., 2020) • Relatively high prices (Unimedios, 2012) and high demand worldwide (Watteyn et al., 2020) • Identified as good alternative for the production of coca (Ocampo Borray, Espitia Fandiño, & Palacios Patiño, 2018) and as good additional income for local communities (Hending, Andrianiaina, Maxfield, Rakotomalala, & Cotton, 2019) (Velázquez-Rosas, Silva-Rivera, Ruiz-Guerra, Armenta-Montero, & Trejo González, 2018)	• Use in color, for example for tattoos and food coloring (SINCHI, 2015)

Reasons for the chosen close relationships were named as bad prior experiences with intermediaries (#C5), the aim of helping specific communities (#C4; #C5; #C3) and the conservation of particular ecosystems (#C4; #C3). In some cases, products were sourced only from AFS or natural forests with an environmental harvest plan (#C3). None of the participants worked with existing certification schemes, as it seemed impossible due to bureaucratic challenges or was too expensive (#C3, #C4).

Long-term relationships are important for most participants (#C3; #C1; #C2; #C4, #C5). #C1 and #C2 have already worked with their producing communities for 10+ years. Many companies expressed that trust between them and their partner increased considering the limited initial trust which resulted from years of conflict. Therefore, long-term relationships are especially important. Besides, by mentioning where their products come from, #C5 wants to give credit to producers and create other ways of talking about the country (#C3; #C5). The aim is to highlight a more positive narrative of biodiversity conservation than talking about the Colombian armed conflict and its victims.
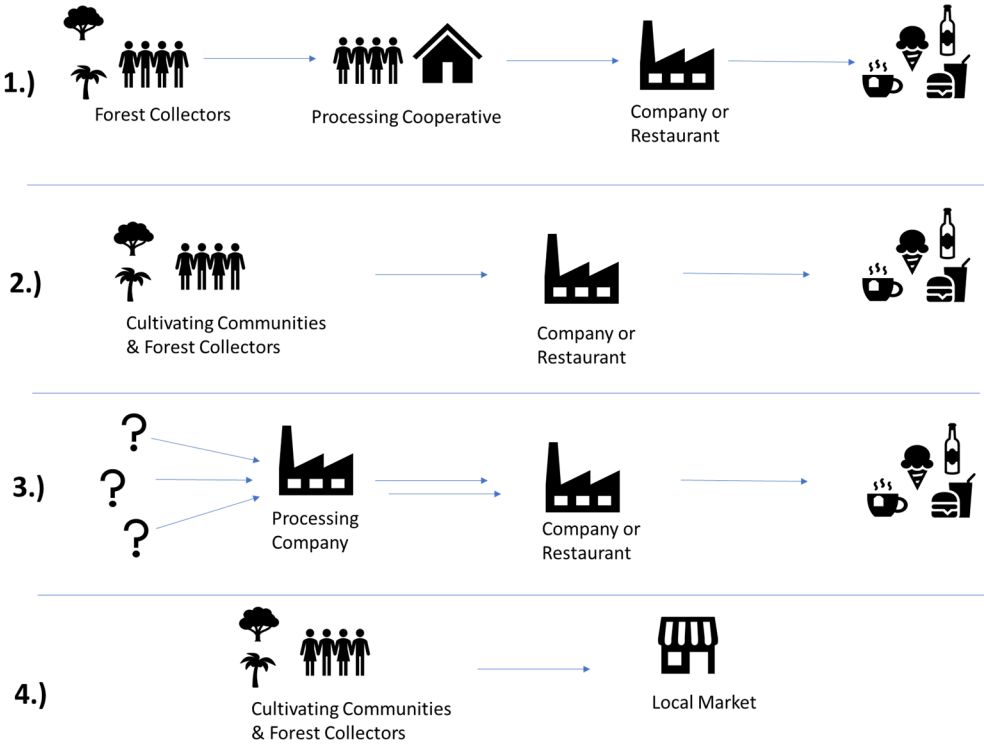
Figure 9. Different value chains of tree products from the perspective of final selling companies**.** In the first value-chain, the company works with a processing cooperative that receives its fruits from forest collectors. In the second value chain, the company directly receive their products from the cultivating communities or forest collectors. In the third example, the company receives its products from a processing company whose suppliers remain unknown. In the fourth example, products are directly sold at local markets (Source: Own Illustration, based on Interview among others #N3; #C3; #C1; #C2; and Garcia et al., 2017)

6.2 Economic Possibilities

#C2 is emphasizing that environmental and social interests of the projects could be hindered if the importance of economic consequences and possibilities is not taken into account. The overall demand for tree products in the national market is still relatively low (#C2), and only developing (#E3). Reasons for this are a lack of value for biodiversity (#C4), logistical challenges, and geographical distances (#C2), which further hinder cultural exchange in Colombia and, therefore, the interest for different yet unknown tree products (#C2). The demand of the tree products is further influenced by high demands for products from abroad (#C2) and a lack of knowledge (#E1; #C4; #C5) of different available tree products and their usage. Instead of selling their products at national and international markets, some projects sell their products successfully on local markets (#N2; Castro & Stock, 2015), such as in the case of farmer in Caquetá who were faced with high demand for, among others, their cacay (#N2). However, this was the minority and highly depended on where the farmers are located.

