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Climate-Smart Cocoa in Ghana: How Ecological Modernisation Discourse Risks Side-Lining Cocoa Smallholders

Felix Nasser[1]*, *Victoria A. Maguire-Rajpaul*[2,3], *William K. Dumenu*[4,5] and *Grace Y. Wong*[1]

[1] Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, [2] Environmental Change Institute, University of Oxford, Oxford, United Kingdom, [3] Department of Land Economy, University of Cambridge, Cambridge, United Kingdom, [4] Forestry Institute of Ghana, Kumasi, Ghana, [5] Environmental Economics and Resource Management, University of Freiburg, Freiburg, Germany

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***Correspondence:**
Felix Nasser
Felixnasser@gmx.de

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Climate-smart agriculture (CSA) aims to transform and reorient farming systems to decrease greenhouse gas emissions, boost adaptive capacity, and improve productivity while supporting incomes and, ostensibly, food security. In Ghana—the world's second biggest cocoa producer—the cocoa sector is challenged by increasing global cocoa demand, climate change impacts, as well as mounting consumer pressure over cocoa's deforestation. Climate-smart cocoa (CSC) has emerged to address these challenges as well as to improve smallholder incomes. As with CSA more widely, there are concerns that CSC discourses will override the interests of cocoa smallholders, and lead to inequitable outcomes. To better understand if and how the implementation of CSC in Ghana can meet its lofty ambitions, we examine (1) the dominant CSC discourses as perceived by stakeholders, and their reflection in policy and practice, and (2) subsequent implications for cocoa smallholders through an equity lens. Through semi-structured interviews and focus group discussions with key stakeholders in Ghana's cocoa sector, we find overwhelming consensus for an ecological modernisation discourse with the promise of a "triple win" narrative that simultaneously stops deforestation, supports climate mitigation and adaptation, and increases smallholder livelihoods. Moreover, we find that implementing CSC on the ground has generally converged around "sustainable intensification" and private-sector-led partnerships that aspire to generate a "win-win" for environment and productivity objectives, but potentially at the expense of delivering equitable outcomes that serve smallholders' interests. We find that the success of CSC and the overly-simplistic sustainable intensification narrative is constrained by the lack of clear tree tenure rights, complexities around optimal shade trees levels, potential rebound effects regarding deforestation, and the risks of agrochemical-dependence. More positively, local governance mechanisms such as Ghana's Community Resource Management Area

Mechanisms (CREMAs) may give cocoa smallholders a stronger voice to shape policy. However, we caution that the discursive power of dominant private sector actors may risk side-lining equity which could prove detrimental to the long-term wellbeing of Ghana's ~800,000 cocoa smallholders.

Keywords: climate-smart agriculture, climate-smart cocoa, equity, discourse analysis, supply-chain initiatives, sustainable intensification, zero-deforestation

INTRODUCTION

Industrial agriculture not only emits around 30% of global greenhouse gas (GHG) emissions (Tubiello et al., 2013) with the rate increasing at around 1% per annum (Lamb et al., 2016), but it is also vulnerable to climate change impacts (Vermeulen et al., 2012; Nelson et al., 2014; Tubiello et al., 2015; IPBES, 2018). In particular, agricultural expansion into tropical rainforest has been identified as a substantial driver of global GHG emissions and local climatic changes (Lawrence and Vandecar, 2015). To address the complexity of these multiple challenges, climate-smart agriculture (CSA) has become an increasingly popular concept (Taylor, 2018), which proposes triple wins through an approach that incorporates: (i) climate change mitigation (ii) climate change adaptation, and (iii) food security (Campbell et al., 2014; Lipper et al., 2014; Rahn et al., 2014). Proponents of CSA include global institutions such as the World Bank and the Food and Agriculture Organization (FAO), and research organizations such as the World Agroforestry Center (ICRAF). In Africa alone, USD 1 billion has already been committed to CSA trials and implementation (Rosenstock et al., 2018). However, CSA is not without its critics. Some scholars and civil society groups have questioned the vagueness of the 'triple wins' concept and associated agricultural practices, which range from the adoption of agroforestry, to sustainable intensification, to genetically modified organisms (Karlsson et al., 2017; Afrika Kontakt and La Via Campesina, 2018). Critics fear the continuation or reinforcement of the current, in their opinion, highly inequitable agricultural systems, which are based on external inputs, the dominance of multinational actors, the exploitation of nature, and profiting from the most vulnerable people (Climate Smart Agriculture CONCERNS, 2015; Taylor, 2018).

In concurrence with the global emergence of CSA, the concept of climate-smart cocoa (CSC) has become a new umbrella term for sustainability and supply-chain initiatives in order to deal with the multiple challenges in the Ghanaian cocoa sector. Cocoa is Ghana's principal commodity crop and an estimated 95% of its total production is exported (Tsiboe et al., 2018). Meeting foreign demand for chocolate has relied on cheap labor and cheap land for more than a century, but Ghana and neighboring Côte d'Ivoire (the world's number one cocoa producer) are reaching the end of the forest frontier (Odijie, 2016; Ruf and Varlet, 2017). In addition to these land pressures, low global market prices and price fluctuations continuously risk farmers' livelihoods and the food security of around 800,000 smallholders.

Against this backdrop, the global cocoa industry faces increasing international pressure with its supply chain being associated with deforestation (Mithöfer et al., 2017) and multinational chocolate corporations have signed various deforestation-free pledges (Higonnet et al., 2017). At the 2017 UN Climate Change Conference of Parties (COP23) in Bonn, the governments of Ghana and Côte d'Ivoire, together with 34 leading chocolate and cocoa companies established the Cocoa & Forests Initiative [*sic*], which committed to no further conversion of forests to cocoa. Many influential stakeholders in the Ghanaian cocoa sector—led by multinational chocolate companies, cocoa buyers, and the parastatal cocoa board (COCOBOD)—have thereby adopted CSA interventions and the related triple wins concept as their response to the challenges of projected climate change impacts; cocoa's increasing pressure on the scarce remaining forests; low cocoa productivity; and high rates of smallholder poverty. Climate change is projected to negatively impact West African cocoa production, albeit with spatial variation (Läderach et al., 2013; Schroth et al., 2016, 2017; Bunn et al., 2019). Between 2001 and 2014, Ghana lost 700,000 hectares of forest, with about 25% of the deforestation caused by cocoa expansion (Higonnet et al., 2017). In Ghana's most productive cocoa producing area, the Western Region, the conversion of intact forest has increased from 2.8% per year from 1986 to 2000, to 6.1% from 2000 to 2011 (Kroeger et al., 2017). Reduced forest extents are suggested to have dire implications for biodiversity and regional climate patterns (Asare et al., 2014; Lawrence and Vandecar, 2015; Morel et al., 2019) thus affecting climate suitability for cocoa cultivation and the livelihoods of cocoa smallholders (IDH, 2018).

The globalized agricultural commodity trade, including that of cocoa, is widely recognized as a major telecoupling process (da Silva et al., 2017; Andriamihaja et al., 2019; Llopis et al., 2020). The increased and intense connectedness of cocoa's supply and demand sites can result in land-use change and social injustices where economic, political, and sustainability agendas overlap, leading to conflicting claims over land (Gasparri et al., 2016; Friis and Nielsen, 2017; Zimmerer et al., 2018). This study of CSC in Ghana, thus, presents a useful case for telecoupling research since it highlights global-local flows in three aspects. Firstly, cocoa is primarily an export crop with supply chains dominated by foreign cocoa companies. Secondly, CSC, and its precursor CSA, are global concepts—formulated and popularized by global institutions such as the FAO (2010) and the World Bank. And thirdly, the global discourses underlying CSC—as knowledge flows—are partly interpreted and adapted to local policies and practices (Persson and Mertz, 2019). In this paper,

we examine the last two points of telecoupling by examining how environment-development meta-discourses—discourses that emerged from countless studies of environmental and development policies over the past two decades (Bäckstrand and Lövbrand, 2006; Di Gregorio et al., 2017)—around the global concept of CSA are re-interpreted and re-imagined within Ghanaian CSC policy and practice. We argue that a discursive analysis is critical since the adoption of certain discourses and its subsequent practices, mechanism or investments can create path-dependencies that keep cocoa systems locked-in to specific pathways—which may be inequitable or unsustainable—for years or decades. This study examines CSC discourses in Ghana across various scales—from national to local—with the objective to understand how different narratives, supported by relevant policies and dominant messages, can have different implications for smallholders. We examine national to local stakeholders' discursive understandings of CSC with the aid of Bäckstrand and Lövbrand's (2006) three meta discourses on environmental governance—namely, ecological modernization, civic environmentalism and green governmentality—to understand how stakeholders interpret problems in the cocoa sector and thus, what they perceive as viable solutions. We anticipate that our study will offer insights into potential inequitable outcomes from CSA interventions for smallholder farmers in other economically-developing countries.

With the popular expectations of CSA and CSC to address poverty alleviation and enable sustainable livelihoods as one of the three wins, we choose to assess its implications for cocoa smallholders through a more critical lens of equity. Given the criticisms of CSA as potentially reinforcing an existing agriculture system that is highly inequitable (Holt-Giménez and Altieri, 2013; Karlsson et al., 2017), we use a multi-dimensional equity framework (McDermott et al., 2013) to understand the procedural, distributional, and contextual aspects of equity as CSC is implemented in Ghana. We thus ask the following research questions to address the above aims:

1. What are Ghanaian stakeholders' interpretations and perceptions of CSC and how are CSC discourses reflected in policy and practice?
2. What are the implications of CSC for cocoa smallholders in terms of equity, and how could CSC provide solutions to resolve inequities?

THEORETICAL FRAMEWORKS

Discourses and Their Interpretations Into Policy and Practice

Following Hajer (1995), this paper understands discourses as "specific ensembles of ideas, concepts and categorization that are produced, reproduced and transformed in a particular set of practices." Discourses are not detached from socio-political contexts and are thus embedded in power relations (Foucault, 2003). Discourses shape actors' understanding of socio-economic and environmental problems as well as their rationalization of policy solutions (Hajer and Versteeg, 2005). Discourses can therefore enable or obstruct policy action (Hajer, 1995; Karlsson et al., 2017). Discourses can also generate mechanisms of exclusion and inclusion, partly by structuring information flows and facilitating participation that favor certain interests over others (Persson and Mertz, 2019), and in many cases it is the interests of the most powerful and best-resourced, which are favored (Adger et al., 2001). In this regard, we hypothesize that stakeholders along Ghana's cocoa value chain are influenced by certain global discourses, which shapes how they interpret the social-ecological phenomena of climate change, deforestation, and low cocoa production—and the implications for the national economy and local livelihoods.

We apply Bäckstrand and Lövbrand's (2006) set of meta-discourses as a framework for understanding the discourses adopted within CSC to examine their potential implications for cocoa smallholders. Bäckstrand and Lövbrand (2006) proposed three environmental governance meta-discourses in their study of local discursive interpretations of afforestation and climate change mitigation programmes: ecological modernization, green governmentality, and civic environmentalism.

Ecological modernization is a win-win narrative, where economic growth and environmental protection are compatible. It is founded on the belief that market solutions can solve environmental problems flexibly and cost-effectively. Within CSA, the ecological modernization discourse is reflected in private sector and win-win propositions such as sustainable intensification. However, such win-win and private-sector led policies are criticized to have unintended negative consequences for livelihoods and local food security (Climate Smart Agriculture CONCERNS, 2015; Karlsson et al., 2017; Giraldo and Rosset, 2018).

