Manuscript Details

Manuscript number	JAPG_2019_1240
Title	Reducing deforestation through value chain interventions in countries emerging from conflict: the case of the Colombian cocoa sector
Article type	Full Length Article

Abstract

Sustainability commitments by private sector actors are emerging as promising interventions to help reduce global deforestation. Much attention is placed on the forest conservation impact of these interventions in areas where commodity production constitutes a main driver of deforestation. It is however less clearly understood what role they could play in areas where the production of commodities is not evidently leading to the loss of forest, and how they could contribute to other objectives including sustainable rural development and peacebuilding. In this paper, we examine the potential of the cocoa value chain in Colombia in achieving deforestation reduction and peacebuilding simultaneously, as aimed by the country's Cocoa, Forests and Peace Initiative. Results from correlations and spatially explicit analyses show that regardless of its widespread production across Colombia, cocoa is not an important driver of deforestation. This suggest that efforts to end deforestation in the Colombian cocoa sector emerged following global trends, and not because of an evident link between cocoa production and deforestation. Furthermore, results from spatial clustering analyses highlight areas where different types of value chain interventions may be appropriate to parallel forest conservation and peacebuilding, while interviews with key actors in the cacao sector provide clues as to how these interventions should be developed and implemented. Specifically, our results show that narratives around approaches to achieve zero-deforestation from agricultural commodities should (1) be adjusted to local contexts, (2) incorporate location-specific development needs, (3) complement existing rural development efforts, (4) enhance collaboration among actors that operate both within and beyond the value chain, and (5) apply high-resolution data to assess deforestation-commodity relations and verify zero-deforestation commitments. These considerations are particularly relevant in contexts where commodity production is not evidently leading to deforestation, as in the case of cocoa production in Colombia.

Keywords	Zero-deforestation, agricultural commodity, value chain, peacebuilding, land use change

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Dr. N. Hoalst-Pullen Date: 17-12-2019

Editor in Chief:

Applied geography

Dear Dr. Hoalst-Pullen

We are pleased to submit our manuscript entitled *"Reducing deforestation through value chain interventions in countries emerging from conflict: the case of the Colombian cocoa sector"* for your consideration for publication as a research article in Applied Geography.

In this paper, we examine the potential of the cocoa value chain in Colombia in achieving deforestation reduction and peacebuilding simultaneously, as aimed by the country's Cocoa, Forests and Peace Initiative. Results from correlations, spatially explicit analyses and interviews with key actors in the value chain provide insights on how these interventions should be developed and implemented.

This manuscript describes original work and is not under consideration for publication elsewhere. All authors have approved the manuscript and agree with the submission. Thank you for receiving our manuscript and considering it for review. We look forward to hearing from you at your earliest convenience.

Sincerely,

Augusto Castro-Nunez (on behalf of all authors)

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Reducing deforestation through value chain interventions in countries emerging from conflict: the case of the Colombian cocoa sector

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Acknowledgements

This research was developed as part of the project 18_III_106_COL_A_Sustainable productive strategies. This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag.

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Abstract

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Keywords

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1. Introduction

Global clamor over the need to reduce deforestation linked to agricultural production in order to lower carbon emissions and curb the loss of biodiversity is increasing. Commitments on sustainability by private sector actors are emerging as promising interventions to help reduce global deforestation (Lambin et al., 2018). Hundreds of corporations have pledged to enhance transparency and accountability in their supply chains as a means to achieve zero-deforestation. However, the impact of such commitments on reducing deforestation has been limited (Garrett et al., 2019). Greater impacts may be accomplished through the implementation of value chain interventions (VCI), here defined as actions directed at segments of a value chain, or along its entire length, to achieve certain environmental, social or economic development goals (Sola et al., 2017; Zuberi, Mehmood & Gazdar, 2016).

Zero-deforestation VCI provide an opportunity to put zero-deforestation commitments into action. However, such interventions are facing various challenges in reaching desired outcomes (Garrett et al., 2019). In fact, before gaining prominence as a tool to achieve zero-deforestation, VCI were promoted as a means to deliver sustainable development, including conflict resolution, poverty reduction, rural development, gender inclusion, improved nutrition, food security and forest conservation (Bolwig, Ponte, du Toit, Riisgaard & Halberg, 2008; Devaux, Torero, Donovan & Horton, 2018; Maestre, Poole & Henson, 2017; Seville, Buxton & Vorley, 2011; Tallontire & Vorley, 2005; Zuberi et al., 2016). Nevertheless, the impact of such interventions on sustainable development remains a topic of debate (Kidoido & Child, 2014). This is partly because value chains are complex, multi-layered in nature, highly diverse, dynamic, and time and context-specific (Devaux et al., 2018; Kidoido et al., 2014; Reardon et al., 2019; Ton, Vellema & de Ruyter de Wildt, 2011). Furthermore, some authors argue that to achieve sustainable outcomes, VCI alone are insufficient, and they need to be implemented concertedly with other sustainability approaches, engage stakeholders along the entire value chain, and address multiple factors and interactions (Devaux et al., 2018; Seville et al., 2011).

Emerging literature on the topic mainly focuses on assessing corporate supply-chain commitments in contexts where there is a clear link between an agricultural commodity and deforestation (Gardner et al., 2019; Garrett et al., 2019; Lambin et al., 2018). However, contexts where this link is weak or unapparent are often disregarded. Zero-deforestation initiatives were initially developed to reduce forest loss in countries where globally traded commodities are the main drivers of deforestation, such as in Brazil, Indonesia and Malaysia (Boucher & Elias, 2013; Gibbs et al., 2015; Henders, Persson & Kastner, 2015). These initiatives were built upon “name and shame” campaigns that have led to recent trends of incorporating social and environmental concerns into corporations’ supply chains (Vurro, Russo & Perrini, 2009) and implementing governance models that encompass extensive collaboration with all stakeholders involved in the value chain (Jiang, 2009). Arguments for such interventions are supported by evidence indicating that the production of globally traded agricultural commodities – such as palm oil, soy, beef, coffee and cocoa – is an overwhelming cause of tropical deforestation (McCarthy & Tacconi, 2011).

