Peer-reviewed version available at Forests 2018, 9, 621; doi:10.3390/f9100621

Article

Responding to climate change in countries emerging from armed conflicts: harnessing climate finance to deliver forest conservation, peacebuilding, and sustainable food

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Abstract: Linking climate action with sustainable development goals (SDGs) might incentivize social and political support to forest conservation. However, further examination of the conceptual entry points for linking efforts for reducing forest-based emissions with those for delivering SDGs is required. This review paper aims to contribute to fulfilling this research need. It provides insights into the links between conserving forests for climate change mitigation and peacebuilding. Specifically, the paper examines opportunities to harness climate finance for conserving forests and achieving long-lasting peace. It does so via a literature review and the examination of the Orinoquia region of Colombia. Findings from the literature review suggest that harnessing climate finance for conserving forests and peacebuilding is, in theory, viable if activities are designed in accordance with social, institutional, and economic factors. Meanwhile, the Orinoquia region provides evidence that these two seemingly intractable problems are proposed to be solved together. At a time when efforts for reducing forest-based emissions are being designed and targeted at (post-) conflict areas in Colombia and elsewhere, the paper's findings might demonstrate to government agencies — both environmental and non-environmental — the compatibility of programs aimed at reducing forest-based emissions with efforts relating to peacebuilding and sustainable food.

Keywords: climate finance; REDD+; forest conservation; peacebuilding; sustainable food systems

1. Introduction

Whether climate finance can be harnessed to deliver forest conservation and other development priorities of countries experiencing armed-conflicts is this paper's overarching research query. This is an important query given that many of the developing countries officially disposed toward implementing approaches for reducing forest-based greenhouse gas (GHG) emissions, such as the mechanism for reducing emissions from deforestation and forest degradation (REDD+), are currently experiencing or emerging from armed-conflicts [1]–[3]. Also it has been recently argued that the long-term success of such approaches will be contingent upon their capacity to mobilize a broad range of stakeholders [4], which in turn depends on their alignment with development priorities. In the case of tropical countries experiencing (or emerging from) armed conflicts these priorities would be largely related to peacebuilding.

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Arguments around the potential of tropical forest landscapes to contribute to climate change mitigation are contested. On the one hand, it is widely recognized that tropical forest ecosystems provide various services which, to varying degrees, contribute to human well-being and to climate change mitigation [5]–[7]. While fixation and storage of GHGs are important tropical forest environmental services [5], uncertainty is high as to the extent of how changes in forest cover contribute to global GHG emissions [8]. Early estimations indicated that forest cover changes contribute some 18% – 20% of global GHGs. However, recent studies indicate that these estimates are exaggerated [9], [10]. Such variations in estimations largely result from the different measurement methods employed. Initial estimates relied on national GHG inventories or on country reports submitted to the United Nations Food and Agriculture Organization (FAO), whereas recent estimates are based on analyses of forest cover changes and the production of above-ground biomass maps (using satellite imagery). Irrespective of the differences of their findings, these studies commonly recognize the biophysical opportunities for tackling climate change arising from forest landscapes [11], [12]. Other studies, however, argue that approaches to reducing forest-based emissions might pose threats to economic growth, local livelihoods, forest governance, biodiversity conservation, and the rights of indigenous peoples and local communities [13]–[16]. Critics also point to the approaches' low social and political feasibility [17]–[20], in particular because forest landscapes not only play a key role in climate change mitigation, but they also host many of the world's conflicts [21], [22].

Despite arguments contesting the social and political feasibility of approaches for reducing forest-based emissions, they are a key component of a global strategy to achieve the Paris Agreement's goal of limiting global temperature increases to below 1.5 degrees Celsius relative to pre-industrial conditions. For instance, REDD+ has received much attention from developed and developing countries alike since it was first debated in global climate talks [23]. Moreover, bilateral and multilateral donors have pledged more than US$ 4.7 billion to support the design and implementation of approaches for reducing forest-based emissions, such as REDD+ and other initiatives for achieving sustainable forest landscapes [24], [25]. Accordingly, various developing countries are designing and implementing strategies for reducing deforestation as a means to conserve forest landscapes, mitigate climate change, and access climate finance.

There are several reasons for such level of support. REDD+ supporters have labeled it as the most cost-effective approach to tackling climate change [26]. Some supporters have also argued about its potential to generate important social and environmental co-benefits (referred to as "non-carbon benefits" in global policy discussions) for biodiversity conservation [27]; forest governance [13]; sustainable forest management [28]; and community development [29]. Although the current level of resource commitment is unprecedented, REDD+ has yet to incentivize sufficient national-level decision-making in relation to its aims to reduce forest loss and forest degradation. Furthermore, contrary to expectations, REDD+ action is far from adequate and has largely been limited to the environmental sector and to those who agree that climate change action is needed. This trend is consistent across a range of climate change mitigation initiatives [30], perhaps based on evidence that climate finance would not compete with land-use opportunity costs [31]–[36].

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In such contexts, co-benefits could arguably be better linked with sustainable development goals (SDGs) to mobilize a broader range of stakeholders. Recent evidence suggests that co-benefits derived from climate action provide sufficient incentive to secure support for activities, even from those who reject the dire forecasts of climate change impacts [4]. In that respect, linking climate finance with key SDGs might incentivize political support — beyond just the environmental sector — for climate change mitigation. For instance, both academic and policy discussions are exploring mutually beneficial interactions between approaches for reducing forest-based emissions and those for peacebuilding [37]. Such co-benefits will be of particular interest to various countries that are designing and implementing strategies for reducing deforestation as a means to conserve forests and access climate finance and that also experience or are emerging from armed conflicts [38]. Although empirical evidence shows further co-benefits may arise from pursuing forest carbon storage approaches in areas considered priorities for peacebuilding [39], further research is required to understand how climate finance might link forest conservation and peacebuilding.

