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DELIVERING ZERO DEFORESTATION

HOW GOVERNANCE INTERVENTIONS IN AGRO-FOOD COMMODITY
SUPPLY CHAINS CAN FOSTER SUSTAINABLE LAND USE

DOCTORAL DISSERTATION PRESENTED BY

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In many ways, research for a doctoral dissertation have all the elements of a true “coming of age”-story. Excitement at new discoveries, frustrations as hypotheses fail or data go missing, and exertion of physical, intellectual, and emotional strain as one challenge occur after the other. At the end of such a story – which hopefully has a happy ending – the protagonist (read: the doctoral candidate) marvels at his or her accomplishments, blissfully forgetting the hard times and cherishing the wins. It is at this point that the narrator points out that our hero would have never gotten so far, had it not been for the people who had helped him or her along the way. And so it is with this thesis. While the work is undoubtedly my own (the excellent insights as well as the horrible oversights and the inevitable typos), it is clear that it is – as all science is – the product of collaboration and support from a larger network of people. It is these people to whom I would like to extend my sincerest thanks.

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Simon Bager

Copenhagen, 15 August 2021

NOTICE

Parts of this thesis (two chapters) are published or under review in peer-reviewed journals, as indicated below:

- **Chapter 3**

Bager, S. L., Persson, U. M., and Reis, T. N. P. d. (2021). Eighty-six EU policy options for reducing imported deforestation. *One Earth*, 4 (2), 289-306, doi: <https://doi.org/10.1016/j.oneear.2021.01.011>.

- **Chapter 4**

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Note to readers

When writing this, I intended for this thesis to form a coherent whole, rather than a set of disparate publications. While each chapter can be read on its own, I make cross-references to other chapters or findings throughout the thesis to illustrate various points and provide links between the different parts. However, because each chapter should be able to stand alone, especially the three empirical chapters (Chapter 3, Chapter 4, and Chapter 5), there are bound to be repetitions, as various results or points are made in several locations. I ask for my reader to bear with me when these repetitions occur in the hope that they will only serve to help strengthen different arguments.

I am grateful to the various committee members and other reviewers, who have read and commented on early drafts of this work. As always, any faults and omissions remain my responsibility. Thank you.

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LIST OF SYMBOLS AND ABBREVIATIONS

CAP	Common Agricultural Policy (of the European Union)
CBD	United Nations Convention on Biological Diversity
CCD	United Nations Convention to Combat Desertification
CEO	Chief Executive Officer
CGF	Consumer Goods Forum
CGM	Consumer Goods Manufacturer
CITES	United Nations Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoC	Chain of custody
CSR	Corporate social responsibility
DG	Directorate-Generale (of the European Commission)
DLT	Distributed Ledger Technology
EC	European Commission
EP	European Parliament
EU	European Union
EUTR	European Union Timber Regulation
FAO	Food and Agriculture Organization of the United Nations
FLEGT	Forest Law Enforcement, Governance and Trade
FPP	Forest Peoples' Programme
FSC	Forest Stewardship Council
FDI	Foreign direct investment
GAP	Good Agricultural Practices
GCP	Global Canopy Programme
GHG	Greenhouse gas
GRI	Global Reporting Initiative
GRSB	Global Roundtable for Sustainable Beef
GVC	global value chain
HCS	High Carbon Stock
HCV	High Conservation Value
HS	Harmonized System (of trade codes)
IA	Impact Assessment
(I)NDC	(Intended) Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
JA	Jurisdictional Approach

KPI	Key Performance Indicator
MNC	Multi-national Corporation
NGO	Non-Governmental Organization
NYDF	New York Declaration on Forests
PEFC	Programme for the Endorsement of Forest Certification
PPP	Public-Private Partnership
RED	Renewable Energy Directive (of the European Union)
REDD+	Reducing emissions from deforestation and forest degradation
RFA	Rainforest Alliance
RSB	Roundtable on Sustainable Biomaterials
RSPO	Roundtable on Sustainable Palm Oil
RTRS	Roundtable on Responsible Soy
SDG	Sustainable Development Goals
SIA	Sustainability Impact Assessment
TFA	Tropical Forest Alliance
TOC	Theory of change
UNFCCC	United Nations Framework Convention on Climate Change
UK	United Kingdom of Great Britain and Northern Ireland
UN	United Nations
US	United States of America
VPA	Voluntary Partnership Agreement
VSS	Voluntary Sustainability Standard
WTO	World Trade Organization
WWF	World Wide Fund for Nature
ZD	Zero Deforestation
ZDC	Zero Deforestation Commitment
ZGD	Zero gross deforestation
ZND	Zero net deforestation

“The dispersion of supply chains makes corporate accountability beyond the boundaries of the firm one of the defining grand challenges of our era.” (Kim & Davis, 2016).

“Why would you invest in a company which is out of synch with the needs of society, that does not take its social compliance in its supply chain seriously, that does not think about the costs of externalities, or of its negative impacts on society?” (Paul Polman, former CEO, Unilever)

CHAPTER 1

INTRODUCTION

The agro-food commodities that we consume – the coffee we have during breakfast, the ham and cheese sandwich we eat for lunch, the steak we cook for dinner – are intricately linked to the loss of the planet's forest areas. We are essentially eating the planet's forests one meal at a time. This is not a new problem; humans have been cutting down forests to make room for agriculture since the Neolithic revolution more than 10,000 years ago, but the problem is growing increasingly acute, as forest areas dwindle and few – if any – natural habitats remain entirely untouched by modern civilization (Ellis, 2011). With more people, economic growth, changing dietary patterns, and growing non-food biomass consumption, demand for agro-food commodities increases, while undisturbed forest areas are fewer and far between. This loss of forests negatively affects biodiversity and contributes to global climate change. Deforestation is challenging to address, as agro-food commodities are produced and traded within complex, global supply chains involving millions of producers, traders, manufacturers, retailers, and consumers. These are further affected by globalization processes, which tie distant places together, causing consumption in one region to affect the agricultural system in another – effectively imbuing the agro-food commodities we consume with environmental and social challenges affecting distant societies and ecosystems.

It is in this context that this thesis takes its point of departure. There is a growing realization among stakeholders within the global agro-food sector that current production and consumption patterns are contributing to unsustainable levels of deforestation and other environmental and social harms. This begs the question: how

can public and private actors intervene in agro-food systems to reduce deforestation and foster sustainable land use?

1. BACKGROUND: AGRO-FOOD SYSTEMS AND LAND-USE CHANGE

The global agro-food system can be understood as “the totality of actors involved in the production, distribution, and consumption of food, the relations between them, and the regulatory apparatus governing these arrangements” (Rogers et al., 2013)¹. The global agro-food system has significant implications for global sustainability. It is a major contributor to anthropogenic climate change (Hong et al., 2021; IPCC, 2019), biodiversity loss (Dasgupta, 2021b; IPBES, 2019) and several other planetary boundaries (Rockström et al., 2009), including water consumption, land degradation, and loss of ecosystem services. It is also the main driver of forest loss (Curtis et al., 2018), which causes enormous negative environmental, climate, economic and social impacts (Foley et al., 2011; Gibson et al., 2011; Rockström et al., 2009). Well-functioning forests provide ecosystem services, such as water circulation, climate regulation, and livelihood provision, which are significantly reduced when forests are converted to agriculture (Seymour and Busch, 2016). Deforestation is the second-largest source of greenhouse gas emissions after fossil fuels (IPCC, 2019) and the primary driver of terrestrial biodiversity loss (IPBES, 2019; Ortiz et al., 2021).