On the other hand, there is no clear understanding of the role of such interventions in reducing or preventing deforestation where forest cover changes are tied to interlinkages that are more complex. For instance, the expansion of commodities on previously cleared land may have limited impacts on forest cover, and could even contribute to reforestation in the case of tree crops such as cocoa (Schroth, Garcia, Griscom, Teixeira & Barros, 2016). Similarly, it is not clear how these interventions should be developed and implemented in such contexts, particularly because on-the-ground implementation would naturally vary between countries where deforestation is driven by agricultural commodities and those where it is not (McCarthy et al., 2011). Implementation should also vary between cases that involve global brands that dominate the market and small producers located in isolated regions, such as regions emerging from armed conflict (Perez-Aleman & Sandilands, 2008; Reed & Reed, 2009; Rein & Stott, 2009). For instance, there is no doubt that in some parts of the globe, cocoa farming has led to deforestation; the sector, hence, has been the subject of sharp criticism. This is the case for countries where cocoa has been promoted as an economic alternative in post-conflict settings, such as Ghana (Deans, Ros-Tonen & Derkyi, 2018). It is not clear, however, as to what extent cocoa is causing deforestation in other countries, such as Colombia, where i) complex interlinkages between coca leaf production, cattle pastures and land grabbing drive deforestation (Castro-Nunez, Mertz, Buritica, Sosa & Lee, 2017), ii) the cultivation of cocoa has been promoted as an alternative to illegal crop production (Charry, Castro-Llanos & Castro-Nunez, 2019), and iii) most of the cocoa production is traded nationally (Abbott et al., 2018)).

In this paper, we contribute to the understanding of the role of VCI in achieving zero-deforestation in areas where the link between deforestation and commodity production is not evident. It does so via quantitative analyses and interviews with key stakeholders in the cocoa sector in Colombia. We use Colombia, a country emerging from armed conflict, as a case study; because, despite a lack of evidence in the literature that cocoa is causing significant deforestation, Colombia's government has joined global efforts to achieve deforestation-free cocoa production, which is being carried out under the country's Cocoa, Forests and Peace Initiative (Minambiente, 2018). We first perform correlations and spatially explicit analyses to explore to what degree deforestation is associated with cocoa production in Colombia, and examine how locations with similar cocoa, forest and conflict characteristics are spatially distributed. We then use semi-structured interviews with key stakeholders to better understand their viewpoint about the potential role of the cocoa value chain as a tool for forest conservation and peacebuilding and identify opportunities and barriers in delivering both forest conservation and long-lasting peace, as aimed by the Cocoa, Forests and Peace Initiative. After this introductory section, the methods are described. Subsequently, results from Spearman correlation analysis, Local Indicators of Spatial Association (LISA) analysis, Hierarchical Cluster Analysis and interviews are presented. We then discuss the implications of our results for on-the-ground implementation of zero-deforestation VCI.

2. Methods

2.1 Cocoa, forests and peace in Colombia

Since the beginning of the peace negotiations between the Colombian government and the Revolutionary Armed Forces of Colombia (FARC), the country has been experiencing changes in multiple dimensions, which has brought about new environmental, social and political challenges (Eufemia et al., 2019). Approximately 52% of Colombia's 114.2 million hectares of land are covered with natural forests. Around 60% of its natural forests are found in the Amazon region, while 17% and 9% are found in the Colombian Andes and Pacific region, respectively. According to the Colombian Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), more than 5.6 million hectares of forests were lost between 1990 and 2010, with an average annual deforestation rate of 0.42% between 1990 and 2000, a rate of 0.52% between 2000 and 2005, and a rate of 0.47% between 2005 and 2010. Lower deforestation was observed between 2010 and 2013, at an average rate of 0.28% per year (IDEAM, 2018).

Deforestation has been particularly severe in areas affected by the armed conflict and illicit crop production (Charry et al., 2019). In these areas, cocoa cultivation has been promoted by the Government of Colombia (GoC) and international cooperation agencies as a productive alternative to illicit crops for several decades. In light of recent global trends to achieve zero-deforestation in agricultural value chains, several actors have highlighted existing opportunities to produce cocoa with zero-deforestation in areas prioritized for peacebuilding and rural development efforts. These areas include municipalities defined by the GoC as Areas Most Affected by Armed Conflict (ZOMAC) and prioritized for Development Programs with Territorial Approach (PDET). For example, in July 2018, the Cocoa, Forests and Peace Initiative was signed by the GoC, producer associations, the National Federation of Cocoa Producers (FEDECACAO), industry representatives and national and international civil society organizations. The signatories have agreed to work together to end deforestation and promote forest protection and restoration through the Framework Agreement for Joint Action, which is structured around the following three priority areas: (1) forest protection and restoration; (2) sustainable cocoa production and livelihood security of farmers; and (3) community participation and social inclusion.

Unlike other producing countries, most of Colombia's cocoa production is used to meet domestic demand. Production occurs mostly within the departments of Santander and Nariño in the north and south respectively, where many conflict zones and areas emerging from conflict are located. Production occurs on a smaller scale in the departments of Antioquia, Arauca, Tolima and Norte de Santander. Cocoa is mainly produced by small producers (about 90%), who typically plant around 3 hectares of cocoa (Abbott et al., 2018). Figure 1 illustrates the average cocoa crop area per department between 2007 and 2017.

