

RESEARCH ARTICLE **OPEN ACCESS**

Existing Sustainability Interventions are Insufficient to Scale Up Cocoa Agroforestry in West Africa

Keessy Maria-Prisca Kouakou¹  | Joss Lyons-White¹ | William J. Thompson² | Thomas Addoah¹ | Federico Cammelli^{1,3}  | Wilma J. Blaser-Hart⁴  | Victoria Maguire-Rajpaul^{1,5} | Evans Dawoe⁶ | Rachael D. Garrett¹

¹Conservation and Development Lab, Department of Geography and Conservation Research Institute, University of Cambridge, Cambridge, UK | ²Nature-Based Solutions Initiative, Department of Biology, University of Oxford, Oxford, UK | ³Sustainable Agroecosystem Group, Department of Environmental System Science, ETH Zurich, Zurich, Switzerland | ⁴School of the Environment and Centre for Biodiversity and Conservation Science (CBCS), The University of Queensland, Brisbane, Queensland, Australia | ⁵Global Sustainability Institute, Anglia Ruskin University, Cambridge, UK | ⁶Department of Agroforestry, Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Correspondence: Keessy Maria-Prisca Kouakou (prisca.kouakou@outlook.com)

Received: 28 April 2025 | **Revised:** 5 September 2025 | **Accepted:** 15 September 2025

Funding: This work was supported by 2019-2020 BiodivERsA joint call BiodivClim ERA-Net COFUND programme, Swiss National Science Foundation Grant #108BD13_193959; Cambridge Trust; European Research Council (ERC, FORESTPOLICY, #949932); UKRI Natural Environment Research Council [HARP, NE/V018590/1].

Keywords: agroforestry | cocoa | multi-level perspective | niche | regime | sustainability transitions

ABSTRACT

Sustainability transitions in agri-food systems are required to address climate change, biodiversity loss, and social inequities. In the West African cocoa sector, supply chain sustainability initiatives (SSIs) have emerged as key environmental governance tools to address these challenges and promote agroforestry. Agroforestry is a climate adaptation strategy that supports both nature and the livelihoods of smallholder farmers, yet its adoption remains limited. This study combines the Multi-Level Perspective (MLP) and the Creative Destruction (CD) frameworks to qualitatively assess how the interventions of SSIs influence the scaling up of agroforestry adoption in Côte d'Ivoire and Ghana. Through policy mapping, 101 semi-structured interviews and focus groups with governments, private companies, non-governmental organizations (NGOs), and cocoa farmers, we found that most interventions (~93%) support agroforestry as a niche innovation, relying on extension services and short-term incentives. Only 7% of the interventions pursue regime-level changes, such as land and tree tenure reforms, which remain limited due to institutional and informal barriers. Additionally, SSIs have not significantly changed policy network structures, and smallholder farmers remain excluded from governance processes. Based on these findings, we recommend that scaling up agroforestry adoption requires regime-destabilization interventions, including the integration and strengthening of land and tree tenure reforms, as well as the simplification of tree registration procedures. Furthermore, greater efforts are needed to ensure the inclusion of smallholders within policy networks, as their participation remains limited.

1 | Introduction

Agri-food systems face multiple threats from climate change and biodiversity loss, including rising temperatures, droughts, extreme weather events, shifting rainfall patterns, increased pest pressure, and reduced pollination (Kumar et al. 2022).

Collectively, these problems reduce agricultural productivity and food security, worsening the already precarious livelihoods of smallholder farmers (Arora 2019; FAO 2019; Pachauri et al. 2015). At the same time, agri-food production is also a leading driver of climate change and biodiversity loss through the expansion of largely monocultural cropping systems into native

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2025 The Author(s). *Sustainable Development* published by ERP Environment and John Wiley & Sons Ltd.

vegetation. In the tropics, agriculture is the largest driver of deforestation, with the international trade of forest-risk commodities (i.e., cattle, soy, cocoa, palm oil) accounting for up to ~39% of deforestation-related greenhouse gas emissions (Pendrill et al. 2019).

The cocoa sector in Côte d'Ivoire and Ghana, which supplies more than 60% of global cocoa exports, exemplifies these challenges. Climate projections indicate that areas suitable for cocoa cultivation in West Africa will shrink by 2050 (Läderach et al. 2013; Schroth et al. 2016). However, the cocoa frontier has continued to expand into forests, accounting for 45% and 57% of all forest loss attributed to cocoa cultivation in Côte d'Ivoire and Ghana, respectively, between 2000 and 2019 (Renier et al. 2023, 2025). The cocoa sector is dominated by smallholders farming 2 to 5 ha, 78% of whom earn less than a living income (Bermudez et al. 2022; Bymolt et al. 2018; Van Vliet et al. 2021). Their limited ability to afford agro-inputs, combined with yield reductions from climate change, and the loss of biodiversity-mediated ecosystem services puts them at an increasing risk of livelihood losses (Kouassi et al. 2021a, 2021b). These challenges impact several Sustainable Development Goals (SDGs), the Kunming-Montreal Global Biodiversity Framework, and the Paris Agreement. This highlights the urgent need for sustainability transitions in the cocoa sector that address ecological degradation while enhancing the livelihoods of smallholder farmers.

Over the last decades, private companies and governments have adopted various supply chain sustainability initiatives (SSIs), including voluntary sourcing standards and certifications to address environmental and social challenges in the West African cocoa sector (Ingram et al. 2018). Building on sustainability transition theories, these initiatives signal a shift from a system primarily characterized by the goal of increasing productivity to one that emphasizes the principles of sustainable production, resilience, social justice, and food security (Brunori et al. 2013; Marsden 2004). Within this shift, SSIs aim to reduce deforestation, restore forests, improve smallholder livelihoods, and promote sustainable agricultural practices, such as agroforestry (CFI 2017a; Garrett et al. 2021). Agroforestry is considered a niche innovation—an alternative to conventional cocoa systems with the potential to challenge socio-technical regimes (the incumbent system of dominant technologies, practices, and institutions) (Kemp et al. 1998; Elzen et al. 2012). By integrating trees into cocoa farms, agroforestry can enhance biodiversity, improve soil health, and increase farmers' resilience to climate change, thereby improving their livelihoods (Clough et al. 2011; Gockowski and Sonwa 2011; Jezeer et al. 2019). However, its adoption remains limited (Becker et al. 2025).

Sustainability transitions research emphasizes that supporting niches is rarely sufficient for transformative change; scaling requires regime destabilization that challenges lock-in and opens space for alternatives (Geels and Schot 2007; Kanger et al. 2020; Kivimaa and Kern 2016). Existing work has focused mainly on the determinants of household agroforestry adoption, including voluntary sustainability standards and certifications (DeFries et al. 2017; Oya et al. 2018; Zabala et al. 2025). Research on cocoa agroforestry adoption, specifically within West Africa,

is similarly limited, having focused mainly on the behavioral, socioeconomic, and biophysical factors influencing farmers' decision-making (Kouassi et al. 2021a, 2021b, 2023; Meijer et al. 2015). However, there has been little study of the broader structural factors (e.g., markets, policies, narratives, or climate) that affect cocoa agroforestry adoption, how the mix of conditions enables or constrains its adoption, and the overall scale up of adoption (Heim 2024). Furthermore, few studies have examined the regional contextual factors in enabling cocoa agroforestry adoption at the landscape scale (Cammelli et al. 2025). There is also a need to look at how broader policy and economic factors interact with household and regional factors to influence cocoa agroforestry adoption.

This study fills this gap by assessing how multiple aspects of the global, national, and local context surrounding cocoa production in Côte d'Ivoire and Ghana interact to influence the potential scaling up of agroforestry adoption. Besides improving understanding of cocoa agroforestry adoption in the region, the study makes conceptual and methodological contributions by aiming to disentangle the degree to which contextual attributes are likely to support incremental adoption of agroforestry or a transformation of cocoa systems. We assess whether existing policies are likely to lead to incremental (e.g., primarily increasing cocoa productivity) or transformative (e.g., restructuring market incentives to support diversification and empower smallholders) change. We do so by applying the Multi-Level Perspective (MLP) (Geels and Schot 2007) and the Creative Destruction (CD) frameworks (Kivimaa and Kern 2016). The MLP highlights how niches interact with incumbent regimes and broader landscapes, while CD specifies processes by which interventions may destabilize regimes or merely support niches. Together, they enable the systematic evaluation of contextual conditions and processes that enable or constrain sustainability transitions in the cocoa sector. This evaluation is timely in the West African cocoa sector, given the proliferation of efforts by governments and supply chain actors to promote cocoa agroforestry (CFI 2017a; Kouassi et al. 2021a, 2021b).

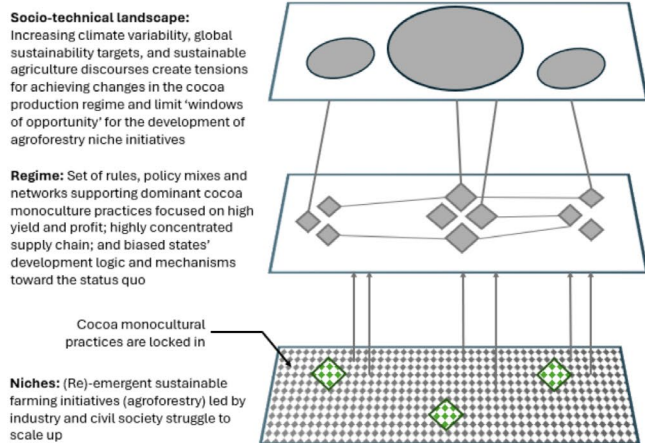
Here, we ask: (i) What is the global context influencing cocoa agroforestry adoption in West Africa? (ii) What policy instruments have been deployed to support agroforestry adoption? (iii) Are these instruments likely to facilitate more incremental or transformative adoption of agroforestry? In this analysis, we implicitly assume that incremental interventions are less likely than transformative ones to scale up agroforestry adoption (either across farms or in terms of the intensity of agroforestry adoption within farms) or to sustain themselves over time. These assumptions influence the potential effectiveness of such SSIs in achieving specific ecological and/or social outcomes, but their actual effectiveness is not directly analyzed.

2 | Analytical Framework

2.1 | The MLP Framework

The MLP (Geels 2002) is an analytical framework for analyzing sustainability transitions in multiple sectors, including energy, transport, and agri-food (Biely and Chakori 2025). In the

a. The existing system locks in conventional cocoa farming activities (grey)



b. Disruptive changes needed to scale up cocoa agroforestry (green)

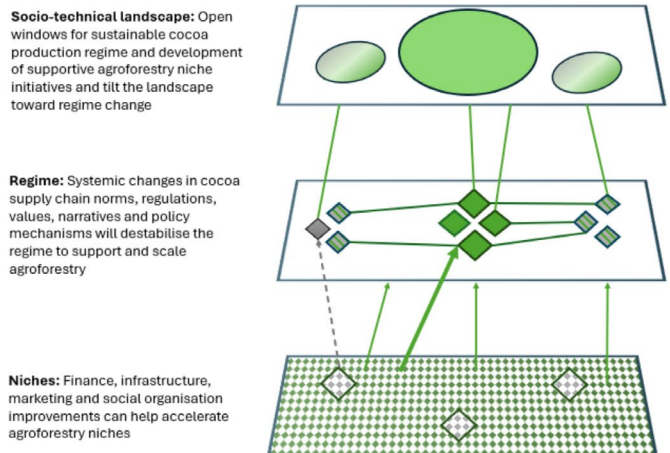


FIGURE 1 | Multi-level perspective (MLP) framework for transformative changes adapted from Garrett et al. (2024). **a.** This panel represents the MLP (landscape, regime, and niches) and shows how existing regime and landscape lock-in conventional cocoa monocultural practices and block the scale of cocoa agroforestry adoption. **b.** This panel summarizes what policy changes are needed at the niche, regime, and landscape levels to support the scaling up of cocoa agroforestry adoption. Small grey diamonds represent dominant cocoa monocultural practices supported by the existing regime and landscape. Small green diamonds represent the emergence and/or re-emergence of sustainable farming initiatives (e.g., agroforestry) led by cocoa companies, civil society, and governments. Grey circles and medium diamonds are conditions (for example, networks of reinforcing actors, institutions, rules, and so on), respectively, in the landscape and regime that support cocoa monocultural practices. Green circles and medium diamonds represent conditions in the landscape and regime that could help to scale-up agroforestry adoption.

agri-food sector, the MLP framework has often been used to understand how agricultural technologies are adopted at scale or not (Garrett et al. 2020; Hastings et al. 2021; van der Haar et al. 2023). The MLP examines processes occurring within a given context at three levels of analysis: (1) the landscape, (2) the regime, and (3) the niches (Figure 1).