From agricultural production through transport, manufacturing, retail, consumption, and eventual disposal, the global food system is responsible for about a third of total global greenhouse gas (GHG) emissions, with estimates ranging from about 19-37%, depending on scope and definitions, including estimates of land-use change (Crippa

¹ Forestry and non-food biomass commodities, e.g. for bioenergy and materials, are not part of the agro-food system when narrowly defined, as above. However, this thesis still considers the role of forestry and biomass in driving deforestation and the governance approaches used for governing forests, when analysing and discussing agro-food systems and deforestation. Thus, in the context of this thesis, forestry and non-food biomass commodities are considered part of the broader agro-food system.

et al., 2021; IPCC, 2019; Poore and Nemecek, 2018; Rosenzweig et al., 2020; Vermeulen et al., 2012). The recent IPCC Special Report on Land estimates the contribution from agriculture, forestry, and other land use (AFOLU) to 23% (IPCC, 2019). A recent study on global and regional drivers of land-use emissions in the period from 1961–2017 show that land-based emissions alone contribute about 25% of total global GHG emissions (Hong et al., 2021). Crippa et al. (2021) estimate that approximately 18 Gt CO₂-equivalent (CO₂e) emissions annually are attributable to the agro-food system, corresponding to 34% of total global GHG emissions. This figure also includes emissions from energy consumption for transport and retail, and end-of-life emissions from waste handling. Of the total contribution of the global agro-food system, land-based activities collectively contribute almost two-thirds (equal to about 22% of total global GHG emissions). As such, deforestation and other land-use change alone account for about a third of all food system emissions, or about 10-12% of total global GHG emissions (Figure 1-1) (Crippa et al., 2021).

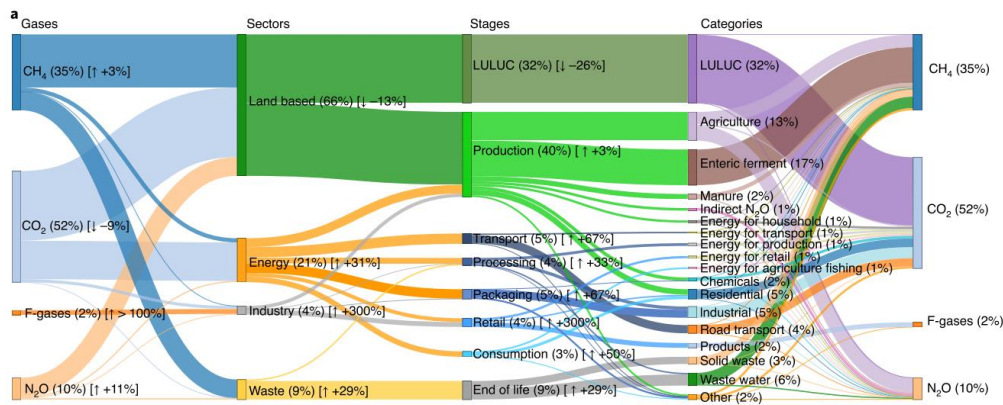


Figure 1-1. Global GHG emissions from the food system in 2015. A third of all food systems emissions arise from deforestation and other land-use changes (labelled “LULUC”), highlighting the importance of reducing deforestation and land-use changes to curb food system emissions. Source: Crippa et al. (2021).

Poore and Nemecek (2018) estimate that the global agro-food system cause emissions of ~13.7 GtCO₂e, corresponding to 26% of total anthropogenic GHG emissions with a further 2.8 GtCO₂e (5% of total global GHG) caused by “non-food agriculture and

other drivers of deforestation”. The recent IPPC report puts the contribution from deforestation slightly higher, at 13% of total global GHG emissions (IPCC, 2019). Although absolute emissions from the agro-food system have grown in the past decades, the relative share of total global GHG emissions contributed by the global agro-food system is decreasing, as emissions in other sectors increase at higher rates (Crippa et al., 2021; IPCC, 2019; Tubiello et al., 2015).

Global agro-food system emissions are expected to increase in the coming decades as production grows to meet future demand for food, feed, and fuel. The global population is growing, getting wealthier, changing consumption patterns, and demanding increasing shares of non-food biomass for clothes, biofuels, and the growing bio-economy, among others; all of which increases demand (Godfray et al., 2010a, 2010b; Kastner et al., 2012; Springmann et al., 2018). Fundamentally, there are three ways to increase supply: grow more food per unit of land (i.e. increase yields), utilize existing production better (i.e. reduce food waste, loss, and inefficiencies), or grow food on more land (i.e. increase the size of agricultural lands).

The so-called “Green Revolution” of the 1960s took aim at the first option, dramatically increasing yields through the use of high-yielding hybrids and increased application of fertilizer and agro-chemicals. Emissions have grown at a slower rate than total global food production, signalling a decrease in emission intensity; a result of a significant decrease in the area of land required per unit of agricultural production (Crippa et al., 2021; Hong et al., 2021). However, despite progress, many areas still produce below capacity and increasing attainable crop yields (i.e. closing the ‘yield gap’) would reduce the cropland area required to maintain present production volumes by as much as 50% (Folberth et al., 2020).

Opportunities to reduce loss and inefficiencies are still greatly underutilized (FAO, 2019; Springmann et al., 2018). About a third of all agricultural production currently gets wasted – in poorer countries primarily in the upstream part of the supply chain as post-harvest losses and during transport, in richer countries, primarily at the retail and consumer stage (FAO, 2019). Equally important, changing food consumption patterns can contribute to reducing agriculture’s environmental and climate footprint by

obtaining more calories for human consumption per unit of GHG emission released. Particularly, eating more plant-based diets and reducing the amount of red meat and dairy products eaten reduces emissions significantly. This is because less land is required to raise animals and grow animal feed (Willett et al., 2019).

Throughout history, the main approach to meeting increased demand for agro-food commodities has been to expand the agricultural production area. Even today, expanding production areas remains a widely used option for increasing agro-food production across many areas of the planet. Since 1960, almost a fifth of the planet's land surface has changed land use at least once, equal to an area the size of Germany annually (Winkler et al., 2021). Land-use changes sometimes occur in dynamic approaches where land gets taken in and out of production, as demand and broader socio-economic, regulatory, and biophysical production conditions change. Most often, agriculture and other man-made areas increase at the expense of natural habitats, especially forests and savannah biomes. As a result, the global agro-food system is now the number one land use across the planet (Foley et al., 2011) with at least a third of the ice-free area on the planet being agricultural lands (Ramankutty et al., 2018). Poore and Nemecek (2018) estimate that the global agricultural system covers 43% of all ice-free land, of which 87% is used for food and 13% for biofuels and non-food crops. Total human demand for land for agriculture, forestry, and infrastructure appropriates approximately three-quarters of all ice-free land (Foley et al., 2011; Ramankutty et al., 2008, 2018).

1.1. AGRO-FOOD COMMODITIES AND DEFORESTATION

As demand for agro-food commodities grows, the pressure to convert natural ecosystems to agricultural production thus increases. Since the turn of the century, land-use changes have resulted in about 200 million hectares of forests across the tropics – just under a tenth of the total forest area – being converted to agricultural production (Hansen et al., 2013b). While this is a staggering amount, even larger areas have been degraded, as pressure increases on remaining forest areas (IPCC, 2019). 55% of new agricultural areas replaced intact forests, while all-together, former forest

areas were the source of more than 80% of all new agricultural areas between 1980-2000 (Gibbs et al., 2010).