The demands for the individual products are very different depending on location and product (#E1; #E4). Asaí and camu-camu are becoming more and more nationally and internationally known and demanded (Blare & Donovan, 2018; Pepper & De Freitas Navegantes Alves, 2017; #E3; #C2; #E4; #E1). However, the cultivation of asaí in Colombia is facing competition by the partly economically cheaper large-scale cultivation in Brazil (#C2; #E1; Pepper & De Freitas Navegantes Alves, 2017) as still the national demand and the processing capacities are limited within Colombia. #C2 explains that they only buy asaí from a company in Colombia because of their positive social and environmental consequences. If they wanted to have a cheaper product with consistent high quality, they would import asaí from Brazil (#C2). Camu-camu is increasingly cultivated in Peru (Blare & Donovan, 2018). Cacay's demand is determined by the action of the company Kahai (Colombia Sostenible, 2020) and seen as very promising (#C1; #E3; #E1; Tiempo, 2017). Its demand is currently even higher than its supply (#C1). Other small products are instead niche products such as genipa americana or achiote. Canangucha is highly consumed in Peru and Brazil, but in Colombia, next to the consumption by indigenous communities, only commercially used as an animal food (Garcia et al., 2018; #E1; #E3). Chontaduro is commonly known as a very accessible nutritious food and used in regular meals or as street food (Graefe, Dufour, van Zonneveld, Rodriguez, & Gonzalez, 2013). The international demand for vanilla is high. However, most commercial food producers in Colombia use synthetic vanilla in their production (Nicola Flanagan & Mosquera-Espinosa, 2016; #C4).

How easy it is to sell products consequently differs as well. Whereas #C4 is collaborating with a community who searched one-year-long for a buyer of asaí *palmitos* (palm hearts), #N3 had a collaboration with a commercial buyer of cacay but was faced with such a high local demand for the product that this cooperation was not necessary.

It is still disputed what should be the priority of rehabilitation projects: to choose highly demanded products, to opt for commercial cooperation from the beginning, or to emphasise the biological importance of used plants. An approach from a conservation perspective is the choice of trees which support biological conservation, and then afterwards the search for possible markets. This could be combined with payments for ecosystem services (#E3). However, it was seen as risky as possible economic revenues might be too low for a continuation of the project (#E3). Participants working for companies share the opinion that products should be chosen which have a demand, are already known or whose buyers are identified (#C2; #E1; #E3; #E4; #C2; Castro & Stork, 2015). Further, predicted prices should be known and included in the project planning (#E3). Inclusive public-private partnerships might be a possible solution in which risks, investment costs, and knowledge would be shared (#E3). However, this is not always possible due to security concerns or further difficult political situations in certain regions (#N4; Castro & Stork, 2015). #C1 approached this question differently. They identified the cacay nut as very promising and built the national and international market for it over a time-period of ten years. However, this might be very difficult to achieve and not viable by a conservation organisation alone (#E1).

Most participants claim that they do not create an income throughout the year, as most are working with one product per community. #C1 and #C3 think that they cannot ensure a sufficient year-long income but a substantial additional income for some months. This is supported by #E3, who is evaluating the possibilities of NTFPs, due to their limited economic potential, as a viable option only when combined with other, more commercially used products. For him, this would ideally be in an AFS with cocoa and plantain. Another possibility would be the combination with payments for ecosystem services, which, however, need a lot of monitoring, quantification, and certification. Only one environmental conservation organisation (#ON4) claims that the income which they create with the cultivation of asaí is enough to ensure a sustainable income for the whole year. Numbers on how much income projects with tree products provide are difficult to obtain. However, Castro & Stock (2015) found that the commercialization of different NTFPs could yield an annual income of around € 1,000

to €2,000 in 2013[10] (2.650.000 COP)[11]— which is far from a living wage (Andersen, Anker, & Anker, 2020).

6.3 Experienced Infrastructural and Related Challenges

The eight products have different characteristics, with some needing a lot of equipment and knowledge to process and others being easy to handle and transport. Cacay was identified as one of the least laborious. It falls from the tree itself and only needs to dry (#C1). In contrast, asaí and camu-camu require more labor. Asaí is most frequently harvested by climbing the palms, which often leads to injuries (#E3, García Botina et al., 2018). Further, the fruits need to be processed within eight hours of harvesting (García Botina et al., 2018). The harvest of camu-camu is easier, as fruits are picked from small trees (Penn Jr, 2008), but they also need to be processed shortly after their harvest. For both products, transportation is difficult as they need to be cooled (García Botina et al., 2018). Chontaduro needs to be processed within three to five days of the harvest (Graefe et al., 2013), and canangucha needs further processing steps depending on its final use. In the case in Caquetá, animal feed is produced from the fruit by simply grinding it up (Garcia et al., 2018).