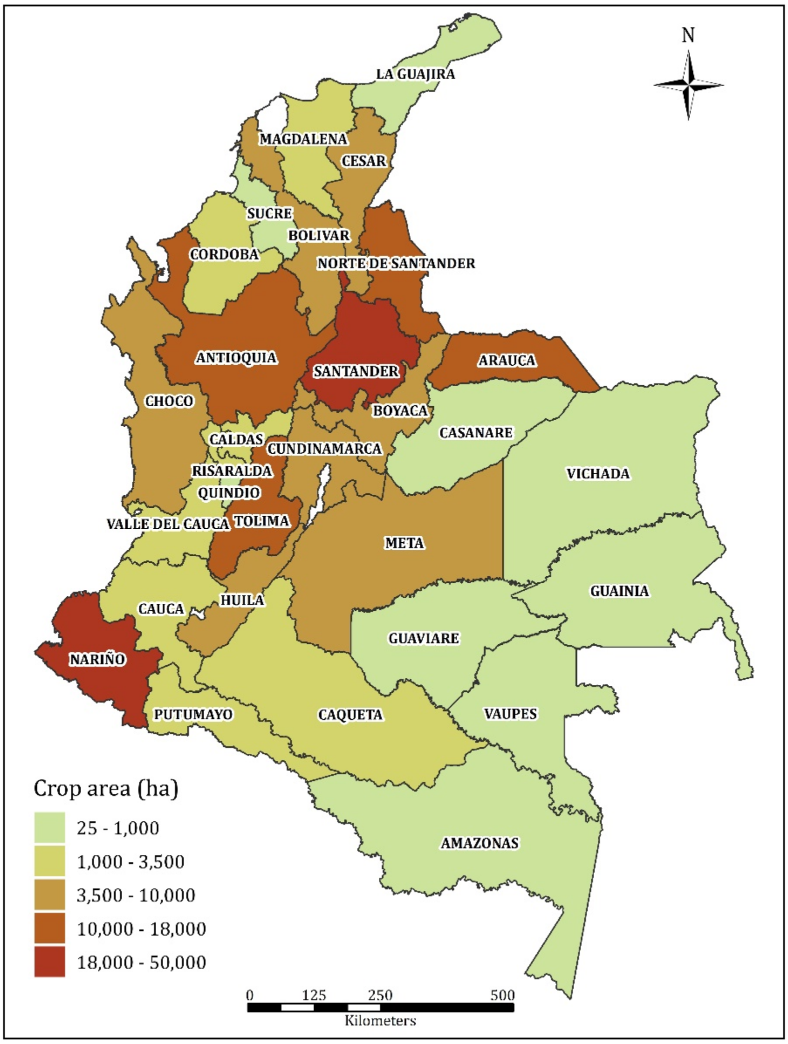

Figure 1. Average crop area of cocoa cultivation at the department level between 2007 and 2017 as reported by the Colombian Ministry of Agriculture and Rural Development.

2.2 Correlations and spatially explicit analyses

We first examined to what degree deforestation is associated with cocoa production in Colombia and how areas with similar cocoa, forests and conflict characteristics are spatially distributed. Analyses were limited to cocoa-producing municipalities in Colombia (n = 529), taking the municipality as the unit of analysis. This study utilized official data on cocoa from the Ministry of Agriculture and Rural Development (MADR, 2018) and data on forest cover from IDEAM (IDEAM, 2018), (Table 1). Selection of data sources depended on data availability at the municipal level.

Spearman's rank correlation coefficients (r_s) were calculated to identify correlations among the following 6 variables related to forest cover, cocoa production, and the armed conflict: (1) forest area; (2) change in forest cover; (3) cocoa area; (4) cocoa production; (5) cocoa yields; and (6) armed conflict index. In addition, we examined local spatial associations between "change in forest cover" and "cocoa area" by computing bivariate local Moran's I values, also known as Local Indicators of Spatial Association (LISA) (Anselin, 1995). The municipalities were then clustered using Hierarchical Cluster Analysis (Euclidean distances and Ward's method), which included five variables: (1) forest area; (2) change in forest cover; (3) cocoa area; (4) cocoa yields; and (5) land suitable for cocoa cultivation. The clusters are composed of municipalities that are similar with respect to the cocoa production and forest cover variables included in the analysis. The location of the clusters were mapped to examine how they are spatially distributed. Then, the number of municipalities defined by the GoC as Areas Most Affected by Armed Conflict (ZOMAC) and prioritized for Development Programs with Territorial Approach (PDET) within each cluster were identified. The Hierarchical Cluster Analysis was conducted using the Stats package in R v2.9.2 (R Core Team) and bivariate local Moran's I values were estimated using the software GeoDa v1.6.7.9 (Anselin, Syabri & Kho, 2006).

Table 1. Variables used to examine the relationship among cocoa cultivation, changes in forest cover and the armed conflict in Colombia.