Processes of forest loss and change are unevenly spread across the planet with large regional variations (Figure 1-2). In the two decades since 2000, the largest areas of forest have been lost across South America and South East Asia. While forest areas have reduced drastically across the tropics (Curtis et al., 2018; FAO, 2016; IDH, 2020), temperate and boreal regions have seen growing forest areas due to reforestation or afforestation (FAO, 2016; Song et al., 2018).

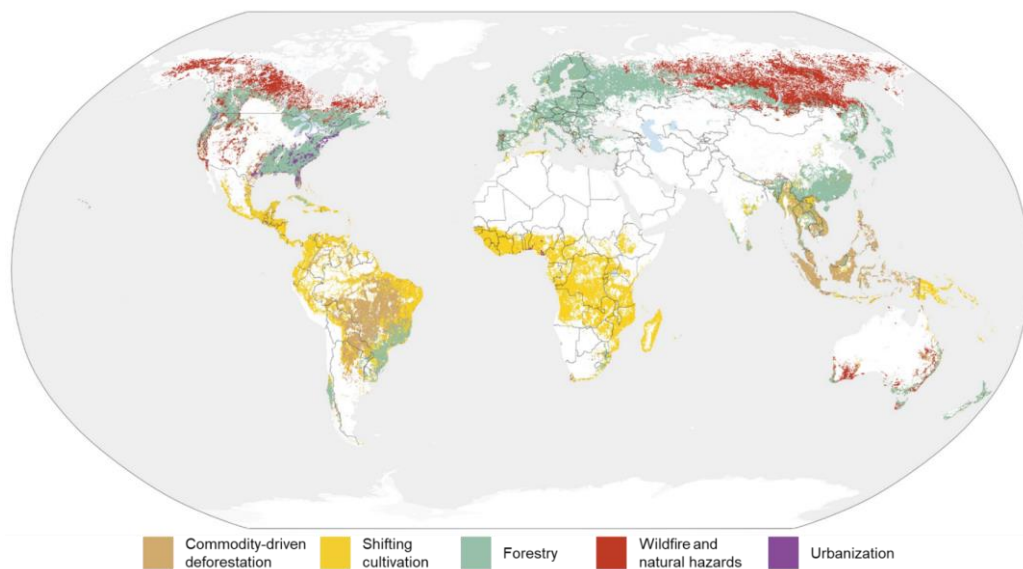


Figure 1-2. Dominant cause of tree cover change or loss. Source: Image by NASA Earth Observatory. Illustration by author.

As has been documented extensively, deforestation has been especially drastic along the ‘arc of deforestation’ in the Amazon rainforest in South America (Alix-Garcia and Gibbs, 2017; Barlow et al., 2020; Carvalho et al., 2019; Matricardi et al., 2020; Nepstad et al., 2014) and on Borneo, Papua, and peninsular South East Asia (Carlson et al., 2018; Davis et al., 2020; Feng et al., 2021; Heilmayr et al., 2020b; Richards and Friess, 2016). Other hotspots of deforestation include the Cerrado and the Gran Chaco in South America (Bastos Lima and Persson, 2020; IDH, 2020; le Polain de Waroux

et al., 2016; De Sy et al., 2015), the Congolese basin, the Guinea forest basin, and the Miombo woodlands in Africa (Brandt et al., 2016; Ordway et al., 2017; Song et al., 2018; Wade et al., 2020) and various local hotspots across the tropics and sub-tropics. Deforestation patterns are dynamic, responding to different local and global drivers, and as some areas become exploited, new frontiers open up in areas previously spared from deforestation (IDH, 2020).

Various economic, social, technological, and cultural factors act on multiple scales to shape forest loss and land-use change globally (Busch and Ferretti-Gallon, 2017; Geist and Lambin, 2002; Meyfroidt, 2016). Approximately 60% of all land-use changes are caused by direct human activities, such as agriculture and forestry, while the remaining 40% are associated with indirect drivers, such as wildfire and climate change (Song et al., 2018). The most important direct driver of forest loss is expansion of agricultural areas to produce agro-food commodities, especially across tropical and sub-tropical regions (Curtis et al., 2018; Pendrill et al., 2019a; Song et al., 2018). Other direct drivers of forest loss and land-use change are forestry, primarily for timber, pulp and other forest-based commodities, infrastructure, and shifting cultivation (Curtis et al., 2018) (see also Figure 1-2 above). The link between deforestation and the agro-food system is well documented (Busch and Ferretti-Gallon, 2017; Curtis et al., 2018; Lambin and Meyfroidt, 2011; Laurance et al., 2014). Cropland, pastures, and tree plantations are responsible for the majority of global forest loss. In a recent estimate, Pendrill et al. (2019b) attribute 62% of global forest loss to these causes. Hosonuma et al. (2012), using a slightly different metric – that of deforestation – found that agriculture, including subsistence agriculture, accounted for 73% of tropical and sub-tropical deforestation in the decade leading up to 2010, while a synthesis report covering the same period put the figure as high as 80% (Kissinger et al., 2012).

Agro-food commodities are not equally linked to deforestation. Most global forest loss is caused by a limited number of so-called “forest-risk commodities” (FRCs) (Rautner et al., 2013), notably palm oil, soy, and beef, but cocoa, coffee, rubber, pulp, paper, timber, and some staple crops, such as maize and rice, also contribute

significantly to deforestation (COWI et al., 2018; Curtis et al., 2018; IDH, 2020; Pendrill et al., 2019a). Locally, specific commodities can be the primary drivers of deforestation, such as avocados in Mexico (Cho et al., 2021; Denvir et al., 2021), even if their contribution at a global level is minuscule.

1.2. GLOBAL AGRO-FOOD SUPPLY CHAINS

Food consumption was historically tied to the production capacity of the immediate surroundings and met by local resources with trade limited to local and regional interactions. With the advent of globalization, the agro-food system became global, increasing the scale, complexity, and reach of agro-food companies and their supply chains. The exact size of the global agro-food system is difficult to judge, but likely amount to about 10% of global gross domestic product (GDP) (Clapp, 2015). The global commodity supply chains through which commodities move from production through processing and manufacturing to retail and final consumption are the lifeblood of the global agro-food system. Figure 1-3 below shows a typical route taken by agro-food commodities as they move from farm or plantation through processing and manufacturing to retail and consumption, involving local, national and international traders along the way.

The global agro-food systems' supply chains are dominated by a limited number of very large actors (Clapp, 2018; Folke et al., 2019), whose activities are large in both scale and scope. Most global agro-food trade passes through the supply chains of the multi-national corporations (MNCs), some of which are among the largest and most well-known companies and brands in the world (e.g., Walmart, Coca-Cola, Nestlé, Unilever), while other players – especially traders and other midstream operators – are enormous companies, but due to the setup and opacity of the global agro-food supply chains, they remain largely unknown to the average consumer (e.g. ADM, Bunge, Cargill, Minerva, JBS).