The *landscape* represents the broader context that pressures the interactions between niches and the existing regime, which include slow-changing developments (e.g., climate and biophysical conditions, demographics, cultural repertoires, societal concerns, geopolitics, macro-economic trends) and external shocks (e.g., climate shocks, natural disasters, financial crises, price shocks). Important factors at the landscape level include macroeconomic trends, socioeconomic trends, macro-political developments, and cultural patterns (Geels and Schot 2007; Kern 2012). When discussing the cocoa industry, the relevant landscape includes all of these factors (e.g., climate change threats and changes in rainfall patterns, social and environmental movements, and international environmental policies). Particular importance can be placed on global sustainability conventions (i.e., UN Convention on Biological Diversity and UN Framework Convention on Climate Change), international markets, as well as behaviors and attitudes toward agriculture and conservation (i.e., productivist vs. pro-environmental attitudes).

The *regime* refers to the prevailing socio-technical system. It is the set of existing practices, technologies, institutions, rules, and norms within the system that shape actors' behaviours, perceptions, and actions (Geels and Schot 2007). In the West African cocoa sector, the regime involves a set of rules, institutions, and actor networks that support conventional full-sun cocoa systems. Conventional full-sun cocoa is a mainstream

production system that focuses on the extensification of production (Renier et al. 2023, 2025). This production system is often associated with sustainability and ethical issues, such as deforestation, child labor, and low income among smallholder farmers (Carodenuto 2019). The regime is carried by a wide range of actors, including governments, multinational chocolate manufacturers, traders and grinders, certification bodies, non-governmental organizations (NGOs), cooperatives, and farmers. In Côte d'Ivoire and Ghana, government marketing boards, Forestry Commission and the Ghana Cocoa Board (COCOBOD), and the Conseil Café-Cacao play central roles by controlling farm-gate prices—the prices farmers receive for their beans—and by shaping production techniques through extension services (Gockowski and Sonwa 2011; Maguire-Rajpaul et al. 2020). NGOs and certification bodies further shape the regime by implementing sustainability standards, such as the Rainforest Alliance (Rainforest Alliance 2020; Thorlakson 2018). Meanwhile, a small number of private actors, including traders, grinders, and manufacturers, significantly influence the cocoa market through segregated and mass-balanced sourcing (Carodenuto and Buluran 2021; Grabs and Carodenuto 2021). Segregated sourcing involves separating conventional cocoa from certified cocoa. In contrast, mass-balanced sourcing allows conventional and certified cocoa to be mixed, thereby increasing the sourcing of certified cocoa (Rainforest Alliance 2023). Private actors also provide additional support to farmers through the provision of inputs and extension services (Thorlakson 2018). Beyond state and private institutions, cooperatives serve as channels for collective cocoa sales, certification contracts, training, and financial services for farmers (Carodenuto et al. 2025). Finally, farmers influence the regime through their choices of agricultural practice and compliance or noncompliance with company demands.

The *Niches* represent innovations that can challenge the mainstream practices and institutions yet have exhibited limited reach within the system (Geels 2019). While agroforestry has been practised for millennia in traditional land systems in West Africa (Leach and Mearns 1996), we characterize the re-emergence of cocoa agroforestry, led by companies, certification bodies, and civil society initiatives, as a niche endeavor, given the background of conventional full-sun cocoa as the regime-dominant agricultural practice.

Without landscape pressures and/or interventions, including policy instruments to disrupt the socio-technical regime, most niche innovations that counter ongoing trends are expected to remain locked in niches and fail to scale (Kanger et al. 2020). We anticipate a similar phenomenon with agroforestry, positing that transformative changes—“fundamental, system-wide reorganizations across technological, economic, and social factors, including paradigms, goals, and values” (IPBES et al. 2019)—would be necessary to scale up agroforestry (Pascual et al. 2022). As such, we combine the MLP with the CD framework to examine the conditions that could foster land use sustainability scaling under a regime that has entrenched more environmentally degrading practices.

2.2 | The CD Framework

The CD framework provides an analytical lens for assessing how policy instruments drive sustainability transitions (Kivimaa and Kern 2016). This framework identifies two processes of influence for sustainability transitions: (1) the creation of niche innovations, and (2) the destruction of dominant regimes. In the West African cocoa sector, it provides a means to develop a systematic understanding of the influence of existing sustainability interventions on scaling up cocoa agroforestry adoption.

The creation of niche innovations is a stepwise process that supports the development of alternative sustainability solutions, challenging mainstream regimes over time (Kanger et al. 2020; Smith and Raven 2012). It focuses on incremental changes restricted to interventions that are accommodated within unchanged regime structures. Such interventions are defined as conformist, whereby interventions are geared toward improving sustainability under an overarching goal of constant and exponential economic growth (Pascual et al. 2022). In the cocoa sector, interventions promoting productivity through capacity-building and training of farmers, as well as the introduction of market-based policy instruments, fall under this category (Table 1).

The destruction of dominant regimes is a process in which an innovative entrepreneur challenges mainstream industries or technologies in a way that makes the existing technologies obsolete, forcing incumbents to withdraw from the market (Soete and Ter Weel 1999). Drawing upon sustainability transitions literature, transitions do not happen merely when niches are present (Geels and Schot 2007). The regime also needs to be destabilized so that the niches can break through and restructure it (Kanger et al. 2020). The destruction of the dominant regime can be an intentional process for deeper and fundamental transformative changes (Pascual et al. 2022). In the cocoa

sector, interventions to destabilize the regime may include scaling down conventional cocoa sourcing, scaling up financial mechanisms for diversification and sustainable agriculture, or balancing the involvement of incumbents in policy advisory councils with niche actors.

Overall, the framework seeks to conceptualize how different interventions are likely to influence the creation of niche innovations and the destruction of dominant regimes. This analytical framework is used to assess whether existing policy measures or interventions used in the cocoa sector have the potential to scale up cocoa agroforestry and drive sustainability transition.

2.3 | Integrating the MLP With the CD Framework

By combining the MLP with the CD frameworks, we allow for two further distinctions in our assessment of the potential impacts of existing interventions to generate incremental versus transformative changes in agroforestry adoption. We posit that only “regime-destabilizing” interventions are likely to generate transformative changes (Kanger et al. 2020). In contrast, other interventions that merely support agroforestry as a niche, that is, “niche-supporting” instruments, inherently provide only incremental change over time (DeFries and Nagendra 2017). We further assume that even a combination of multiple niche innovations will likely result in only incremental changes since they fail to disrupt existing regime locking in existing practices (Table 1).

We identify three key “regime-destabilizing” interventions with disruptive functions (D-functions) that apply to transformative upscaling of agroforestry. First, changes in regime rules (D1) refer to disruptive policy reforms that substantially alter economic and legislative frameworks and can destabilize the regime (Kivimaa and Kern 2016; Turnheim and Geels 2012). This could involve tree and land tenure reforms in the cocoa sector, which represent the main factors hindering smallholder agroforestry adoption (Kouassi et al. 2021a, 2021b, 2023). Second, reductions in support for dominant regime technologies (D2) entail moving funding and emphasis away from incumbent technologies that hinder innovation (Smith and Raven 2012). In our case, this would entail reducing support for conventional cocoa (i.e., cocoa mainly from monocultural agronomic technology), which dominates exports (60%–70% for conventional cocoa vs. 30%–40% for certified “sustainable” cocoa) (Zu Ermgassen et al. 2022). Case studies in the energy sector show that withdrawing support for incumbent technologies can have significant impacts, such as decreasing the share of coal and increasing alternatives (Turnheim and Geels 2012). The final disruptive function is the replacement of key actor networks (D3). Changes in leadership away from people who have long worked within the status quo to people who think “outside the box” can contribute to radical innovation (Bower and Christensen 1995) and policy processes (Christopoulos and Ingold 2015). Diverting power from the vested interests of incumbent actors is needed since these actors carry more “sunk costs” and are consequently more tied to perpetuating the status quo.

We identify seven niche-support interventions or policy instruments clustered as creative functions (C-functions): Knowledge

TABLE 1 | Analytical framework combining concepts from the Multi-Level Perspective (MLP) by Geels (2002) and the Creative Destruction Framework by Kivimaa and Kern (2016).

Policy instrument functions	Description	Examples in agroforestry
Niche-support instruments and factors (creative support functions or “C-functions”) Knowledge creation, development, and diffusion (C1)	Strengthening the knowledge base and diffusion through networks such as cooperatives and farmers’ groups is key to building internal niche momentum in agri-food sustainability transitions (Kaweesa et al. 2020).	<ul style="list-style-type: none"> • R&D in sustainable farming, agroforestry • Extension services on agroforestry, including Good Agricultural Practices (GAPs) and Good Environmental Practices (GEP)
Establishing market niches/market formation (C2)	Market-based policy instruments such as third-party certifications and company-led sustainability programs that include agroforestry requirements and/or recommendations.	<ul style="list-style-type: none"> • Companies’ agroforestry policies and policy instruments; RA/UTZ • Public procurement and price guarantee policies
Price-performance improvements (C3)	Payment for ecosystem services (PES) or performance-based payments for agroforestry adoption to offset opportunity costs and enhance competitiveness versus incumbent full-sun cocoa (Schot and Geels 2008).	<ul style="list-style-type: none"> • Agroforestry price-performance payments • PES
Entrepreneurial experimentation (C4)	Policies or policy instruments stimulating entrepreneurship and diversification (Bergek et al. 2008). In our study context, this involves policy instruments aiming to reduce barriers and uncertainties to testing agroforestry as a reemerging technology or farming practice.	<ul style="list-style-type: none"> • Seedling distribution, establishing community nurseries • Demonstration plots • Tree registration
Resource mobilization (C5)	Mobilization of human and financial capital and complementary assets such as infrastructure to support agroforestry scaling up.	<ul style="list-style-type: none"> • <u>Financial</u>: R&D funding, deployment of subsidies • <u>Human</u>: educational policies (e.g., integration of agroforestry into university curricula)
Support from powerful groups/legitimation (C6)	Legitimacy, that is, positive social acceptance among supply chain actors, is needed to support sustainable farming/agroforestry (Schot and Geels 2008). This involves social acceptance by governments, cocoa companies, CSOs and NGOs and cooperatives and farmers’ groups with relevant institutions supporting agroforestry transition to protect and nurture the agroforestry niche	<ul style="list-style-type: none"> • Voluntary sustainability agreements supporting sustainable production through agroforestry or shade-grown cocoa
Influence on the direction of search (C7)	Pressures for the main cocoa actors to enter the new technological field are influenced by visions and expectations articulated by landscape changes and legitimization (Bergek et al. 2008).	<ul style="list-style-type: none"> • Action plans including clear targets for agroforestry or shade-grown cocoa with clear goals

(Continues)

TABLE 1 | (Continued)