Variable	Period	Source *
Forest area (%)	2017	IDEAM
Change in forest cover (%)	2005 - 2017	IDEAM
Average cocoa area (ha)	2007 - 2017	MADR
Average cocoa production (ton)	2007 – 2017	MADR
Average cocoa yields (ton/ha)	2007 – 2017	MADR
Land suitable for cocoa cultivation (%)	2017	UPRA
Armed conflict index[1]	2016	DNP
ZOMAC municipalities[2]	2016	DNP
PDET municipalities[3]	2017	DNP

[1] Index ranging from 0 to 1, with values 0 indicating no conflict and 1 indicating high conflict
[2] Municipalities defined as Areas Most Affected by Armed Conflict
[3] Municipalities prioritized for Development Programs with Territorial Approach
* Data sources: Instituto de Hidrología, Meteorología y Estudios Ambientales Institute of Hydrology, Meteorology and Environmental Studies (IDEAM); Ministry of Agriculture and Rural Development (MADR); Rural Agricultural Planning Unit (UPRA); National Planning Department (DNP)

2.3 Semi-structured interviews

The quantitative analyses described above were coupled with 30 semi-structured interviews conducted with key actors in the cocoa value chain. The interviews were conducted from December 2018 to January 2019 and focused on: (1) the role of cocoa in forest conservation, restoration and peace processes, and (2) opportunities and limitations for the development of the national cocoa value chain. Respondents were selected from all three levels of the value chain (i.e. micro, meso and macro; according to the classification proposed by Jäger, Jiménez & Amaya (2013)). Several of the respondents fulfilled more than one role within the value chain. The most represented role was related to the processing of cocoa into chocolate or other products, with eight interviewees assuming this role. Other roles represented by respondents included artisan chocolatiers, representatives of the Bean to Bar sector, large industrial companies, academia, producers, union representatives, policymakers and other government employees (from ministries and other public entities), representatives from international cooperation agencies, and suppliers of plant material and other business services.

3. Results

3.1 Correlations among cocoa, forests and conflict in Colombia

A Spearman correlation matrix was computed based on the 529 cocoa-producing municipalities in Colombia (Table SM1 in the supplementary material). The results show that mainly weak correlations ($r_s <0.30$, $p < 0.05$) exist among the forest, cocoa and conflict variables included in the analysis. However, a positive, moderate correlation was found between “forest area” and “armed conflict index” ($r_s = 0.46$, $p < 0.05$), and a strong positive correlation between “cocoa production” and “cocoa area” ($r_s = 0.76$, $p < 0.05$).

3.2 Local spatial associations between deforestation and cocoa production (LISA)

The distribution of bivariate Moran’s I values sheds light on local patterns of spatial associations between “change in forest cover” and “cocoa area” at municipality level (Figure 2). More specifically, the results point to statistically significant spatial associations ($p < 0.05$) between deforestation in a given municipality and cocoa area in a neighboring municipality, for 118 out of the 529 municipalities included in the analysis.

In 11 out of the 118 municipalities, high deforestation pressure is spatially associated with high cocoa production within neighboring municipalities (High-High associations; highlighted in red in Figure 2). This suggests that only in and around these 11 municipalities, the production of cocoa could potentially be a driver of forest loss. However, further analysis would be needed to attribute causal relationships. Nine out of eleven municipalities are located in the departments of Nariño and Santander, where currently most of Colombia’s cocoa production is taking place. One municipality in Santander has been defined as ZOMAC. In addition, five municipalities in Nariño have been defined as ZOMAC, of which two also have been prioritized for PDET.

In 49 municipalities, high deforestation pressure is spatially associated with low cocoa production within neighboring municipalities (High-Low associations; highlighted in orange in Figure 2). This implies that in these areas, activities other than cocoa cultivation seem to be driving deforestation. More than half of the municipalities characterized by High-Low associations are located in the departments of Casanare, Meta and Valle del Cauca. Five municipalities have been prioritized for PDET, while 25 have been defined as ZOMAC.

In 24 municipalities, low deforestation pressure is spatially associated with high cocoa production in neighboring municipalities (Low-High associations; highlighted in light blue in Figure 2), which points to extensive cocoa production activities with, nonetheless, limited impacts on forest cover. These municipalities are mainly located in the departments of Boyacá and Santander. Two of them (both located in Santander) have been defined as ZOMAC, while none have been prioritized for PDET.

In 34 municipalities, low deforestation pressure is spatially associated with low cocoa production within neighboring municipalities (Low-Low associations; highlighted in dark blue in Figure 2). This points to limited cocoa production activities that, in turn, generate a low impact on forest cover. Almost 60% of these municipalities have been prioritized for PDET and are mainly located in the Amazon region, within the departments of Caquetá (6 municipalities), Meta (5 municipalities), Putumayo (5 municipalities) and Guaviare (3 municipalities). More than 80% of the municipalities characterized by Low-Low associations have been defined as ZOMAC.