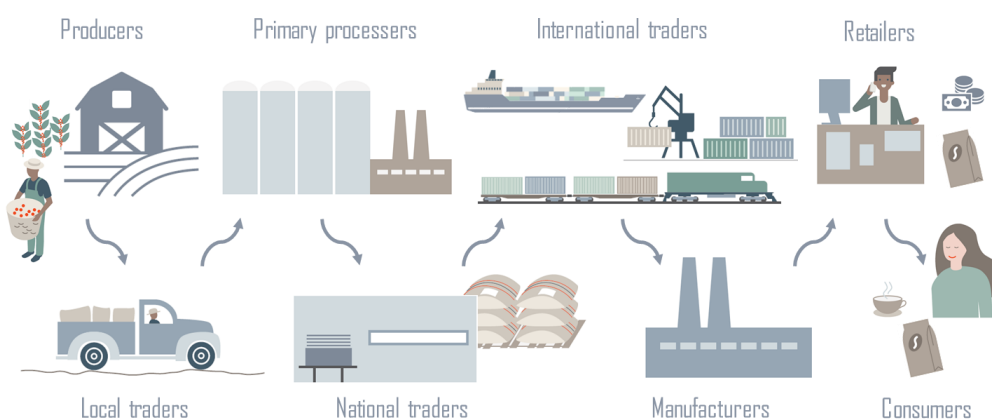


Figure 1-3. Schematic illustration of an agro-food commodity supply chain. Illustration by author.

Through consolidations, mergers, and acquisitions, companies' role has grown rapidly (Clapp, 2018, 2021; Sexton and Xia, 2018), especially since the turn of the century. The economic activities of many of the largest agro-food companies outweigh that of most countries; Walmart, the world's biggest retailer and largest private employer being a case in point (Clapp, 2021). If it were a country, its annual turnover would place it among the 20-25 largest countries, as measured by GDP (Goldstein and Newell, 2019). Collectively, MNCs account for at least two-thirds of world trade in goods and services (Dicken, 2014) and a mere 100 companies account for a quarter of total global trade (Bartley, 2018). This consolidation and globalization of the global agro-food system result from several factors, including the commodification of most agro-food commodities, free capital mobility, reduced trade barriers and preferential trade agreements, and the possibility of managing fragmented global supply chains (Clapp, 2018, 2021; Dicken, 2014).

The relative simplicity of the supply chain shown above (Figure 1-3) gives the impression of an orderly and linear process in which supply chains can be easily mapped and products and their production practices traced and verified by moving up through the chain. In reality, the illustration does not convey the size and complexity of global agro-food supply chains (UNDP, 2019). Unlike high-value supply chains,

such as pharmaceuticals, commodities are generally low-cost and often traded in bulk. Further, they involve a very large upstream basis with hundreds or sometimes thousands of producers involved in each supply chain of final products reaching consumers. Global commodity traders, such as Cargill or Louis Dreyfus Commodities source palm oil, soy, cocoa, and other agro-food commodities from thousands of mills and silos – both integrated within the company and owned by other actors – in the process relying on thousands of farmers and hundreds of intermediaries (processors, traders, logistics, warehouses, shipping, etc.) (zu Ermgassen et al., 2020a). At the same time, actors have become more specialised within each stage and place, operating within only specific segments of a supply chain, and engaging only with the immediate up- or downstream actor (Godar and Gardner, 2019). Downstream actors, such as large consumer goods manufacturing companies (CGMs), e.g., Cargill and Nestlé, and retailers, e.g., Carrefour and Walmart, source from millions of suppliers, who deliver the commodities and inputs for the millions of food products they place on the global market, with some supply chains being highly fragmented, containing ten, twenty or even fifty layers between production and final consumption. Companies might be able to identify first-tier suppliers (though for some retailers and CGMs, even the first layer can number above a hundred thousand), but have great difficulty getting information further up the chain (Trienekens et al., 2012; Villiers, 2019).

In these complex supply chains, production, trade, manufacturing, consumption, and disposal of agro-food commodities link actors, such as producers, traders, logistics providers, manufacturers, retailers, and end-customers spread across numerous countries through flows of agro-food commodities, information, and financial products (Stadtler and Kilger, 2002). Although conceived of as supply chains, in reality, it would be more accurate to talk about supply ‘systems’ (UNDP, 2019), ‘networks’ or ‘webs’, as illustrated in Figure 1-4, due to the numerous actors and (re)configurations and the lack of linear upstream-downstream paths. Adding to the complexity, most agro-food commodities are traded on spot markets and exchanges, meaning supply chains can change on a daily or hourly basis.

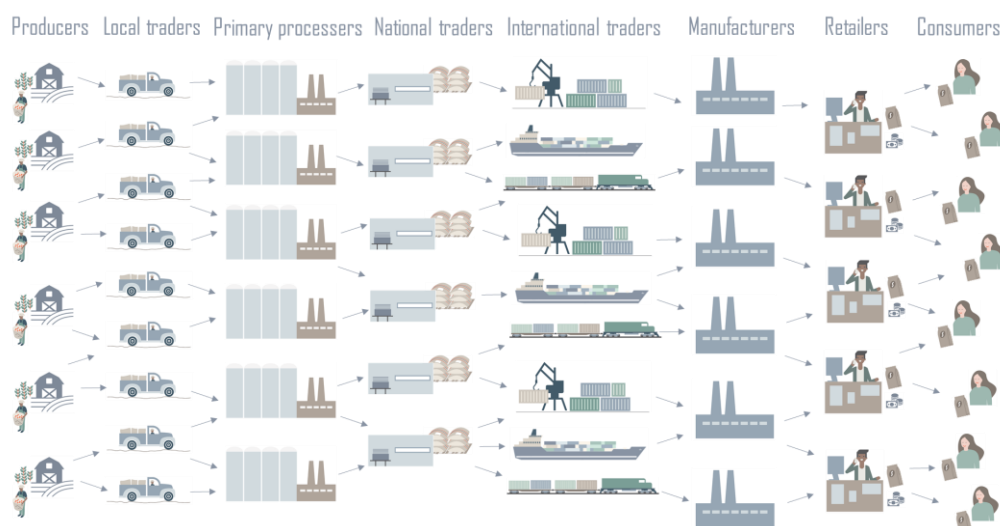


Figure 1-4. Agro-food commodity supply chains exist in complex systems or networks of actors, where each entity can be part of multiple chains and supply configurations can change daily or even hourly.

1.3. ADDRESSING DEFORESTATION AND SUSTAINABILITY RISKS

With agro-food commodities being critical drivers of deforestation, climate change, and other sustainability problems, companies across the global agro-food sector – especially MNCs – are under increasing pressure from governments, consumers, investors, and even other companies to reduce the negative climate and environmental impacts of the sector. Especially the question of deforestation driven by agro-food commodity production has become an increasing concern to companies across the global food sector. To the companies involved in this, deforestation across supply chains and commodities can carry legal, operational, regulatory, and reputational risks, especially to those whose products and brands are well-known by consumers.

As a consequence, hundreds of companies have pledged various sustainability governance initiatives and strategies aiming to, *inter alia*, improve the social and environmental performance of their own – and in some cases also their suppliers’ – activities, enhance transparency, traceability and accountability, or achieve

deforestation-free sourcing across selected commodities (Jopke and Schoneveld, 2018; Lambin et al., 2018). Some commitments have a narrow focus on individual commodities – usually the commodities most strongly linked to deforestation, including beef, palm oil, soy, and timber. Others are broader commitments encompassing several supply chains and commodities or expanding beyond deforestation to also include other sustainability considerations, such as carbon emissions or child labour, among others.