Policy instrument functions	Description	Examples in agroforestry
<p>Regime-destabilization instruments and factors (creative destruction functions or “D-functions”)</p> <p>Significant changes in regime rules (D1)</p>	<p>The socio-technical cocoa regime is structured around a set of rules that guide and coordinate supply chain actors. In a fit-and-conform approach to maintaining the status quo, institutional rule adjustments are made to support niche innovations without altering the core regime, thereby safeguarding the vested interests of powerful actors. This path-dependent evolution reinforces regime stability (Geels 2010). However, significant changes to regime rules—such as disruptive policy reforms that substantially alter economic and legislative frameworks—can destabilize the regime (Kivimaa and Kern 2016; Turnheim and Geels 2013).</p>	<ul style="list-style-type: none"> • Tree and land tenure reforms
<p>Reduced support for dominant unsustainable agronomic farming technologies (D2)</p>	<p>Support for incumbent technologies can become embedded within regime rules, hindering innovation (Smith and Raven 2012). In our case, conventional cocoa (i.e., cocoa from monocultural agronomic technology) dominates exports (60%–70% vs. 30%–40% for certified ‘sustainable’ cocoa) (Zu Ermgassen et al. 2022), and reducing its share could destabilize the regime. Case studies in the energy sector show that withdrawing support for incumbent technologies can have significant consequences, such as decreasing the share of coal and increasing alternatives (Kivimaa and Kern 2016; Turnheim and Geels 2012).</p>	<ul style="list-style-type: none"> • Cutting or removing R&D funding that supports unsustainable agronomic technologies
<p>Changes in social networks/Replacement of key actors (D3)</p>	<p>Balancing the involvement of incumbent actors (e.g., government, cocoa companies) with niche actors (e.g., cocoa farmers, cooperatives, NGOs, etc.) in sustainability intervention programs can reduce regime lock-in and facilitate the replacement of existing paradigms, knowledge, and skills (incumbent actors) with new ones (Turnheim and Geels 2013).</p>	<ul style="list-style-type: none"> • Precompetitive landscape approaches and landscape management board (HIA Management Board—HIMB)
<p>Landscape-level instruments and factors</p>	<p>Soil and rainwater constraints limit cocoa yields. Also, climate change reduces areas suitable for cocoa (Läderach et al. 2013). These landscape-scale ecological pressures may influence regime actors to minimize their impacts (van der Haar et al. 2023).</p>	<ul style="list-style-type: none"> • Climate change • Drought • Rainfall pattern
<p>Macroeconomic and socioeconomic trends^a</p>	<p>Changes in macroeconomics and socioeconomics play an important role in supporting transition (Geels and Schot 2007).</p>	<ul style="list-style-type: none"> • Globalization • Migration • Economic growth and recession • Cocoa productivity decline • Cocoa price fluctuation
<p>Macro-political developments^a</p>	<p>International political agendas are important drivers of sustainability transitions in agri-food systems (Elsner et al. 2023).</p>	<ul style="list-style-type: none"> • The philosophy behind policymaking • Multilateral environmental agreements • Political instability or war • Political will • Change in government
<p>Cultural patterns^a</p>	<p>Social movement, lifestyle choices, preferences, and behavior-associated implications for sustainable farming practices (Geels and Schot 2007).</p>	<ul style="list-style-type: none"> • Trend toward ‘green consumerism’ or cultural values of trees

^aLandscape factors are omitted in the ‘creative destruction’ functions (system of influence) because neither niche nor regime actors directly influence landscape-level developments (Geels and Schot 2007).

creation, development, and diffusion (C1), for example, strengthening agroforestry knowledge through research, extension services, and farmer networks (Kaweesa et al. 2020; Maguire-Rajpaul et al. 2020); market formation (C2), for example, through market-based policy instruments such as third-party certifications and company-led sustainability program incorporating agroforestry requirements; price performance improvement (C3), for example, incentives like payments for ecosystem services or tree planting performance payments; entrepreneurial experimentation (C4), for example, policies reducing barriers to testing agroforestry as a viable farming practice; resource mobilization (C5), for example, allocating financial, human, and infrastructural resources to support agroforestry scaling up; legitimization (C6), for example, gaining social acceptance among key stakeholders (Schot & Geels, 2008), including governments, cocoa companies, and farmers' cooperatives; and changes in direction (C7), for example, providing incentives and strategic direction to align agroforestry scaling up with broader sustainability goals.

3 | Methods and Materials

3.1 | Study Design

We used an inductive qualitative approach to assess whether and how cocoa sustainability initiatives can support a transition to cocoa agroforestry in West Africa.

First, we conducted a policy mapping exercise (S1 File) to systematically identify and analyze existing policies, program, and policy instruments potentially influencing cocoa agroforestry transition in both countries. The policy mapping aimed to assess how the current policy mix enables or hinders processes that may be critical for agroforestry transitions. This analysis focused on processes supporting agroforestry as a niche and processes disrupting dominant regimes to scale up agroforestry adoption.

We then conducted semi-structured interviews (S2–S4 Files) with key informants in the cocoa supply chain. The interviews aimed to provide in-depth contextual insights about the transition to cocoa agroforestry in both countries.

The analytical framework guided the processing and analysis of the data.

3.2 | Policy Mapping

We identified relevant policies through a review of each country's domestic public forest policies from 1965 to 2024, as well as company-level Cocoa and Forest Initiative (CFI) policy documents, action plans, and reports (see S5 File). This review was complemented by searches of chocolate manufacturers' and cocoa traders' websites. We selected documents that satisfied the following criteria: (1) common agroforestry interventions in cocoa supply chains (i.e., shade tree distribution, training); (2) subnational rules and legal interventions about keeping trees on farms (i.e., tree and land tenure reforms); and (3) landscape-level interventions targeting climate change (i.e., international

treaties like the United Nations Framework Convention on Climate Change—UNFCCC).

The policy interventions (S1 File) we identified included domestic public policies (e.g., Côte d'Ivoire's 2019 Forest Code (MINEF 2019b)), national program (e.g., Reducing Emissions from Deforestation and Forest Degradation—REDD+), and supply chain initiatives (e.g., the Lindt & Sprüngli Farming Program, including the Cocoa No-Deforestation and Agroforestry Action Plan). For each intervention, we documented its objectives, scope (i.e., duration, geographical scale, location, and targets) and types of policy instruments. In total, we identified 45 instruments in Côte d'Ivoire and 44 instruments in Ghana.

Policy instruments in each country were categorized by domain: domestic public policies, regional program, or supply chain initiatives. Many were co-designed and implemented by public (e.g., government) and private sector actors (e.g., traders). Policy instruments involving actors from multiple sectors were classified based on the primary implementing organization.

3.3 | Interviews and Focus Groups

We used a stratified, purposeful sampling approach to recruit interview participants from preidentified actor groups within the cocoa supply chain in Côte d'Ivoire and Ghana (Table 2). The objective of sampling was to include perspectives from all relevant groups and achieve thematic saturation, thereby ensuring no relevant actor groups or themes were omitted (Saunders et al. 2018). In addition to actors within the cocoa sector, representatives from the forestry sector were also included, given the influence of forestry institutions and regulations on cocoa agroforestry (Dieng and Karsenty 2023). We developed a candidate list of participants by stratifying the following groups: government agencies (including forestry and agricultural agencies), cocoa and chocolate companies, international civil society, intergovernmental organizations, and representatives from cooperatives or farmer groups. The development of the list was informed by the policy mapping exercise to avoid overrepresentation of any single perspective. We invited candidate participants via email and LinkedIn. After candidates from the initial list were recruited, we employed snowball sampling, asking interviewees to recommend additional participants. This allowed us to identify relevant actors and perspectives not captured in the initial candidate list, thereby expanding the diversity of the participant pool (Bernard 2011). We continued sampling participants at all levels in the cocoa supply chain until no new themes emerged from additional interviews (as assessed by continually reviewing our field notes), indicating we had reached thematic saturation (Bernard 2011; Morse 2015).

Interview guides were developed based on guides used in previous studies on the adoption of forest-focused supply chain policies (Cammelli et al. 2022; Grabs and Garrett 2023) and a review of the academic literature on agroforestry adoption. The interview guides included questions about the adoption and design of agroforestry policy instruments, as well

as participants' perceptions of implementation progress and challenges.

We conducted a total of 93 semi-structured interviews across both countries, covering actors at all levels in the cocoa supply chain (Table 2). We conducted the interviews between November 2021 and January 2022 in Ghana, and March and April 2022 in Côte d'Ivoire. Seventy-nine (79) interviews were conducted in person during field data collection in both countries. We complemented these interviews with 14 online interviews via Zoom with chocolate manufacturers ($n=6$), traders ($n=4$), and international organizations ($n=4$) not based in either of the countries. We conducted the interviews using the open-ended guides described above, with adapted questions and probes for each actor group (S2–S4 Files), ranging from chocolate companies to cocoa farmers. Additionally, we conducted eight in-person focus groups with farmers ($n=69$) across five main cocoa areas in both countries. The goal of the focus groups was to collect individual and collective perspectives from farmers on sustainability interventions and barriers they face in adopting cocoa agroforestry.

All interviews (online and in person) and focus groups were conducted under the condition of anonymity, and ethical approval was provided by the ETH Zurich Ethics Commission (S7 File). Informed consent was obtained from all participants prior to the interviews and focus groups using an informed consent form. All interviews and focus groups were audio-recorded with the participants' permission, and notes were taken to supplement the recordings.

3.4 | Data Analysis

The policy interventions identified from the policy mapping exercise were coded in Microsoft Excel following the analytical framework (see S1 File). Each policy instrument was deductively categorized using the descriptive indicators in Table 1. The table includes a set of 9 policy instrument functions that either support the niche (C1-6 functions) or destabilize the regime (D1-3 functions), as well as four landscape indicators. The CD functions (i.e., niche-supporting C-function vs. regime-destabilizing D-function) were used to categorize the types of impacts and assess the relative effectiveness of policy instruments in scaling up the adoption of agroforestry.

Particular attention was given to the analysis to identify the relative coverage of the number of policy instruments per function group (C-function vs. D-function) and per country (Côte d'Ivoire vs. Ghana), as well as any gaps. Investigator triangulation was employed to ensure the validity of coding, as two authors independently coded the data and then compared their results. In case of differing opinions, the authors negotiated the final coding to ensure consistency.

The list of policy instruments was expanded using the interview data to provide an in-depth understanding of the policy instruments, their implementation and influence on the transition to agroforestry. First, we coded the interview notes in NVivo 14 (Lumivero 2023), generating codes for the agroforestry interventions reported by the participants. These codes were then

TABLE 2 | Overview of interviews conducted in Côte d'Ivoire and Ghana.

Participant group	Code	# Interviews	
		Côte d'Ivoire (ci)	Ghana (gh)
Government agencies (incl. forestry and agricultural agencies)	gov	6	9
Chocolate manufacturers	man	5	7
Cocoa trading companies	tra	6	6
Licensed Buying Companies (Ghana)	lbc	NA	3
Cooperatives/Community-based organizations	fcb	8	4
Farmers or farmer communities (focus groups)	far	9 (7)	4 (1)
Non-Governmental Organizations	ngo	12	9
Third-party certification bodies	cer	1	1
Research institutions/consultants/expert informants	rie	1	1
<i>Pisteurs</i> (informal local cocoa traders)	pis	1	NA
Total		56	45

Note: Each participant group was assigned a three-letter code (e.g., man), followed by a two-letter country code (e.g., ci) and a participant number (e.g., 01), creating a unique identifier for each interviewee (e.g., man-ci01).

analyzed using Braun and Clarke's (2006) stepwise thematic analysis. We iteratively compared and grouped the codes into candidate themes using both semantic and latent approaches (Braun and Clarke 2006). For example, participants reported interventions such as *agroforestry training* and *demonstration plots*. These interventions are intended to support farmers in adopting cocoa agroforestry. According to the semantic approach, we grouped these codes under the theme "training and extension services". Then, according to the latent approach, we interpreted this theme as a "*productivity enhancement*" alongside codes such as the *supply of agrochemicals* and *pruning training*, because the underlying aim for this group of interventions is to increase cocoa productivity. As the analysis progressed, we compared each new interview against the evolving codes and candidate themes.

Finally, we evaluated the balance between the number of policy instruments supporting the niche and destabilizing the regime in both countries. While we demonstrated the number of instruments per function, we also focused on their influence on scaling up cocoa agroforestry adoption, rather than the number of instruments.

4 | Results

We present the results according to the three levels of the MLP, starting with the landscape-level factors influencing the potential to scale up agroforestry adoption, followed by the regime- and niche-level factors.