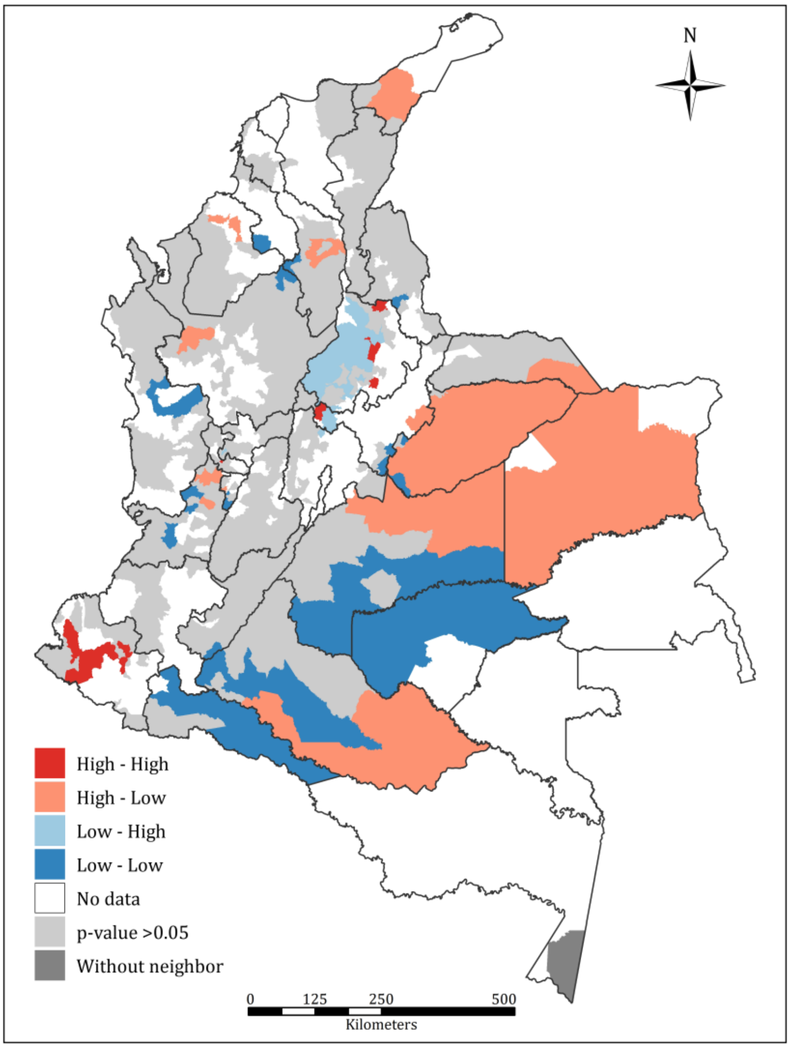

Figure 2. Moran cluster map of the local spatial associations between "change in forest cover" and "cocoa area" at municipality level. High-High associations point to high deforestation surrounded by high cocoa area (red); High-Low associations point to high deforestation surrounded by low cocoa area (orange); Low-High associations point to low deforestation surrounded by high cocoa area (light blue); Low-Low associations point to low deforestation surrounded by low cocoa area (dark blue). Municipalities with non-significant local Moran's I values ($p > 0.05$) are colored in light grey.

3.3 Spatial clustering of cocoa, forests and conflict

The Hierarchical Clustering Analysis resulted in four clusters of municipalities that are similar with respect to the cocoa production and forest cover variables included in the analysis (Figure 3). The spatial distribution of municipalities defined as ZOMAC and prioritized for PDET show to what degree the municipalities within the four clusters have been affected by the armed conflict and have been prioritized for rural development efforts (Table 2). Figure SM1 in the supplementary material shows the descriptive statistics of the five variables used for the clustering.

The results show that cluster 2 and cluster 3 stand out in terms of average forest coverage at the municipal level (45% and 73%, respectively). Furthermore, municipalities located within cluster 2 are associated with high levels of forest cover change (on average -0.27%), which is about twice as high as municipalities within the other clusters. Most extensive cocoa production areas are located in municipalities within cluster 3, although the corresponding cocoa yields are relatively low compared to municipalities in other clusters. Municipalities within cluster 4 contain considerably more land suitable for cocoa production. Meanwhile, clusters 2 and 3 contain the greatest share of municipalities defined as ZODAC (81; 100% and 54; 86%, respectively) and prioritized for PDET (29; 36% and 41; 65%, respectively).

Table 2. Characteristics of municipalities within the four clusters, as defined by the Hierarchical Clustering Analysis

	Cluster 1 (n=192)	Cluster 2 (n=81)	Cluster 3 (n=63)	Cluster 4 (n=193)
Average municipal land suitable for cocoa cultivation (%)	19	19	14	57
Average municipal land used to grow cocoa (%)	0.43	0.46	1.68	0.83
Average cocoa yield (ton/ha)	0.58	0.54	0.47	0.58
Average forest area (%)	13	45	73	15
Average rate of forest cover change (%)	-0.14	-0.27	-0.15	-0.16
Number of ZOMAC municipalities	83	81	54	78
Number of PDET municipalities	29	29	41	36

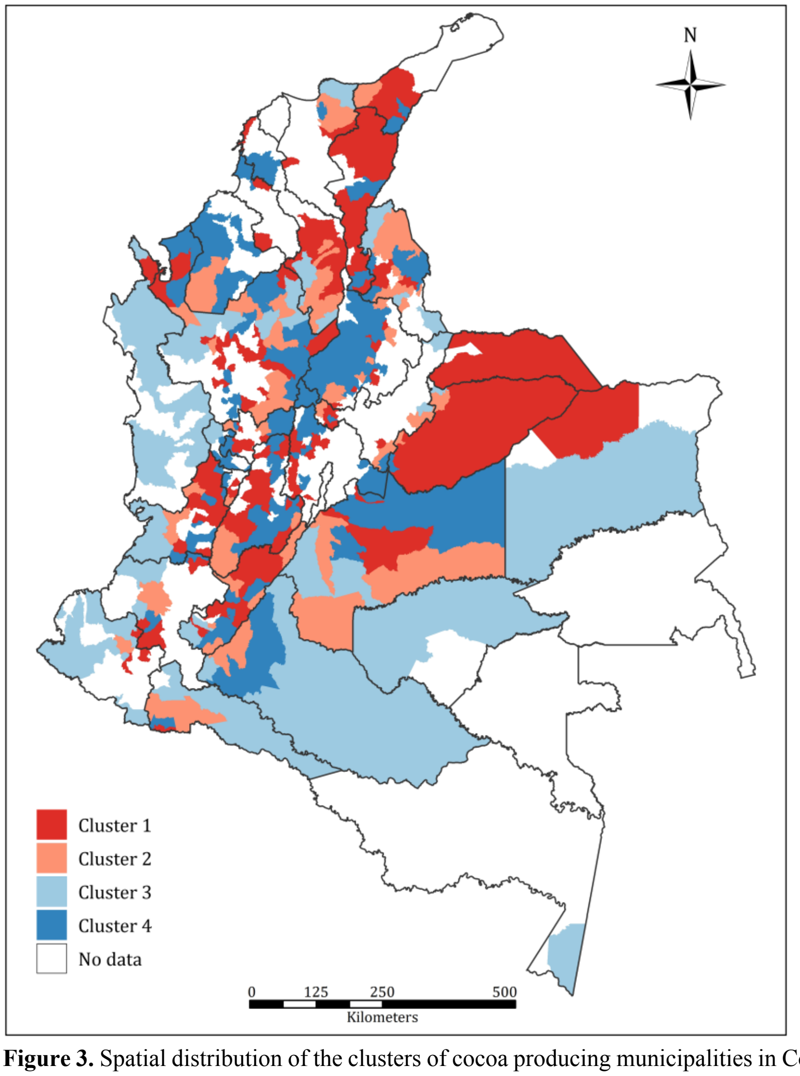

Figure 3. Spatial distribution of the clusters of cocoa producing municipalities in Colombia, based on 5 variables related to cocoa production and forest cover.