This paper examines opportunities to harness climate finance for conserving forests and achieving long-lasting peace. It does so via a literature review and the examination of a case study. In the following section, I provide the conceptual entry points for linking efforts for reducing forest-based emissions with those for delivering peace. I then present and discuss how these two seemingly intractable problems could to be solved together and simultaneously support sustainable (low-carbon) food production in the Orinoquia region of Colombia, within an initiative for achieving sustainable forest landscapes that is being implemented and that could be expanded to other regions facing similar challenges around the world. Finally, the paper discusses findings and concludes with a consideration of the lessons learned emerging from designing landscape approaches in a region that while emerging from a long period of armed conflict aspires to become a center of agricultural production. The article draws on the experience of the author in the research, policy (global climatic negotiations) and practitioner aspects of climate finance, forest conservation, and peacebuilding.

2. Conceptual entry points for linking climate finance, forest conservation and peacebuilding

2.1 Peacebuilding

Recent studies suggest that REDD+ contributions to SDGs may also arise outside the environmental sector, for instance, in considering the mechanism's compatibility with peacebuilding activities [37]–[39]. There could be, however, further examination of the peacebuilding concept and its links with rural development and forest conservation [40], [41]. Peace research, along with the peacebuilding concept, has its beginning in the mid-20th century when the International Peace Research Institute (PRIO) launched in Oslo [42], [43]. From the very start, peace studies focused on understanding the conditions for peace, ideally, in transdisciplinary (integration of different academic perspectives) and transnational (integration of different global, national, regional, and local establishments) manners [42]. It is within this emerging academic discipline that the concept of peacebuilding continues to evolve [44], [45]. This discipline emphasizes the importance of addressing the root causes of conflict and differentiates among responses to conflict. As Johan Galtung (1976) argues in his essay "Three Approaches to Peace: Peacekeeping, Peacemaking, and Peacebuilding," there are different levels at which peace can be established. He argues that short-term measures (i.e., peacekeeping approaches)

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aim to reduce overt physical violence (usually in the form of armed conflict), whereas, longer-term measures (i.e., peacemaking and particularly peacebuilding) aim to address the root causes of conflict, which he terms as "structural violence" (e.g., institutions that impede certain social groups' access to services). Galtung argues that achieving sustainable peace requires addressing the structural causes of war and undertaking efforts to support local communities' capacities to manage and overcome conflict. Lederach (1997) expands this line of thought by arguing that peacebuilding is a dynamic process that goes beyond post-conflict reconstruction and involves several activities that both precede and follow peace agreements. Violent conflict, therefore, should be managed at all phases by processes of "conflict transformation," which entails building new relationships, behaviors, attitudes, and structures [46].

Over the years, peace studies have been moving from solely understanding the conditions of the presence (or absence) of violence, toward a discipline that also puts forward suggestions on how to build resilient, peaceful environments, for example, by means of "peace education" and "peace action"[42]. This evolution is built on the similarities between peace and development studies. Indeed, peacebuilding approaches resemble development programs in a way that it is difficult to determine which output would be specifically attributable to which objective. Some scientists have even considered them as "two faces of the same coin" [42]. Furthermore, some of the metrics to measure performance of peacebuilding initiatives are based on development indicators [47]–[49].

In practice, there are wide-ranging interpretations of what constitutes a "peacebuilding intervention." Definitions range from "support to safety, security, and political processes" to "provision of basic services and livelihoods" (UN, 2010). The common agreement, however, is that to reduce the risk of a relapse into conflict, interventions should include a relatively narrow set of activities. Even conservation approaches (e.g., those that restrict rural peoples' access to forests) could create conditions for further violence if implemented, for example, in contexts where the root causes of conflict are linked to access to land and forest resources [50]. Therefore, to reduce the risk of a relapse into conflict, the United Nations recommends that any peacebuilding intervention be designed to achieve the following objectives: address drivers and root causes of conflict; build institutions and capacities of individuals, communities, and authorities to manage conflict and deliver services; enhance social cohesion and build trust among social groups; and build trust in and the legitimacy of governments.

2.2 Links between tropical forests and armed conflicts

Identifying opportunities for reducing deforestation as a means to access climate finance while simultaneously contributing toward peacebuilding requires understanding of the links between tropical forests and armed conflicts. In the tropics, countries with extensive forested areas also often have conflicts, ranging from local-level disputes to armed conflicts [21], [22]. Across the globe, disputes have arisen around issues such as land access, resources and property rights, and land use policies that prioritize particular uses (i.e., legal uses) over others (i.e., illegal uses) [22], [51]. Disputes may also arise over conservation priorities. When powerful actors with vested interests intervene in local disputes, they often inflame latent tensions, which may escalate into violence [52]. Different academic disciplines propose a range of causal links between forest cover and armed conflicts,

although the majority originates from the "environmental security" field. According to this discipline, natural resources can influence armed conflict through any of three possible mechanisms: scarcity or unequal sharing of natural resources [53]; accessibility to and competition over natural resources [54]; or opportunities for covert operations of illegal armed groups [55]. Meanwhile, research has found that tropical forest landscapes are often areas (1) where state presence is weak; (2) where disputes over land rights and access to land exist; and (3) that contain high-value natural resources, which can finance combatants and armed groups' hideouts [55]–[57].

2.3 Causes of forest cover change in the tropics

Proposing appropriate strategies to achieve forest conservation, either for biodiversity or for climate change mitigation, requires understanding of what causes forest cover changes. Interlinks between the causes of deforestation and forest degradation are complex and at different levels (international, national, and local) [58], [59]. Over the last few decades, scientists have sought to elucidate the causes of deforestation using different academic perspectives, methods, and approaches [60], [61]. These approaches include meta-analyses of economic models [62] and subnational case studies [63]. Angelsen and Kaimowitz (1999) consistently conclude that causes of deforestation include: increased roads; raised agricultural prices; decreased wages; and a shortage of off-farm employment. Meanwhile, Geist and Lambin (2002) argue that the influence of complex factors (demographic, economic, technological, cultural, institutional, and political) on agricultural expansion, wood extraction, and infrastructure extension drives deforestation.