Quality requirements represent a challenge for many participants. The first step of their cooperation would often be the improvement of the quality in the processing and cultivation of the fruits (#C2; #C1; #C4) in order to enter the market. Often, companies have been relaxed with quality regulations in the beginning and achieved the appropriate quality during their cooperation (#C4; #C2; #C1). The National Food and Drug Surveillance Institute is the authority in Colombia which is responsible for the food industry (INVIMA, n.d.), and creates many challenges for companies (#C4), as their requirements do not always match the conditions of the places of production (#C4). If public services such as running water and energy are missing, the right processing cannot be ensured for some products (#C3; #C2). In general, one participant (#C2) is seeing the general need for more knowledge about processing in Colombia.

"We are doomed by our treasure" (#C4). This was the explanation of #C4 to the infrastructural challenges faced in Colombia. By treasure, she means three cordilleras of the Andes, which divide the country into different areas and create immense biodiversity. However, this makes

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[10] Further specifications if this calculation was per hectare or not were not made in the published article.

[11] Their data were calculated using the "prevailing exchange rate of Dec. 2013". Whit this rate, calculated by using OANDA.com, the income would be around 2.650.000 COP.

transportation within the country very difficult (#C4; #C5). The majority of participants mentioned transportation as a challenge. Nevertheless, this differs between products. Whereas asaí and camu-camu are very difficult to process and transport, cacay is rather easy (#E1). Transportation challenges are faced due to the remote locations of their producers (#C1; #C4); the medium-sized quantities which are transported (#C1) or other logistical requirements such as the cooling of the fruits (#C4). Sometimes, the problematic transportation situation is even hindering the use of certain products (#C5; #C2; #C4). One example is the case of asaí for #C4. The company is cooperating with a community for the cultivation of palmitos from the asaí palm. This community wants to also sell the asaí fruits to them. However, currently, due to transportation obstacles they are not yet able to do so: they still do not have cooling facilities for their boats with which they transport their goods. Therefore, challenges regarding transportation, processing, and harvesting should be known before the start of the project and addressed through the right equipment and training (#E3; #C2).

6.4 Institutional Support and Legal Requirements

Experts and companies showed themselves to be frustrated by the requirements and support of official institutions. Legal factors which are hindering the work of different companies are regulations such as the p*lan de manejo ambiental* (Environmental Harvest Plan) (#E3; #C3; #C4) or *s*anitary regulations (#C2; #C4). The most mentioned institutional challenge, the plan de manejo ambiental, (#E3; #C3; #C4; García Botina et al., 2018) must be agreed upon with the Ministry of the Environment and is required, among others, to harvest wild fruits in forests (#E3). It is thought to be a protection for the forests (#C3). However, this permit is complicated to obtain, and the government does not have the terms of reference which are needed to apply for it finalised (#E3). For companies and projects, it presents a significant challenge due to bureaucratic requirements (#C3; #C4). One reason for this is seen as due to the relatively new market situation of NTFP in Colombia (#C1) and a lack of political interest (#C3).

Land titles are another legal requirement which are problematic for businesses cooperating with farmers and communities. #E4 is arguing for the need of land titles for contracts with investors and is therefore seeing cooperation within a national park as problematic. The other respondents mentioned land titles as an issue. However, as they are very often cooperating with communities which do not have land titles, they do not interfere too much with their daily commercial activities.

Most participants shared disappointment with the support of governmental institutions. #C1 had to obtain connections in the government in order to work without problems (#C1). Especially at the beginning of their work, they faced a lot of obstacles. However, today, after

more than ten years of discussion, they agreed with the Ministry of Environment to report their activities in order to ensure its legality (#C1). #C2 wishes for more governmental support. From his perspective, the government is not doing enough for business activities. #C3 has not seen any improvement in the situation over the last 15 years. For him, legal requirements that should ensure sustainable forest management are complicating the work of several actors who want to work with those products sustainably to conserve the forest. However, at the same time, few actions are taken by the government to stop environmentally destructive activities such as large-scale deforestation (#C3). According to #E3 and #C3, improving the conditions for NTFP trade is not a priority as the government instead supports activities such as cattle ranching, due to its perceived economic profitability. Moreover, #E3 criticises that there is not a sufficient policy environment that supports the trade with NTFP at local, regional, and national levels.