Green governmentality focuses on top-down and techno-scientific management, with scientific monitoring, large business entities, and experts as the expected providers of solutions to environmental challenges (van der Heijden, 2008). Within CSA and other climate interventions, this discourse is evidenced by the widespread expansion of monitoring, reporting, and verifying (MRV) technologies, such as satellite surveillance of forest cover. Scientific MRV tools favor some ecological knowledge and ignore other, for example by institutionalizing measurable indicators that enable forest carbon to be calculated, governed (McGregor et al., 2015), and enforced when those calculable outcomes are not met. Another practice promoted by proponents of green governmentality is the use of genetically modified organisms (GMOs).

Civic environmentalism can be understood as a counter-narrative to the first two discourses (Adger et al., 2001) by calling for increased participation of marginalized groups in policy processes, accountability, with a focus on equity and justice issues. Civic environmentalism's radical versions demand a radical transformation of agriculture's unsustainable and inequitable institutional arrangements. More reformist versions of civic environmentalism have entered CSA pushing for focus on equity and human rights (Karlsson et al., 2017).

Equity as a Lens for Measuring Benefits and Burdens

CSA is often presented as a strategy to address long-standing equity challenges for smallholder farmers (FAO, 2012, 2013; World Bank et al., 2015), a narrative that is also taken up by some CSC stakeholders in Ghana (IDH, 2018). Yet, there is still much debate as to what extent, and how, CSA and CSC interventions are willing to invest into equity issues, such as land tenure reforms, poverty alleviation, and inclusive participation. As such, we examine the impacts of discursive practices within the CSC context, particularly in relation to smallholder farmers who represent the most marginalized group within the cocoa value chain (Südwind, 2016; Karlsson et al., 2017; Saeed et al., 2018), through the lens of a multi-dimensional equity framework of distributive, procedural, and contextual equity (McDermott et al., 2013).

Distributional equity refers to the allocation of material and non-material benefits, costs, and risks associated with an intervention. This dimension is often framed as who wins and who loses (Karlsson et al., 2017). Distributional equity has typically received most attention within equity discourses (Ikeme, 2003). CSC interventions primarily focus on the distribution of technical support or resources for implementation of new farming practices, yet there are still many who are not able or eligible to access these resources.

Procedural equity focuses on the participation or representation in decision- and policy- making. In this context, participation can range *"from minimal guarantees of equal basic rights in decision-making…favoring groups that have been marginalized, such as women, the landless and ethnic minorities"* (McDermott et al., 2013). Against this background, we examine processes of inclusion of cocoa farmers in the creation and implementation of CSC, and also the processes of exclusion.

Contextual equity considers pre-existing social, political, and economic conditions. These are seen as the "playing field" (Chomba et al., 2016), which includes laws, processes, and policies, which will enable or restrain resource users from benefits. Being able to participate and derive benefits is not only dependent on individual capabilities but also on pre-existing conditions, such as tenure rights, institutional practices, traditional rules, or hierarchy (Ribot and Peluso, 2003; Forsyth and Sikor, 2013).

The three dimensions of equity are interdependent and can often reinforce each other in different ways (McDermott et al., 2013). To fully understand the equity implications of CSC, we use a deductive and iterative process to interpret and analyse data relative to these three equity dimensions, as we describe in the section Data Collection and Analysis.

METHODS AND MATERIALS

Case Study Sites

The study sites of the Western Region's Juaboso-Bia district and the Central Region's Assin-South district (**Figure 1**) fall within the tropical ecological zone of moist evergreen forest located in southern Ghana. The landscape is predominantly characterized by a mosaic of cocoa farms and forest reserves.

In the two study sites, cocoa production is the primary income source of rural households (Hirons et al., 2018a; Asaaga et al., 2020). While there are generally few alternative livelihood sources in Juaboso-Bia (Gockowski et al., 2011), some smallholders in Assin-South generate additional income from oil palm (Khatun et al., 2020). Even though land tenure is largely held by traditional authorities, a plurality of different land tenure arrangements exist (Hirons et al., 2018b), which include ownership of farmland on short or long-term farm leases (approximately from 2 to 50 years), which are often granted to migrant farmers. The social-ecological dynamics of the study sites are further characterized by the dependence on forest cover to provide a suitable micro-climate for cocoa production (Asare et al., 2014; Lawrence and Vandecar, 2015).

Forest reserves in the study areas include Bia National Park and Krokosua Hills Forest Reserve in the Juaboso-Bia site, and Kakum National Park in Assin-South. The forest reserves of Juaboso-Bia are, in particular, under increasing threat of deforestation (**Figure 2**). Moreover, mainly due to forest degradation and climatic changes, dominant cocoa production areas have shifted over the past half-century from the Central Region to the Western Region—putting additional pressure on western Ghana's forest frontiers (Anim-Wapong and Frimpong, 2004; Ruf et al., 2015).

The selection of the study sites was primarily based on the presence of CSC interventions. We also included one control study site: in Gomoa district in which CSC interventions were completely absent. At the time when we gathered data (December 2018–February 2019), Juaboso-Bia district had received the most CSC interventions. The CSC interventions that we studied included the Forest Investment Program (FIP), the multi-stakeholder Partnership for Productivity, Protection and Resilience in Cocoa Landscapes (3PRCL), and the Climate-Smart Landscapes initiative by the multi-national agribusiness Olam. These interventions are often merged with existing extension and sustainability schemes such as Mondelēz's "Cocoa Life". CSC efforts in Assin-South district were predominantly characterized by the implementation of Community Resource Management Area Mechanisms (CREMAs), and are, in contrast, relatively new, having only been active since 2018. The Ghanaian NGO, Nature Conservation Research Centre (NCRC) led the implementation of two CREMAs as part of the "Kakum Cocoa Agroforestry Landscape Program." Nevertheless, major cocoa buying companies such as Mondelēz, Touton, and ECOM have run sustainability interventions in Assin-South for several years, which often include elements of CSC, mainly the promotion of agroforestry systems. The diversity of activities between the two study sites provided an opportunity to explore the current range of CSC interventions in Ghana.

Data Collection and Analysis

To address our research questions, we used mixed qualitative research methods (**Table 1**), including a literature review of global discourses on CSA, semi-structured interviews, focus group discussions (FGDs), participant observation (PO), and

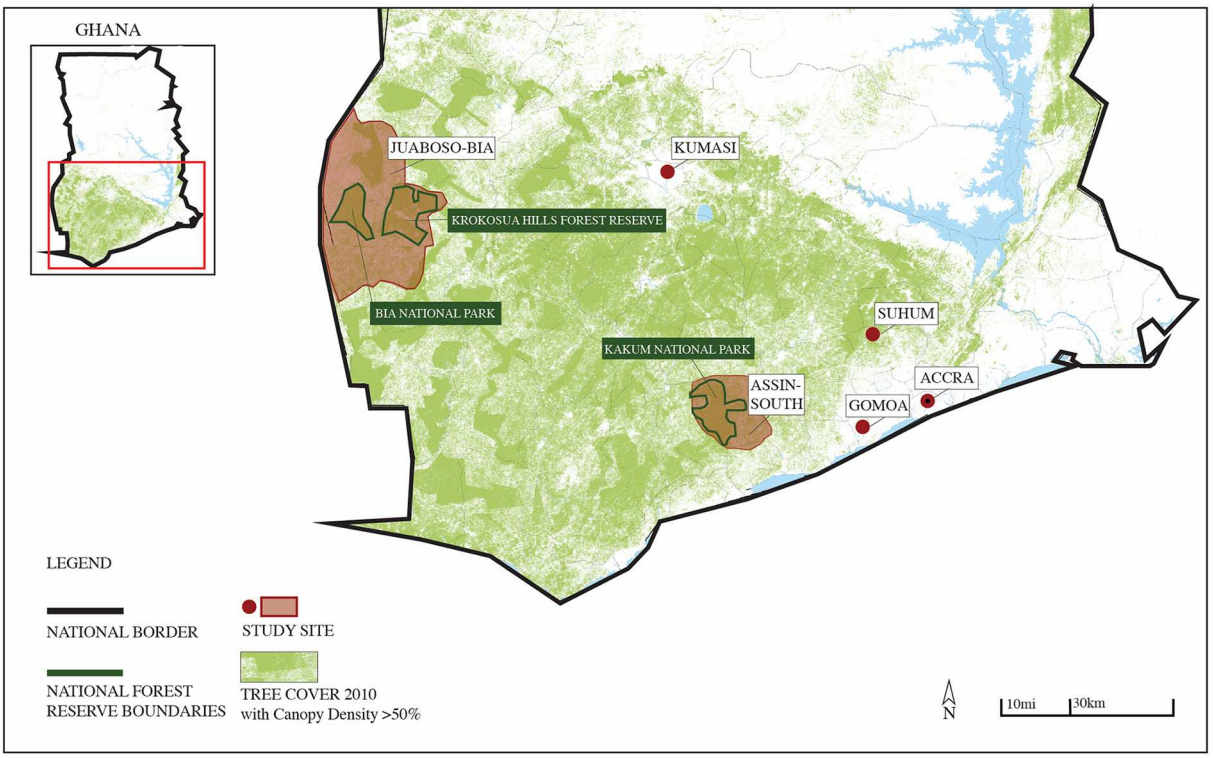

FIGURE 1 | Map of study sites in Ghana. Source: World Resources Institute (2019) and author's own creation.

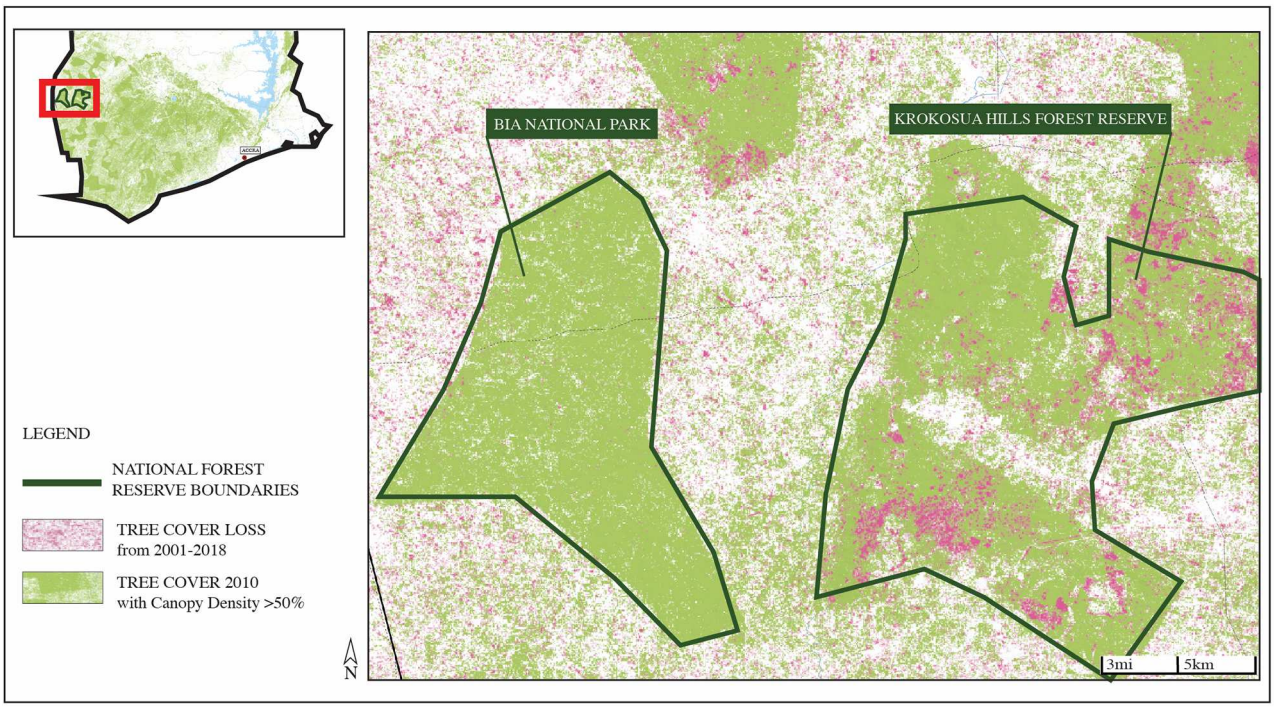

FIGURE 2 | Map showing deforestation adjacent to, and within, the Bia National Park and the Krokosua Hills Forest Reserve in the Juaboso-Bia district. Source: World Resources Institute (2019) and author's own creation.