4.1 | Identifying Landscape Factors

Table 3 summarizes how the landscape factors in Côte d'Ivoire and Ghana facilitate and/or limit the development of niche policy instruments and regime changes around cocoa agroforestry. Landscape factors were rarely mentioned in interviews ($n=6$), so most of the analysis drew from the document review. We find that increased public awareness of climate change threats to cocoa productivity mobilized supply chain actors to expand their sustainability initiatives. As part of the cocoa sustainability initiatives, agroforestry has been added as a climate adaptation and reforestation strategy (far-ci01¹; tra-gh08; cer-gh09). One third-party certification representative illustrated the process of agroforestry becoming mainstream when commenting on drivers of cocoa agroforestry policy instruments:

People [supply chain actors] are beginning to understand that with climate change, you need to plant shade trees with cocoa (cer-gh09).

Over time, national policies targeting climate change increased in both countries, facilitating innovations around cocoa agroforestry (e.g., FC 2016; MINEF 2019a; MLNR 2012). In the 2010s, both countries joined the REDD+ mechanism under the UNFCCC, which provides financial incentives for reducing carbon emissions (FC 2016; MINESUDD 2017). In the cocoa sector, this was mainly implemented using policy instruments promoting sustainable production practices, such as climate-smart agriculture and agroforestry (Antwi-Agyei et al. 2018; van der Haar et al. 2023). However, two participants (cop-c26; tra-gh14) reported that farmers are confused about recent cocoa sustainability initiatives and narratives (i.e., since 2010 onward), which promoted planting trees with cocoa. These initiatives and narratives are understood by some actors to conflict with previous recommendations from extension services, which have encouraged the removal of shade trees perceived to reduce cocoa yields (Gockowski and Sonwa 2011; Olwig et al. 2024; Ruf and Zadi 1998). One trader in Ghana illustrated this incoherence, resulting in the confusion of farmers about planting trees in cocoa farms:

Trees in Ghana with cocoa farmers have a long history, and we understand, like, years back, COCOBOD asked farmers not to maintain these trees, and now farmers are asked to plant them. Farmers are quite confused. (tra-gh14)

Cultural trends toward “productivism,” that is, discourses and narratives giving productivity primacy over other objectives, have also emerged as a key landscape factor that constrains agroforestry from scaling up. Some of the interviewed farmer cooperatives and

certification bodies' representatives reported that farmers preferred planting more cocoa trees than shade trees, arguing that shade trees compete with cocoa for resources and reduce cocoa productivity (cer-ci05; cop-c26). An Ivorian cooperative stated:

For us, it is [planting trees] not really in our favour because, in the end, we do not want to plant trees. We want to plant cocoa. (cop-ci26)

These landscape factors thus show mixed developments in climate, macro-politics, and cultural trends, which do not fully support the transition to cocoa agroforestry in Côte d'Ivoire or Ghana. However, these factors have shaped the development of niche policy instruments and regime changes around cocoa agroforestry, as outlined in the next section.

4.2 | Evaluating Regime Change and Niche Policy Instruments

4.2.1 | Côte D'ivoire

Our analysis of Ivorian cocoa agroforestry policies shows a substantial number of policy instruments that support the niche. However, we observed only a few policy instruments that destabilize the regime (Figure 2).

At the regime scale, we identified three significant changes in regime rules (D1). These changes include the original Forest Code (1965—Act 875), its reform in 2014 (Law N°2014–427), and the 2019 Forest Code (No. 2019–675). All three policies regulated forestry activities and the use of trees on farms (S1 File). Participants reported that the original Forest Code (1965) restricted farmers' rights over trees on their farms (“tree tenure”), discouraging them from adopting agroforestry and justifying successive legislative reforms (tra-ci02, tra-ci04, far-ci03, far-ci04). The 2019 Forest Code reform (MINEF 2019b) aimed to address this problem and expand support for the cocoa agroforestry transition by assigning tree tenure to the owners of the land on which a tree stands or the person who planted it (Article 27). The reformed Forest Code thus aimed to enhance the protection and restoration of forests, as well as promote sustainable farming practices that are connected to forests. The 2019 Forest Code also introduced new forest categories,

TABLE 3 | The degree to which agroforestry policy instruments are helped (+) or hindered (–) by factors and developments at the landscape level.

	Côte d'Ivoire	Ghana
Biophysical factors		
Climate change	(+)	(+)
Macro-Political developments		
Confusion on agroforestry re-emergence	(–/+)	(–/+)
Cultural patterns		
Productivist attitudes and narratives	(–)	(–)

including agroforests (i.e., 95% degraded forest reserves classified as “Category III”), which require cocoa farmers in degraded forest reserves to shift from conventional full-sun cocoa to agroforestry (gov-ci01). However, no significant policies to remove support for dominant conventional full-sun cocoa practices (D2) or changes in policy or key actor networks (D3) were identified. The key actor networks remained the same, including the Ministry of Water and Forests (MINEF), Forest Development Company (SODEFOR), and the CCC.

At the niche scale, we observed 42 policy instruments supporting niche innovations around cocoa agroforestry (C1–7). In total, we found 14 policy instruments linked to knowledge development and diffusion (C1), three contributing to market formation (C2), seven on price-performance improvements (C3), five on entrepreneurial experimentation (C4), six on resource mobilization (C5), four on legitimation (C6), and three on the direction of search. Most policy instruments focus on knowledge development and diffusion (C1) in cocoa agroforestry systems, which involve R&D (ngoc06, man-g24), farmer training, and capacity-building on agroforestry systems, shade management, and climate-smart cocoa. These are delivered through Good Agricultural Practices (GAPs) and Good Environmental Practices (GEPs) program.

These interventions, coupled with company-led sustainability policies, aim to support farmers’ adoption of agroforestry (tra-ci02, tra-ci04, tra-ci05, tra-ci06). Company-led agroforestry policies, such as the Lindt and Sprüngli Cocoa No-Deforestation and Agroforestry Action Plan, are linked to market formation (C2), price performance improvements (C3), entrepreneurial experimentation (C4), resource mobilization (C5), and direction of search (C7) functions. They include interventions such as seedling distribution, tree nurseries, demonstration plots, and payments for ecosystem services. Additionally, companies also engage in land and

tree registration, defined as a system where farmers can officially bundle their land documentation with shade tree documentation in collaboration with governmental agencies, such as the Rural Land Agency (AFOR) and third-party organizations like Meridia. The combination of the high number of niche-supporting policy instruments (C1–7) with tree tenure reforms (D1) could destabilize the existing cocoa regime and contribute to the scaling up of agroforestry in Côte d’Ivoire. However, participants reported a lack of clarity in land ownership between migrants and local cocoa communities that limits the potential for farmers to demonstrate tree tenure, and hence the effectiveness of the policy mix to scale up agroforestry (tra-ci04):

Ownership is not clear between migrants and local people and there have been many conflicts, so I think it is important to take time to solve some of the uncertainties about that situation.

Overall, the Ivorian policy instruments around cocoa agroforestry show an imbalance between niche-supportive and regime-destabilization policy instruments. This imbalance is evident not only in the number of instruments but also in their content, particularly in relation to significant changes that reduce support for dominant full-sun cocoa production practices and changes in official policy networks and actors.

4.2.2 | Ghana

Our analysis of Ghanaian policy instruments to scale up cocoa agroforestry shows a wide range of instruments that influence the niche-supporting functions (C1-7). However, as in the Ivorian case, very few instruments address the regime-destabilization functions (D1-3) (Figure 3).

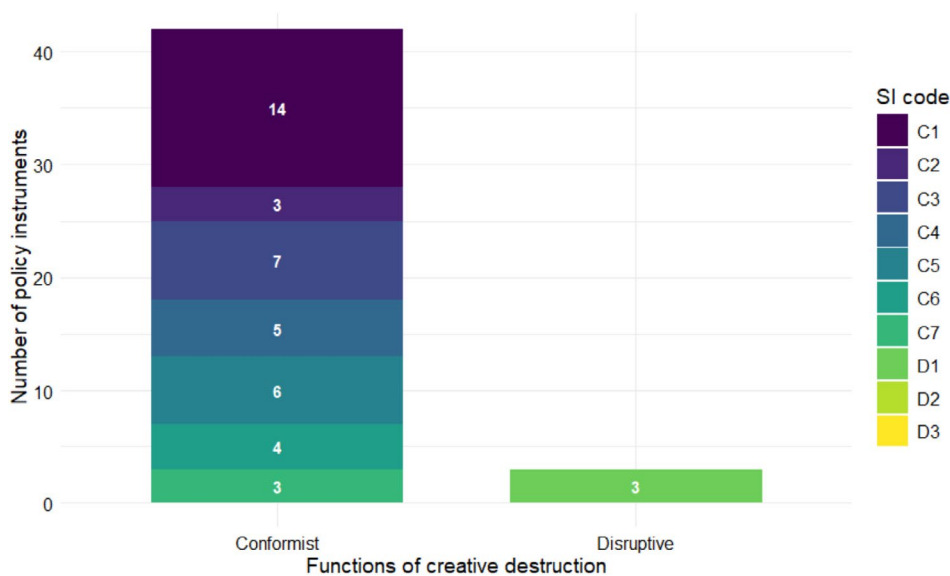


FIGURE 2 | Côte d’Ivoire’s cocoa agroforestry policy instruments grouped by the functions of “creative destruction”. These functions include the niche-support policy instruments (C-functions) and the regime-destabilization function (D-functions). The SI codes capture these two functions. The niche-supporting functions include Knowledge creation, development, and diffusion (C1), Establishing market niches/market formation (C2), Price-performance improvements (C3), Entrepreneurial experimentation (C4), Resource mobilization (C5), Support from powerful groups/legitimation (C6), and Influence on the direction of search (C7). The regime-destabilization functions include Significant changes in regime rules (D1), Reduced support for dominant unsustainable agronomic farming technologies (D2), and Changes in social networks/Replacement of key actors (D3).

At the regime scale, we identified two significant changes in regime rules (D1) and one new actor (D3). We did not observe policies removing support for dominant cocoa production practices (D2). The changes in regime rules include the Forest Plantation Development Fund Act (2000, Act 83) and the Timber Resources Management Act (2002, Act 617). Both policies are subsequent reforms that aim to enable agroforestry adoption by acknowledging the rights of farmers to own the trees they plant on farm and forest lands (S1 File). As in Côte d'Ivoire, Ghanaian farmers did not historically have rights to the trees on their farms. Ghana's 1992 Constitution (Article 257) granted the President ownership of naturally occurring and planted trees on public lands, discouraging farmers from planting trees on cocoa farms (tra-gh08, man-g49). The 2000 policy reform acknowledges farmers' tree tenure rights, while the 2002 Timber Resources Management Act allows them to own and commercially use the trees they have planted. The 2002 reform also led to the creation of a national tree register; however, the Ghana Forestry Commission is still developing the registration process, limiting private sector policy instruments to support the removal of tree tenure barriers.

Unlike in Côte d'Ivoire, our analysis in Ghana identified one change in policy and key actor networks. Under the Ghana Cocoa & Forests REDD+² Program (GCFRP),³ an action-focused network was established, based on a collaborative governance structure with a variety of actors from government (e.g., COCOBOD), private sector (e.g., Olam, Touton), NGOs/CSOs (e.g., Tropenbos Ghana, Proforest), and community institutions (e.g., Community Resource Management Committees, CRMCs).⁴ The network aims to enable a collaborative governance structure in the cocoa sector through a landscape approach for sustainable cocoa (e.g., climate-smart cocoa agroforestry) and focuses on fostering the participation of marginalized communities. As one manufacturer described:

We thought the companies would come together and develop a governance structure and then have a management plan to really manage that hotspot area (GCFRP). So, I would say that CFI is on board to help us think along those lines—collaborative work, landscape kind of work, where we all [including local and farmers' communities] put something on the table and bring expertise to reduce the burden per partner. (man-g30).

At the niche scale, we observed 41 policy instruments supporting niche innovations around cocoa agroforestry (C1-7). In total, we found 20 policy instruments linked to knowledge development and diffusion (C1), three contributing to market formation (C2), two on price-performance improvements (C3), four on entrepreneurial experimentation (C4), two on resources mobilization (C5), nine on legitimation (C6) and one on direction of search (C7) (S1 File). Similarly to Côte d'Ivoire, most niche-supporting policy instruments concentrated on knowledge development and diffusion of cocoa agroforestry systems (C1), which involve farmer training and capacity-building on agroforestry systems, shade management and climate-smart cocoa. This intervention, coupled with other policy instruments of the CFI's productivity package, that is, seedling distribution, community nurseries, demonstration plots, tree registration (linked to entrepreneurial experimentation C4, resource mobilization C5, and direction of search C7) and company-led agroforestry policies, that is, Lindt and Sprüngli Farming Program and Halba Agroforestry Policy (linked to market formation C2, price performance improvements C3), aims to support agroforestry adoption by cocoa farmers (tra-gh04, tra-gh08, tra-gh14, man-g30, gov-g40, man-g49). All these policy instruments create enabling conditions for farmers to adopt agroforestry.