Table 5. Lessons learned from companies working with tree products

Theme	Summary
Value chain structures	• Close relationships between farmers and companies can improve trust and cooperation • Focus on biodiversity instead of conflict-related topics reduces stigmatisation of farmers
Economic possibilities	• Markets for the eight tree products are still new and limited in Colombia and therefore brings risks • Growing interest but also growing cultivation of in asaí in Brazil is increasing competition through the use of economies of scale
Experiences infrastructural and related challenges	• Missing infrastructure (road and access to water and energy) are a major challenges which need to be considered in the implementation • Sanitary requirements by the responsible governmental institution do not match with certain local infrastructural circumstances and present challenges
Institutional support and legal requirements	• Legal obstacles are presenting mayor obstacles through environmental harvest rights for which companies need to apply to be allowed to use fruits from forests. • Missing institutional support for policy change and a missing political interest in the market of NTFP and AFS is increasing the difficulty of business with tree products

7. Key Findings and Discussion: A Value chain Approach for Environmental Peacebuilding?

As shown before, lessons learned include value-chain structures, economic possibilities, infrastructural and related challenges, institutional support and legal requirements (Table 5, p. 38). Having identified lessons learned by companies working with tree products and by taking environmental peacebuilding literature into account, several considerations were identified which are important for the development of value chains with tree products. However, unaddressed elements which could deteriorate the situation in PNN-SDLM remain. In the SES of PNN-SDLM, variables such as land titles, income creation, governmental actions and infrastructural developments are influencing the system (Table 3, p. 22). Not all of these can be addressed by a value chain approach. In the following section, I introduce the identified considerations, integrate these into the CLD (Figure 10, p.40), and discuss relevant environmental peacebuilding literature with these key findings.

7.1 Income Creation

One criterion for value chain creations for peacebuilding is the necessity to create long-term and sustainable incomes. As 'lessons learned' showed us that income is not automatically created, especially not with products whose demand is only now increasing, an analysis into future payments and revenues is important. As most companies showed that created income is not automatically ensured through planting trees and that demand differs between products, calculations around possible incomes before the start of the projects are essential to ensure that sustainable livelihoods are created which help in the economic recovery and present alternatives to illicit crops. A conservation agreement whose economic returns are not met could increase tensions between the conflict's parties and adversely affect conservation goals.

The question around which product should be planted is of importance. Whereas plantations with only the most economic viable options will have environmental damaging effects, a system with an equal distribution between the plants might lead to insufficient income creation. As the literature review showed that the demand and price for asaí and camu-camu differ to those of genipa americana and achiote, trade-offs between the choice of economic viable and environmental adaptable rehabilitation planting structures have to be found.

In the CLD, in PNN-SDLM, short-term economic necessities (10) are worsening the situation of deforestation (1) and the economic situation of small-scale farmers (6). Through a lack of institutional support and sometimes limited infrastructural conditions, alternatives to deforestation

Figure 10. Influences of Rehabilitation Projects within the social-ecological context of PNN-SDLM. The green elements represent the possible impacts of rehabilitation projects within the context. Endogenous elements are red and exogenous elements are blue. Elements that are not clearly distinguishable are black; (-) presents the opposite direction, and (+) presents the same direction. 1 – 17 are elements from the social-ecological system in Fig. 5. A – D present new elements linked to rehabilitation projects. (Source: Own Illustration, based on Interviews and literature reviews)

and coca production are difficult to achieve, reintroducing the reinforcing loop, which worsens the overall social-ecological situation in PNN-SDLM. Creating sustainable income sources would decrease the necessities for additional income (10) and improve the economic situation of small-scale farmers (8). Therefore, they would have positive effects on deforestation (1) and conflict potentials (4).

The findings of value chain considerations and tendencies in the SES of PNN-SDLM show several similarities concerning income creation with findings and discussion in environmental peacebuilding literature: Income necessities were identified to be an urgent need in other post-conflict situations (Webersik & Levy, 2016). However, experiences differed around the creation of value chains in a post-conflict situation. Some reported positive peace-related consequences (Castro & Stork, 2015) while others were not able to identify changes due to its implementation (Tamer-Chammas, 2012).

Several articles mention the necessity of being aware of bottlenecks within a value chain and to choose a value chain which is economic viable (Gingembre, 2012; Young & Goldman, 2015). In particular, cultivating high-value products has shown to be a successful way to promote nature conservation and economic recovery simultaneously (Gingembre, 2012). Furthermore, economic incentives in both the short and long term are essential. By providing economic benefits in a short time or by offering cost-effective solutions, sustainable resource management can be achieved in post-conflict situations in which it would otherwise not be the priority. For example, the distribution of free seedlings was successful in Haiti (Gingembre, 2012). Overall, by building transparent, inclusive, and fair relationships between actors, value chain approaches are seen to actively contribute to the solving of conflicts (Castro & Stork, 2015; Young & Goldman, 2015). Finally, even after establishing a successful value chain, it is essential to protect the cultivation against negative effects of climate change or price volatility (Webersik & Levy, 2016).