3.4 Perspective of value chain actors regarding the role of the cocoa sector in delivering forest conservation and peacebuilding

Most of the stakeholders interviewed believe that cocoa cultivation has the potential to become a mechanism for peacebuilding and forest conservation – provided that the conditions needed to make cocoa a viable livelihood for families in areas affected by conflict and deforestation are met.

Regarding the impact of the cocoa value chain on forest areas, respondents from the public sector assured that forest clearing is inadmissible for cocoa-related development projects. On the other hand, they recognized that plantings have occurred in areas unsuitable for cocoa production. International cooperation actors indicated that they are not carrying out new planting campaigns. Instead, they are focusing on the agricultural intensification of existing plantations, which they claimed does not result in additional deforestation. Most stakeholders acknowledged the potential of cocoa in activities related to reforestation and forest restoration (20 mentions) – particularly in areas that were previously used for the cultivation of coca or converted to pastures for livestock. Three respondents mentioned that the potential for reforestation is evident in areas with illicit crop substitution programs. Meanwhile, 10 respondents mentioned that cocoa-agroforestry systems could positively contribute to biodiversity conservation. Five respondents referred to cases where cocoa production had caused deforestation in the past, but they were uncertain of how much and to what degree deforestation continues to occur. Additionally, one actor pointed out that large-scale industrial plantings pose a threat to forests. Lastly, four respondents mentioned that they could not give an opinion regarding the role of cocoa initiatives in stabilizing the agricultural frontier and halting deforestation because they did not know statistics related to the dynamics of land use changes among forests, degraded pastures and cocoa.

Regarding the role of cocoa in peacebuilding and stabilization, 21 actors mentioned that cocoa is a suitable productive alternative for rural areas affected by illicit crops, mainly because it requires similar agro-climatic conditions, enhances community cohesion in the region, encourages associativity and trade networks, raises enthusiasm and commitment for cultivation among the population involved, facilitates learning, and has logistical advantages such as low perishability and greater storability compared to other products. Five actors highlighted the high commercial potential of cocoa (due to favorable prevailing market conditions) as a key advantage of engaging in the cocoa business.

Eight stakeholders recognized that the effectiveness of the crop as an instrument for peacebuilding depends on its profitability, which is in turn directly related to the productivity of the system and bean quality. They also mentioned that cocoa cultivation alone is not a solution, but it should be part of a larger bundle of services and investments that are needed in some regions to achieve satisfactory peace outcomes. Four actors mentioned the importance of production diversification, especially in regions affected by the conflict. Three others emphasized the importance of supporting producers during the first 3 to 5 years. During this period, families must assume considerable costs without gaining significant income from cocoa and producers must become familiar with the physiology of the crop. Similarly, two producers stated that technical support alone is not sufficient to turn cocoa production into a viable livelihood in conflict-affected territories. They pointed out that starting cocoa producers are unable to generate income from temporary crops such as plantain during the initial cocoa-growing period, due to poor accessibility of plantain and other crop markets. This poses a considerable challenge for the use of cocoa in promoting peace, as lack of sufficient income to meet the basic needs of producers could reinforce the initial causes of the conflict. In this regard, two actors mentioned that there are more suitable alternatives to the widely promoted conventional crop arrangements, such as agroforestry systems of cocoa, bananas and timber. They mentioned that some communities have started implementing systems with lower cocoa densities and greater varieties of species, such as nitrogen-fixing timber, fruit trees, and short-cycle crops that align with the concept of "edible forests," which could respond better to the needs of some territories.

Additionally, actors identified various opportunities to strengthen the current value chain and increase its impact potential. The most commonly identified opportunity comes from the specialty, origin and "fine flavor" cocoa markets, which the actors agree have the competitive advantage. They also recognized other market opportunities, such as cosmetic markets, as easier outlets with capacity to absorb an important share of the national production given their size, lower quality and traceability requirements. On the supply side, the actors emphasized the need for increasing yields through sustainable intensification technologies, which would reduce the amount of land needed to achieve similar output levels. They also emphasized the need for innovation in products and services along the value chain, including sustainable certifications and zero-deforestation commitments (through third party and participative certification approaches), tailor-made financial services, promotion of business services and entrepreneurship along the value chain, and the harnessing of sub-products and byproducts.

Lastly, actors mentioned several threats and bottlenecks that currently affect the value chain performance – stating that they must be addressed to ensure its sustainability. The main threat is a lack of sufficient volumes with consistent quality and regularity needed to successfully penetrate foreign markets. This is partly attributable to other threats such as low productivity, high transaction costs, insufficient and inefficient institutional support services and lack of capacities along the value chain. Other external factors such as climate change, the EU legislation on cadmium, price variability and improper traceability systems are also recognized as having the potential to negatively impact the value chain and its role in forest conservation and peacebuilding.