Policies influencing forest cover change include those for infrastructure (road construction that increases agricultural and logging revenues and open access for new agricultural colonization), land tenure, and agriculture [64]. Governments usually implement such policies in order to achieve national priorities, such as "economic development" and "food production." For instance, the agricultural sectors in developing countries are usually a major contributor to their respective national gross domestic products (GDP), employment levels, and international trade balances. This observation is often used to justify policies promoting the expansion of the agricultural frontier into forestland as a means of increasing agricultural production, ensuring food security, boosting employment, raising incomes, and achieving rural development.

Scientists have applied the [Forest] Environmental Kuznets Curve (EKC), and the Forest Transition Theory (FTT) to identify and analyze relationships between economic development and deforestation [65]–[68]. EKC broadly proposes that during the early phases of a country's development, deforestation occurs due to economic growth (i.e., income growth results from land use changes for agriculture and the exploitation of forest products). It argues that increases in economic indicators accelerate deforestation, but that (at a certain stage of economic expansion) deforestation then decreases. An inverted U-shape depicts this tendency. Some critics of EKC's findings argue that the statistical analyses, on which the curve is based, are not robust [67]. Meanwhile, FTT states that it is not likely that deforestation will continue over time, as the opportunity costs of deforestation increase in line with forest scarcity [66]. Circumstances that might influence the emergence of forest transitions include forest scarcity, economic development, and rural out-migration [68], [69].

While some studies link rural out-migration with forest recovery [70], others identify its counterpart (i.e., rural in-migration) as a major driver of forest cover loss [71]–[73]. Other evidence, however, suggests that the impact of out-migration on forest cover depends on numerous factors. It points to the importance of the drivers of migration (e.g., armed conflicts or the scarcity of land for agricultural production), as well as the interplay of evolving characteristics, such as household resettlement, flows of resources, changes in labor availability, and shifts in household composition [74]–[78].

Other researchers assert that rural in-migration only partially explains deforestation in tropical agricultural frontiers [79]. Others again point to the additional contribution to deforestation of a lack of formal tenure among newly arrived migrants, as farmers clear patches of forests to demonstrate "improvements" to the land so as to enhance their legal claim over it [69], [80]. Indeed, this pattern continues where farmers then sell their "claimed" land and move further into forested areas to repeat the process [69], [81]. A common conclusion drawn from this observation is that providing tenure security would reduce deforestation. There is, however, not enough evidence to ensure that tenure security will result in forest conservation [82], [83]. Moreover, evidence suggests that under certain circumstances (e.g., if investments into forestland conversion is the driver of deforestation), tenure insecurity could protect forest [62], [84].

Although the identified causes of deforestation and forest degradation differ, the literature reflects a general consensus on several issues. One is that the causes of deforestation are context-specific and involve processes occurring at multiple scales [60]. Another is that agricultural expansion, globally, is the main direct cause of deforestation [58], [79], [85]–[87]. Meanwhile, there is a divergence on the question of whether commercial or subsistence agriculture has greater impact on forest cover [85]. This debate continues despite the significant reduction in government-led settlement programs, which have facilitated access to new agricultural colonization fronts since the 1970s, at which time industrial agriculture became demonstratively the overwhelming cause of deforestation [85], [87].

There is even more divergence in opinion and arguments around the trends of deforestation, in particular the correlation between deforestation and poverty, which are often founded on faulty premises. For instance, the prevailing misconception that clearing forests is inexpensive [88] prompts the assumption that subsistence farmers invest limited resources in clearing great areas of forests as a way out of poverty. Another misconception is that poverty reduction will lead to the reduction of deforestation caused by subsistence agriculture [89]. In contrast, evidence indicates links between poverty and reduced rates of forest loss [90]. This may relate in part to the financial and labor requirements for both agricultural production and frontier expansion [62], [84]. Moreover, there is an increasing recognition that less intensive subsistence agricultural systems such as slash-and-burn agriculture helps maintain forest biomass [91], particularly when this provides a period of fallow regrowth to allow forest regeneration [92]. As such, some researchers argue that lands under agricultural systems that include fallow periods in their cycles should not be regarded as deforested but as degraded [92]–[94]. Another body of research points to clear correlations between deforestation and armed conflicts. For instance, Geist and Lambin (2002) considered the influence of socio-political events, such as war and forced displacements, as an underlying cause of forest cover

change. Similarly, some studies have found links between deforestation and corruption, democracy, political instability, and armed conflict [95]–[97].

There is no clear consensus in the literature as to whether conflict has negative impacts on forest cover or conversely helps to conserve it. Armed conflicts may influence forest cover dynamics through a number of channels [70], [98]–[101]. On the one hand, armed conflicts might lead to forest cover losses in places where armed groups exploit natural resources in order to finance their military campaigns [96]. On the other hand, armed conflicts might result in forest regeneration and reduced deforestation, as armed forces preserve dense forest areas as cover for their operations [76].

In sum, studies provide varied and often divergent findings about the impacts of conflict and post-conflict processes on forest cover. Country-level studies suggest that conflict may contribute to both increases and decreases in forest cover [76]. Some scientists have attributed forest conservation within conflict-affected areas to economic disruption [98][102], forced migration [70], and international remittances [76]. For instance, in Sierra Leone, conflict-affected areas have reportedly experienced less forest loss in comparison to conflict-free areas [98]; in the Democratic Republic of the Congo, conflict has caused increased forest loss and reduction of economic activities, such as mining [99]. Meanwhile, in El Salvador, international migration influenced by periods of violence (and subsequent remittances) has caused forest recovery. In contrast, in Rwanda, few differences in forest cover net gains were detected between conflict and post-conflict periods. Existing differences appear to be explained by resource exploitation proximity to refugee settlements (forest losses) and forced migrations (forest gains) [100]. Similarly, in Colombia, varied impacts on forest cover have been reported. For instance, in some cases, forced migration has resulted in forest recovery, while in others in further deforestation [103]. Differences may be related to armed groups' economic and conservation policies. For instance, one study relates that in one area, a non-legal armed force enforced coca eradication and prevented mining, thereby avoiding deforestation, while in a neighboring area, a different armed group promoted coca cultivation, causing deforestation [104].