At the same time, consumer governments and other public actors are aware of the sustainability challenges caused by the global agro-food sector and are under pressure from their constituents to act to address these. Several national governments, especially in Europe, have taken unilateral steps to reduce deforestation, pledging to halt imported deforestation generally or for a particular commodity, industry, or geography. France and Germany have made national plans for addressing “imported” deforestation (Bundesministerium für Ernährung und Landwirtschaft, 2016; Ministère de la Transition Écologique et Solidaire, 2018), and the UK, Norway, and Switzerland are at various stages of reviewing regulatory options for addressing deforestation. A group of European countries have formed the Amsterdam Declaration Partnership (2015) committed to “eliminating deforestation.”

The international community has adopted several high-level policy commitments, aspirations and programs aiming to reduce deforestation. In the Bonn Challenge, companies and governments have committed to restoring forests on degraded lands, while both the Paris Agreement and the United Nations Sustainable Development Goals (SDGs) also feature targets on deforestation. The SDGs, which are embraced by public and private actors alike, specifically aim to “halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally” (target 15.2). In the Paris Agreement, article five states the intent of the signatories to “take action to conserve and enhance [...] sinks and reservoirs of greenhouse gases [...] including forests” (UNFCCC, 2015, p. 6). From a deforestation perspective, the most notable of the international commitments, however, is the New York Declaration on Forests (NYDF). NYDF is a voluntary and non-binding international declaration

to take action to halt global deforestation, which among its ten goals intends to “at least halve the rate of loss of natural forests globally by 2020 and strive to end natural forest loss by 2030” (NYDF, 2014, p. 1) and to “support and help meet the private-sector goal of eliminating deforestation from the production of agricultural commodities such as palm oil, soy, paper, and beef products by no later than 2020” (NYDF, 2014, p. 1). As of August 2019, NYDF has been signed by 60 corporations, 41 national governments, 21 subnational governments, 22 Indigenous Peoples organizations, and 65 NGOs (NYDF Assessment Partners, 2019).

2. RESEARCH OBJECTIVES

In this thesis, I analyse how public and private actors can deliver zero deforestation. Or, to put it in more elaborate terms, I analyse how actors can adopt governance interventions in agro-food commodity supply chains to foster sustainable land use – in particular, to reduce agro-food commodity-driven deforestation. I understand governance to be the variety of formal and informal instruments that public and private actors use in different interventions and approaches (Boström et al., 2015) to foster or hinder particular actors’ behaviour and activities. While sustainability governance approaches exist across all sectors (Comas Martí and Seifert, 2013; Dauvergne and Lister, 2012; Klettner et al., 2014; Koberg and Longoni, 2019; Lund-Thomsen, 2019; Renckens, 2020), the agro-food sector has historically been at the forefront of adopting governance initiatives to address sustainability issues (Clapp et al., 2018; Elder and Dauvergne, 2015; Grabs and Carodenuto, 2021; Henson and Humphrey, 2010; Lee et al., 2012; Rimmington et al., 2006; Thorlakson et al., 2018a). Sustainability governance approaches have been especially widely adopted within the coffee and forestry sectors, and to a somewhat smaller extent within cocoa, but have slowly spread to almost all agro-food commodities.

Governance interventions can address deforestation by regulating, incentivizing, or informing about the production, consumption, and trade of agro-food commodities. The conditions for such governance interventions to address agro-food commodity-driven deforestation are often unclear or highly context-specific, as governance of

agro-food commodity supply chains is complicated by the globalized nature of the agro-food sector and the spatial and temporal separation of causes and impacts, often in complex, non-linear systems with unclear feedback mechanisms (Biermann et al., 2016; Foley et al., 2011; Garrett and Rueda, 2019; Lambin and Meyfroidt, 2011).

In this sense, agro-food commodity-driven deforestation shares many characteristics with so-called ‘wicked problems’ (DeFries and Nagendra, 2017; Palmer, 2012; Rittel and Webber, 1973) and other global environmental problems, such as climate change or biodiversity loss (Underdal, 2010). Firstly, it has multiple causes existing across multiple scales, which separate cause-effect relationships and link land-use decisions to land-use changes at multiple levels (local, regional, global) and scales (temporal, jurisdictional, spatial, institutional, sectoral, etc.). This means that addressing the issue requires governing actors and processes across these multiple scales (DeFries and Nagendra, 2017; Geist and Lambin, 2002; Ostrom et al., 2007). However, governance institutions – and thereby their interventions – are frequently limited in their extent, *inter alia*, to a single jurisdiction, country, commodity, sector, or supply chain, complicating cross-scale interaction (DeFries and Nagendra, 2017; Termeer et al., 2015). For example, public governance interventions usually reside within the region or country, where the institution resides, while private governance interventions concern individual companies or supply chains. Further, the problem (deforestation) is embedded in a complex system (the global agro-food system), which include multiple actors, whose interconnections and interrelations are not fully understood or easy to account for. Finally, deforestation involves the loss of “common” or “collective” goods (Gardner et al., 1990), which are linked to a wide range of activities, yet difficult to exclude users from, thus leaving them beyond the scope of unilateral solutions (Underdal, 2010). Figure 1-5 illustrates the various scales, sectors, and supply chain levels, which governance interventions within the agro-food sector seek to affect.