4. Discussion

In Colombia, government authorities, international organizations and other stakeholders are looking for opportunities to enhance the performance of agricultural value chains and tackle drivers of deforestation and conflict simultaneously (Castro-Nunez, 2018; Castro-Nunez, Mertz & Sosa, 2017). These interventions aim at increasing rural incomes, market access, productivity and welfare to help reconstruct the social fabric and reduce pressure on forests. Most of these programs incorporate environmental components and emphasize reaching international and high-value markets as part of their strategy (Castro-Nunez, 2018).

This study explored the potential role of interventions in the cocoa value chain in delivering forest conservation and peacebuilding in Colombia. Findings are consistent with those of previous studies on deforestation in Colombia, in that cocoa is not one of its major drivers (Baptiste et al., 2017; Chadid, Dávalos, Molina & Armenteras, 2015; Dávalos, Holmes, Rodríguez & Armenteras, 2014). National level Spearman's rank correlation coefficients indicated weak correlations between cocoa production and deforestation, while bivariate Moran's I values showed limited spatial associations between cocoa production and deforestation at the local level. Together these results suggest that cocoa production is not strongly linked to municipalities that have high rates of forest cover loss.

Yet in some places, for instance where bivariate Moran's I values point to High deforestation-High cacao associations, additional analyses at the local level could provide more conclusive evidence of the role cocoa production plays in the deforestation process.

The outcomes of the Hierarchical Cluster Analysis show how the degree of cocoa production, forests and conflict varies across Colombian municipalities. This points to biophysical, social and institutional differences among cocoa-producing regions and highlights the importance of adjusting zero-deforestation VCI accordingly. For instance, clusters 2 and 3 contain municipalities with presently the most extensive forest coverage. Hence, focusing zero-deforestation VCI on these municipalities could potentially have a major impact on forest conservation. Even though we find limited evidence that cocoa production drives deforestation, strengthening the cocoa value chain may nevertheless be part of a strategy to reduce deforestation caused by other activities (Castro-Nunez, Bax, Ganzenmuller & Francesconi, 2020). This is particularly true for municipalities subjected to high deforestation rates (i.e. cluster 2), where reinforcing sustainable cocoa production could be a productive alternative to prevailing forest destructive agricultural practices and poor forest management. In a similar manner, in municipalities with high cocoa production levels or extensive areas suitable for production (e.g. cluster 4), incentivizing sustainable agricultural practices for instance through certification and price premiums may be a viable strategy to prevent the expansion of cocoa plantations into forest areas in the future (Castro-Nunez et al.). At the same time, a considerable proportion of municipalities in cluster 2 and cluster 3 have been defined as ZOMAC (100% and 86%, respectively) or prioritized for PDET (36% and 65%, respectively). In consequence, together with the extensive forest coverages within these municipalities, they constitute opportune places to pursue peace and forest conservation objectives simultaneously.

Results also show that the majority of stakeholders interviewed report that cocoa is not an important driver of deforestation. Instead, cocoa has the potential to contribute to forest conservation by providing sustainable livelihoods to families involved in economic activities linked to deforestation and address degradation through agroforestry systems. Similarly, they believe that it has a role in peacebuilding as a means for cooperativism, increasing rural incomes and providing licit economic opportunities. Nevertheless, there is a broad agreement that this can only be achieved if the activity becomes a "profitable business".

Results from interviews are consistent with other studies indicating that why and how stakeholders choose to become more sustainable varies along the value chain (Vurro et al., 2009). At the same time, the potential benefits of developing a zero-deforestation cocoa value chain in Colombia are widely recognized. Specifically, there is a strong interest in supporting value chain stakeholders to transition from nationally oriented businesses to engaging in and benefiting from more profitable foreign markets. Interviews suggest that underlying this interest is the assumption that the possibility of getting a better price will incentivize farmers and other stakeholders in the value chain to adopt practices that contribute to improving productivity and comply with social, environmental and quality standards at international levels. Such benefits along the value chain improve livelihood opportunities and could indirectly reinforce public services and institutions that are essential to sustaining peace and achieving the United Nations Sustainable Development Goals (SDG), including deforestation reduction.

Findings suggest that efforts to end deforestation in the Colombian cocoa sector emerged following global trends, and not because of an evident link between cocoa production and deforestation. These trends are, nevertheless, consistent with Colombia's ambitions to strengthen the cocoa sector, mainly in areas affected by the armed conflict, and to do so without harming forests

(Minambiente, 2018). In this light, the outcomes of this study bring forward a number of key considerations for design and on-the-ground implementation of VCI aimed at preserving tropical forests and cutting carbon emissions linked to the production of globally traded commodities. These considerations are particularly relevant for regions where there is no clear link between agricultural commodity production and deforestation.

First, ending deforestation from agricultural commodities will require tailoring global level narratives and approaches to local contexts (Seymour & Harris, 2019). This is particularly true for contexts where the link between agricultural commodities and deforestation is weak, and where most produce is traded nationally and does not involve global brands that dominate the market (Seymour, 2012). For instance, global supply chain interventions as certification programs or moratoria may not be adequate to reach small-scale farmers who produce for domestic or informal markets (Lambin et al., 2018). In addition, global certification programs are less likely to factor in current local production practices, which could open the door to farmers who already comply with production criteria (Blackman & Rivera, 2011) and in turn, reduce the additional forest protection impact of the programs. On the other hand, zero-deforestation initiatives at the national or local level may be more suited to incorporate location-specific problems and development priorities such as peacebuilding, illicit crop eradication, economic growth, rural development, increased agricultural productivity, or increased agricultural exports (Castro-Nunez, Mertz & Quintero, 2016; Castro-Nunez et al., 2017; De Pinto et al., 2016). In the case of Colombia, the goal of achieving zero-deforestation in the cocoa sector as promoted by the Cocoa, Forests and Peace Initiative is compatible with the Colombian government's priorities for reducing coca leaf production and achieving stabilization by developing value chains in conflict-affected areas. In particular, because cocoa production takes place in conflict-affected areas and initiatives emphasize reaching international and high-value markets as a means to increase the profitability of the crop and reduce pressure on forests.