TABLE 1 | Overview of data collection.

Respondent/Event	Number	Location of data collection	Level	Method of data collection
COP24	6*	Katowice, Poland	International	Participants observation
Global Landscape Forum 2018	4*	Bonn, Germany		
Government representative (COCOBOD and Forestry Commission)	2	Accra, Ghana	National	Semi-structured Interviews
	4	Accra & Suhum, Ghana		
Private sector representative	1	Accra, Ghana		
Representative of an international NGO	1	Accra, Ghana		
Representative of a national NGO	1	Kumasi, Ghana		
Researcher (CSIR-FORIG, Forestry Research Institute of Ghana)				
Governmental officers (COCOBOD district and extension officers)	4	Juaboso-Bia, Ghana	Local	Semi-structured Interviews
	2	Juaboso-Bia, Ghana		
Private sector extension officers	2	Juaboso-Bia & Assin-South, Ghana		
Field officers of a national NGO	19	Juaboso-Bia, Assin-South & Gomoa, Ghana		
Farmers	1	Juaboso-Bia, Ghana		
Farmers women's group representative				
Farmers	5** (34 participants in total)	Juaboso-Bia, Assin-South & Gomoa, Ghana	Local	Focus group discussion
Forest guards	1***	Assin-South, Ghana	Local	Transect walk
Farmers	4***	Juaboso-Bia, Assin-South & Gomoa, Ghana		
Kakum Cocoa Agroforestry Landscape Program Launch	1*	Assin-South, Ghana	Local	Participants observation

*Number of sessions observed, **number of focus group discussions, ***number of transect walks.

transect walks. Data collection was conducted at multiple study levels (from international to farm level) and combined deductive and inductive approaches (Bryman, 2016). Our choice of multiple methods at multiple study scales aimed to adequately capture the perceptions, the way in which something is regarded, understood, or interpreted OED (2010), of the multitude of stakeholders involved in CSC along cocoa's global value chain, as well as enabling triangulation (Bryman, 2016). In the same vein as Stott and Sullivan (2000), we trace narratives concerning *"the environment"* by identifying power relationships supported by such narratives, and asserting the consequences of hegemony over, and within, these narratives' (p.2). Furthermore, we assume that discourses and social realities are constantly constructed through social interactions on various levels. The social world is, thus, not external to us but shaped in, and through, these interactions (Bryman, 2016). Identifying power asymmetries helps us to recognize that environmental discourses are not equally shaped by all social actors and that consequently the distribution of risk and opportunities is not necessarily borne equally (Pelling et al., 2015).

Literature Review

We carried out a literature review, which provided insights into the current debates on CSC as well as into potential inequities and trade-offs around CSA and CSC. Reviewing the salient literature further informed how we designed the guides for semi-structured interviews. Search strings such as: "*climate-smart agriculture," "climate-smart cocoa," "equity and climate-smart agriculture," or "zero-deforestation"* were applied to Google Scholar and Web of Science. The review included national policy and strategy documents such as the Benefit Sharing Plan Ghana Cocoa Forest REDD+ Programme 2018 Ghana Forestry Commission (2018), the Cocoa & Forests Initiative Joint Framework for Action in Ghana Cocoa & Forests Initiative (2017), and the Ghana Cocoa & Forests Initiative National Implementation Plan 2018–2020 (IDH, 2018).

Semi-structured Interviews and Focus Group Discussions

Through snowball sampling (Teddlie and Yu, 2007), we identified fourteen key private, governmental, and non-governmental organizations involved in CSC in both study sites. We began by interviewing one key non-governmental organization in Accra that provided us with a list of possible interviewees. Subsequent interviewees were asked in turn to provide more potential interviewees until we had developed an overview of 14 key organizations involved in Ghanaian CSC. Of these, the lead author carried out 17 semi-structured interviews with representatives from 11 organizations (see **Table 1** for distribution regarding sectors and roles). Three of the 14 organizations did not participate due to a lack of time availability. The lead author carried out another 19 semi-structured interviews with farmers and an additional interview with a representative from a female farmers' group. Through semi-structured interviews and focus-group discussions, a total of 71 respondents were involved in the study.

Interviews with farmers, extension officers, and farmer cooperative leaders were conducted in 12 different communities and three district capitals in the Juaboso-Bia and Assin-South Districts (**Figure 1**). Communities were selected because of the existence of CSC interventions, recommendations by interviewees and informants, and the willingness of these communities to participate. In order to cover a broad range of local perceptions, farmer interviewees included chief farmers,

traditional leaders, and women's group representative. Our selection of farmer interviewees was supported by extension officers who provided their in-depth knowledge of the study sites. All primary data were gathered between December 2018 and February 2019.

Overall, the interviews aimed to elicit diverse perceptions and experiences regarding CSC and subsequently deforestation, climate change, equity, and agroforestry (see **Supplementary Materials** for interview guide). If appropriate, and when consent was granted, interviews were recorded on a dictaphone. At the start of each interview, respondents were encouraged to speak freely about their perceptions of CSC. This open approach was elected to avoid strong biases in initial responses, especially when eliciting reflections of meta-discourses (Rubin and Rubin, 2011). The language of national-level interviews was English, while local level interviews were conducted in Twi by the fluent lead author. No translator was employed, but field officers when present would sporadically elaborate upon answers or questions in Twi (to the researcher or interviewee). This allowed all participants to communicate in the same language at all times. To avoid research fatigue and respect farmers' time, a very flexible interview approach was employed. This meant that interviews ranged from being informal and short to being formal and long, depending on the perceived willingness of farmers to participate. Towards the end of collecting data (from participants), a theoretical saturation point was reached (Patton, 2002) as no new narratives emerged from the farmers or from their organizational representatives. This sentiment was further confirmed by a final key informant interview with a representative of a national non-governmental organization at the end of the data collection. Due to the constant repetition of organization names and potential interviewees during the snowball method, we felt that our data collection covered most of the relevant organizations involved in CSC.

Across the study sites and different communities, five focus group discussions (FGDs) complemented the interviews and aimed to create more realistic accounts of what people think by bringing groups together in conversation and recording their interactions with each other (Bryman, 2016). Participants were selected by their availability as well as by traditional leaders and extension officers. The FGDs informed this study by eliciting a diverse range of views and by observing how farmers respond to each other's views on CSC. Importantly, this method provided complementary information on commonly-held views and those views, which were contested. FGDs followed the same themes used in the interviews. Thus, while a potential limitation of the FGDs was that some participants might have felt inhibited to voice their perspectives due to social hierarchies in the groups, we expect that their perspectives were captured during the one-on-one interviews.

Additional farmer interviews and one FGD in the Gomoa district of the Central Region, outside the CSC intervention area, served as a "control group" for a comparison of perspectives and to have a better understanding of the impact of CSC interventions. Despite efforts for gender-balanced data sources, the generalisability of the collected data is constrained by the underrepresentation of women and their perceptions in both farmer interviews and FGDs (six female interviewees out of 37 and five female FGD participants out of 34).

Participant Observation (PO)

To inform the study with a preliminary understanding of the global discourses on CSA, the lead researcher participated in an international climate policy event in Germany and the COP in Katowice, Poland, during November and December 2018 (see **Table 1**). The lead researcher participated in 10 sessions, which were directly related to either CSA or CSC. These climate-smart sessions were hosted by international organizations (including the World Bank) and the private sector (including Olam).

Participant observation (PO) in Ghana included numerous informal conversations with regional, district, and field officers from government, private sector, or civil society, as well as forest guards and cocoa farmers. Additional insights on the local context were gained during transect walks. Transect walks involved an open dialogue with farmers and forest guards as the lead researcher visited their cocoa farms or the forest. Our rationale for choosing PO as a method was due to the belief that researchers can never be fully detached from the spaces they study, thus PO is understood as "learning with people" (Ingold, 2011). Accordingly, the role of the lead researcher was always highlighted during participant observations. PO was generally open and unstructured but remained influenced by the chosen theoretical frameworks.

As a part of an iterative, reflective approach, the lead researcher took notes and wrote journals at the end of each day, which were used during the coding process and in the analysis of the broader context of the dataset.

Data Analysis

Nvivo 12 was used to organize and code interview transcripts and participatory observation notes from Ghana and global events into themes. The coding was mostly deductive, specifically guided by the Bäckstrand and Lövbrand's (2006) meta discourses and McDermott's equity framework (2011). However, a later inductive round of coding allowed for further themes to emerge. To aid the analysis of the interview transcripts and determine perception and interpretation of CSC in the Ghanaian cocoa sector, key indicative expressions and narratives that reflect the central thoughts on ecological modernization, green governmentality and civic environmentalism; including distributive, procedural and contextual equity were identified. For example, in relation to ecological modernization that posits a win-win narrative, where economic growth and environmental protection are compatible, we looked out for narratives that argued i.e., for "sustainable intensification, CSC as a business opportunity, or private-sector led." Likewise, in the case of green governmentality indicative expressions and meanings such as "forest monitoring maps, top-down, agrochemical at core" were determined. For civic environmentalism, which calls for increased participation of marginalized groups in policy processes, accountability, and a focus on equity and justice issues, we focused on indicative expressions and meanings such as "secure tree tenure or equitable benefit sharing." Similarly,

codes were used to trace equity implications accordingly. Key indicative expressions were then traced to respondent groups interviewed. Percentages were created to illustrate and underline certain stances expressed by these groups. Percentages show the proportion of a respondent group agreeing with or expressing certain stances. Due to our open semi-structured interview approach, the percentages do not indicate, however, the proportion of respondents disagreeing with these stances. As the data analysis process was iterative, FGDs were used to discuss, redefine, and validate initial data. Further validation was sought through a key informant interview after the field work.

RESULTS

Following an overview of CSC in Ghana in **Table 2** below, the results are presented first with the presentation of discourses used within CSC in Ghana (Discursive Understandings and CSC Practice), followed by equity implications of those discourses (Equity Implications for Smallholders).

Discursive Understandings and CSC Practice

As can be seen in **Table 3** below, features of all three meta-discourses—as described by Bäckstrand and Lövbrand (2006)—were observed during data collection. Interviewees mentioned features of all meta-discourses were visible. Yet, ecological modernization emerged as the most dominant discourse adopted by Ghanaian CSC actors. PO at the global CSA-related sessions showed that the meta-discourses were more distinctly expressed by actors exogenous to Ghana's cocoa sector, such as international civil society groups or other international institutions, as compared to Ghanaian cocoa stakeholders. We observed that actors such as *La Via Campesina* express strong civic environmentalism narratives and are very critical of actors such as the World Bank, which promoted narratives that adhere to elements of ecological modernization. Among Ghanaian stakeholders groups, surprisingly we observed few differences between them, except for a few critical positions raised during interviews with, for example, stakeholders from non-governmental organizations or extension and field officers. One non-governmental national representative explained a possible reason for the lack of critical voices and discursive differences between stakeholders as follows:

> *In order to keep a seat at the CSC table, stakeholders adhere to the mainstream opinion of bigger actors such as COCOBOD or the World Bank.*

TABLE 2 | Overview of CSC in Ghana.