Just as in the 'lessons learned', the choice of plants was difficult in the case of Haiti (Gingembre, 2012). If invasive species which are fast-growing are planted, the risk is that these plants will not be adaptable to the natural ecosystem. Therefore, native but fast-growing species should be chosen to create an economic benefit.

7.2 Cooperation and Trust

The SES and lessons learned have shown that it is essential to create value chains which are close, interdependent and long-term-oriented and, through this, foster cooperation and trust between parties. Especially, inclusive public-private partnerships were mentioned to provide, along with

platforms for dialogue, the necessary economic stability. By including the PNN into the value chain creation and by creating conservation agreements, cooperation between them can increase. Cooperation is not directly addressing elements within the CLD. However, it indirectly can address stigmatisation (3) and conflict potential (4) by creating a better understanding of the other party. Furthermore, a positive conservation agreement, which is followed by farmers and PNN, can create trust, leading to more securities for both, land-use allowances for the farmers and the security that no prohibited activities are executed within PNN-SDLM by PNN.

Several interviewees mentioned that often organisations create awareness of former roles of farmers as former FARC member or victim of the conflict. This vocabulary only increases the stigmatisation of their partners. They pointed out that instead the goal should be to overcome those stories from the past and build something new together – by emphasising the biodiversity conservation role of the farmers. Furthermore, these cooperations can increase the participatory power of farmers in land-use decisions which further decrease conflict tensions.

Many case studies have shown that cooperation around natural resources can lead to peace (Walters, 2015; Westrik, 2015; Zahler, Wilkie, Painter, & Ingram, 2016). In particular, natural resources can help to show common interests, improve communication between parties, improve the trust between them and help in the unification of communities as well as enable possibilities for reconciliation (Environmental Peacebuilding, 2017c). Examples in which National parks contributed to the improvement of dialogue and cooperation between different parties are the Cordillera del Condor park between Ecuador and Peru, the Balkan Peace Parks between Kosovo and Montenegro and the Bamyan Plateau Protected Area in Afghanistan (Environmental Peacebuilding, 2017c). However, in other cases such as in Lebanon, natural resource management did not see an overall increase in cooperation nor confidence building (Tamer-Chammas, 2012).

Most examples of cooperation in environmental peacebuilding deal with partners who work on the same hierarchical level. Here, power symmetries were identified as essential in order to achieve a long-lasting peace. Power asymmetries are defined as "disparities in wealth, power and negotiating capacity" (UNDP, 2006, p. 223) and can hinder cooperation and negatively influence negotiation outcomes (Dresse, Fischhendler, Nielsen, & Zikos, 2018). Therefore, power imbalances must be addressed in the cooperation between farmers and PNN as clear power asymmetries concerning wealth, power and negotiating capacity exist. This is especially important as intergroup inequalities are identified as factors leading to a return to a conflict situation (Webersik & Levy, 2016).

7.3 Land Tenure Security

Even though land tenure did not present a major challenge for most of the interviewed companies, it remains a decisive variable which increases the tensions within PNN-SDLM. Land title security (17) is a decisive factor in the SES of PNN-SDLM. Farmers do not have the formal rights to stay within the PNN, even though many already lived within PNN-SDLM for decades, with some living within the area even before the creation of PNN-SDLM. The missing land titles are causing simutaneously insecurities for rehabilitation projects. Due to the restrictions of PNN-SDLM, this cannot be changed easily. However, conservation agreements between PNN and farmers can be a step in the right direction by creating land-use securities for the farmers living within PNN-SDLM. However, further steps still need to be taken: PcC demand to establish the ZRC. This would give the farmers living within and around PNN-SDLM a first tenure security and would secure their land from other interests such as land-grabbing or oil exploitation, as private land rights and permits for oil exploitation are not allowed in ZRCs (Minagricultura, n.d.). A collective land ownership through ZRC, as discussed since the signing of the peace agreement (Herrera Arango, 2017), would further increase the land security for the farmers and has proven successful in other post-conflict situations. Such a community-based natural resource management system is practiced effectively in Timor-Leste under the name tara bandu (Miyazawa, 2013). It provides community land rights under customary law, as it establishes an alternative for land rights in a situation in which the government was hindered due to limited financial and human resources (Miyazawa, 2013).

The interaction of land tenure with topics such as economic recovery and the necessity for a holistic approach became obvious in the case of Aceh in Indonesia and El Salvador. Even though a land tenure security program was established in Aceh, possible positive outcomes were hindered by the missing connection to themes such as economic recovery and by failing to take conflict factors into account (Green, 2013). Green (2013) therefore argues that a communal title of land would have been more beneficial and cost effective for the post-conflict realities in Aceh. In El Salvador, the narrow focus on land distribution, and the neglectance of other issues such as income creation, was not conducive to peace creation, especially because the redistribution of land did not yield the expected results in inequality reduction (Corriveau-Bourque, 2013).