Other examples of observed impacts from the way armed groups govern forests include increased agricultural coverage (including grassland) and deforestation associated with the presence of paramilitary groups [101], and increased deforestation rates linked to illegal crop cultivation in demilitarized zone granted by the government of Colombia (GoC) to the Revolutionary Armed Forces of Colombia (FARC) at the end of 1990s [105]. Such trends in post-conflict settings include the resultant conservation of the demilitarized zone between North and South Korea [102], and the increased forest cover in post-conflict Puerto Rico (i.e., linked to economic development) [106].

2.4 Economic and policy approaches for tackling causes of forest cover changes

During the last few decades, diverse economic and policy instruments aimed at curbing deforestation and forest degradation have been promoted and abandoned at both international and national levels [107]. Despite these interventions, the annual global rate of deforestation remains above 13 million ha [108]. Arguably, globally promoted mechanisms, such as those for biodiversity conservation, respond to global priorities that do not necessarily match developing countries' national or local development priorities. Policies derived from such mechanisms generally aim to curb deforestation

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by promoting legal reforms in the forestry sector [64]. Among the most commonly used mechanisms are: loan conditionality (i.e., providing loans conditional upon legal reforms within the forestry sector); donor coordination (i.e., increasing the effectiveness of official development assistance); debt relief (i.e., reducing international debt in exchange for establishing a trust fund to finance conservation initiatives); and demand management (i.e., trade certifications).

At the national scale, the adoption of such policies is usually limited to the environmental sector. Forest conservation is not generally a priority activity for governments, which typically allocate resources to other activities. Policies aimed at curbing deforestation include restrictions on land and natural resource use (e.g., delimitation of "natural protected areas") and attempts to increase the value of standing forest through the provision of economic incentives to promote sustainable production alternatives, such as payment for environmental services (PES) schemes [32]. Likewise, concessions (i.e., permits for sustainable use of forest resources) and decentralization (i.e., transfer of forest management authority to local governments or communities) are common mechanisms (implemented nationally) to avoid deforestation and forest degradation [28]. Although, to ensure success, these policies should address nationally determined causes of deforestation, they all too often focus on promoting local initiatives that are dependent on donor funding. At the local level, projects to mitigate forest clearance commonly include: sustainable forest management; conservation areas; integrated development and conservation; or capacity building. More recently, these efforts have been expanded to include afforestation, reforestation, and avoided deforestation. These initiatives, however, are usually designed to address the direct (and most obvious) causes of deforestation and forest degradation and do not necessarily consider communities' priorities and preferences [40].

2.5 The mechanism for reducing forest-based emissions

REDD+ is the latest internationally promoted approach to incentivizing developing countries to implement national policies aimed at reducing forest carbon emissions. It was proposed in the United Nations Framework Convention on Climate Change (UNFCCC) as an alternative to previous approaches tackling causes of deforestation described above. Discussions around REDD+ started in 2005, during eleventh session of the Conference of the Parties (COP11). Then, Papua New Guinea and Costa Rica jointly proposed options to reduce GHG emissions caused by deforestation, known as RED [109], [110]. The argument put forward was that neither UNFCCC nor the Kyoto Protocol considered emissions resulting from deforestation in developing countries.

The initial RED proposal constituted the first attempt to include deforestation in tropical countries as part of a global climate agreement. Nonetheless, these proposals neglected socio-political issues that prevent the successful implementation of clean development mechanisms (CDM) in the forestry sector [19]. Moreover, the proposals failed to recognize that most developing countries did not yet have the necessary capacities for monitoring emissions from forest cover changes [8], [111], [112], nor did they take into account that few tropical forested countries have the requisite social and political stability to implement such initiatives [17], [20].

The scope of the initial proposal has increased over time. COP11 delegates viewed forest degradation (mainly identified as a result of selective and illegal logging) as an important cause of GHG emissions.

The COP, as such, requested the Subsidiary Body for Scientific and Technological Advice (SUBSTA) to undertake consultations and necessary actions to evaluate REDD feasibility. This has led to the inclusion of forest degradation in the mechanism. The Bali Action Plan agreed to at COP13 indicated that approaches to mitigating climate change must include "*forest degradation in developing countries and the role of conservation, sustainable forest management and enhancement of carbon stock*'" [113]. Following decisions taken at COP15, REDD+ now refers to "*policy approaches and positive incentives in issues related to reduction of emission from deforestation and forest degradation; and the role of conservation, sustainable forests management and enhancement of forest carbon stocks in the developing countries*" [114]. UNFCCC COPs' successive decisions offer further details on the evolution of the concept from RED to REDD+ [23].

Reaching agreement on the means of implementing REDD+ was challenging. This arguably relates to the diverse and context-specific causes of tropical deforestation and forest degradation [86], operating at different scales [63] and involving a variety of stakeholders and economic agents [28]. Expansions in the mechanism's scope could be interpreted as an attempt to reach mitigation goals without omitting countries with low deforestation but high forest degradation [115]. The mechanism's scope was expanded in COP15 so as to avoid damage to: local livelihoods; indigenous peoples and local communities' rights; biodiversity; forest governance; and economic growth [116].

Policy discussions were primarily linked with concerns related to: the scale of implementation or whether to implement the mechanism at national and/or subnational scale [117]; REDD+ economics and expectations of high carbon payments; social and environmental safeguards; and more recently, REDD+ non-carbon benefits. Consensus was expected to be reached at COP15 (held in December 2009 in Copenhagen, Denmark). Instead, decisions about voluntary actions (to be implemented by developing countries and the eligible forestry sectors) were delayed until COP16. Further details about the means to implement the mechanism were defined only in the Warsaw framework for REDD+, decided at COP19 [118].

For developing countries to achieve the status of being "ready" for REDD+, they must undertake four main actions: (1) establish forest reference emissions levels (FREL); (2) implement systems for measuring, reporting, and verifying (MRV) GHG emissions reductions; (3) design and implement REDD+ national strategies or strategies to combat the causes of deforestation; and (4) implement systems to inform how environmental and social safeguards are considered. Eligible activities include: reducing deforestation emissions; reducing forest degradation emissions; conserving forest carbon stocks; managing forests sustainably; and enhancing forest carbon stocks. Additionally, a COP decision was reached regarding the three phases of REDD+ (readiness, implementation, and result-based payments). Currently, developing countries are designing strategies and implementing pilot projects supported by bilateral and multilateral funds, such as the Forest Carbon Partnership Facility (FCPF), the United Nations REDD initiative (UN-REDD) and the Forest Investment Program (FIP) [109], [119], [120].