Original motivation	High deforestation rates, low cocoa productivity, negative impacts due to climate shocks, and future impacts of climate change
Definition	As yet, no common and specific definition of CSC in Ghana. But a definition commonly referred to is provided by FAO on CSA 2013: 1. sustainably increasing agricultural productivity and incomes; 2. adapting and building resilience to climate change; 3. reducing and/or removing greenhouse gass emissions, where possible
Emergence	A cross-sectoral working group formed in 2011, which included governmental (the Forestry Commission and the national cocoa board, COCOBOD), private sector (Touton), and NGO representatives (NCRC)
Stakeholders and governance	Cross-sectoral consortia, including stakeholders from government, private sector, and NGOs. Interventions are mainly driven by these actors and implemented through extension and field officers in the respective intervention areas. For the first time in their histories, the Ghana Forestry Commission and COCOBOD work in alliance
Main practices	Distribution of shade tree seedlings and other assistance with agroforestry; access to extension services (e.g., agronomic information or agrochemical input); CREMAs and additional livelihoods programmes. CREMAs consist of farmer committees and are a mechanism that aims to create a community-based governance structure for benefit-sharing, forest conservation, and enhanced alternative livelihood initiatives, such as beekeeping or NTFP collection. CREMAs were mainly supported by NGOs or the Forestry Commission
Dominant interventions	Forest Investment Programme (FIP), the "Partnership for Productivity, Protection and Resilience in Cocoa Landscapes (3PRCL)," Olam's climate-smart cocoa landscape programme or the Kakum Cocoa Agroforestry Landscape Programme

Ecological Modernization

The triple wins narrative of simultaneously achieving environmental, economic, and social aspirations emerged as the dominant narrative. Triple wins narratives chime with ecological modernization discourses and both were strongly represented in CSC narratives. Although several respondents, from farmers to national representatives, contested a general win-win on a societal level (e.g., between industrialization and environmental protection), the perception that a win-win solution between cocoa production and forest conservation was shared by around 80% of a total of 37 respondents and across levels. Around 95% of these—and especially smallholders—deemed forests and cocoa

TABLE 3 | Summary of dominant discourses in Ghanaian CSC in accordance with Bäckstrand and Lövbrand (2006) environmental discourses.

	Ecological modernization	Green governmentality	Civic environmentalism
Reflections in Ghanaian CSC	CSC as a triple win solution	Scientific knowledge important	Tree tenure a key issue
	CSC as a business opportunity	Baseline maps for cocoa productivity and forest cover important	Shade trees at core of CSC strategy
	Big private sector actors play an increasingly important role	New agricultural methods, such as irrigation or hand pollination	Negative perceptions of chemical inputs
	Mix of agroecological and agrochemical-based practices		

production as interdependent, underscoring the importance of forests to function as favorable cocoa microclimates to provide rainfall and regulate the climate. Further, ∼90% of a total of 37 respondents across study scales adhere to the narrative that successful forest conservation is dependent on the involvement and incentivisation of cocoa farmers, despite such financial support mechanisms being almost wholly absent.

Around 80% of a total number of 17 national representatives and extension officers stated that sustainable intensification of farms would lead to higher farm incomes and less need to expand into forests, thus most national representatives and extension officers espoused an ecological modernization narrative. Some of them detailed how income earned from shade trees' timber and from alternative livelihood programmes would further mitigate farmers' encroachment onto forests.

The sustainable intensification narrative was further evident in several corporate documents. Touton and IDH aim *to mitigate impacts of climate change by preventing deforestation and increasing productivity* (p. 9; Touton and IDH, 2018). Touton and IDH (2018) have further articulated the triple wins approach of CSA as:

> *Agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals* (p. 2)

The Ghana Cocoa & Forests Initiative National Implementation Plan 2018–2020 advocates for *measures that promote investment in long-term productivity of high-quality cocoa in an environmentally sustainable manner. Grow "more on less land" through intensification of farming practices* (p. 45). Its *signatories recognize that sustainable agricultural intensification in environmentally suitable areas and increased farmer income are essential pre-requisites for reducing pressure for agricultural encroachment into forests, and strengthening the resilience of cocoa farming to climate change* (Touton and IDH, 2018, p. 45).

Further examples of intensification policies include the*...development of implementation plans for cocoa intensification and* to*...implement climate-smart cocoa Guidelines on farms (p. 27; IDH, 2018).*

However, few interviewees or focus group discussants questioned the assumption as to why a successful farmer, following intensification, would not set up a new farm on forested land. Close to all respondents, including most farmers, agreed, moreover, that CSC represents a "business opportunity" for both farmers and the economic growth of the cocoa sector. A national-level private sector respondent described CSC as an opportunity beyond business-as-usual practices:

> *The private sector sees this as a business opportunity. That's why they are willing to be involved. It's important that the farmers also see this as a business opportunity. Otherwise we continue to do business-as-usual.*

Stakeholder interviews and PO demonstrated the increased involvement of the private sector. A national-level government respondent's statement reflected this observation: *The way forward in environmental sustainability issues is the private sector. We see private sector as playing the lead. The government will play the regulatory and monitoring role.*

Green Governmentality

The green governmentality discourse was generally more contested than ecological modernization positions. Green governmentality narratives, which proclaim the advantages of techno-scientific management, were evident in the Cocoa & Forests Initiative's central focus of "supply chain monitoring." Such techno-fixes were promoted quite widely through the use of forest monitoring maps, importance of scientific knowledge, which were especially narrated by national-level respondents. Local or regional respondents from different sectors had a stronger focus on the creation of new agricultural practices such as hand pollination or irrigation systems.

Nevertheless, across sectors of the cocoa value chain and studied scales, around one fifth of all respondents contested these interpretations of green governmentality. These respondents warned of discrediting local knowledge. Indeed, around one third of farmers felt their own knowledge to be more appropriate to their farm realities than that given by extension services. About half of the respondents from all sectors agreed that complementing scientific knowledge with local knowledge was favorable. A governmental national-level government representative's statement epitomizes this sentiment:

> *I would argue for complementarity because you can introduce all these (science-based) things. Then at the end of the day they have their local experiences…you don't go there and teach them how to cultivate cocoa and how to take care of trees on their farms. They have been doing this already.*

Civic Environmentalism

Civic environmentalism as a meta-discourse serves as a counter-narrative role to conventional approaches by demanding the inclusion of civil society or a major transformation toward equitable food systems. In Ghanaian CSC, we found that the single most dominant manifestation of this discourse was the emphasis on tree tenure as a major equity issue. Further, this meta-discourse was evident through the emphasis of agroforestry, which stands in contrast to full-sun cocoa monocultures. Despite the fact that civic environmentalism explicitly calls for new approaches to agrochemical inputs and rejects mixed practices, roughly 90% of all 37 respondents did not interpret agroforestry as a substitute for agrochemical inputs, but rather as incorporated into an input-based system. Nevertheless, some respondents, especially local governmental extension and NGO field officers, pointed to organic farming as an alternative to the current agrochemical-based system. However, most of these respondents perceived organic farming as hardly implementable due to the high costs and, as they described it, "bulkiness" of organic fertilizers, along with the added barrier of limited knowledge on low-costs practices. Moreover, rather than creating farming systems based on local agroecological practices, more than 70% of all 37 interviewees, including local respondents,

understood organic cocoa farming as a heavy input-based system since the use of organic fertilizers and pesticides are advocated to substitute synthetic ones.

One national-level respondent explained the dominant role of agrochemicals in sustainable intensification, which contrasts civic environmentalism discourses:

> *What are the options for us to be able to maximize profits and to spare land? The sure way to go is to have inputs increased, and the inputs here are fertilizer and pesticides.*

While more than half of the respondents expressed negative perceptions of agrochemicals and some suggested more effective use of these, the majority of these respondents felt that agrochemicals were a "*a necessary evil*" for farm productivity.

Furthermore, while civil society actors were the most vociferous on civic environmentalism discourse, this study only encountered a few local NGOs or community-based farmers organizations involved in CSC, in contraposition to a strong involvement of the private sector.

Equity Implications for Smallholders

The following sections depict findings regarding distributive, procedural, and contextual equity (see **Table 4** for a summary).

Distributive Equity

We found that the main economic or material benefits that cocoa smallholders received through CSC were derived from: (i) the distribution of "shade tree" seedlings, (ii) advice from extension services, and (iii) additional livelihood programmes. The general narrative was articulated around a "silver bullet" logic that shade trees and extension services—as part of the sustainable intensification of farms—will increase productivity and provide farmers with co-benefits such as timber and diversified income streams. In practice, however, CSC interventions neither reach all regions nor all farmers. A non-governmental local field officer in Assin-South explained:

> *You can see that most of the private sector, NGOs, and government attention goes to one landscape. For instance, look at the number of organizations in the Juaboso landscape, and look at this place. You see a vast difference.*

We found that the farmers in our control group and others who live in remote areas or those outside the CSC intervention areas were generally disadvantaged or excluded from benefits. Access to extension services depended in many cases on making an extra effort, a sentiment shared by around 80% of the 28 extension officers and farmer respondents, as reflected in this local governmental extension officer's statement:

> *It is the duty of us extension officers to go there (remote farms). Staff is few. But we are trying the best we can, because staff numbers are not enough. I will still do my best.*

The group that many farmers singled out as receiving least benefits were short-term caretakers, who take care of shade trees on cocoa farms without eventually benefiting once on-farm timber trees are felled and sold. Long-term lease farmers were generally able to fully or partly benefit from on-farm timber trees. However, several extension and national-level respondents explained that older farmers, which constitute the large proportion of cocoa smallholders in Ghana, would not benefit from newly-planted shade trees, since it would take 10–20 years for these trees to be felled and sold.

Furthermore, wealthier farmers seemed to benefit more from CSC. These farmers had more available resources to invest in tree maintenance and additional livelihoods. Meanwhile, financially-poor farmers were struggling to invest in, and thus benefit from, CSC-related initiatives.

While more than two thirds of farmers generally had positive perceptions of shade trees and were satisfied with the number of seedlings distributed to them, more than half of the farmers complained about the lack of benefits received through CREMAs and additional livelihood programmes. This was especially true for Juaboso-Bia, where farmers predominantly complained about a lack of financial resources and inactivity of CREMAs. Moreover, about half of the farmers were concerned about the lack of financial support for initial investments into additional livelihood practices.

Even though more than 80% of the 37 respondents across study scales saw shade trees as the best way to combine environmental benefits, such as biodiversity, with economic benefits, such as timber, interviews and transect walks with farmers revealed a more in-depth understanding of shade trees' negative impacts, such as increased pests and diseases. A farmer in the Assin-South district explained the disadvantages of an increased use of shade trees:

> *There are many negative things that come with shade—such as pests and diseases. By the end of the day, I am not sure if the trees help more than they do harm.*

TABLE 4 | Summary of CSC's main equity concerns encountered during field work.

Main equity concerns	
Distributive	Not all farmers benefit due to limited resources and coordination
	Areas outside of intervention areas do not benefit
	Lack of resources and continuity for CREMAs and additional livelihood programmes Financially-poor farmers likely to benefit less due to lack of resources to engage and invest in CSC strategies
Procedural	Farmers included through consultations, rather than direct representation in creation and discussion of CSC
	Insufficient, or malfunctioning, mechanisms to file complaints or voice dissatisfaction with CSC interventions
Contextual	Tree tenure uncertainty and subsequent lack of tree registration is a major barrier to benefits

Procedural Equity

Farmers were generally not directly involved in the creation or official negotiations of CSC. Several respondents across study scales complained that the lack of farmer participation will be a barrier to the success and general uptake of CSC, as a national-level research-related interviewee warned:

> *Farmers have accepted (CSC production), but as to whether they believe this is the solution to the problem. . . I don't know.*

Correspondingly, more than half of all farmers saw existing mechanisms for filing complaints or voice dissatisfaction with cocoa and tree related issues as inefficient and ineffective.