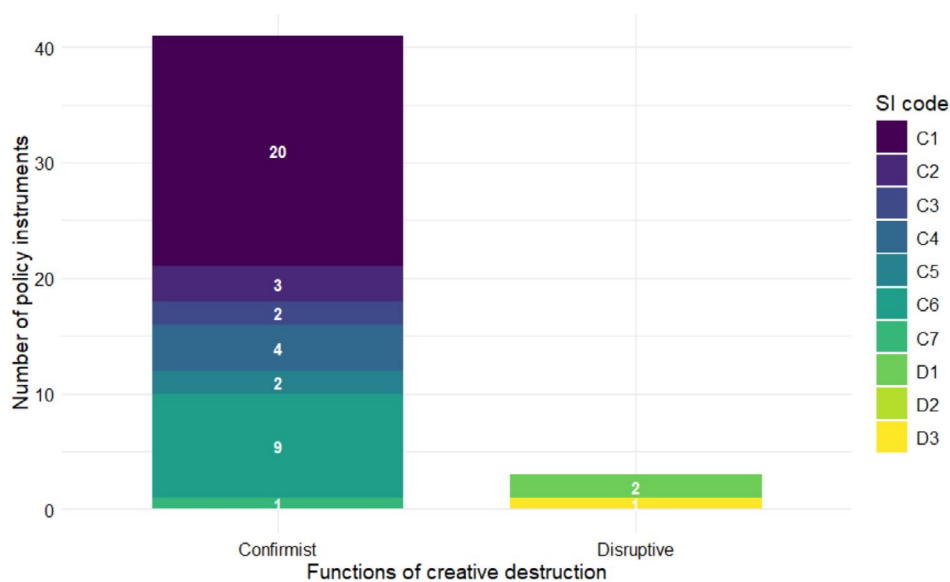


FIGURE 3 | Ghana's cocoa agroforestry policy instruments grouped by functions of “creative destruction.” These functions include the niche-support policy instruments (C-functions) and the regime-destabilization function (D-functions). The SI codes capture these two functions. The niche-supporting functions include Knowledge creation, development and diffusion (C1), Establishing market niches/market formation (C2), Price-performance improvements (C3), Entrepreneurial experimentation (C4), Resource mobilization (C5), Support from powerful groups/legitimation (C6), and Influence on the direction of search (C7). The regime-destabilization functions include Significant changes in regime rules (D1), Reduced support for dominant unsustainable agronomic farming technologies (D2), and Changes in social networks/Replacement of key actors (D3).

Overall, as in the Ivorian case, there is an imbalance between supportive and disruptive policy instruments. However, Ghana is slightly more focused on destabilizing policies than Côte d'Ivoire, with two more destabilization policies (i.e., changes in regime rules and actor-network) being used in terms of content (Figure 4).

Table 4 provides a summary of the key findings in both countries.

5 | Discussion

This study assessed the factors influencing the scaling up of agroforestry adoption in Côte d'Ivoire and Ghana, using the MLP and CD frameworks. Results suggest that there are numerous niche interventions by cocoa companies, NGOs, and governments, but few examples of regime-level reforms. As such, there is likely insufficient pressure to disrupt conventional systems and scale up agroforestry adoption. The cocoa sector is locked into the existing full-sun production paradigm, which supports incremental improvements in monocultural systems, rather than a redesign of the land system and associated political structures and narratives. We now discuss these findings in relation to the literature on cocoa sustainability transition and transformative change.

5.1 | Imbalances Between Niche Support and Regime-Destabilizing Policy Instruments

Our study showed fewer policy instruments focused on regime destabilization (D-functions) than there is niche support (C-functions) for cocoa agroforestry in Côte d'Ivoire and Ghana. Destabilization policies are politically challenging (Otto et al. 2020; Sztompka 2000); therefore, it is not surprising that we find few examples of such policies.

In our case studies, the policy mixes used in Côte d'Ivoire and Ghana to directly and indirectly enable the scaling up of

agroforestry adoption represent what Kern and Howlett (2009) classify as *layering*. Layering consists of adding new goals or policy instruments to existing regimes, which may produce incoherence in the policy goals and inconsistency in the policy instruments used (Kern and Howlett 2009). However, destabilizing policies, particularly those addressing reduced support for dominant regime technologies, changes in key actors, and/or significant changes in regime rules, would require *replacement*. Replacement involves the creation of new goals and/or policy instruments that replace the old ones, ensuring coherence and consistency (Kern and Howlett 2009).

DeFries and Nagendra (2017) have argued that adopting multiple niche-support policies—an incremental approach—can help overcome political inertia in implementing more ambitious policies. On the other hand, as evidenced here, overlapping policies can create administrative complexity, incoherence between narratives, and conflicts between stakeholders. Understanding the new rules and incentive structures around agroforestry can be confusing. Such incoherence can reduce the cost-effectiveness and overall effectiveness of any given policy. Thus, increased efforts are needed to build coalitions of actors that see mutual gain and take collaborative and inclusive actions to shift incentives from monocultural production to more sustainable and resilient practices.

5.2 | Insufficient Reform of Land and Tree Tenure Regimes

We found three consecutive changes in regime rules (D1) in Côte d'Ivoire (the Forest Code of 1965, Forest Code Reform of 2014, and Forest Code Reform of 2019) and two in Ghana (the 2000 Forest Plantations Fund Act and the 2002 Timber Resources Management Act), all aiming to facilitate smallholders' access to land and tree tenure. The relatively higher number of changes in regime rules can be explained by the political commitment of both countries to sustainable cocoa

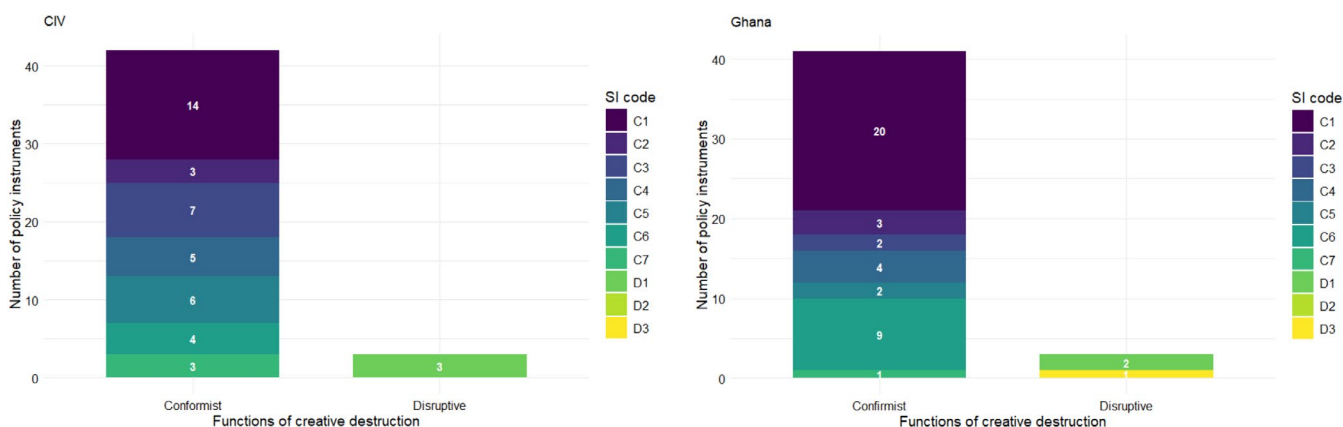


FIGURE 4 | Agroforestry policy instruments grouped by functions of 'creative destruction' in Côte d'Ivoire (CIV) and Ghana. These functions include the niche support policy instruments (C-functions) and the regime-destabilization function (D-functions). The SI codes capture these two functions. The niche-supporting functions include Knowledge creation, development and diffusion (C1), Establishing market niches/market formation (C2), Price-performance improvements (C3), Entrepreneurial experimentation (C4), Resource mobilization (C5), Support from powerful groups/legitimation (C6), and Influence on the direction of search (C7). The regime-destabilization functions include significant changes in regime rules (D1), Reduced support for dominant, unsustainable agronomic farming technologies (D2), and Changes in social networks or the Replacement of key actors (D3).

TABLE 4 | Summary of key findings by level and degree to which interventions at the niche, regime and landscape levels facilitated (+) or hindered (–) the scale-up of agroforestry adoption in Cote d’Ivoire and Ghana (Justification for scores provided in S1).

	Côte d’Ivoire	Ghana
Landscape		
Biophysical factors		
Climate change	+	+
Macro-Political developments		
Confusion on agroforestry re-emergence	–/+	–/+
Cultural patterns		
Productivist attitudes and narratives	–	–
Regime (supporting disruptive changes)		
Significant changes in regime rules		
Policy reforms	++ (occurs through the 2019 land and tree tenure reform)	+
Reduced support for dominant unsustainable agronomic technologies	n/a	n/a
Changes in social networks/Replacement of key actors	n/a	+ (occurs through the CREMA mechanisms under GCFRP)
Niche (supporting incremental changes)		
Knowledge creation and diffusion		
Agricultural research and extension services focused on sustainability (e.g., GAP, GEP)	++++	++++
Distribution of seedlings	++++	++++
Establishing market niches		
Shade tree recommendations from certifications and/or company-led sustainability programs	++	++
Price-performance improvements		
PES program	+++	++
Entrepreneurial experimentation		
Demonstration plots	+++	++
Resources mobilization and ILegitimation		
REDD+ fund	++	+++

Note: Low = +, Moderate = ++, High = +++, Very High = ++++ and Non observed (n/a).

(CFI 2017a, 2017b), which requires farmers to obtain tenure rights over their lands and trees (Schulte et al. 2020). However, these structural reforms have proven insufficient to achieve sustainable cocoa (Addoah et al. 2025; van der Haar et al. 2023) and to scale up agroforestry. In Ghana, there has been insufficient tree tenure reform, as natural trees remain vested in the President, and it is expensive and logistically impossible to register trees planted by farmers at scale. In Côte d’Ivoire, tree tenure reforms were introduced in the 2019 Forest Code, but the absence of land tenure reforms has prevented farmers from claiming ownership of trees on their farms. One likely reason for these ongoing problems is that efforts to reform timber management and benefit-sharing have been hindered by administrative elites’ and timber companies’ vested economic and political interests, some of which date

back to the colonial era (Asare et al. 2014; Maguire-Rajpaul et al. 2022). A key challenge is the lack of consensus among actors on how timber benefits should be shared between farmers and communities, with pilot experiences of tree registration suggesting that such niche policy instruments may be too bureaucratic and costly to scale up (Asare et al. 2014).

Additionally, Côte d’Ivoire’s 2019 Forest Code reform may exacerbate land tenure insecurity and economic instability for marginalized smallholder farmers. The reclassification of highly degraded classified forests (Category III) into agroforests permits cocoa farming in these areas, provided farmers plant trees as part of a reforestation strategy. However, while farmers are allowed to cultivate in these areas, they are required to vacate the land after 40 and 50 years (Dieng and Karsenty 2023).

While intended to promote reforestation, this policy creates uncertainty for farmers, discouraging any form of investment in agroforestry.

Furthermore, our empirical data indicate that very few farmers are aware of the new Ivorian forest code. Most surveyed farmers reported reluctance to plant trees due to restrictions on tree tenure rights that discouraged farmers from adopting agroforestry and justified the policy reforms. This aligned with (Kouassi et al. 2021a, 2021b, 2023) findings, which indicate that many Ivorian farmers remain unaware of their new Forest Code. This may further delay the adoption of trees on farms. As of the data collection period (2021/2022), most farmers were unaware of these changes. Addressing both institutional and informal barriers is important for disrupting the existing regime and scaling up agroforestry and sustainable cocoa production.