As detailed above, many studies have explored the ways different groups within climate negotiations conceptualize and negotiate ideas and resources [110], [121], [122]. However, scholars outside the

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environmental discipline, such as those from political science and international relations, have not paid enough attention to the topic [109]. This disinterest might signal that REDD+ discourses have not yet extended beyond the environmental sector; it might also indicate that REDD+ will prove nothing more than the most recent "conservation fad" [107], [123].

2.5.1 The REDD+ rationale

REDD+ aims to incentivize developing countries to reduce deforestation and conserve their forests in a bid to reduce GHG emissions. Therefore, a key expectation is that financial benefits resulting from REDD+ activities will outweigh their costs and that the rent generated will incentivize governments and local communities to maintain them [36]. Such expectation was mainly built upon land use opportunity cost models [31], [32], [35], which generally assume land use opportunity costs to be the largest and principal cost component. It remains uncertain, however, what constitutes total costs of and benefits from REDD+ [34], [124], [125].

A number of studies that have assessed the benefits and costs of REDD+ demonstrate uncertain or low benefits (Coomes et al., 2008; Isenberg and Potvin, 2010, as well as high transaction and implementation costs [125], [126]. Moreover, evidence indicates that even in the absence of transaction and implementation costs, REDD+ might not compete with high land use opportunity costs [31]–[33], [35], [36]. For instance, a recent study based on six carbon-based Peruvian projects calculated transaction and implementation costs to be between US$0.16 and 1.44 ha-1 yr-1 [125]. The analysis, nonetheless, did not consider that these initiatives build upon long-term conservation efforts. Therefore, transaction and implementation costs in areas without previous interventions (such as those affected by armed conflicts) may greatly exceed these estimates, thereby limiting the mechanism's efficiency and, therefore, its effectiveness. In such scenarios, actions should demonstrate that they contribute toward the priorities of respective governments and farmers in order to gain their support and secure subsidies for their implementation.

2.5.2 Environmental safeguards and non-carbon benefits

Beyond expectations of financial revenues, constraints to REDD+ implementation are comparative to those faced by other rural development and conservation efforts [40] [127]. These constraints include economic dependence on natural and forest resource exploitation; trade-offs between economic growth and environmental objectives; lack of effective coordination mechanisms for the integration of environmental objectives into non-environmental policy sectors; lack of capacity to design and implement strategies to combat deforestation; presence of corruption, illegal activities, and conflicts; and the emergence of undesired social and environmental impacts [17], [20], [128]. Indeed, recognized impacts of these listed challenges prompted the need to define environmental and social safeguards [114], [129].

Meanwhile, other scholars argue that these challenges should not overshadow the potential for REDD+ to generate SDG co-benefits. Moreover, it has been argued that generating evidence of the co-benefits of addressing climate change could attract funding and increase political and social support [4], particularly among sectors of society that would not support mitigation actions based purely on anticipated climate change impacts [30]. Furthermore, studies of co-benefits point to the

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importance of integrating carbon storage actions into sustainable development efforts more broadly, thereby integrating social and environmental goals [129].

In response, evidence of further co-benefits is arising from considering REDD+'s compatibility with peacebuilding activities. However, while a few studies examine the relationship between forest-based emissions and land-related conflicts, they are dwarfed by the body of research focused solely on the link between conflict and unclear "carbon rights" (which are closely linked to unclear land tenure rights) [36], [130]. These studies suggest that forest-based mitigation efforts implemented in situations of unresolved land tenure might exacerbate existing tensions [131]. Awareness of these types of conflicts led the UNFCCC to adopt safeguards aimed at conflict prevention and securing the rights of indigenous peoples and local communities [114]. These important safeguards are designed to increase the potential for success of forest carbon storage approaches. Importantly, however, they do not consider peacebuilding co-benefits that could also arise from REDD+ implementation, and vice-versa.

3. The case study

The opportunities for and barriers to harnessing climate finance to conserve forests and build peace are best understood through ongoing efforts that link a country's climate change policy with its ongoing peace process. We analyze here the case of the Orinoquia (Figure 1), a region in Colombia where a program to reduce forest-based emissions and achieve low-carbon agricultural development is being implemented.