Several CSC interventions, such as those led by NCRC, promoted CREMAs as a way to increase local governance structures and participation by involving farmers and traditional leaders at all district governance levels. Moreover, CREMAs promote additional livelihood initiatives. Yet, most CREMAs we encountered seemed inactive or only at the stage of creation. The following quote by a local NGO field officer demonstrates the complexities of CREMAs, which was echoed by most local field officers and farmers involved in CREMAs:

> *It's a process. CREMA is not like a one-year project, where you go and do an intervention and leave. I think that was the approach a lot of organizations were taking there. . . But they come and go, this organization comes and starts the whole process again. You confuse the people.*

Correspondingly, a farmer in Juaboso-Bia explained the importance of greater community involvement and participation by highlighting the lack of continuity of CREMAs:

> *Before regional meetings, they (a CREMA NGO) did meetings in every community. That was really good. But they left and we have never heard from them again. Now another NGO came. But they only take two people to the regional meeting without any meetings in the villages. Meetings in every community would help people to understand the process. But like this, people will be less interested (in the CREMA).*

Contextual Equity

Contextual equity is concerned with pre-existing social, political, and economic conditions. As per in other economically-developing country communities, gendered disadvantage patterns are shaped by locally-embedded social norms (Barrientos, 2014), and with regard to the particular context of smallholder cocoa farming in Ghana: tree-tenure and gender recurred as significant contextual factors, which threaten to perpetuate inequality (Maguire-Rajpaul et al., 2020). According to the Constitution of Ghana, "naturally-occurring trees" on cocoa farms belong to the government, while planted trees belong to farmers. The complexity of the tenure system has created a lot of uncertainty for farmers regarding their rights to trees and the role of trees on farms. This is reinforced by farmers' experience with legal and illegal timber contractors, who felled timber trees on cocoa farms without compensating for damages to cocoa. One farmer in Juaboso-Bia explained a sentiment shared by more than half of the farmer respondents:

> *When we leave the trees on the farm, contractors might enter and cut them. They destroy the cocoa. But they will not give you anything (no compensation).*

Even though the vast majority of respondents cite the current tree tenure system as a critical issue, there was a variance in what this then meant for CSC and cocoa farming. All farmers strongly agreed that the tree tenure system needed to change in order for CSC to become equitable. Several national-level respondents across the sectors stated, however, that CSC activities would have to start with the current tree tenure system to not delay CSC-related activities.

One national-level representative explained the historical persistence of tree tenure issues in the Ghanaian cocoa sector:

> *It is not easy to change these things overnight. These are legislations that we must amend...You do not expect that the next morning everything's changed because we are going to climate-smart cocoa production.*

To provide farmers with documentation of their tree ownership, registration of on-farm shade trees has been announced by governmental and non-governmental extension services. In our study sites, despite the distribution of shade tree seedlings, no registration forms had been distributed. National representatives from both the private and the governmental sector agreed, that the tree registration is a legal and practical challenge yet to be solved, which was constrained by a limited common understanding of execution, funding, and accurate data on tree ownership. Moreover, around one quarter of farmers were not even aware of the planned registration. Nevertheless, especially local-level interviewees across sectors had a strongly stance on the importance of registration. One farmer's view in Juaboso-Bia—which echoed most farmer respondents—is illustrated through this quote:

> *Registration would be great. Many more farmers would engage in planting trees. If the registration comes today, you will see people planting trees tomorrow. But where are the registration letters (forms)? If we don't see them, how can we know that they will actually come and register our farms?*

Regarding alternative income sources, about half of the farmers stated that additional livelihood initiatives paid insufficient attention to the limited access to markets for products such as plantains, cassava, or NTFPs, or to the specific contexts of farmers. Limited access to markets or decent roads meant higher transportation prices or dependence on opportunistic intermediaries—cited by about half of the farmers as a barrier to the commercialization of additional livelihood products. Moreover, one farmer complained that additional livelihood initiatives myopically assume *"that everybody wants to be a bee-keeper or snail farmer," and* thus neglect differentiated voices and aspirations.

DISCUSSION

This study examined the perspectives and discourses on CSC by Ghanaian stakeholders at various study scales, and considered how they represent recognized environmental meta-discourses. The study also examined the implications of these discourses and policy designs on cocoa smallholders through an equity lens. Our analysis reveals several new insights into how these discourses are translated within CSC policy and practice, which, in turn, influence the lives and livelihoods of many already marginalized cocoa smallholders. We find that most of the expressed CSC discourses could be predominantly classified within the ecological modernization meta discourse, apparent as sustainable intensification with shade trees to achieve triple wins in terms of environmental, and production, and livelihood outcomes. Crucially, however most interviewees voiced tree tenure concerns as a significant barrier to CSC achieving socially-equitable outcomes.

Ecological Modernization—do the Triple Wins Hold?

The dominance of the ecological modernization discourses in climate and sustainability interventions has been widely reported (Adger et al., 2003; Bäckstrand and Lövbrand, 2006; Lemeilleur et al., 2015; Di Gregorio et al., 2017). In this study, two closely related triple wins solutions were identified. The first is at a landscape level: a triple wins proposition involving forest protection and climate mitigation and adaptation, as well as cocoa productivity. Various scholars have shown the crucial importance of landscape-wide forest ecosystem services to sustain cocoa production (Lawrence and Vandecar, 2015; Odijie, 2018). The second solution is at the farm level: this triple wins concept has been translated into a sustainable intensification narrative. Hereby cocoa farmers sustainably intensify their production, which should potentially lead to enhanced climate adaptation capacity, productivity and farm income, which would in turn, lower the demand for additional land use—thus sparing forests from further encroachment.

This paper identifies and subsequently discusses three key barriers, which challenge the success of the overly simplistic triple wins approach in the practice of CSC in Ghana: (1) Complexities around tree tenure and optimal shade tree levels risk reinforcing contextual and distributive inequities. (2) Such tree tenure and local governance uncertainties may further offset land sparing effects. (3) The intensive use of agrochemicals risks undermining environmental sustainability objectives with effects that are unequally distributed. Our results further suggest that CSC provides an opportunity for local governance mechanisms such as the CREMAs, which could support procedural equity. As other authors have highlighted, there are often contestations and trade-offs associated with the pursuit of multiple objectives by multiple stakeholders (Tallis et al., 2008; Carpenter et al., 2009; Redford and Adams, 2009; Vira et al., 2012; Nyborg et al., 2016; Galafassi et al., 2017). We advocate that by paying more attention to these local complexities and potential trade-offs between different social-ecological objectives, CSC interventions might be more likely to create the sustainable outcomes to which they aspire (Howe et al., 2014; Hirons et al., 2017; Maguire-Rajpaul et al., 2020).

Complexities Around (Shade) Tree Tenure Rights and Shade Optima

Nurturing shade trees represents an integral practice to CSC's principle of sustainable intensification. However, the myriad legal issues related to tree tenure likely represents the most debilitating factor to achieving pro-poor, equitable CSC. Complexities surrounding tree tenure is not a new phenomenon, but deeply embedded in the Ghanaian cocoa and forestry sector (Ruf, 2011; Hirons et al., 2018a; Asaaga and Hirons, 2019; Bunn et al., 2019). Farmers remain highly uncertain about their legal rights to trees on their own farms. Constitutionally, the Government of Ghana owns all remnant and naturally-occurring trees, including those which exist as shade trees on privately-owned cocoa farms (Ghana Forestry Commission, 2016). However, farmers who successfully register the trees that they plant on their farms with the government, legally own those shade trees. Nevertheless, tree registration remains unattainable to most of Ghana's 800,000 cocoa smallholders (Maguire-Rajpaul et al., 2020). Simplifying administrative procedures and increasing access to both legal support and to up-to-date information for tree registration would be a crucial step toward meeting the triple wins expected of CSC. The current meaningful dialogue of COCOBOD and the Forestry Commission on tree tenure issues, which are increasingly recognized as a debilitating factor, presents a window of opportunity for coordinated action toward tree registration and legislative changes, which could provide farmers with clear tenure rights to the trees they nurture and thereby address contextual inequities.

Although nurturing on-farm shade trees is promoted as part of sustainable intensification in CSC, the potential of shade trees to increase both cocoa productivity and ecological sustainability is not straightforward. Asare et al. (2018) and Blaser et al. (2018) suggest that shade cover exceeding 30% makes it increasingly difficult to create win-win situations because of a higher incidence of pests and diseases. Considering this delicate ecological balance of varying shade levels, there is a risk that insufficient extension services will not be able to provide farmers with sufficient technical guidance. Extension programmes translate optimal shade levels into numbers of trees per hectare a farmer should plant and nurture. However, this kind of information based on only numbers of trees is insufficient without taking into account, neither the species of shade trees nor their crown sizes. Any intervention that results in shade levels above 30% would have to provide farmers with a premium to compensate for decreased production and incentivise farmers to plant and maintain shade trees (Tscharntke et al., 2015). While shade-related premiums are, however, rare, and consumer demands and prospects for yet another eco-label or certification are low (Harvey et al., 2014; Camargo et al., 2018), the development of a CSC standard is a feature of recent CSC discussions in Ghana (R. A. Asare, personal communication). The commercialization of timber from shade trees is one way to compensate for high levels of shade and the current lack of a premium. However, unless tree tenure insecurity is adequately

addressed, selling timber trees is not a feasible option for most farmers given their smallholdings and lack of legal ownership of trees on their own farms. Empirical field research on shade levels in CSC interventions could be part of a monitoring system that supports better understanding of the trade-offs and the complex relationship between shaded cocoa, livelihoods, and resilience to climate change that is purported by the dominant discourse in CSC (Abdulai et al., 2018).

Land Sparing or Rebound Effect?

Those leading the CSC debate expect sustainable intensification to prevent expansion of cocoa production into forests. There is, however, little empirical evidence that intensification will lead to land sparing in Ghana (Ruf and Varlet, 2017; Carodenuto, 2019). In our study, few interviewees questioned the assumption as to why a successful farmer would not set up a new farm on forested land. To some extent, this is to be expected. Jevon's paradox, which is also known as the rebound effect, suggests that in theory, increased productivity and gains in resource efficiency do not necessarily lead to a decreased use of that resource. Ceddia et al. (2013, 2014) and Ceddia (2019), in their extensive studies conducted in South America showed that only under certain circumstances, agricultural intensification leads to reduced expansion. They suggest that when accompanied by high inequality and weak environmental governance (as typifies our studied system of smallholder cocoa commodity cultivation in Ghana), agricultural intensification more frequently leads to agricultural expansion rather than to land sparing. Ruf and Varlet (2017), who analyzed the zero-deforestation initiatives in Côte d'Ivoire and Ghana, present a grim outlook on the effectiveness of these schemes to avoid deforestation. They suggest that contextual inequities regarding current tree tenure uncertainty represent the key barrier for the effectiveness of on-farm trees and as a driver against deforestation, which corroborates our findings.

Looking forward, empirical research based on cocoa productivity and forest cover baselines could provide further insights regarding the complex interaction of intensification and land sparing. Future research would also have to investigate what type of governance and related issues such as inequality, corruption control, accountability, or rule of law (Ceddia et al., 2014; Ceddia, 2019) are crucial to avoid rebound effects in Ghana. Continued deforestation will not only have dramatic environmental consequences but would also increase cocoa production costs and, thus, ultimately affect smallholder livelihoods.