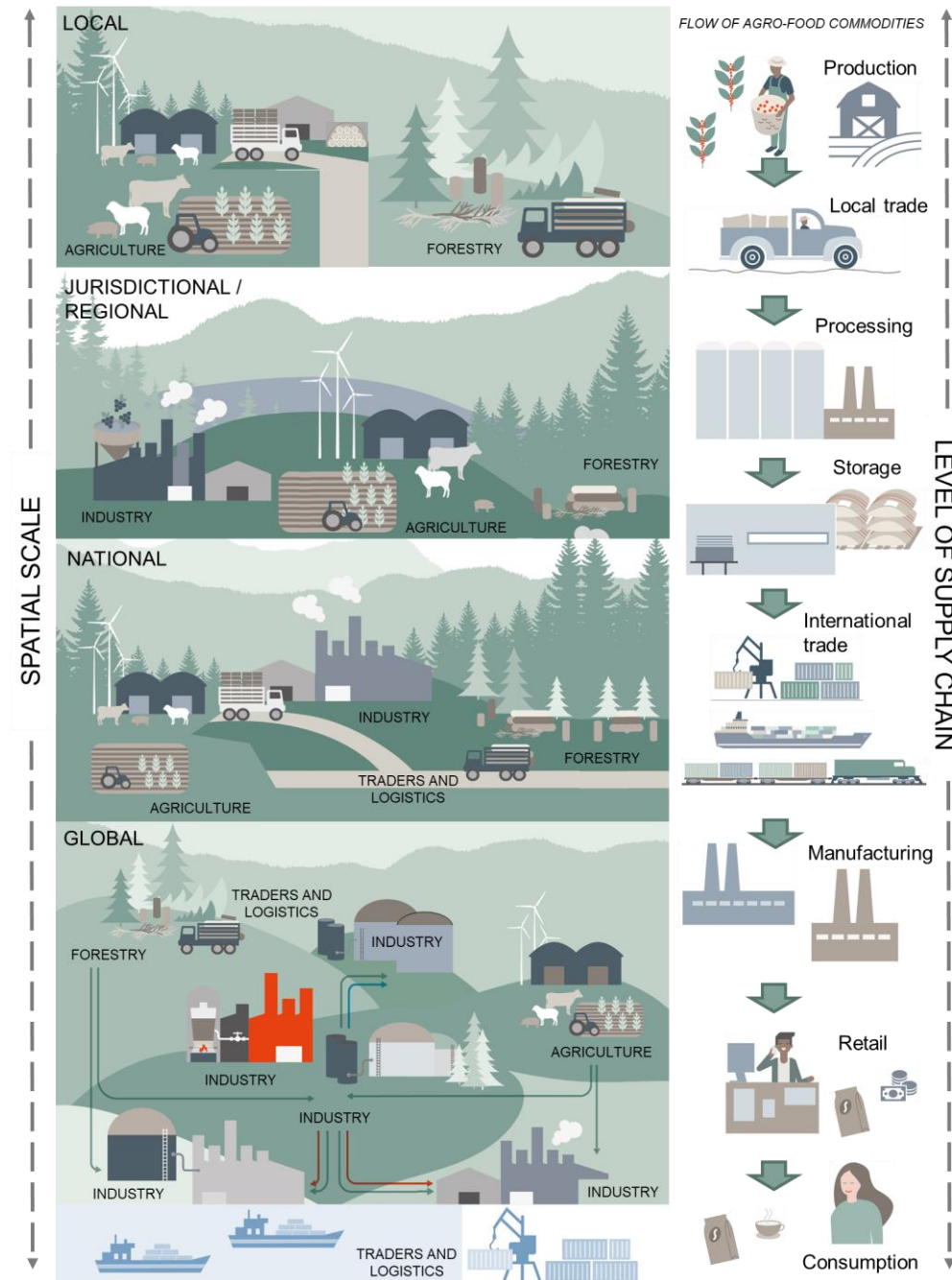


Figure 1-5. Governance approaches at different scales, sectors, and levels.

Governance interventions in the agro-food sector can address various sustainability issues within different sub-sectors (agriculture, forestry, industry), at different levels along agro-food supply chains (production, processing, trade, manufacturing, retail, or consumption), and at different spatial scales within production landscapes (local, jurisdictional/regional, national, or global), while targeting different actors. Illustration by author.

As such, due to the complexity and interconnectedness of the system, as well as “institutional gaps” (Ekstrom and Crona, 2017) – ‘mismatches’ between agro-food system processes and governance institutions – most governance responses do not adequately address the human-environmental interaction, which it seeks to govern. In this case, drivers of agro-food commodity-driven deforestation act at multiple levels and scales (Busch and Ferretti-Gallon, 2017; Curtis et al., 2018; Geist and Lambin, 2002), while most governance mechanisms are designed at a single level, most often the sovereign state or the individual production system. Further, depending on the viewpoint, “different aspects appear to be triggers, root causes, effects, priorities, side effects, or leverages for intervention” (Termeer et al., 2015, p. 684). As such, given their different viewpoints – including their values, political beliefs, norms, and attitudes – actors frequently have different perceptions of the problem, driver, and suitable governance intervention to reduce agro-food commodity-driven deforestation. If the governance approaches do not align with the drivers, it precludes effective solutions for the overarching challenge (Nagendra and Ostrom, 2012). The governance challenge lies in developing governance institutions that align with the dynamics and drivers of agro-food commodity-driven deforestation, while also acknowledging the capabilities of and interactions between the different actors.

2.1. RESEARCH QUESTIONS

Global agro-food supply chains cover and cross multiple jurisdictions, involve hundreds of different actors with vastly different objectives and capabilities, and are governed by an interplay of public, private, and hybrid governance approaches. The combination of a complex governance setting and a confluence of private and public governance approaches to address sustainability challenges makes the agro-food sector a particularly interesting case for furthering our understanding of how

governance interventions can foster sustainability – in this case, delivering zero deforestation. Here, I understand sustainability to mean managing the environmental and social impacts within and across agro-food supply chains in such a way that both current and future needs can be met.

The complex governance landscape characterizing the global agro-food system requires increased knowledge, *inter alia*, about the prevalence of, conditions for, and impact of governance interventions to address the sustainability impacts of the agro-food sector. A key challenge of particular relevance to deforestation and global agro-food commodity production is the relationship between biophysical processes at the landscape level and governance interventions by public and private actors at national and transnational levels and along agro-food supply chains to govern production, consumption and trade of agro-food commodities (Auld, 2013; Challies et al., 2019; Meyfroidt et al., 2018; Thorlakson et al., 2018a; Turner et al., 2007, 2021). Among the problems arising are challenges of how to govern supply chains both within and beyond legislative borders, how to avoid leakage across and within different systems, how to increase actors' compliance and accountability, how to make the private sector contribute effectively and efficiently, how to ensure a regulatory frame, and how to utilize technological developments (Bastos Lima et al., 2019; Bush et al., 2015; Garrett et al., 2021; Lambin and Thorlakson, 2018; Munroe et al., 2019).

With these perspectives and challenges in mind, in this thesis, I aim to extract theoretical, empirical and policy-relevant knowledge and insights on private and public governance approaches and strategies in the global agro-food sector to address sustainability and deforestation. In doing so, I grapple with three overarching questions, concerning, respectively, public governance, private governance, and governance approaches, challenges and solutions.

- (i) On public governance, I ask how public actors can contribute to, support, coerce, incorporate, or otherwise foster governance efforts across the agro-food sector.

- (ii) On private governance, I ask to what extent, how, and why companies in the agro-food sector are governing sustainability, in particular challenges related to delivering zero-deforestation.
- (iii) On governance approaches, challenges, and solutions, I ask what approaches exist for governing agro-food commodity supply chains, what the challenges for implementing these are, and how governance solutions can foster sustainable land use.

These overarching questions are too broad to empirically analyse within the scope of this thesis. Nonetheless, they serve two important purposes. Firstly, they raise important questions, which I discuss throughout the thesis, in particular in the governance review that follows (Chapter 2) and in the final discussion (Chapter 6). Secondly, they guide the development of the specific research questions that I analyse in three empirical chapters (Chapter 3, Chapter 4 and Chapter 5). Within the overall frame of public governance, private governance, and governance approaches, challenges and solutions, respectively, I address the following research questions on agro-food supply chain governance based on three specific cases:

- (i) Concerning public governance, I use the European Union (EU) as a case to explore what options exist for public actors to address deforestation, how feasible specific policies are, and how these are expected to have an impact on deforestation. Specifically, the case addresses two research questions:
 - a. Which policy options exist for consumer countries to reduce commodity-driven tropical deforestation?
 - b. What is the political feasibility and ‘theory of change’ underlying these policy options?
- (ii) Concerning private governance, I use the coffee sector as a case to explore the current state of play for private-sector sustainability governance in a specific agro-food sector, focusing on how, to what

extent, and why companies address sustainability. Specifically, the case analyses two research questions:

- a. How is sustainability addressed by companies in the global coffee sector?
 - b. Which companies adopt which sustainability strategies and why?
- (iii) Using the specific sustainability governance instrument collectively known as “zero-deforestation commitments” (ZDCs), I explore how companies implement sustainability governance approaches across agro-food supply chains and what facilitates or hinders this. The case addresses two specific research questions:
- a. How do the processes and mechanisms, which companies rely on to implement ZDCs, facilitate implementation?
 - b. What conditions enables or hinders companies’ ZDC implementation?