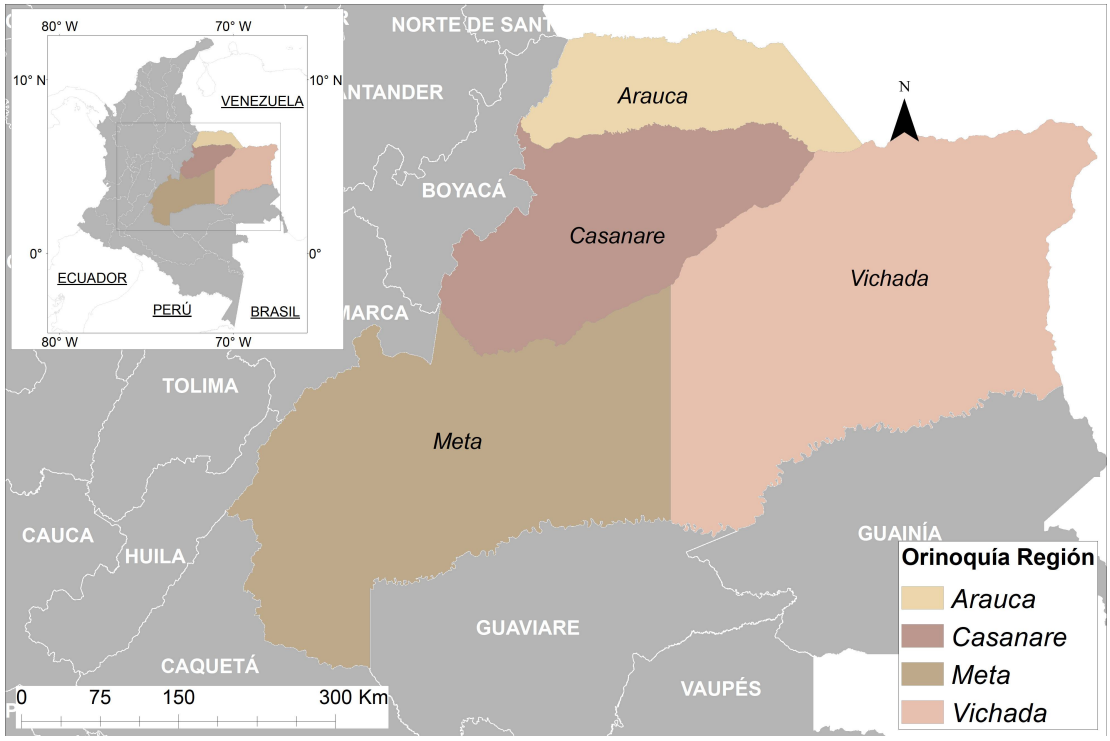

Figure 1. The Orinoquia region as prioritized by the Colombian government in its efforts to reduce forest-based emissions, address the causes of armed conflict, and achieve sustainable food production.

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

3.1. The Orinoquia region, Colombia

Located in eastern Colombia, Orinoquia's vast areas of natural savannas and grasslands extend into the Amazon rainforest. The Orinoquia region of Colombia spans four departments: Arauca, Casanare, Meta and Vichada. These four departments comprise an area of about 250,000 square kilometers that belong to the Orinoco River watershed and is home to 1.37 million people, 32 percent of whom reside in rural areas. Despite the peace agreement, violence, though latent, remains there, due to the presence of organized crime gangs, reportedly made up of ex-paramilitary group members.

Considered one of the last agricultural frontiers in the world, the agricultural sector significantly contributes to the economy of the region. Consistently, the agriculture, forestry, and other land uses (AFOLU) sector is a major contributor to the region's emissions. The conversion of forest to pasture lands is a main source of region´s emissions. As indicated by various studies over time, the expansion of areas for cattle grazing and illicit crop production — mainly in southern areas where savannas meet the Amazon forests — constitutes the main causes of deforestation in the Orinoquia [103], [105], [132] . New studies, however, indicate the existence of a strong connection between the armed conflict and deforestation, which are interconnected with coca production, cattle pasture, and land grabbing [38]. The second most important category of emissions relates to enteric fermentation, followed by forest degradation, land conversions to cropland, and nitrous oxide emissions from soil management. Current land use trends show that oil palm production has had the greatest increase in plantation area. Establishment of forest plantations and cultivation of agricultural commodities (e.g., maize, soybean, forage grasses, and rice) have also taken place, especially in Altillanura of the departments Meta and Vichada.

Land use dynamics are expected to change in the Orinoquia, particularly considering the Colombian government's plans to promote agricultural development in the region. Some authors argue that because of the peace agreement, land use dynamics would exacerbate deforestation and shrink further the area for endangered species in Colombia [133]. Upcoming causes of forest and species loss might include opening of new deforestation frontiers, new infrastructure investments, and large-scale agricultural development [134]. Conversely, other studies argue that the peace agreement will create an environment conducive to implementing policy measures to counteract threats to Colombian forest landscapes and simultaneously address structural causes of conflict [39].

3.2. The Orinoquia Sustainable Integrated Landscape Program

Reducing forest-based emissions is a key component of Colombia's strategy to achieve its Paris Agreement commitments. The Colombian government has committed to reduce 20% of countrywide emissions (against a business-as-usual level) and to increase climate ambition if provided with international financial support. It has also committed to reducing the country's deforestation to zero by the year 2020. In that context, Colombia is prioritizing the Orinoquia as a region that can help reduce forest-based emissions, achieve sustainable peace, and realize its potential to become a breadbasket for the country and the world.

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The World Bank is also looking at the Orinoquia as a region that can help mitigate climate change, address the causes of armed conflict in Colombia, and achieve sustainable food production [135]. Implementation of the first phase of the World Bank-funded Orinoquia Sustainable Integrated Landscape (OSIL) project has started under the leadership of two Colombian agencies, the Ministry of Agriculture and Rural Development (MADR) and the Ministry of Environment and Sustainable Development (MADS). OSIL is part of a broader program funded by the World Bank's BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL) [136]. It adopts a two-phase approach. During the first phase, OSIL will define the strategy to reduce deforestation and achieve payments for emissions reductions in the Orinoquia's AFOLU sector [137] It will also identify how such financing can achieve long-lasting peace and sustainable (and low-emissions) food production [137]. In the subsequent phase, the initiative will establish an emissions reduction program, which will include a performance-based payment mechanism, to achieve sustainable (low-carbon) landscape management and promote the adoption of suitable land uses among farmers.

ISFL will provide result-based finance at jurisdictional scale based on a comprehensive carbon estimation approach of AFOLU emissions [138]. Accounting for emissions reduction from AFOLU for result-based payments on a jurisdictional scale has yet to be tested in the country or elsewhere. Thus, OSIL's first phase will also put in place a set of tools needed to assess the program's performance and ensure the accomplishment of the BioCarbon Fund's requirements relating to landscape carbon accounting and social and environmental safeguards. Among the necessary tools that the initiative will develop include: the AFOLU reference level that will be used as benchmark to assess performance of the emissions reduction program (ER program) and make payments; the benefit-sharing mechanism that defines the equitable sharing of the (carbon and non-carbon) benefits deriving from the ER program and its beneficiaries; and the safeguard instruments to mitigate social and environmental risks and to comply with World Bank safeguard policies, land use strategies, and forest and land management practices.