The Role of Agrochemicals in Sustainable Intensification

Apart from additional GHG emissions (Tubiello et al., 2013), the intensification of cocoa production with agrochemicals, risks reinforcing distributive and contextual inequities due to agrochemical input dependencies and loss of additional livelihoods. Our interviews and the wider literature suggest that shade trees alone will not be able to achieve the production intensification proposed through CSC—from around 400 kg/ha to more than 1000 kg/ha (Gockowski and Sonwa, 2011; IDH, 2018). In our study many CSC actors deemed agrochemical inputs as a necessary part of the CSC strategy. In Ghana, diminishing forest ecosystem services, partly due to forest degradation, have led to a high dependence on agrochemicals to fertilize soils and to control pests (Kolavalli and Vigeneri, 2011; Green, 2017; Odijie, 2018). Under such a situation of agrochemical-dependence, the cocoa farmgate price would either have to increase to compensate higher production costs, or farmers would have to shift to cash crops, such as oil palm and rubber, more suitable to the social-ecological context (Odijie, 2018) especially with recurrent droughts and erratic rainfall now plaguing cocoa cultivation under a changed climate and a deforested landscape (Ruf, 2015; Khatun et al., 2020; Maguire-Rajpaul et al., 2020). The current political economy of cocoa does not, however, allow farmers to negotiate their selling prices since Ghana's parastatal COCOBOD sets one pan-territorial farmgate price at the start of every season. What is more, a shift toward other cash crops is not part of the CSC strategy, which could reflect the fact that CSC strategies are driven by chocolate companies whose priority is securing cocoa supplies rather than assisting sustainable livelihoods with agricultural diversification (Lemeilleur et al., 2015; Odijie, 2016, 2018; Mithöfer et al., 2017). While promoting agrochemicals within CSC can create a new form of long-term input dependency among smallholders (Carodenuto, 2019), simply refraining from agrochemicals seems unlikely and—for many farmers—undesirable, since agrochemicals currently represent the most available route to increase cocoa productivity, and thus raise their incomes.

The use of agrochemicals and their environmental effects may, however, prevent farmers from tapping into other sources of potential income, for example harvesting NTFPs like mushrooms or snails, both of whose availabilities decline due to the presence of agrochemicals. NTFP decline is not felt equally, but mostly affects women, who are especially involved in the harvest of NTFPs (Ahenkan and Boon, 2011). Such changes in land use intensity can impact differentially on traditional farming roles of men and women, and have the potential to transform or perpetuate existing gender inequalities and relations depending on the different ways of inclusion in new economic systems (Elmhirst et al., 2017; Haug, 2017; Friedman et al., 2018). Fixed farmgate prices and low profit margins provide an opportunity to shift to more sustainable, yet more labor-intensive, practices such as organic composting or integrated pest management. However, our findings suggest that these potential alternatives are still underrepresented, partly due to chemical input practices and dependency, and related power dynamics, of current cocoa systems.

CREMAs and Local Governance Structures

CREMAs and similar local governance structures, such as the Land Management Board in Juaboso-Bia, have been promoted by NGOs, the Forestry Commission, and chocolate companies across the study sites in an attempt to deliver more inclusive CSC practices. In order to amplify smallholders' voices, CREMAs address issues, which are either side-lined or wholly ignored by an ecological modernization discourse. Because CREMAs

are both traditionally- and legally-recognized, they can be powerful and represent perhaps the only farmer-centered governance mechanism in Ghanaian CSC—thereby improving procedural equity issues. If implemented successfully, CREMAs could provide a platform for inclusive participation in CSC interventions, farmer-to-farmer learning, informed land-use choices, and increased landscape accountability regarding benefit sharing (Asare et al., 2013). Such community-led governance, which is associated with civic environmentalism discourses (Bäckstrand and Lövbrand, 2006), could elevate pressing issues such as tree tenure, tree registration, or more context-appropriate additional livelihood initiatives to those with the power to remedy these issues. That said, the financial sustainability of CREMAs remains a challenge, and most CREMAs encountered in this study depended largely on external support from NGOs, private entities, or government. Chocolate companies and cocoa buyers might be well-suited to provide CREMAs with long term financial commitments, especially in contrast to many NGOs, whose involvement because of budgetary constraints tends to be short-lived. It would be important to conduct further research on finance mechanisms such as independent landscape funds, in part to identify those that are not necessarily subject to political influence by corporations or other sources of funding.

Perhaps more critical than finance, our results suggest that CREMAs cannot simply be treated as a different kind of development project but as a complex and context-dependent governance structure, whose success is influenced by a wide range of factors including, but not limited to, tenure arrangements, trust, social cohesion, and the participation of local leaders. Underestimating these complexities may lead to undesired outcomes such as contestations over rights or power, exacerbation of elite capture, mistrust, and conflicts among stakeholders.

CONCLUSION

There is discursive power in how a problem is framed and its solution is defined. This paper set out to assess how Ghanaian stakeholders' interpretations and perceptions of CSC are colored by discourses and reflected in CSC policy and practice. Furthermore, we examined CSC's implications for cocoa smallholders using McDermott et al.'s tripartite equity lens 2013. Overall, we found that CSC is dominated by an ecological modernization discourse, which promises triple wins solutions through a highly polished message of CSC as a "business opportunity" for all stakeholders involved. Yet, when multiple objectives are pursued by multiple stakeholders in natural resource management, there will be winners and losers. Indeed, our study identified three fundamental challenges that must be addressed if equitable outcomes are to be achieved in Ghana's cocoa sector: (1) Risks of contextual and distributive inequities due to complexities around tree tenure and optimal shade tree levels; (2) offset land sparing effects due to such tree tenure and local governance uncertainties; (3) unequally distributed risks of the intensive use of agrochemicals. We advocate that those governing CSC in Ghana must afford more attention to these local complexities and trade-offs so that CSC interventions may deliver the sustainable and equitable outcomes to which they aspire. By continuing to side-line these issues, CSC initiatives in Ghana may further marginalize those without influence and power, namely Ghana's ∼800,000 smallholder cocoa farmers.

Positively however, tree tenure issues are beginning to be discussed among a variety of influential stakeholders, even if they are not yet sufficiently embedded in CSC practice. The use of shade trees is a critical component of Ghana's CSC, albeit one that is complicated to immediately be embedded into CSC practice. Legislative reform that seeks to transfer ownership of naturally-growing timber trees to farmers and landowners is still lacking but appears fundamental for equitable benefit sharing in CSC.

CREMAs and similar community-based mechanisms could advance local governance and promote farmers' interests, but only when local complexities and associated costs are recognized and CREMAs are meaningfully integrated into CSC initiatives. While we only provided limited insights into gender and other contextual inequalities, future studies should closely examine discourses around gender within climate change and sustainable development policy and practice to better understand how CSC, and other sustainability initiatives, might avoid reinforcing current contextual and gender inequalities. Furthermore, deeper understandings of social differentiation, inequalities, and power relations could prove crucial in identifying opportunities for inclusive local participation, as well as governance mechanisms that address both local equity and social-economic concerns. Throughout, we thus argue that confronting equity concerns should not be considered as a mere appendage to CSC policy, but rather that they form the core of any initiative purporting sustainable outcomes.

DATA AVAILABILITY STATEMENT

The datasets generated for this study will not be made publicly available in their entirety. This is because providing the full articles could potentially make respondents identifiable and, thus, risk their anonymity. We will consider making the raw data available following a request, but only in a way that protects the respondents.

ETHICS STATEMENT

The Ethics Committee at the Stockholm Resilience Centre, University of Stockholm reviewed, and approved our research plans and proposed methods. All participants provided their informed consent to participate in this study. We expressly chose not to involve potentially vulnerable participants (e.g., there were no children involved).

AUTHOR CONTRIBUTIONS

The lead author carried out fieldwork in Ghana and data analysis. All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2020.00073/full#supplementary-material

REFERENCES

Abdulai, I., Vaast, P., Hoffmann, M. P., Asare, R., Jassogne, L., Van Asten, P., et al. (2018). Cocoa agroforestry is less resilient to sub-optimal and extreme climate than cocoa in full sun. *Glob. Chang. Biol.* 24, 273–286. doi: 10.1111/gcb.13885

Adger, W. N., Benjaminsen, T. A., Brown, K., and Svarstad, H. (2001). Advancing a Political Ecology of Global Environmental Discourses. *Dev. Change* 32, 681–715. doi: 10.1111/1467-7660.00222

Adger, W. N., Huq, S., Brown, K., Conway, D., and Hulme, M. (2003). Adaptation to climate change in the developing world. *Prog. Dev. Stud.* 3, 179–195. doi: 10.1191/1464993403ps060oa

Afrika Kontakt and La Via Campesina (2018). Peasant Agroecology Achieves Climate Justice. a primer. Building Climate Justice Advocacy Project. Retrieved from: https://viacampesina.org/en/wp-content/uploads/sites/2/2018/05/primer_english_print.pdf. (accessed: 04. 06. 2019)

Ahenkan, A., and Boon, E. (2011). Non-timber forest products farming and empowerment of rural women in Ghana. *Environ. Dev. Sustain.* 13, 863–878. doi: 10.1007/s10668-011-9295-7

Andriamihaja, O. R., Metz, F., Zaehringer, J. G., Fischer, M., and Messerli, P. (2019). Land competition under telecoupling: Distant actors' environmental versus economic claims on land in North-Eastern Madagascar. *Sustain* 11:851. doi: 10.3390/su11030851

Anim-Wapong, G. J., and Frimpong, E. B. (2004). *Vulnerability and Adaptation Assesment Under the Netherlands Climate Change Studies Assistance Programme Phase 2 (NCCSAP2). Vulnerability of Agriculture to Climate Change-Impact of Climate Change on Cocoa Production*. (New Tafo Akim: Cocoa Research Insitute of Ghana).

Asaaga, F. A., and Hirons, M. A. (2019). Windows of opportunity or windows of exclusion? Changing dynamics of tenurial relations in rural Ghana. *Land Use Policy* 87:104042. doi: 10.1016/j.landusepol.2019.104042

Asaaga, F. A., Hirons, M. A., and Malhi, Y. (2020). Questioning the link between tenure security and sustainable land management in cocoa landscapes in Ghana. *World Dev.* 130:104913. doi: 10.1016/j.worlddev.2020.104913

Asare, R., Afari-Sefa, V., Osei-Owusu, Y., and Pabi, O. (2014). Cocoa agroforestry for increasing forest connectivity in a fragmented landscape in Ghana. *Agrofor. Syst.* 88, 1143–1156. doi: 10.1007/s10457-014-9688-3

Asare, R., Markussen, B., Asare, R. A., Anim-Kwapong, G., and Ræbild, A. (2018). On-farm cocoa yields increase with canopy cover of shade trees in two agro-ecological zones in Ghana. *Clim. Dev.* 11, 435–445. doi: 10.1080/17565529.2018.1442805

Asare, R. A., Kyei, A., and Mason, J. J. (2013). The community resource management area mechanism: a strategy to manage african forest resources for REDD+. *Philos. Trans. R. Soc. B Biol. Sci.* 368, 1–9. doi: 10.1098/rstb.2012.0311

Bäckstrand, K., and Lövbrand, E. (2006). Planting trees to mitigate climate change: contested discourses of ecological modernization, green governmentality and civic environmentalism. *Glob. Environ. Polit.* 6, 50–75. doi: 10.1162/glep.2006.6.1.50

Barrientos, S. (2014). Gendered global production networks: analysis of cocoa–chocolate sourcing. *Reg. Stud.* 48, 791–803. doi: 10.1080/00343404.2013.878799

Blaser, W. J., Oppong, J., Hart, S. P., Landolt, J., Yeboah, E., and Six, J. (2018). Climate-smart sustainable agriculture in low-to-intermediate shade agroforests. *Nat. Sustain.* 1:234. doi: 10.1038/s41893-018-0062-8

Bryman, A. (2016). *Social Research Methods*. 5th Edition. (New York, NY: Oxford University Press).