7.4 Political Considerations

Lessons learned have shown that institutional requirements hinder the activities of companies through insufficient support (D). At the same time, several governmental actions (8, 14, 16) influence the SES in PNN-SDLM and negatively impact the economic situation of small-scale farmers (8) or deforestation (1). Regarding the issue of the lack of institutional action and support presented in chapter 5.3.2 and 5.3.3, rehabilitation projects can positively contribute to filling certain gaps while being hindered by missing institutional support themselves: they create alternative sources and increase trust and cooperation, as previously discussed. Nevertheless, the current government is not complying with the peace agreement (Kroc Institute, 2020) in topics such as PNIS and through this establishes barriers for a sustainable peace within PNN-SDLM and Colombia. At the same time, the government creates obstacles for rehabilitation projects themselves by not creating an enabling policy environment for the trade with tree products - as some companies expressed. Therefore, next to implementing solutions such as rehabilitation projects, political change is necessary to stop deforestation and improve the economic situation of farmers. The strongest influencing elements within the system are the political actions of the government as these have the consequence of affecting several elements and sides of the reinforcing feedback loop, which leads to more deforestation and more conflict.

Keeping the political influences in mind has proven to be important in environmental peacebuilding. Ide (2020) identified depoliticisation as one of five adverse effects of environmental peacebuilding. By seeing "environmental issues as [..] low politics issues" (ibid, p.3) underlying political structures, such as power relations and social-economic structures, are ignored, which leads to adverse effects on the sustainability of environmental peacebuilding initiatives. In projects which aimed to increase the cooperation around water issues between Israel and Palestine, the problems regarding depoliticisation became clear. Through its focus on low political issues, highly disputed and political topics such as the territorial distribution of water or the occupation of the West Bank by Israel are not addressed (Fischhendler & Tenenboim-Weinblatt, 2019; Ide, 2020; Michael, Mark, & Ziad, 2012). Therefore, identifying the underlying political structures in the SES of PNN-SDLM is essential - reminding us that governmental actions have a decisive impact on the success of rehabilitation and rural development projects.

7.5 Road Infrastructure

Infrastructural road development (13) improves the possibilities of alternative income projects for (11) and the economic situation of (6) small-scale farmers. More accessible transportation lowers the challenges faced by communities and in projects involving tree products. Especially for projects which deal with products such as asaí and camu-camu, having a good infrastructural connection is essential. On the other hand, infrastructural connectivity is driving deforestation (1), as areas are becoming more accessible. The trade-off between negative environmental consequences and positive social and economic consequences can, however, be taken into account in the planning of roads at the national level (Vilela et al., 2020). Also in environmental peacebuilding literature, the need to balance between social and environmental impacts became apparent (Anand, 2013). In a case study in Afghanistan, the construction of roads did not only lead to negative environmental but also to negative social consequences with the increase in land-grabbing especially by wealthy Afghans which further increased conflict tensions (Unruh & Shalaby, 2013).

7.6 Rehabilitation Initiatives and Nature Conservation

Deforestation within PNN-SDLM is not only environmentally problematic, especially because PNN-SDLM is located at the beginning of the Amazon rainforest, but it is also driving the SES of PNN-SDLM. Forest conservation can benefit from rehabilitation projects. Several participants mentioned that work with tree products is going to increase the perceived importance of forest conservation (C). Therefore, it increases the actions for forest conservation and reduces deforestation pressures by small-scale farmers. This is reaffirmed by a recent study conducted on the border of PNN-SDLM which found a correlation between the perceived importance of forests, the use of forest products and the willingness to conserve the remaining forest (Castro-Nunez, Mertz, & Quintero, 2016).

Forest governance plays an important role in environmental peacebuilding research. Either through investigations into the effects of post-conflict situations on forest resources or by investigating the possible livelihood options which exist through forest management. Ecosystem restoration and peacebuilding cannot always be combined, as Lonergan (2012) showed. Sometimes, ecosystems have changed too much and economic recovery necessities stand in contrast to environmental restoration goals.

The impact of rehabilitation projects on nature conservation are limited when deforestation within PNN-SDLM and Colombia continues in the current pace. The consequences of the pace of deforestation cannot be mitigated by rehabilitation projects alone. Therefore, the impact of rehabilitation projects might be very limited considering larger deforestation drivers. Therefore, more extensive national and international measures are necessary. This needs to be achieved by stronger governmental actions which should address large-scale land-grabbing. However, international pressures need to increase simultaneously. In a long-term perspective, having considerations around trade restrictions on products cultivated on former deforested land might be part of the future discussion on the sustainability of this area.

9. Conclusion

Post-conflict situations face challenges such as the need to create income and to overcome disparities between conflict parties. Colombia is currently in a post- peace agreement phase and its ecosystems are threatened by high deforestation rates. In this context, rehabilitation projects, as a form of reforestation, emerge as an initiative to increase nature conservation while simultaneously addressing peacebuilding necessities.