5.3 | Insufficient Inclusion of Smallholders in Actor Networks

We identified only one significant change in actor networks (D3): the inclusion of cocoa communities and smallholders in the GCFRP landscape management boards (known as Hotspot Intervention Areas, or HIA, management boards), with no such change observed in Côte d'Ivoire. The HIA management boards include government agencies (e.g., Forestry Commission (FC), COCOBOD), the private sector (e.g., Touton, Rainforest Alliance), and local communities (van der Haar et al. 2023). HIA management boards build on the preexisting CREMA governance model, established in the early 2000s, to integrate cocoa communities near protected areas and forest reserves into management boards. CREMAs function as a decentralized governance mechanism that shifts aspects of decision-making authority over natural resource management from state agencies to local communities, granting farmers and traditional leaders a formal role in shaping landscape governance and negotiating sustainability program at the district level (Adeyanju et al. 2021; Baruah et al. 2016).

However, the effectiveness of both HIA boards and CREMAs has been mixed. In practice, they remain heavily dependent on external actors, particularly NGOs, donors, and cocoa companies for technical, financial, and organizational support. This dependence not only constrains their ability to act independently in the interests of farmers but also raises concerns about their long-term sustainability (Adeyanju et al. 2021; Dugasseh et al. 2024). When external funding or facilitation is withdrawn, these institutions often struggle to maintain activities, undermining their capacity to deliver any transformation in the landscape. In contrast, the governance structure in Côte d'Ivoire remains unchanged, with three key actors: MINEF, the Forest Development Company (SODEFOR), and the Cocoa and Coffee Council (CCC). These results align with Nasser et al. (2020), who found insufficient co-development with smallholders in cocoa sustainability policies.

The lack of inclusion of smallholders in policy networks more generally may be explained by competing interests in some adaptation initiatives (Sovacool et al. 2015). Previous studies

on climate adaptation programs have shown that cocoa agroforestry policy instruments often contend with vested political interests and corporate influences (Dieng and Karsenty 2023; Kumeh 2024; Maguire-Rajpaul et al. 2022; Nasser et al. 2020; van der Haar et al. 2023). In their study of the 2019 forest reforms in Côte d'Ivoire, Dieng and Karsenty (2023) found that the government sought to regain control over contested classified forests—which were more than 75% degraded—by granting agroforest concessions to private companies. While this strategy was intended to promote reforestation, it also established a new administrative structure that enhances the power of private companies. This approach aligns with what Sovacool et al. (2015) define as enclosure—a process that transfers public assets into private ownership. In this case, smallholder farmers are excluded from decision-making, serving as a containment strategy that limits their influence while enabling the government and private companies to advance their agenda. The exclusion of farmers from the design of climate adaptation policy has been widely lamented in the literature and by critics in adaptation policy arenas (Boillat et al. 2022; Huq et al. 2004; Perry 2021; Schipper and Mukherji 2024; Thomas 2024; Wright et al. 2014). In Ghana, Nasser et al. (2020) found that smallholder farmers were generally not directly involved in the official negotiation or creation of cocoa agroforestry policies. The lack of participation of farmers in agroforestry policy design and its implementation risks undermining the adoption and scale-up of climate adaptation initiatives (Do et al. 2020; Nasser et al. 2020).

5.4 | Limitations and Future Research

Our understanding of the factors influencing the scaling up of agroforestry in the West African cocoa sector has been improved by taking a multi-scalar approach using the MLP framework. This complements past microscale and national institutional analyses (Kouassi et al. 2021a, 2021b, 2023; Meijer et al. 2015; Thompson et al. 2022). However, while inclusive, our stratified sampling approach might not have captured the perspectives of all relevant stakeholders, particularly marginalized groups within the land tenure system (Dumas et al. 2025), such as women and migrant farmers, because of accessibility and time constraints. Those marginalized groups play a critical role, particularly in understanding how localized and sociocultural factors influence the adoption and transition to agroforestry. Incorporating perspectives from marginalized communities, including migrant farmers and women, through targeted interviews could offer a more inclusive understanding of how different actors perceive and respond to policy interventions. Here, sociocultural factors refer to the customary land tenure rights and security of women and migrants. Future research could explore the effects of these marginalized farmer groups and their land tenure rights on scaling up agroforestry adoption, which could inform the design of future agroforestry policy instruments. Another key limitation of this study is that while it identifies and characterizes the range of instruments that drive agroforestry adoption, it does not directly assess their effectiveness. Future research should conduct a more detailed analysis of the instruments, their evolution over time, and their impacts on smallholder farmers' decision-making and on-farm shade tree cover.

6 | Conclusion

This study fills a critical gap in the transformative change literature by analyzing the potential of sustainability initiatives to accelerate the scaling up of agroforestry adoption in the West African cocoa sector. Applying the MLP framework enabled an assessment of how current sustainability initiatives support the transition from unsustainable to sustainable cocoa land use through the adoption of agroforestry.

The findings reveal that existing interventions primarily rely on incremental approaches rather than disruptive ones, such as the distribution of seedlings, agroforestry training, and demonstration plots. While these measures stimulate agroforestry adoption, they fall short of accelerating it. This is particularly concerning in the context of climate change, as cocoa-growing regions may face climatic unsuitability by the 2050s, leaving only 25 years to drive large-scale transformation. Some disruptive changes were identified, such as the land and tree tenure reforms in Côte d'Ivoire and the inclusion of smallholder farmers in the decision-making of sustainability policies in Ghana. However, tenure reforms and community inclusion in decision-making (e.g., CREMA) remain too limited in scope to catalyze large-scale agroforestry adoption.

The findings of this study have significant implications for policymakers seeking to achieve transformative adaptation through scaling up agroforestry adoption. We advocate for more disruptive interventions, particularly through reshaping actor networks by fostering inclusive collaborations with smallholder farmers. Strengthening farmer engagement in policy design and implementation could create more substantial incentives for adoption, contributing to the structural changes required for transformative change in the cocoa sector.

Acknowledgments

This work was supported by the SUSTAIN-COCOA project, funded through the 2019-2020 BiodivERSA jointcall for research proposals under the BiodivClim ERA-Net COFUND programme, and with the funding from the Swiss National Science Foundation under Grant #108BD13_193959. We thank Sustain-Cocoa's teams, especially Prof. Johan Six, for their guidance and feedback. PK was further supported by the Cambridge Trust. J.L.-W., T.A., F.C., and R.G. acknowledge funding by the European Union (ERC, FORESTPOLICY, #949932). WT acknowledges funding by the UKRI Natural Environment Research Council [HARP, NE/V018590/1]. Views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the Swiss National Science Foundation or UKRI, nor the European Union, nor the European Research Council Executive Agency. Neither the European Union nor the granting authorities can be held responsible for them. This work contributes to the Global Land Programme glp.earth.

Endnotes

¹ Unique identifier for the interviewed participants (see Table 2).

² REDD+ stands for "Reducing Emissions from Deforestation and Forest Degradation." It is a framework under the United Nations Framework Convention on Climate Change (UNFCCC) that encourages developing countries to reduce emissions and enhance greenhouse gas removals through various forest management options and provides technical and financial support for these efforts.

³ GCFRP stands for "Ghana Cocoa Forest REDD+ Programme." This programme aims to reduce carbon emissions from cocoa expansion into forests by promoting climate-smart cocoa agroforestry production and addressing other deforestation and forest degradation drivers. It will also enhance livelihoods and secure the future of Ghana's forests.

⁴ CRMC stands for Community Resource Management Committee, representing all interest groups in the community of interests; for the CGRFP Hotspots Intervention Areas (HIAs), for example, traditional authorities, youth, and women representatives. The FC Wildlife Division established the CREMA and CRMC in the early 2000s for community wildlife management and habitat protection in areas near protected areas and forest reserves.

References

- Addoah, T., J. Lyons-White, F. Cammelli, et al. 2025. "Is the Implementation of Cocoa Companies' Forest Policies on Track to Effectively and Equitably Address Deforestation in West Africa?" *Sustainable Development* 33, no. 4: 5197–5213. <https://doi.org/10.1002/sd.3380>.
- Adeyanju, S., A. O'Connor, T. Addoah, et al. 2021. "Learning From Community-Based Natural Resource Management (CBNRM) in Ghana and Zambia: Lessons for Integrated Landscape Approaches." *International Forestry Review* 23, no. 3: 273–297. <https://doi.org/10.1505/146554821833992776>.
- Antwi-Agyei, P., A. J. Dougill, T. P. Agyekum, and L. C. Stringer. 2018. "Alignment Between Nationally Determined Contributions and the Sustainable Development Goals for West Africa." *Climate Policy* 18, no. 10: 1296–1312. <https://doi.org/10.1080/14693062.2018.1431199>.
- Arora, N. K. 2019. "Impact of Climate Change on Agriculture Production and Its Sustainable Solutions." *Environmental Sustainability* 2, no. 2: 95–96. <https://doi.org/10.1007/s42398-019-00078-w>.
- Asare, R., V. Afari-Sefa, Y. Osei-Owusu, and O. Pabi. 2014. "Cocoa Agroforestry for Increasing Forest Connectivity in a Fragmented Landscape in Ghana." *Agroforestry Systems* 88, no. 6: 1143–1156. <https://doi.org/10.1007/s10457-014-9688-3>.
- Baruah, M., S. Bobtoya, P. Mbile, and G. Walters. 2016. "Governance of Restoration and Institutions: Working With Ghana's Community Resource Management Areas." *World Development Perspectives* 3: 38–41. <https://doi.org/10.1016/j.wdp.2016.11.008>.
- Becker, A., J. D. Wegner, E. Dawoe, et al. 2025. "The Unrealized Potential of Agroforestry for an Emissions-Intensive Agricultural Commodity." *Nature Sustainability* 8: 994–1003. <https://doi.org/10.1038/s41893-025-01608-7>.
- Bergek, A., S. Jacobsson, B. Carlsson, S. Lindmark, and A. Rickne. 2008. "Analyzing the Functional Dynamics of Technological Innovation Systems: A Scheme of Analysis." *Research Policy* 37, no. 3: 407–429. <https://doi.org/10.1016/j.respol.2007.12.003>.
- Bermudez, S., V. Voora, C. Larrea, and E. Luna. 2022. "Global Market Report: Cocoa prices and sustainability." (Sustainable Commodities Marketplace Series, p. 42). IISD.org/ssi.
- Bernard, H. R. 2011. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. 5th ed. AltaMira Press.
- Biely, K., and S. Chakori. 2025. "Sustainability Transition Theories: Perpetuating or Breaking With the Status Quo." *Sustainable Development* 33, no. 1: 52–68. <https://doi.org/10.1002/sd.3101>.
- Boillat, S., R. Belmin, and P. Bottazzi. 2022. "The Agroecological Transition in Senegal: Transnational Links and Uneven Empowerment." *Agriculture and Human Values* 39, no. 1: 281–300. <https://doi.org/10.1007/s10460-021-10247-5>.
- Bower, J. L., and C. M. Christensen. 1995. "Disruptive Technologies: Catching the Wave." *Harvard Business Review* 73, no. 1: 43–53.