Bunn, C., Läderach, P., Quaye, A., Muilerman, S., Noponen, M. R. A., and Lundy, M. (2019). Recommendation domains to scale out climate change adaptation in cocoa production in Ghana. *Clim. Serv.* 16:100123. doi: 10.1016/j.cliser.2019.100123

Camargo, M. C., Hogarth, N. J., Pacheco, P., Nhantumbo, I., and Kanninen, M. (2018). Greening the dark side of chocolate: a qualitative assessment to inform sustainable supply chains. *Environ. Conserv.* 46, 9–16. doi: 10.1017/S0376892918000243

Campbell, B. M., Thornton, P., Zougmoré, R., van Asten, P., and Lipper, L. (2014). Sustainable intensification: What is its role in climate smart agriculture? *Curr. Opin. Environ. Sustain.* 8, 39–43. doi: 10.1016/j.cosust.2014.07.002

Carodenuto, S. (2019). Governance of zero deforestation cocoa in West Africa: New forms of public–private interaction. *Environ. Policy Gov.* 29, 55–66. doi: 10.1002/eet.1841

Carpenter, S. R., Mooney, H. A., Agard, J., Capistrano, D., Defries, R. S., Diaz, S., et al. (2009). Science for managing ecosystem services: beyond the millennium ecosystem assessment. *Proc. Natl. Acad. Sci. U.S.A.* 106, 1305–1312. doi: 10.1073/pnas.0808772106

Ceddia, M. G. (2019). The impact of income, land, and wealth inequality on agricultural expansion in Latin America. *Proc. Natl. Acad. Sci. U.S.A.* 116, 2527–2532. doi: 10.1073/pnas.1814894116

Ceddia, M. G., Bardsley, N. O., Gomez-y-Paloma, S., and Sedlacek, S. (2014). Governance, agricultural intensification, and land sparing in tropical South America. *Proc. Natl. Acad. Sci. U.S.A.* 111, 7242–7247. doi: 10.1073/pnas.1317967111

Ceddia, M. G., Sedlacek, S., Bardsley, N. O., and Gomez-y-Paloma, S. (2013). Sustainable agricultural intensification or Jevons paradox? The role of public governance in tropical South America. *Glob. Environ. Chang.* 23, 1052–1063. doi: 10.1016/j.gloenvcha.2013.07.005

Chomba, S., Kariuki, J., Lund, J. F., and Sinclair, F. (2016). Roots of inequity: How the implementation of REDD+ reinforces past injustices. *Land Use Policy* 50, 202–213. doi: 10.1016/j.landusepol.2015.09.021

Climate Smart Agriculture CONCERNS (2015). *Don't be fooled ! Civil Society says NO to "Climate Smart Agriculture" and Urges Decision -Makers to Support Agroecology International organisations. COP21 Statement*. Paris, France Available online at: www.climatesmartagconcerns.info/cop21-statement.html (accessed April 10, 2020)

Cocoa and Forests Initiative (2017). *Joint Framework for Action.* (London: Cocoa and Forests Initiative). Available online at: https://www.idhsustainabletrade.com/uploaded/2017/03/Ghana-Framwork.pdf (accesed: June 5, 2019).

da Silva, R. F. B., Batistella, M., Dou, Y., Moran, E., Torres, S. M. M., and Liu, J. (2017). The Sino-Brazilian telecoupled soybean system and cascading effects for the exporting country. *Land* 6, 1–19. doi: 10.3390/land6030053

Di Gregorio, M., Gallemore, C. T., Brockhaus, M., Fatorelli, L., and Muharrom, E. (2017). How institutions and beliefs affect environmental discourse: evidence from an eight-country survey on REDD+. *Glob. Environ. Chang.* 45, 133–150. doi: 10.1016/j.gloenvcha.2017.05.006

Elmhirst, R., Siscawati, M., Basnett, B. S., and Ekowati, D. (2017). Gender and generation in engagements with oil palm in East Kalimantan, Indonesia: insights from feminist political ecology. *J. Peasant Stud.* 44, 1137–1159. doi: 10.1080/03066150.2017.1337002

FAO (2010). *Climate-Smart Agriculture: Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation.* (Rome, FAO). doi: 10.1111/j.1467-6346.2009.02662.x

FAO (2012). *Identifying Opportunities for Climate-Smart Agriculture Investments in Africa*. (Rome: Food and Agriculture Organization of the United Nations).

FAO (2013). *Climate-Smart Agriculture Sourcebook*. (Rome: Food and Agriculture Organization of the United Nations). doi: 10.1080/03068374.2014.874687

Forsyth, T., and Sikor, T. (2013). Forests, development and the globalisation of justice. *Geogr. J.* 179, 114–121. doi: 10.1111/geoj.12006

Foucault, M. (2003). *Society Must be Defended: Lectures at the College de France 1976-77*. (New York, NY: Picador). doi: 10.1177/174387210500100108

Friedman, R., Hirons, M. A., and Boyd, E. (2018). Vulnerability of Ghanaian women cocoa farmers to climate change: a typology. *Clim. Dev.* 11, 446–458. doi: 10.1080/17565529.2018.1442806

Friis, C., and Nielsen, J. Ø. (2017). Land-use change in a telecoupled world: The relevance and applicability of the telecoupling framework in the case of banana plantation expansion in Laos. *Ecol. Soc.* 22:30. doi: 10.5751/ES-09480-220430

Galafassi, D., Daw, T. M., Munyi, L., Brown, K., Barnaud, C., and Fazey, I. (2017). Learning about social-ecological trade-offs. *Ecol. Soc.* 22:2. doi: 10.5751/ES-08920-220102

Gasparri, N. I., Kuemmerle, T., Meyfroidt, P., le Polain de Waroux, Y., and Kreft, H. (2016). The emerging soybean production frontier in southern africa: conservation challenges and the role of south-south telecouplings. *Conserv. Lett.* 9, 21–31. doi: 10.1111/conl.12173

Ghana Forestry Commission (2016). *Tree Tenure & Benefit Sharing Framework in Ghana*. (Accra: Ghana Forestry Commission).

Ghana Forestry Commission (2018). *Benefit Sharing Plan Ghana Cocoa Forest REDD + Programme.* Accra: Ghana Forestry Commission.

Giraldo, O. F., and Rosset, P. M. (2018). Agroecology as a territory in dispute: between institutionality and social movements. *J. Peasant Stud.* 45, 545–564. doi: 10.1080/03066150.2017.1353496

Gockowski, J., Robiglio, V., Muilerman, S., and Agyeman, N. F. (2011). *Agricultural Intensification as a Strategy for Climate Mitigation in Ghana. An evaluative study of the COCOBOD High Tech Program, rural incomes, and forest resources in the Bia (Juaboso) District of Ghana*. (Ibadan: Sustainabnle Tree Crops Program).

Gockowski, J., and Sonwa, D. (2011). Cocoa intensification scenarios and their predicted impact on CO 2 emissions, biodiversity conservation, and rural livelihoods in the Guinea rain forest of West Africa. *Environ. Manage.* 48, 307–321. doi: 10.1007/s00267-010-9602-3

Green, E. (2017). From Extensive to Involutionary Growth: A Dialectic Interpretation of the Boom and Busts of Cocoa Production in the Gold Coast. *J. Agrar. Chang.* 17, 518–534. doi: 10.1111/joac.12153

Hajer, M., and Versteeg, W. (2005). A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *J. Environ. Policy Plan.* 7, 175–184. doi: 10.1080/15239080500339646

Hajer, M. A. (1995). *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. (Clarendon, TX: Oxford). doi: 10.2307/2580543

Harvey, C. A., Chac, M., Donatti, C. I., Garen, E., Hannah, L., Andrade, A., et al. (2014). Climate-smart landscapes : opportunities and challenges for integrating adaptation and mitigation in tropical Agriculture. *Conser. Letters* 7, 77–90. doi: 10.1111/conl.12066

Haug, M. (2017). Men, women, and environmental change in Indonesia: The gendered face of development among the Dayak Benuaq. *Austrian J. South-East Asian Stud.* 10, 29–46. doi: 10.14764/10.ASEAS-2017.1-3

Higonnet, E., Bellantonio, M., and Hurowitz, G. (2017). *Chocolate's Dark Secret: How the Cocoa Industry Destroys National Parks*. Available online at: http://www.mightyearth.org/wp-content/uploads/2017/09/chocolates_dark_secret_english_web.pdf (accessed April 10, 2020)

Hirons, M., McDermott, C., Asare, R., Morel, A., Robinson, E., Mason, J., et al. (2018a). Illegality and inequity in Ghana's cocoa-forest landscape: How formalization can undermine farmers control and benefits from trees on their farms. *Land Use Policy* 76, 405–413. doi: 10.1016/j.landusepol.2018.02.014

Hirons, M., Morel, A., McDermott, C., Boyd, E., Malhi, Y., Norris, K., et al. (2018b). Understanding climate resilience in Ghanaian cocoa communities – Advancing a biocultural perspective. *J. Rural Stud.* 63, 120–129. doi: 10.1016/j.jrurstud.2018.08.010

Hirons, M. A., McDermott, C. L., and Maguire-Rajpaul, V. A. (2017). Responsible chocolate is about protecting both forests and cocoa farmers' livelihoods. Available online at: https://theconversation.com/responsible-chocolate-is-about-protecting-both-forests-and-cocoa-farmers-livelihoods-87551

Holt-Giménez, E., and Altieri, M. A. (2013). Agroecology, food sovereignty, and the new green revolution. *Agroecol. Sustain. Food Syst.* 37, 90–102. doi: 10.1080/10440046.2012.716388

Howe, C., Suich, H., Vira, B., and Mace, G. M. (2014). Creating win-wins from trade-offs? Ecosystem services for human well-being: a meta-analysis of ecosystem service trade-offs and synergies in the real world. *Glob. Environ. Chang.* 28, 263–275. doi: 10.1016/j.gloenvcha.2014.07.005

IDH (2018). *Ghana Cocoa & Forests Initiative National Implementation Plan 2018-2020*. Cocoa & Forests Initative, Ghana

Ikeme, J. (2003). Equity, environmental justice and sustainability: incomplete approaches in climate change politics. *Glob. Environ. Chang.* 13, 195–206. doi: 10.1016/S0959-3780(03)00047-5

Ingold, T. (2011). *Being Alive: Essays on Movement, Knowledge and Description*. (London: Routledge). doi: 10.4324/9780203818336

IPBES (2018). *The assessment report on Land Degradation and Restoration. Bonn, Germany* Available online at: www.ipbes.net (accessed April 10, 2020)

Karlsson, L., Naess, L. O., Nightingale, A., and Thompson, J. (2017). 'Triple wins' or 'triple faults'? Analysing the equity implications of policy discourses on climate-smart agriculture (CSA). *J. Peasant Stud.* 6150, 1–25. doi: 10.1080/03066150.2017.1351433

Khatun, K., Maguire-Rajpaul, V. A., Asante, E. A., and McDermott, C. L. (2020). From agroforestry to agroindustry: smallholder access to benefits from oil palm in ghana and the implications for sustainability certification. *Front. Sustain. Food Syst.* 4:29. doi: 10.3389/fsufs.2020.00029

Kolavalli, S., and Vigeneri, M. (2011). "Cocoa in Ghana: shaping the success of an economy," in *Yes Africa can Success Stories from a Dynamic Continent.* (Washington, DC) 201–217. doi: 10.1596/978-0-8213-8745-0