My research investigates, based on the local case of social-environmental tensions in PNN-SDLM, the considerations which need to be taken into account when implementing and planning rehabilitation projects through a value chain approach. I identified considerations for rehabilitation projects and their contributions towards environmental peacebuilding by first classifying the variables which influence the SES of PNN-SDLM and then comparing those to lessons learned from companies working with NTFP or AFS in Colombia.

Rehabilitation projects through a value chain approach can contribute positively to environmental peacebuilding and the social-environmental tensions within PNN-SDLM. Several examples have shown that income creation and increased cooperation between conflict parties can reduce discrepancies between conflict parties. However, for the success of the projects, it is decisive to identify and address bottlenecks in value chains, power asymmetries, and the proposed structure of the value chain itself. Trust and economic risks are likely to be mitigated if risk is shared and interdependent relationships between the participants of the value chain exist. In consequence, stigmatisation of farmers as a factor leading to deforestation, can be reduced when the projects frame farmers as biodiversity conservationists beyond their previous connections with the armed conflict. Moreover, it is necessary to identify trade-offs between the environmental and economic contributions of specific tree products within the rehabilitation projects.

However, further issues, such as land tenure, need to be simultaneously addressed. Missing land titles are an essential factor that is increasing the tensions between farmers and PNN. Solutions here would be, for example, a scheme of community land ownership. Finally, political influence and governmental actions are decisive around these questions if peacebuilding processes are strengthened while globally important ecosystems are conserved.

The outcomes of the rehabilitation projects are uncertain as they are only in their implementation phase. Success or failure will depend on several factors, such as the future actions of the government, the market development for tree products and the development of deforestation within and around PNN-SDLM. If the current governmental actions continue to not comply with the peace-agreement and do not implement land reforms or address large-scale land-grabbing through deforestation, rehabilitation projects might be only be a drop in a bucket of critical environmental and social issues in the Macarena region.

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A.1 List of Interviews, observations and additional sources used in the thematic analysis

Table 6. List of interviews

ID	Organisation	Date	Topics
#N1	Practicioner working with nature conservation	12.03.2020	Alternative Production Projects in Meta, Colombia
#N2	Practicioner working with nature conservation	19.03.2020	Alternative Production Projects in Sierra de la Macarena & Conflicts in Sierra de la Macarena
#N3	Practicioner working with nature conservation	25.03.2020	Alternative Production Project in Caqueta, Colombia
#E1	Think-tank or Institute	02.04.2020	Value Chain of Non-Timber Forest Products
#E2	Think-tank or Institute	27.03.2020	Interconnection between land use, climate change and peace
#E3	Think-tank or Institue	27.03.2020	Value Chain of Non-Timber Forest Products
#E4	Think-tank or Institue	03.04.2020	Environmental peacebuilding
#SO1	A working with a social organization	02.06.2020	Social-environmental conflict in PNN Sierra de la Macarena & Contributions of reforestation/rehabilitation projects
#C1	Company working with NTFP	04.06.2020	Value chain and experiences with cacay
#C2	Company working with NTFP	01.06.2020	Value chain of Non-timber Forest Products and experiences of their collaboration with producers
#C3	Company working with NTFP	03.06.2020	Value chain of Non-timber Forest Products (camu-camu & asaí) and experiences of their collaboration with their suppliers
#C4	Company working with NTFP	03.06.2020	Value chain of Non-timber Forest Products (palmito & asaí) and experiences of their collaboration with their suppliers
#C5	Company working with NTFP	04.06.2020	Value chain of Non-timber Forest Products (asaí; camu-camu; canangucha and others) and experiences of their collaboration with their suppliers
#N4	Practicioner working with nature conservation	29.06.2020	Conservation approach

Table 7. List of observations

ID	Organisation	Date	Name (if public event)	Event
#OE1	Think-thank or scientific institute	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#ON1	Nature Conservation	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#OO1	Public Administration	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#OE2	Think-thank or scientific institute	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#OE3	Think-thank or scientific institute	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#OO2	Unknown to the author	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#OO3	Unknown to the author	31.03.2020	-	WWF: Taller Virtual de Línea base del proyecto Parques & Paz
#OO4	Public Media	24.02.2020	Jimena Duzan / introduction video	Online talkshow: Incendios en la Serranía de la Macarena: campesinos demienten a Min. Defensa
#ON2	Nature Conservation	24.02.2020	Rodrigo Botero	Online talkshow: Incendios en la Serranía de la Macarena: campesinos demienten a Min. Defensa
#OO5	Human Rights	24.02.2020	Jhenifer Mojica	Online talkshow: Incendios en la Serranía de la Macarena: campesinos demienten a Min. Defensa
#OO6	Member of a Political Party	24.02.2020	Juan Carlos Losada	Online talkshow: Incendios en la Serranía de la Macarena: campesinos demienten a Min. Defensa
#OE4	University	04.03.2020	Darío Farjado	Public Panel Discussion: Foro: ¿Qué está pasando realmente en La Macarena?
#OE5	University	04.03.2020	Henry Salgado Ruiz	Public Panel Discussion: Foro: ¿Qué está pasando realmente en La Macarena?
#OE6	University	04.03.2020	Nicolás Pérez	Public Panel Discussion: Foro: ¿Qué está pasando realmente en La Macarena?