The first phase of OSIL will also develop and test approaches for sustainable landscape management with a strong focus on reducing deforestation, as well as an emphasis on promoting sustainable (low-carbon) agricultural production systems. Specifically, it will implement activities oriented toward creating the enabling environment for the implementation of sustainable landscape management that leads to emissions reductions. These activities include: improving land use policies; mainstreaming sustainability and climate considerations into land use planning processes and land title programs currently under implementation as part of the peacebuilding agenda; developing and promoting sustainable, low-carbon agricultural production systems; and developing an incentive mechanism to reward communities and other value chain stakeholders for making the transition to zero-deforestation and low-emission practices.

4. Discussion and concluding remarks

Since the success of climate change mitigation action is highly dependent on general policy reforms and governance [139], there is a compelling need for it to be linked to broader SDGs priorities. Evidence of such links might serve, firstly, to persuade policymakers and sectors of society skeptical

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of the potential additional benefits of mitigation activities [4], [30], and, secondly, to mobilize a broader range of stakeholders. In the case of forest-based climate change mitigation, such evidence would also strengthen the argument that while approaches for reducing forest-based emissions are not as cost-effective as initially expected, they are ultimately viable [125], [126]. Furthermore, these assurances are necessary for maintaining current political and social support for REDD+ and other climate change mitigation activities. In this way, the evidence of co-benefits serves as something of a self-fulfilling prophecy — that is, sufficient evidence might secure the necessary level of social and political support to make forest conservation viable. Meanwhile, the counter-logic is that, in the absence of evidence of co-benefits, political will is liable to fail, as might social support, leading to yet another failed attempt to tackle deforestation and forest degradation [107], [123].

Recognizing that REDD+ is at a cross-roads, where political and public confidence, or lack thereof, may determine its future, this paper investigates the role of climate finance to contribute toward achieving SDGs. Specifically, it examines the opportunities to harness climate finance to achieve forest conservation, long-lasting peace, and sustainable food production. This idea is framed in current policy discussions regarding the role of non-carbon benefits to increase political and social support for REDD+. For instance, in the context of limited financial resources to incentivize climate action, we propose that co-benefits of climate change mitigation could be better exploited to attract funding and increase political and social support, for example, by generating evidence that shows the potential for integration of forest carbon storage and development priorities.

Findings from the literature review suggest that harnessing climate finance for conserving forests and promoting peace is, in theory, viable if activities are designed in accordance with social, institutional, and economic factors. Meanwhile, the Orinoquia region of Colombia provides evidence that these two seemingly intractable challenges can be proposed to be solved together. It also offers lessons on how to implement sustainable (and low-carbon) forest landscapes in a region that, while emerging from a long period of armed conflict, aspires to become a center of agricultural production.

First, there are common elements among strategies implemented to achieve sustainable development, peacebuilding, and forest conservation. Moreover, their objectives are increasingly compatible, and some authors even consider that sustainable development is a prerequisite to peacebuilding and forest conservation [40], [42], [140]. For instance, rural development objectives include conditions conducive to achieving peacebuilding aims of gaining territorial control and reducing conflict. In that regard, rural development activities apparently contribute toward re-establishing farmers' control over their territories and thus to building peace. This is reflected in the recently signed Colombian peace agreement, where rural development-oriented aspects (including land tenure considerations and agricultural development) were an important part of the negotiation agenda [141][141]. In turn, evidence suggests that in Colombia, peacebuilding activities enable conditions for and predispose conflict-affected farmers toward forest conservation [140]. Castro-Nunez et al. (2016) found that the impacts of previous conservation and sustainable development programs influence farmers' propensity to conserve forests. Implementation of these programs generally aimed to conserve biodiversity and reduce the causes of conflict. This finding highlights the positive effect of long-term peacebuilding and conservation efforts on farmers' propensity toward forest conservation. This, in

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571 turn, suggests that establishing preconditions (i.e., some degree of stability or peace) is an important
572 precursor to undertaking forest-based mitigation projects. Indeed, it implies that these efforts should
573 be jointly designed and appropriately co-delivered. Castro et al. (2016) also found that farmers will
574 generally support forest conservation activities, provided these are compatible with their respective
575 livelihood priorities, including cattle ranching. Despite this discernible propensity toward
576 conservation, however, deforestation continues in the studied area. This default to deforestation
577 indicates that conservation efforts will need to be carefully designed to enhance farmers' livelihood
578 options.
579
580 Second, achieving reduction of forest-based emissions storage in the tropics implies dealing with
581 interconnected issues of deforestation, illegal activities, and armed conflict. In such case, it requires
582 operationalizing governance models, building capacity, improving infrastructure, implementing
583 land titling programs, facilitating land use planning, and providing sustainable land uses to move
584 beyond the conflict and contribute toward reducing forest-based emissions. This is particularly true
585 for Orinoquia. The region has just emerged from a 52-year armed conflict and hosts significant part
586 of the country's deforestation and conflict-affected areas, where public services and infrastructure
587 remain lacking. In Colombia, there are indeed links between the causes of armed conflict and those
588 of deforestation. Therefore, reducing forest-based emissions require addressing simultaneously the
589 causes of conflict. Recent studies suggest links between conflict and deforestation in Colombia and
590 access to and control over land [38]. In some areas, cattle ranching may appear to be the cause of
591 deforestation. In reality, however, this is a way to claim ownership of the land, which "owners"
592 intend to sell and thus profit from when the opportunity arises. Within that context, land titling
593 provides a good strategy for linking peacebuilding approaches and REDD+. In fact, evidence suggests
594 that promoting land titling can help preserve both peace and forests, and enhance the quality of life
595 in certain areas. It also suggests, as mentioned above, that the strategies for reducing the causes of
596 the conflict, including but not limited to land titling programs, could facilitate forest conservation
597 and, thus, reduction of forest-related greenhouse gas emissions. However, research findings today
598 only permit partial conclusions to be drawn about the impacts on conservation decisions of land
599 titling programs (these constitute common approaches to reducing forest-based emissions). Instead,
600 results provide empirical evidence of "preconditions" and other factors that need to be considered
601 alongside common REDD+ approaches.
602
603 Third, reducing AFOLU emissions goes beyond providing sustainable land uses and addressing
604 commodity-driven deforestation. It requires developing a sustainable food system. The Colombian
605 government is working to realize the Orinoquia's potential to becoming a breadbasket for the world,
606 while contributing to climate change mitigation, forest conservation, and peacebuilding. The
607 rationale behind this objective is that feeding the human population has become an increasing
608 development challenge. Global population keeps growing and with it the demand for food [142].
609 There are direct links between agriculture and supply chains and tropical deforestation, a major
610 climate change contributor, and experts anticipate that the increasing demand for food and farmland
611 will worsen tropical deforestation, ecosystems degradation, hunger, and armed conflicts, if action is
612 not taken [143]. Within that context, developing sustainable land use practices is an approach
613 commonly used to address both the causes of deforestation and the causes of conflict. Such practices