Kroeger, A., Bakhtary, H., Haupt, F., and Streck, C. (2017). *Eliminating Deforestation from the Cocoa Supply Chain*. World Bank Report 61, Washington DC: Climate Focus North America Inc. doi: 10.1016/j.carbpol.2017.03.073

Läderach, P., Martinez-Valle, A., Schroth, G., and Castro, N. (2013). Predicting the future climatic suitability for cocoa farming of the world's leading producer countries, Ghana and Côte d'Ivoire. *Clim. Change* 119, 841–854. doi: 10.1007/s10584-013-0774-8

Lamb, A., Green, R., Bateman, I., Broadmeadow, M., Bruce, T., Burney, J., et al. (2016). The potential for land sparing to offset greenhouse gas emissions from agriculture. *Nat. Clim. Chang.* 6:488. doi: 10.1038/NCLIMATE2910

Lawrence, D., and Vandecar, K. (2015). Effects of tropical deforestation on climate and agriculture. *Nat. Clim. Chang.* 5, 27–36. doi: 10.1038/nclimate2430

Lemeilleur, S., N', Y., Dao, N. A., and Ruf, F. (2015). The productivist rationality behind a sustainable certification process: evidence from the Rainforest Alliance in the Ivorian cocoa sector. *Int. J. Sustain. Dev.* 18:310. doi: 10.1504/ijsd.2015.072661

Lipper, L., Thornton, P., Campbell, B. M., Baedeker, T., Braimoh, A., Bwalya, M., et al. (2014). Climate-smart agriculture for food security. *Nat. Clim. Chang.* 4, 1068–1072. doi: 10.1038/nclimate2437

Llopis, J. C., Diebold, C. L., Schneider, F., Harimalala, P. C., Patrick, L., Messerli, P., et al. (2020). Capabilities under telecoupling: human well-being between cash crops and protected areas in North-Eastern Madagascar. *Front. Sustain. Food Syst.* 3:126. doi: 10.3389/fsufs.2019.00126

Maguire-Rajpaul, V. A., Khatun, K., and Hirons, M. A. (2020). Agricultural information's impact on the adaptive capacity of Ghana's Smallholder cocoa farmers. *Front. Sustain. Food Syst.* 4:28. doi: 10.3389/fsufs.2020.00028

McDermott, M., Mahanty, S., and Schreckenberg, K. (2013). Examining equity: a multidimensional framework for assessing equity in payments for ecosystem services. *Environ. Sci. Policy* 33, 416–427. doi: 10.1016/j.envsci.2012.10.006

McGregor, A., Challies, E., Howson, P., Astuti, R., Dixon, R., Haalboom, B., et al. (2015). Beyond carbon, more than forest? REDD+ governmentality in Indonesia. *Environ. Plan. A* 47, 138–155. doi: 10.1068/a140054p

Mithöfer, D., Roshetko, J. M., Donovan, J. A., Nathalie, E., Robiglio, V., Wau, D., et al. (2017). Unpacking 'sustainable' cocoa: do sustainability standards, development projects and policies address producer concerns in Indonesia, Cameroon and Peru? *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* 13, 444–469. doi: 10.1080/21513732.2018.1432691

Morel, A. C., Adu Sasu, M., Adu-Bredu, S., Quaye, M., Moore, C., Ashley Asare, R., et al. (2019). Carbon dynamics, net primary productivity and human-appropriated net primary productivity across a forest-cocoa farm landscape in West Africa. *Glob. Change Biol.* 25, 2661–2677. doi: 10.1111/gcb.14661

Nelson, G. C., Valin, H., Sands, R. D., Havlík, P., Ahammad, H., Deryng, D., et al. (2014). Climate change effects on agriculture: economic responses to biophysical shocks. *Proc. Natl. Acad. Sci. U.S.A.* 111, 3274–3279. doi: 10.1073/pnas.1222465110

Nyborg, K., Anderies, J. M., Dannenberg, A., Lindahl, T., Schill, C., Schlüter, M., et al. (2016). Social norms as solutions Policies. *Science* 354, 42–43. doi: 10.1126/science.aaf8317

Odijie, M. E. (2016). Diminishing returns and agricultural involution in Côte d'Ivoire's cocoa sector. *Rev. Afr. Polit. Econ.* 43, 504–517. doi: 10.1080/03056244.2015.1085381

Odijie, M. E. (2018). Sustainability winners and losers in business-biased cocoa sustainability programmes in West Africa. *Int. J. Agric. Sustain.* 16, 214–227. doi: 10.1080/14735903.2018.1445408

OED. (2010). *Oxford English Dictionary*. Available online at: http://oxforddictionaries.com (accessed April 18, 2020).

Patton, M. Q. (2002). *Qualitative Evaluation and Research Methods. Sage, Beverly Hills*. Third Edit. (Thousand Oaks, CA: Sage Publications).

Pelling, M., O'Brien, K., and Matyas, D. (2015). Adaptation and transformation. *Clim. Change* 133, 113–127. doi: 10.1007/s10584-014-1303-0

Persson, J., and Mertz, O. (2019). "Discursive telecouplings. in telecoupling," in *Telecoupling* eds. F. C. and N. J. (Cham: Palgrave Macmillan), 313–336

Rahn, E., Läderach, P., Baca, M., Cressy, C., Schroth, G., Malin, D., et al. (2014). Climate change adaptation, mitigation and livelihood benefits in coffee production: where are the synergies? *Mitig. Adapt. Strateg. Glob. Chang.* 19, 1119–1137. doi: 10.1007/s11027-013-9467-x

Redford, K. H., and Adams, W. M. (2009). Payment for ecosystem services and the challenge of saving nature: editorial. *Conserv. Biol.* 23, 785–787. doi: 10.1111/j.1523-1739.2009.01271.x

Ribot, J. C., and Peluso, N. L. (2003). A Theory of Access*. *Rural Sociol.* 68, 153–181. doi: 10.1111/j.1549-0831.2003.tb00133.x

Rosenstock, T. S., Nowak, A., and Girvetz, E. (2018). *The Climate-Smart Agriculture Papers. Investigating the Business of a Productive, Resilient and Low Emission Future*. (Cham: Springer Open) doi: 10.1007/978-3-319-92798-5

Rubin, H. J., and Rubin, I. S. (2011). *Qualitative Interviewing: The Art of Hearing Data*. 3rd Editio. (Thousand Oaks, CA: Sage Publications Inc).

Ruf, F. (2015). "Diversification of cocoa farms in Côte D'Ivoire: Complementarity of and competition from rubber rent," in *Economics and Ecology of Diversification: The Case of Tropical Tree Crops*. eds. F. Ruf and G. Schroth (New York, NY: Springer)

Ruf, F., Schroth, G., and Doffangui, K. (2015). Climate change, cocoa migrations and deforestation in West Africa: what does the past tell us about the future? *Sustain. Sci.* 10, 101–111. doi: 10.1007/s11625-014-0282-4

Ruf, F., and Varlet, F. (2017). The myth of zero deforestation cocoa in Côte d 'Ivoire. *ETFRN News* 58, 86–92.

Ruf, F. O. (2011). The myth of complex cocoa agroforests: the case of Ghana. *Hum. Ecol.* 39, 373–388. doi: 10.1007/s10745-011-9392-0

Saeed, A. R., McDermott, C., and Boyd, E. (2018). Examining equity in Ghana's national REDD+ process. *For. Policy Econ.* 90, 48–58. doi: 10.1016/j.forpol.2018.01.006

Schroth, G., Läderach, P., Martinez-Valle, A. I., and Bunn, C. (2017). From site-level to regional adaptation planning for tropical commodities: cocoa in West Africa. *Mitig. Adapt. Strateg. Glob. Chang.* 22, 903–927. doi: 10.1007/s11027-016-9707-y

Schroth, G., Läderach, P., Martinez-Valle, A. I., Bunn, C., and Jassogne, L. (2016). Vulnerability to climate change of cocoa in West Africa: Patterns, opportunities and limits to adaptation. *Sci. Total Environ.* 556, 231–241. doi: 10.1016/j.scitotenv.2016.03.024

Stott, P., and Sullivan, S. (2000). *Political Ecology: Science, Myth and Power*. New York, NY: Oxford University Press Inc. doi: 10.1017/CBO9781107415324.004

Südwind (2016). *Bittersweet Chocolate. The Truth Behind the International Chocolate Industry*. (Wien: Südwind).

Tallis, H., Kareiva, P., Marvier, M., Chang, A., and Mwinyi, A. H. (2008). Practical conservation and economic development. *Proc. Natl. Acad. Sci. U.S.A.* 105, 9457–9464. doi: 10.1073/pnas.0705797105

Taylor, M. (2018). *What's Smart About Climate-smart Agriculture? Policy Brief 22. Oakland, USA*. Available online at: https://foodfirst.org/wp-content/uploads/2018/01/Taylor-Climate-Smart-Ag-Food-First_-Final-1.pdf.

Teddlie, C., and Yu, F. (2007). Mixed methods sampling: a typology with examples. *J. Mix. Methods Res.* 1, 77–100. doi: 10.1177/2345678906292430

Touton and IDH (2018). *The Business Case for Engaging in Landscape Approaches: The Business case for a Landscape Approach to Sustainable Cocoa Production in Ghana*. The Sustainable Trade Initiative Case Study Series.

Tscharntke, T., Milder, J. C., Schroth, G., Clough, Y., Declerck, F., Waldron, A., et al. (2015). Conserving biodiversity through certification of tropical agroforestry crops at local and landscape scales. *Conserv. Lett.* 8, 14–23. doi: 10.1111/conl.12110

Tsiboe, F., Nalley, L. L., and Bajrami, E. (2018). "Economic incentives necessary for adoption of environmentally friendly cocoa production in Ghana," in *Southern Agricultural Economics Association's 2018 Annual Meeting*. (Jacksonville), 2–3

Tubiello, F. N., Salvatore, M., Ferrara, A. F., House, J., Federici, S., Rossi, S., et al. (2015). The contribution of agriculture, forestry and other land use activities to global warming, 1990-2012. *Glob. Chang. Biol.* 21, 2655–2660. doi: 10.1111/gcb.12865

Tubiello, F. N., Salvatore, M., Rossi, S., Ferrara, A., Fitton, N., and Smith, P. (2013). The FAOSTAT database of greenhouse gas emissions from agriculture. *Environ. Res. Lett.* 8:015009. doi: 10.1088/1748-9326/8/1/015009

van der Heijden, H.-A. (2008). Green governmentality, ecological modernisation or civic environmentalism? Dealing with global environmental problems. *Env. Polit.* 17, 835–839. doi: 10.1080/09644010802422701

Vermeulen, S. J., Campbell, B., and Ingram, J. S. (2012). Climate change and food systems. *Annu. Rev. Environ. Resour.* 37, 195–222. doi: 10.1146/annurev-environ-020411-130608

Vira, B., Adams, B., Agarwal, C., Badiger, S., Hope, R. A., Krishnaswamy, J., et al. (2012). Negotiating trade-offs choices about ecosystem services for poverty alleviation. *Econ. Polit. Wkly.* 47, 67–75. Available online at: https://www.researchgate.net/publication/236960000

World Bank, FAO, and IFOAM (2015). *Gender in Climate- Smart Agriculture*. (Washington DC: World Bank Group).

World Resources Institute (2019). *Global Forest Watch*. (Washington, DC: World Resources Institute).

Zimmerer, K. S., Lambin, E. F., and Vanek, S. J. (2018). Smallholder telecoupling and potential sustainability. *Ecol. Soc.* 23:30. doi: 10.5751/ES-09935-230130

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