- Braun, V., and V. Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3, no. 2: 77–101. <https://doi.org/10.1191/1478088706qp0630a>.
- Brunori, G., D. Barjolle, A. Dockes, et al. 2013. "Reform and Innovation: The Role of Learning and Innovation Networks." *EuroChoices* 12, no. 2: 27–33. <https://doi.org/10.1111/1746-692X.12025>.
- Bymolt, R., A. Laven, and M. Tyszler. 2018. *Demystifying the Cocoa Sector in Ghana and Côte D'ivoire*, 145–175. Royal Tropical Institute (KIT).
- Cammelli, F., T. Addoah, N. A. Furrer, et al. 2025. "Scaling out Agroforestry and Forest Conservation in West Africa Requires More Transformative Policy Interventions in Cocoa Supply Chains." *Environmental Research: Food Systems* 2, no. 3: 033001. <https://doi.org/10.1088/2976-601X/adf117>.
- Cammelli, F., S. A. Levy, J. Grabs, J. F. Valentim, and R. D. Garrett. 2022. "Effectiveness-Equity Tradeoffs in Enforcing Exclusionary Supply Chain Policies: Lessons From the Amazonian Cattle Sector." *Journal of Cleaner Production* 332: 130031. <https://doi.org/10.1016/j.jclepro.2021.130031>.
- Carodenuto, S. 2019. "Governance of Zero Deforestation Cocoa in West Africa: New Forms of Public–Private Interaction." *Environmental Policy and Governance* 29, no. 1: 55–66. <https://doi.org/10.1002/eet.1841>.
- Carodenuto, S., and M. Buluran. 2021. "The Effect of Supply Chain Position on Zero-Deforestation Commitments: Evidence From the Cocoa Industry." *Journal of Environmental Policy & Planning* 23, no. 6: 716–731. <https://doi.org/10.1080/1523908X.2021.1910020>.
- Carodenuto, S., C. Cutler, S. Dieng, M. A. Adams, and W. Thompson. 2025. "Formalization Through Contracts: Implications for Power in Smallholder Cocoa Supply Chains." *Geoforum* 164: 104323. <https://doi.org/10.1016/j.geoforum.2025.104323>.
- Christopoulos, D., and K. Ingold. 2015. "Exceptional or Just Well Connected? Political Entrepreneurs and Brokers in Policy Making." *European Political Science Review* 7, no. 3: 475–498. <https://doi.org/10.1017/S1755773914000277>.
- Clough, Y., J. Barkmann, J. Jührbandt, et al. 2011. "Combining High Biodiversity With High Yields in Tropical Agroforests." *Proceedings of the National Academy of Sciences of the United States of America* 108, no. 20: 8311–8316. <https://doi.org/10.1073/pnas.1016799108>.
- Cocoa & Forests Initiative. 2017a. *Joint Framework for Action Côte d'Ivoire*, 6. Cocoa & Forests Initiative.
- Cocoa & Forests Initiative. 2017b. *Joint Framework for Action Ghana*, 5. Cocoa & Forests Initiative.
- DeFries, R. S., J. Fanzo, P. Mondal, R. Remans, and S. A. Wood. 2017. "Is Voluntary Certification of Tropical Agricultural Commodities Achieving Sustainability Goals for Small-Scale Producers? A Review of the Evidence." *Environmental Research Letters* 12, no. 3: 033001. <https://doi.org/10.1088/1748-9326/aa625e>.
- DeFries, R., and H. Nagendra. 2017. "Ecosystem Management as a Wicked Problem." *Science* 356, no. 6335: 265–270. <https://doi.org/10.1126/science.aal1950>.
- Dieng, N. S., and A. Karsenty. 2023. "Power Through Trees. State Territorialization by Means of Privatization and 'Agrobizforestry' in Côte D'ivoire." *World Development Sustainability* 3: 100074. <https://doi.org/10.1016/j.wds.2023.100074>.
- Do, H., E. Luedeling, and C. Whitney. 2020. "Decision Analysis of Agroforestry Options Reveals Adoption Risks for Resource-Poor Farmers." *Agronomy for Sustainable Development* 40, no. 3: 20. <https://doi.org/10.1007/s13593-020-00624-5>.
- Dugasseh, F. A., M. A. Adams, and M. Zandersen. 2024. "Actor Perceptions of the Governance Framework and Non-Carbon Benefits From the Ghana Cocoa Forest REDD+ Program: An Extended Q-Study of the Juabusso-Bia Hotspot Intervention Area." *Environmental Management* 74, no. 1: 73–93. <https://doi.org/10.1007/s00267-024-01978-2>.
- Dumas, Y., J. Ubacht, E. Van Anandel, and L. A. Keledorme. 2025. "Exploring the Transition to Agroforestry for Smallholder Farmers: A Feasibility Study for the Ashanti Region of Ghana." *Frontiers in Sustainable Food Systems* 8: 1493753. <https://doi.org/10.3389/fsufs.2024.1493753>.
- Elsner, F., C. Herzig, and C. Strassner. 2023. "Agri-Food Systems in Sustainability Transition: a Systematic Literature Review on Recent Developments on the Use of the Multi-Level Perspective." *Frontiers in Sustainable Food Systems* 7. <https://doi.org/10.3389/fsufs.2023.1207476>.
- Elzen, B., B. Van Mierlo, and C. Leeuwis. 2012. "Anchoring of Innovations: Assessing Dutch Efforts to Harvest Energy From Glasshouses." *Environmental Innovation and Societal Transitions* 5: 1–18. <https://doi.org/10.1016/j.eist.2012.10.006>.
- FAO. 2019. *The State of the World's Biodiversity for Food and Agriculture*, edited by J. Bélanger and D. Pilling, 572. FAO Commission on Genetic Resources for Food and Agriculture Assessments.
- Forestry Commission (FC). 2016. *Ghana REDD+ Strategy 2016–2035*. Forestry Commission (FC).
- Garrett, R., J. Ferreira, R. Abramovay, et al. 2024. "Transformative changes are needed to support socio-bioeconomies for people and ecosystems in the Amazon." *Nature Ecology & Evolution* 8, no. 10: 1815–1825. <https://doi.org/10.1038/s41559-024-02467-9>.
- Garrett, R., S. A. Levy, F. Gollnow, L. Hodel, and X. Rueda. 2021. "Have Food Supply Chain Policies Improved Forest Conservation and Rural Livelihoods? A Systematic Review." *Environmental Research Letters* 16, no. 3: 033002. <https://doi.org/10.1088/1748-9326/abe0ed>.
- Garrett, R. D., J. Ryschawy, L. W. Bell, et al. 2020. "Drivers of Decoupling and Recoupling of Crop and Livestock Systems at Farm and Territorial Scales." *Ecology and Society* 25, no. 1: art24. <https://doi.org/10.5751/ES-11412-250124>.
- Geels, F. W. 2002. "Technological Transitions as Evolutionary Reconfiguration Processes: A Multi-Level Perspective and a Case-Study." *Research Policy* 31, no. 8–9: 1257–1274. [https://doi.org/10.1016/S0048-7333\(02\)00062-8](https://doi.org/10.1016/S0048-7333(02)00062-8).
- Geels, F. W. 2019. "Socio-Technical Transitions to Sustainability: A Review of Criticisms and Elaborations of the Multi-Level Perspective." *Current Opinion in Environmental Sustainability* 39: 187–201. <https://doi.org/10.1016/j.cosust.2019.06.009>.
- Geels, F. W., and J. Schot. 2007. "Typology of Sociotechnical Transition Pathways." *Research Policy* 36, no. 3: 399–417. <https://doi.org/10.1016/j.respol.2007.01.003>.
- Gockowski, J., and D. Sonwa. 2011. "Cocoa Intensification Scenarios and Their Predicted Impact on CO2 Emissions, Biodiversity Conservation, and Rural Livelihoods in the Guinea Rain Forest of West Africa." *Environmental Management* 48, no. 2: 307–321. <https://doi.org/10.1007/s00267-010-9602-3>.
- Grabs, J., and S. L. Carodenuto. 2021. "Traders as Sustainability Governance Actors in Global Food Supply Chains: A Research Agenda." *Business Strategy and the Environment* 30, no. 2: 1314–1332. <https://doi.org/10.1002/bse.2686>.
- Grabs, J., and R. D. Garrett. 2023. "Goal-Based Private Sustainability Governance and Its Paradoxes in the Indonesian Palm Oil Sector." *Journal of Business Ethics* 188, no. 3: 467–507. <https://doi.org/10.1007/s10551-023-05377-1>.
- Hastings, Z., M. Wong, and T. Ticktin. 2021. "Who Gets to Adopt? Contested Values Constrain Just Transitions to Agroforestry." *Frontiers in Sustainable Food Systems* 5: 727579. <https://doi.org/10.3389/fsufs.2021.727579>.

- Heim, C. 2024. *Drivers and Constraints in Adopting Dynamic Agroforestry Among Cocoa Smallholders in Ghana* [Master Thesis, ETH Zürich; Application/pdf], 101. <https://doi.org/10.3929/ETHZ-B-000691736>.
- Huq, S., H. Reid, M. Konate, A. Rahman, Y. Sokona, and F. Crick. 2004. "Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCs)." *Climate Policy* 4, no. 1: 25–43. <https://doi.org/10.1080/14693062.2004.9685508>.
- Ingram, V., F. Van Rijn, Y. Waarts, and H. Gilhuis. 2018. "The Impacts of Cocoa Sustainability Initiatives in West Africa." *Sustainability* 10, no. 11: 4249. <https://doi.org/10.3390/su10114249>.
- IPBES, S. Díaz, J. Settele, et al. 2019. "Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services (Version Summary for Policy Makers). Zenodo." <https://doi.org/10.5281/ZENODO.3553579>.
- Jezeer, R. E., M. J. Santos, P. A. Verweij, R. G. A. Boot, and Y. Clough. 2019. "Benefits for Multiple Ecosystem Services in Peruvian Coffee Agroforestry Systems Without Reducing Yield." *Ecosystem Services* 40: 101033. <https://doi.org/10.1016/j.ecoser.2019.101033>.
- Kanger, L., B. K. Sovacool, and M. Noorköiv. 2020. "Six Policy Intervention Points for Sustainability Transitions: A Conceptual Framework and a Systematic Literature Review." *Research Policy* 49, no. 7: 104072. <https://doi.org/10.1016/j.respol.2020.104072>.
- Kaweesa, S. H., H. E. Bilali, and W. Loiskandl. 2020. "Analysing the Socio-Technical Transition to Conservation Agriculture in Uganda Through the Lens of the Multi-Level Perspective." *Environment, Development and Sustainability* 23, no. 5: 7606–7626. <https://doi.org/10.1007/s10668-020-00936-2>.
- Kemp, R., J. Schot, and R. Hoogma. 1998. "Regime Shifts to Sustainability Through Processes of Niche Formation: The Approach of Strategic Niche Management." *Technology Analysis & Strategic Management* 10, no. 2: 175–198. <https://doi.org/10.1080/09537329808524310>.
- Kern, F. 2012. "Using the Multi-Level Perspective on Socio-Technical Transitions to Assess Innovation Policy." *Technological Forecasting and Social Change* 79, no. 2: 298–310. <https://doi.org/10.1016/j.techfore.2011.07.004>.
- Kern, F., and M. Howlett. 2009. "Implementing Transition Management as Policy Reforms: A Case Study of the Dutch Energy Sector." *Policy Sciences* 42, no. 4: 391–408. <https://doi.org/10.1007/s11077-009-9099-x>.
- Kivimaa, P., and F. Kern. 2016. "Creative Destruction or Mere Niche Support? Innovation Policy Mixes for Sustainability Transitions." *Research Policy* 45, no. 1: 205–217. <https://doi.org/10.1016/j.respol.2015.09.008>.
- Kouassi, J.-L., A. Gyau, L. Diby, Y. Bene, and C. Kouamé. 2021a. "Assessing Land Use and Land Cover Change and Farmers' Perceptions of Deforestation and Land Degradation in South-West Côte D'ivoire, West Africa." *Land* 10, no. 4: 429. <https://doi.org/10.3390/land10040429>.
- Kouassi, J.-L., A. Kouassi, Y. Bene, D. Konan, E. J. Tondoh, and C. Kouame. 2021b. "Exploring Barriers to Agroforestry Adoption by Cocoa Farmers in South-Western Côte D'ivoire." *Sustainability* 13, no. 23: 13075. <https://doi.org/10.3390/su132313075>.
- Kouassi, J.-L., L. Diby, D. Konan, A. Kouassi, Y. Bene, and C. Kouamé. 2023. "Drivers of Cocoa Agroforestry Adoption by Smallholder Farmers Around the Taï National Park in Southwestern Côte D'ivoire." *Scientific Reports* 13, no. 1: 14309. <https://doi.org/10.1038/s41598-023-41593-5>.
- Kumar, L., N. Chhogyel, T. Gopalakrishnan, et al. 2022. "Climate Change and Future of Agri-Food Production." In *Future Foods*, 49–79. Elsevier. <https://doi.org/10.1016/B978-0-323-91001-9.00009-8>.
- Kumeh, E. M. 2024. "The Political Ecology of Cocoa Agroforestry and Implications for Equitable Land Use in Rural Ghana." *Agroforestry Systems* 98, no. 7: 2463–2481. <https://doi.org/10.1007/s10457-024-01041-3>.
- Läderach, P., A. Martinez-Valle, G. Schroth, and N. Castro. 2013. "Predicting the Future Climatic Suitability for Cocoa Farming of the World's Leading Producer Countries, Ghana and Côte D'ivoire." *Climatic Change* 119, no. 3–4: 841–854. <https://doi.org/10.1007/s10584-013-0774-8>.
- Leach, M., and R. Mearns, eds. 1996. *The Lie of the Land: Challenging Received Wisdom on the African Environment*. International African Institute in association with James Currey; Heinemann.
- Lumivero. 2023. "Nvivo 14." <https://lumivero.com/>.
- Maguire-Rajpaul, V. A., K. Khatun, and M. A. Hirons. 2020. "Agricultural Information's Impact on the Adaptive Capacity of Ghana's Smallholder Cocoa Farmers." *Frontiers in Sustainable Food Systems* 4: 28. <https://doi.org/10.3389/fsufs.2020.00028>.
- Maguire-Rajpaul, V. A., C. Sandbrook, C. McDermott, and M. A. Hirons. 2022. "Climate-Smart Cocoa Governance Risks Entrenching Old Hegemonies in Côte D'ivoire and Ghana: A Multiple Environmentality Analysis." *Geoforum* 130: 78–91. <https://doi.org/10.1016/j.geoforum.2021.09.015>.
- Marsden, T. 2004. "The Quest for Ecological Modernisation: Re-Spacing Rural Development and Agri-Food Studies." *Sociologia Ruralis* 44, no. 2: 129–146. <https://doi.org/10.1111/j.1467-9523.2004.00267.x>.
- Meijer, S. S., D. Catacutan, O. C. Ajayi, G. W. Sileshi, and M. Nieuwenhuis. 2015. "The Role of Knowledge, Attitudes and Perceptions in the Uptake of Agricultural and Agroforestry Innovations Among Smallholder Farmers in Sub-Saharan Africa." *International Journal of Agricultural Sustainability* 13, no. 1: 40–54. <https://doi.org/10.1080/14735903.2014.912493>.
- MINEF. 2019a. *Stratégie nationale de préservation, de réhabilitation et d'extension des forêts*. MINEF.
- MINEF. 2019b. *Le Nouveau Code Forestier Ivoirien, Loi N°2019-675 du 23 Juillet 2019*.
- MINESUDD. 2017. *La stratégie nationale REDD+ Côte d'Ivoire*. MINESUDD.
- MLNR. 2012. *Ghana Forest and Wildlife Policy*. MLNR.
- Morse, J. M. 2015. "Data Were Saturated." *Qualitative Health Research* 25, no. 5: 587–588. <https://doi.org/10.1177/1049732315576699>.
- Nasser, F., V. A. Maguire-Rajpaul, W. K. Dumenu, and G. Y. Wong. 2020. "Climate-Smart Cocoa in Ghana: How Ecological Modernisation Discourse Risks Side-Lining Cocoa Smallholders." *Frontiers in Sustainable Food Systems* 4: 73. <https://doi.org/10.3389/fsufs.2020.00073>.
- Olwig, M. F., A. Skovmand Bosselmann, and K. Owusu. 2024. *Agroforestry as Climate Change Adaptation: The Case of Cocoa Farming in Ghana*. Springer International Publishing. <https://doi.org/10.1007/978-3-031-45635-0>.
- Otto, I. M., J. F. Donges, R. Cremades, et al. 2020. "Social Tipping Dynamics for Stabilizing Earth's Climate by 2050." *Proceedings of the National Academy of Sciences of the United States of America* 117, no. 5: 2354–2365. <https://doi.org/10.1073/pnas.1900577117>.
- Oya, C., F. Schaefer, and D. Skolidou. 2018. "The Effectiveness of Agricultural Certification in Developing Countries: A Systematic Review." *World Development* 112: 282–312. <https://doi.org/10.1016/j.worlddev.2018.08.001>.
- Pachauri, R. K., L. Mayer, and Intergovernmental Panel on Climate Change. 2015. *Climate Change 2014: Synthesis Report*. Intergovernmental Panel on Climate Change.
- Pascual, U., P. D. McElwee, S. E. Diamond, et al. 2022. "Governing for Transformative Change Across the Biodiversity–Climate–Society