2.2. THEORETICAL APPROACH

In this thesis, I employ a mixed-methods approach, building on research from both social and natural sciences. My research takes a starting point in land system science (Meyfroidt et al., 2018; Rounsevell et al., 2012; Turner et al., 2007, 2021; Verburg et al., 2013), which remain central to the discussion of land use, sustainability and coupled-human environment systems. From this, I draw on the concept of “telecoupling” (Friis and Nielsen, 2019; Liu et al., 2013, 2014) to understand links, feedbacks, and ‘spillovers’ between human-environment systems connected within the agro-food sector (Bastos Lima et al., 2019; Liu et al., 2018; Meyfroidt et al., 2018). I further draw on “systems thinking” (Meadows, 1999), governance of the commons (Ostrom, 1999, 2007), and considerations of ‘wicked problems’ (Andersson, 2021; DeFries and Nagendra, 2017; Palmer, 2012) to classify and analyse complex, interlinked problems, such as agro-food commodity-driven deforestation. To

understand how connected human-environment systems affect different governance approaches for sustainability, I draw on discussions of polycentric governance (Dietz et al., 2003; Morrison et al., 2019; Oberlack et al., 2018; Ostrom, 2010a). I complement this with studies on environmental governance, which have analysed private and public sustainability governance efforts and the interaction and evolution of sustainability governance within and beyond the agro-food sector. Using a critical social science perspective, I view stakeholder interactions across agro-food commodity supply chains in a “global value chains” perspective (Gereffi, 1994; Gereffi et al., 2005; Ponte et al., 2019a) to understand how relationships between actors and the power (im)balances embedded in these shape governance across these supply chains. Finally, I use Stakeholder Theory (Freeman et al., 2020; Mitchell et al., 1997; Smith, 2003) to understand and analyse the role different actors play in shaping sustainability governance and how they influence companies’ adoption of this. Where relevant, I draw on various studies from political science, economics and geography that have dealt with the question of agro-food commodities and sustainability governance.

TELECOUPLING

To capture the spatial and temporal decoupling of land-use changes’ cause and effect, the concept of “teleconnection,” a concept borrowed from atmospheric sciences to describe feedbacks between distant systems, has been applied in land system science. Telecoupling (Friis et al., 2016; Friis and Nielsen, 2017b, 2019; Liu et al., 2013, 2014) takes a starting point in teleconnections, but broadens the concept to not only consider distant impacts but “the feedback between social processes and land outcomes in multiple interacting systems” (Eakin et al., 2014, p. 143). Researchers apply the concept of telecoupling to “come to grips with both environmental and socio-economic linkages between distant and seemingly unconnected land systems around the world” (Friis et al., 2016, p. 4). They do so with the knowledge that land-use change must be understood as the result of a spatial and temporal “decoupling” between the underlying environmental, socio-economic and political causes and the resulting effects of those (Friis, 2019).

Using the Telecoupling framework helps to identify feedbacks between seemingly disparate or disconnected systems to “reveal ‘invisible’ and unexpected impacts” (Liu et al., 2021, p. 3) across and between land systems in the global agro-food system. As such, understanding the places, flows, and actors shaping land use processes – and how they interact spatially and temporally – becomes central to understanding how to best govern land use. According to Friis et al. (2016), at least two somewhat diverging frameworks exist within the Telecoupling theory, viewing it as either a structured approach or a heuristic. In line with, among others, Eakin et al. (2014) and Friis and Nielsen (2017a), this thesis takes the view that the concept is a useful “heuristic”. In this way, telecoupling is seen as a frame for understanding networks, chains, actors, and processes within “coupled” human-environment (land) systems of the global agro-food system. In contrast to the approach by, among others, Liu et al., (2013; 2014), telecoupling is thus not seen as a comprehensive conceptualization or grand theory of human-environment systems (Friis et al., 2016), but as a lens to view land interactions through.

Concerning governance of global agro-food commodity supply chains, the concept of Telecoupling is a useful heuristic, as the concept is inherently flow-based. The flows and relationships between actors and systems at multiple scales are in focus, rather than any predefined area or actor (Challies et al., 2019). Further, telecoupling is relevant as governance of agro-food commodity supply chains in essence are telecoupled challenges – the drivers of and solutions are spatially and temporally disconnected, yet “coupled” by supply chains and actors across the global agro-food system (Challies et al., 2019). As the telecoupling framework emphasises the need to trace and analyse the flows, interactions, and feedbacks between two or more systems, often spatially separated, where economic activities impact the environment, it grapples with exactly the problems that play out along commodity supply chains, which connect producers, manufacturers, consumers, and other actors within the global agro-food system. These dynamics require governance solutions that can span the spatial separations and interlinked flows. While local solutions likely lack clout and resources, making them unable to collaborate sufficiently with distant systems

and actors, global governance approaches, such as United Nations conventions, are too broad and unspecific (Oberlack et al., 2018). Even transboundary governance issues are also different, as these indicate a shared boundary between the two biophysical systems, for example, a shared river basin. However, such shared boundaries do not necessarily exist (in fact, rarely exist) along agro-food supply chains, where production, processing, manufacturing and consumption can take place in several different locations. Thus, governance of agro-food commodity supply chains pose a scalar challenge; scaling existing governance solutions up or down fails to account for the telecoupled nature of the problems posed by these systems (Challies et al., 2019). Instead, there is a need to understand and account for these telecoupled systems and their respective actors when designing governance solutions.

POLYCENTRIC GOVERNANCE

Governance of agro-food commodity supply chains takes place in a polycentric system involving numerous actors and governance approaches (Lemos and Agrawal, 2006; Oberlack et al., 2018). Polycentric governance means that the governance landscape is characterized by multiple governing authorities (public and private), which operate at different jurisdictional scales, rather than in a monocentric system, where one actor governs the entire area (Ostrom, 2010b). In polycentric governance systems, governance is not only the purview of governments, but influenced by several stakeholders, who contribute knowledge and resources (Scherer and Palazzo, 2011). As described by the concept of the “governance triangle” (Abbott and Snidal, 2009), the three most important stakeholder groups in the polycentric agro-food supply chain governance landscape are public actors (states and other government entities), companies and other private sector actors, and nongovernmental (NGO) and other civil society organizations. These three groups all seek to shape and influence governance through various approaches and interventions. At the same time, they operate and govern at different scales, depending on the type of actor and the specific system, but engage and interact through decentralized (self)organization (Morrison et al., 2019; Ostrom, 2010a). Actors can initiate, suggest or instil various governance interventions independently, or with the support of or in collaboration with other

actors in various “hybrid” solutions (Lambin et al., 2014), which through various enforcement mechanisms seek to influence agro-food supply chain outcomes. Governance interactions between different actor groups are conceptualized in various typologies (see e.g. Bartley (2011), Cashore et al. (2021), or Lambin et al. (2014)), which share the feature that they generally conceive of the interactions as positive, neutral, or negative. For example, a governance intervention by a company can undermine (negative) or support (positive) a government intervention, while it can also operate entirely separate from it (neutral).

There are several advantages of polycentric approaches to agro-food commodity supply chain governance (Morrison et al., 2019; Newig et al., 2020; Oberlack et al., 2018). A key feature is that governance arises from many different places, rather than from one controlling actor (Lenschow et al., 2016), which allows for greater innovation and knowledge diffusion (Morrison et al., 2019), which can spur diverse governance approaches and introduce novel and additional instruments, such as zero-deforestation commitments. Polycentric systems also allow for different scales (local, jurisdictional, etc.) and types (area or flow) of governance approaches to co-exist, as they do not favour particular actors or scales (Lenschow et al., 2016). They also allow for a greater degree of flexibility than top-down, hierarchical state-led approaches (Morrison et al., 2019), and can take the different strengths, weaknesses, and complementarity between different governance approaches into account (Andreotti et al., 2020; Lam et al., 2020a; Lambin et al., 2014). Further, they are arguably more robust, involving more actors and parts, such that if one actor or part fails, others can take their place (Morrison et al., 2019; Nagendra and Ostrom, 2012; Ostrom, 2010b). However, as Ostrom (2010b) caution: “Self-organized, polycentric systems are not a panacea!” There are no panaceas for complex problems, such as agro-food commodity-driven deforestation.