#ON3	Nature Conservation	04.03.2020	Rodrigo Botero	Public Panel Discussion: Foro: ¿Qué está pasando realmente en La Macarena?
#OF1	Farmer	04.03.2020	Luis Eduardo	Public Panel Discussion: Foro: ¿Qué está pasando realmente en La Macarena?
#ON4	Nature Conservation	02.07.2020	-	Webinar by an environmental conservation organization about the cultivation of saí.

Table 8. Additional references used in the thematic analysis

Author	Year	Title	Type of Source
García et al.	2018	Estrategia sectorial de la cadena de productos no maderables del bosque en Guaviare, con enfoque agroambiental y cero deforestación	Scientific
García et al.	2018	Estrategia sectorial de la cadena de productos no maderables del bosque en Caquetá, con enfoque agroambiental y cero deforestación	Scientific
Daría Fajardo Montana	2020	Disputa por la tierra, la mecha que enciende el conflicto en La Macarena	University Blog Post
Henry Salgado Ruiz	2020	Organizaciones sociales han suplido vacío del Estado	University Blog Post
Nicolás Alexander Pérez Forero	2020	Marginalidad y crisis en el desarollo rural de la Macarena	University Blog Post
Semana Sostenible	2020	Parques con campesinos, el clamor de las comunidades amazónicas al gobierno	Newspaper Article
Castro & Stork	2015	Linking to peace: Using BioTrade for biodiversity conservation and peacebuilding in Colombia	Scientific Paper
Murillo-Sandoval et al.	2020	The end of gunpoint conservation: Forest disturbance after the Colombian peace agreement	Scientific Paper
Semana Sostenible	2020	Mafias pagan 5 millones de pesos por hectarea deforestada en el Meta	Newspaper Article

A.2: Systematic Literature Review

1. **Search for literature around deforestation in La Macarena**
Scopus search string: TITLE-ABS-KEY(deforestation AND Macarena)
Exclusion criteria: only sources since 2016
Sources found: two sources were found and relevant

2. **Search for literature around asaí:**
Scopus search string: TITLE-ABS-KEY(Asaí AND Acaí)
Exclusion criteria: 2020 – 2015; only relevant journals such as Conservation Biology, Landscape Journals , etc. And no journals dealing with Mathematic and Chemistry, etc.
Sources found: 13 sources were found of which 8 were relevant

3. **Search for literature around cacay:**
Scopus search string: TITLE-ABS-KEY(cacay)
Exclusion criteria: none
Sources found: 1 source was found of which 0 were relevant

4. **Search for literature around camu-camu:**
Scopus search string: TITLE-ABS-KEY(camu-camu)
Exclusion criteria: only 2020 – 2015; only journals related to sustainability sciences, conservation biology, business or other relevant areas; only sources in spanish and english; exclusion of clearly irrelevant keywords
Sources found: 13 sources were found of which 6 were relevant

5. **Search for literature around canangucha:**
Scopus search string: TITLE-ABS-KEY(moriche OR aguaj* OR canangucha OR (mauritia AND flexuosa))
Exclusion criteria: none
Sources found: 7 Sources were found of which 5 were relevant

6. **Search for literature around genipa americana:**
Scopus search string: TITLE-ABS-KEY (genipa AND americana)
Exclusion criteria: only since 2015; limited to relevant subject areas
Sources found: 5 sources were found

7. **Search for literature around achiote:**
Scopus search string: TITLE-ABS-KEY ((achiote OR (bixa AND orellana)) AND (conservat* OR agroforest* OR reforest* OR colombia))
Inclusion criteria: multidisciplinary journals; only english articles
Sources found: 5 sources were found of which 1 was relevant

8. **Search for literature around vanilla:**
Scopus search string: TITLE-ABS-KEY ((vanilla) AND (conservat* OR agroforest* OR reforest* OR colombia))
Exclusion criteria: 2015 to 2020
Sources found: 19 sources were found of which 9 were relevant

9. **Search for literature around chontaduro:**
Scopus search string: TITLE-ABS-KEY ((chontaduro OR (bactris AND gasipaes)) AND (conservation OR reforestation OR agroforestry))
Exclusion criteria: 2013 to 2020; limited to relevant subject areas
Sources found: 5 sources were found