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shall ideally be developed in collaboration with stakeholders within agricultural value chains — farmers, governments, technical experts, and buyers, among others — and take into account the needs of and conditions in each region emerging from conflict. For instance, in recent years, companies have been pledging to achieve deforestation-free supply chains as a way to reduce carbon emissions and loss of biodiversity [144]. This is a trend among hundreds of corporations.

This approach to transform supply chains assumes that companies will not only commit but actually take ambitious actions to reduce deforestation. However, this is a big question mark [144]. Companies are, first and foremost, driven by their bottom lines. If it will mean profit, they will take action. If not, they may commit to taking steps but not bold enough to make a difference. Companies may take action, but there's the question of whether this contributes to stopping deforestation. Besides there's currently no mechanism to monitor and measure that contribution, the proposals disregard that most developing countries do not have the necessary capacities for monitoring land cover changes [8], [111], [112]. The supply chain approach likewise relies on efforts by companies. But, as mentioned above, combating deforestation requires establishing policies, institutions, infrastructure, and incentives that will facilitate those efforts. Furthermore, it is likely that agricultural supply chains remain informal in conflict-affected area. For instance, a number of companies that process milk in the Orinoquia do not pay taxes, and therefore monitoring whether or not they follow sustainable manufacturing practices would be a challenge. Achieving zero deforestation and low-carbon development, as such, means going beyond transforming supply chains. Deforestation will also continue if there is a lack of extension services that support efforts to deter agricultural expansion and curb practices and inputs that increase carbon emissions. Colombia actually has a strategy that incorporates this approach and REDD+, which covers both policies and incentives to lower emissions from deforestation and forest degradation. This suggests the need for a broader approach to zero deforestation and low-carbon development. This involves promoting sustainable agricultural practices, improving land use policies, and developing a sustainable food system. Sustainable food systems aim to create environment-friendly supply chains; support value chain actors to meet product quality, safety, and environmental standards; provide incentives that can lead to lower carbon emissions within the food system, from production to food waste disposal; and promote responsible food consumption, among other features. Even with concerted efforts by companies, government, and more, deforestation will continue to happen if the consumption of forest-risk commodities remains at the same level. To meet the demand, the same companies may opt to import those commodities, thus exacerbating deforestation across territories.

Fourth, carbon accounting methodologies can be adjusted with the goal of enhancing the potential of climate finance to generate forest conservation, peace, and sustainable food benefits. Improved understanding of the causal links between tropical forest cover and armed conflicts will be needed to this end. There is a common trend that carbon accounting methodologies prioritize intervention in landscapes with historical higher rates of forest-based emissions [145]. This approach underemphasizes the mitigation potential of landscapes with historic low agricultural development, forests at low risk of deforestation, and degraded lands [115] . Similarly, landscapes that used to host armed actions may not benefit from land-based mitigation actions as they typically have lower historical rates of emissions than their more peaceful counterparts [39]. Reducing deforestation

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figures prominently as an emissions reduction strategy (REDD+) and as best bet for fulfilling international commitments to the UNFCCC. REDD+ prioritizes landscapes with higher forest carbon stocks and that simultaneously are at high risk of deforestation. However, each landscape should have the opportunity to develop its strategy based on its own particular conditions. In Colombia, for example, the Amazon region is important for its dense forest cover, yet all regions of the country can make contributions to reducing emissions. Indeed, from a landscape approach perspective, regions with fewer trees (and forests at low historic risk of deforestation and degraded landscapes) are important for taking pressure off forested areas and may be important for restocking carbon. One such area is the savanna biome of the Orinoquia region, where a diverse landscape constitutes farms, cattle ranches, tree plantations, native savanna, and natural forests. Emissions from the Orinoquia region are comparatively lower than other regions, in part, because of the armed conflict. With the peace agreement, however, experts anticipate that conflict would no longer "prevent" investments. Thus, they expect historical trends in key sources of AFOLU emissions and removal to change. Recent studies indicate that political stability is attracting greater investors and may lead to increases in economic activities, such as industrial agriculture or livestock, logging, and mining [133], [146]. This would particularly happen in areas emerging from the armed conflict. Recent reports confirm this, indicating that land cover change is sharply increasing in areas previously under FARC control [147]. In addition, uninhabited forests and savannas might provide sites for the relocation of former combatants and displaced farmers [39].

Finally, the paper's findings are expected to inform emerging scholarly arguments on the potential of climate finance to bring about improved environmental and peacebuilding outcomes. However, at a time when forest carbon storage is being designed and targeted at (post-) conflict areas in Colombia and elsewhere, they might also demonstrate to government agencies (both environmental and non-environmental) the compatibility of programs aimed at reducing forest-based emissions with efforts relating to peacebuilding, forest conservation, and sustainable food production. Further examination of the role of climate finance in linking forest conservation, peacebuilding, and rural development, as such, is highly relevant. The imperatives for broad contributions from an "environmental peacebuilding" perspective, as defined by Hanson (2018), stem from the undeniable observation that many countries, including Indonesia, the Democratic Republic of the Congo, Peru, Mexico, and Colombia, host armed conflicts in their forest landscapes [21], thus emphasizing the relevance of the present study and the use of the Orinoquia as a case in point.

Acknowledgments: The author thanks CIAT's sustainable food systems team for providing technical and financial support.

Conflicts of Interest: The author declare no conflict of interest

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