- Nexus.” *Bioscience* 72, no. 7: 684–704. <https://doi.org/10.1093/biosci/biac031>.
- Pendrill, F., U. M. Persson, J. Godar, et al. 2019. “Agricultural and Forestry Trade Drives Large Share of Tropical Deforestation Emissions.” *Global Environmental Change* 56: 1–10. <https://doi.org/10.1016/j.gloenvcha.2019.03.002>.
- Perry, K. K. 2021. “The New ‘Bond-Age’, Climate Crisis and the Case for Climate Reparations: Unpicking Old/New Colonialities of Finance for Development Within the SDGs.” *Geoforum* 126: 361–371. <https://doi.org/10.1016/j.geoforum.2021.09.003>.
- Rainforest Alliance. 2020. *Rainforest Alliance Sustainable Agriculture Standard: Farm Requirements*. Rainforest Alliance.
- Rainforest Alliance. 2023. *What Is Mass Balance Sourcing?* Rainforest Alliance.
- Renier, C., T. Adoah, V. Guye, et al. 2025. “Direct and Indirect Deforestation for Cocoa in the Tropical Moist Forests of Ghana.” *Environmental Research: Food Systems* 2, no. 2: 025006. <https://doi.org/10.1088/2976-601X/add01b>.
- Renier, C., M. Vandromme, P. Meyfroidt, V. Ribeiro, N. Kalischek, and E. K. H. J. Zu Ermgassen. 2023. “Transparency, Traceability and Deforestation in the Ivorian Cocoa Supply Chain.” *Environmental Research Letters* 18, no. 2: 024030. <https://doi.org/10.1088/1748-9326/acad8e>.
- Ruf, F., and H. Zadi. 1998. “Cocoa: From deforestation to reforestation. First international workshop on Sustainable Cocoa Growing.” (Nos. 1998-03-29/1998-04-03). Smithsonian Institute.
- Saunders, B., J. Sim, T. Kingstone, et al. 2018. “Saturation in Qualitative Research: Exploring Its Conceptualization and Operationalization.” *Quality & Quantity* 52, no. 4: 1893–1907. <https://doi.org/10.1007/s11135-017-0574-8>.
- Schipper, E. L. F., and A. Mukherji. 2024. “Misguided Negative Adaptation Narratives Are Hurting the Poor.” *Science* 386, no. 6722: 624–626. <https://doi.org/10.1126/science.adq7821>.
- Schot, J., and F. W. Geels. 2008. “Strategic Niche Management and Sustainable Innovation Journeys: Theory, Findings, Research Agenda, and Policy.” *Technology Analysis & Strategic Management* 20, no. 5: 537–554. <https://doi.org/10.1080/09537320802292651>.
- Schroth, G., P. Läderach, A. I. Martinez-Valle, C. Bunn, and L. Jassogne. 2016. “Vulnerability to Climate Change of Cocoa in West Africa: Patterns, Opportunities and Limits to Adaptation.” *Science of the Total Environment* 556: 231–241. <https://doi.org/10.1016/j.scitotenv.2016.03.024>.
- Schulte, I., D. M. Landholm, H. Bakhtary, et al. 2020. *Supporting Smallholder Farmers for a Sustainable Cocoa Sector: Exploring the Motivations and Role of Farmers in the Effective Implementation of Supply Chain Sustainability in Ghana and Côte d’Ivoire*, 59. Meridian Institute.
- Smith, A., and R. Raven. 2012. “What Is Protective Space? Reconsidering Niches in Transitions to Sustainability.” *Research Policy* 41, no. 6: 1025–1036. <https://doi.org/10.1016/j.respol.2011.12.012>.
- Soete, L. L. G., and B. J. Ter Weel. 1999. “Innovation, Knowledge Creation and Technology Policy: The Case of The Netherlands.” *De Economist* 147, no. 3: 293–310. <https://doi.org/10.1023/A:1003797027548>.
- Sovacool, B. K., B.-O. Linnér, and M. E. Goodsite. 2015. “The Political Economy of Climate Adaptation.” *Nature Climate Change* 5, no. 7: 616–618. <https://doi.org/10.1038/nclimate2665>.
- Sztompka, P. 2000. “Cultural Trauma: The Other Face of Social Change.” *European Journal of Social Theory* 3, no. 4: 449–466. <https://doi.org/10.1177/136843100003004004>.
- Thomas, K. A. 2024. “Accumulation by Adaptation.” *Geography Compass* 18, no. 1: e12731. <https://doi.org/10.1111/gec3.12731>.
- Thompson, W. J., W. J. Blaser-Hart, J. Joerin, et al. 2022. “Can Sustainability Certification Enhance the Climate Resilience of Smallholder Farmers? The Case of Ghanaian Cocoa.” *Journal of Land Use Science* 17, no. 1: 407–428. <https://doi.org/10.1080/1747423X.2022.2097455>.
- Thorlakson, T. 2018. “A Move Beyond Sustainability Certification: The Evolution of the Chocolate Industry’s Sustainable Sourcing Practices.” *Business Strategy and the Environment* 27, no. 8: 1653–1665. <https://doi.org/10.1002/bse.2230>.
- Turnheim, B., and F. W. Geels. 2012. “Regime Destabilisation as the Flipside of Energy Transitions: Lessons From the History of the British Coal Industry (1913–1997).” *Energy Policy* 50: 35–49. <https://doi.org/10.1016/j.enpol.2012.04.060>.
- Turnheim, B., and F. W. Geels. 2013. “The Destabilisation of Existing Regimes: Confronting a Multi-Dimensional Framework With a Case Study of the British Coal Industry (1913–1967).” *Research Policy* 42, no. 10: 1749–1767. <https://doi.org/10.1016/j.respol.2013.04.009>.
- van der Haar, S., E. J. Gallagher, G. C. Schoneveld, M. A. Slingerland, and C. Leeuwis. 2023. “Climate-Smart Cocoa in Forest Landscapes: Lessons From Institutional Innovations in Ghana.” *Land Use Policy* 132: 106819. <https://doi.org/10.1016/j.landusepol.2023.106819>.
- Van Vliet, J. A., M. A. Slingerland, Y. R. Waarts, and K. E. Giller. 2021. “A Living Income for Cocoa Producers in Côte D’Ivoire and Ghana?” *Frontiers in Sustainable Food Systems* 5: 732831. <https://doi.org/10.3389/fsufs.2021.732831>.
- Wright, H., S. Vermeulen, G. Laganda, M. Olupot, E. Ampaire, and M. L. Jat. 2014. “Farmers, Food and Climate Change: Ensuring Community-Based Adaptation Is Mainstreamed Into Agricultural Programmes.” *Climate and Development* 6, no. 4: 318–328. <https://doi.org/10.1080/17565529.2014.965654>.
- Zabala, A., U. Pascual, L. E. García-Barrios, and N. Mukherjee. 2025. “Drivers to Adopt Agroforestry and Sustainable Land-Use Innovations: A Review and Framework for Policy.” *Land Use Policy* 151: 107468. <https://doi.org/10.1016/j.landusepol.2025.107468>.
- Zu Ermgassen, E. K. H. J., M. G. Bastos Lima, H. Bellfield, et al. 2022. “Addressing Indirect Sourcing in Zero Deforestation Commodity Supply Chains.” *Science Advances* 8, no. 17: eabn3132. <https://doi.org/10.1126/sciadv.abn3132>.

Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** sd70266-sup-0001-DataS1.xlsx. **Data S2:** sd70266-sup-0002-Supinfo1.docx. **Data S3:** sd70266-sup-0003-Supinfo2.docx. **Data S4:** sd70266-sup-0004-Supinfo3.docx. **Data S5:** sd70266-sup-0005-Supinfo4.docx. **Data S6:** sd70266-sup-0006-Supinfo5.pptx. **Data S7:** sd70266-sup-0007-Supinfo6.pdf.