Second, zero-deforestation commitments, such as those established under the Cocoa, Forests and Peace Initiative in Colombia are an important step toward addressing deforestation from agricultural commodities. Nonetheless, they need to be operationalized by internalizing deforestation concerns in the cocoa value chain. Deans et al. (2018) highlight the importance of strengthening relationships between and collaboration among actors that operate both within and beyond the value chain (e.g. donors, NGO's and entrepreneurs) to achieve objectives not directly related to production cycle and economic efficiency improvements, such as rural development and deforestation reduction. These advanced collaboration-based governance models focus in part on stimulating the flow of knowledge, finance and information (Bolwig, Ponte, du Toit, Riisgaard & Halberg, 2010) to consolidate the position of smallholders in the value chain and develop a landscape conducive to achieving zero-deforestation outcomes. Some of these concerns also apply to the Colombian context. For instance, our results indicate that farmers may not be able to move from informal business operations and networks to formal and sustainable cocoa production, mainly due to a lack of finance and information. Hence, particularly in the first few years of production, it is fundamental to provide financial support to compensate for low productivity and income losses, and enhance farmers' capacities related to production practices and entrepreneurship to turn cocoa production into a profitable business. The provisioning of these services in the initial growing-period provide an entry point to zero-deforestation agreements and certified production, wherein — beyond the private sector — a key role is to be played by non-chain actors as NGOs and financial institutions as facilitators of these services. Enhancing this kind of stakeholder collaboration within and beyond the value chain could provide the enabling conditions for cocoa production to become viable livelihood, an effective alternative to coca leaf farming, and a tool to prevent future conflict (Nepstad, Boyd, Stickler, Bezerra & Azevedo, 2013).

Third, operationalizing zero-deforestation commitments requires big investments. The value chain approach builds on the assumption that companies will not only commit, but actually take ambitious actions to stop deforestation and lower carbon emissions in the tropics. Such actions should be accompanied by supportive public policies to enhance the scale and effectiveness of value chain initiatives and translate them into on-the-ground implementation (Lambin et al., 2018). The current reality is that most rural economies present both a challenging environment for attracting private investment and a difficult arena for public interventions, especially in conflict-affected areas. Thus, zero-deforestation VCI need to be combined with other approaches, engage stakeholders at multiple levels and address multiple factors and interactions to reach zero-deforestation targets (Devaux et al., 2018; Seville et al., 2011). In Colombia, for example, cocoa has been promoted as a productive alternative to illicit crops as part of sustainable rural development strategies. Therefore, it is usually cultivated in areas previously deforested for coca leaf production and where illegal economies predominated. In this context, it is imperative to first support and empower agricultural value chain stakeholders to transform their informal — and sometimes illicit — business activities into formal and professionalized operations that adhere to environmental, social, and quality standards at national and international levels. This will generate an environment conducive for the development of a strong private sector presence, therefore, contributing to long-lasting peace.

Fourth, improving our capacity to understand how agricultural commodities are connected to deforestation will help design both zero-deforestation VCI and monitor forest conservation outcomes. For instance, to meet Colombia's goal of ending deforestation in the Colombian cocoa sector by 2020, the first order of business is to determine where and to what extent deforestation is directly caused by the commodity's production. Although the results of this study suggest that cocoa was planted in areas previously deforested for other purposes, it may still be the case that cocoa is causing deforestation in some areas of Colombia. Therefore, studies at a lower scale that identify when forest cover changes to a specific crop will help assign causality and attribution, which in turn, forms the basis of increasing traceability and verifying zero-deforestation commitments. This is particularly important if the emphasis on reaching international and high-value markets that value zero-deforestation and peace contributions is part of an incentives strategy.

As a final remark, reducing global deforestation may require a transformation of the entire food system. Promoting zero-deforestation in agricultural value chains is undoubtedly a good move. It is not only a way to meet ambitious commitments to preserve tropical forests and cut carbon emissions, but it is also a way to incentivize value chain stakeholders to source, produce, process, and transport agricultural outputs according to environmental, social and quality standards, thus contributing toward sustainable development. Reducing global deforestation, however, will require more than value chain development interventions. It will require changes in farm practices and the farm input supply chain, changes in the intermediating system (change in retail, wholesale, logistics, and processing), and changes on the demand side (diet changes).

5. Conclusion

The narrative that agricultural commodities have caused and continue to cause deforestation is starting to dominate the literature and global policies on tropical forest loss. While this is the case for some countries, a different scenario may apply to others. As our study shows, cocoa production has not led to significant deforestation in Colombia. Rather, the government and its development partners are identifying market opportunities to produce cocoa with zero-deforestation in areas prioritized for the peace process. Our study suggests that we need to do further analysis on the links between agricultural commodities and tropical deforestation. This analysis should look into additional scenarios, such as where zero-deforestation VCI have the potential to be used as a tool to overcome barriers to the adoption of sustainable land use systems that contribute toward the restoration of degraded land and prevention of future deforestation (such as agroforestry systems) — particularly in contexts where the link between the commodity and deforestation is not yet evident.

Zero-deforestation VCI provide an opportunity to put zero-deforestation commitments by private sector actors into action by creating a framework that facilitates an integrative approach to addressing priorities for economic development and conservation objectives. Promoting and implementing sustainable agricultural value chains in Colombia will require policy coordination across agriculture, forestry and natural resources sectors and the integration of policies that incorporate both conservation goals and the needs of stakeholders. Zero-deforestation VCI, therefore, can be used in Colombia to integrate priorities for agricultural development, environmental conservation and peacebuilding.

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