The downside of polycentric governance solutions is that they often rest on voluntary efforts with weak (often absent) enforcement mechanisms (Scherer and Palazzo, 2011). They are further prone to free-riders (Boyd et al., 2010; Potoski and Prakash, 2013; Prakash and Potoski, 2007) and can face substantial transaction costs

(Meyfroidt et al., 2014; Newig et al., 2020). There is also evidence of unintended consequences, spillovers and unanticipated effects of polycentric approaches to agro-food system-related land-use governance (Bager, 2016; Bastos Lima et al., 2019; Gawel and Ludwig, 2011; Lewis et al., 2020). Measuring and evaluating the effectiveness of polycentric interventions is difficult due to the interplay between multiple approaches and actors (Morrison et al., 2019; Oberlack et al., 2018). The most severe criticism, however, is that polycentric governance approaches face challenges turning theoretical ideas into practical policies for governing agro-food commodity supply chains. In more blunt terms, they are “all talk” with little to show for it. For example, Morrison et al. (2019, p. 6) argue that “polycentric governance has proven more useful as a diagnostic and a description than a panacea for solving the multiple challenges of global environmental change.”

That being said, polycentric approaches are potentially well-suited for telecoupled problems, such as agro-food commodity-driven deforestation, as these problems extend beyond individual jurisdictions or countries, are influenced by the actions of several different stakeholders (various companies, consumers, governments, etc.) who share various connections, and involve unclear feedback loops between the different socio-ecological systems connected across supply chains (Munroe et al., 2019). In essence, single governance actors (e.g. a country) and solutions cannot be expected to solve telecoupled (Friis, 2019) or collective-action (Ostrom, 2010b) problems like those caused by agro-food commodity supply chains. Fewer and fewer agro-food products are produced and consumed in the same country. Consequently, no single actor – whether governments, companies, NGOs or individuals – can address the sustainability problems caused by supply chain interactions and exchanges between multiple actors in multiple locations. These challenges require governance approaches able to account for and include the various heterogeneous drivers and actors (Biermann et al., 2016) and the collective interactions among these (Munroe et al., 2019). At the same time, no global governance institution exists in the agro-food sector, which can both handle the heterogeneity and complexity of the agro-food system, as well as the different environmental challenges caused by it, e.g. greenhouse

gas emissions, biodiversity loss, deforestation, water pollution, etc. (Newell et al., 2018). As such, with multi-level and multi-scalar systems and the absence of a global institution, governance requires coordination across multiple arenas and actors, which equals a high degree of polycentrism (Oberlack et al., 2018). Beyond being suited to the particular problem at hand, in the context of this thesis, the concept of polycentric governance also offers the advantage of providing a single lens for analysing various diverse, overlapping, and co-existing governance approaches and their interactions and outcomes (Oberlack et al., 2018).

GLOBAL VALUE CHAINS

The growth in global agro-food supply chains has spurred interest from several scientific fields, who study supply chain dynamics from different standpoints, such as logistics and transportation research, marketing, operations research, organizational behaviour, industrial organization, transaction cost economics, resource-based view, and purchasing, among other² (Cousins et al., 2006; Stadtler and Kilger, 2002). Global Value Chain (GVC) theory, in contrast, takes a critical social-science approach to supply chain research, tracing its origins to political economy, World System theory, and industrial sociology (Bair, 2005; Bush et al., 2015; Hopkins and Wallerstein, 1977). GVC theories (Gereffi et al., 2005) developed from the concept of global commodity chains (GCC)³, but diverged from its sociological roots to place more

² Most of these approaches are rooted in business administration, economics, and information technology studies and do not deal with sustainability, but focus on the organization of the global capitalist production system, and how business processes are coordinated, managed and integrated (Bush et al., 2015; Vorst, 2004).

³ The concept of ‘commodity chains’ was described by World System theorists in 1977. It includes the “inputs that culminated in” a consumable item (i.e. a commodity), including “the prior transformations, the raw materials, the transportation mechanisms, the labour input into each of the material processes, [and] the food inputs into the labour” (Hopkins & Wallerstein, 1977: 128). The global commodity chain (GCC) framework (Gereffi, 1994, 1999) developed – but remain distinct from – this theory, focusing on the inter-firm relations between producers, manufacturers, retailers, and other companies in global industries (Bair, 2005). It thus links the spatial distribution of commodity production and consumption across global (commodity) supply chains to the organizational and socio-economic relationships between the actors (companies, NGOs, states, etc.) along these chains (Challies, 2008).

emphasis on international business and the organization of production and consumption in global supply chains, the (unequal) inter-company relations and power dynamics, and the policy and governance implications of this (Bair, 2005). The related concept of Global Production Networks (GPNs) (Coe et al., 2008; Henderson et al., 2002) developed in parallel, arguing for a networked approach and the need to account for the broader institutional and environmental context in which the actors of the chain/network operate (Bair and Palpacuer, 2015). While initially different, GCC, GVC, and GPN frameworks have converged towards each other (Bush et al., 2015) and are widely used to analyse and understand the transboundary organisation of production and consumption along global supply chains with a particular focus on the company as a distinct actor in this (Figure 1-6).

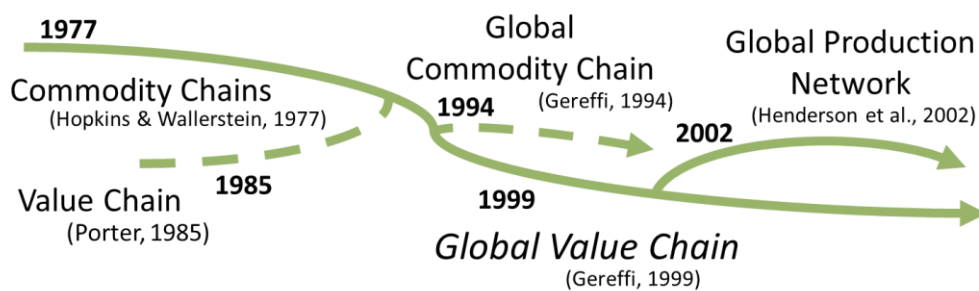


Figure 1-6. The evolution of the studies of “chains”

From the conception of “Commodity Chains” in World System theory (Hopkins and Wallerstein, 1977) and building on the concept of a “value chain” from strategic management literature (Porter, 1985), the critical study of chains has evolved by drawing on insights from political economy, industrial sociology, business studies, and economics, among others. Illustration by author.

GVC-related frameworks do not place sustainability as the central aspect, but several studies in this field have contributed to the understanding of sustainability governance within agro-food commodity supply chains (see e.g, Bush et al., 2015; Coe et al., 2008; Gibbon et al., 2008; Mayer et al., 2017; and Ponte et al., 2019b). The GVC framework highlights how companies affect sustainability efforts and outcomes within supply chains (Bush et al., 2015), focusing on the importance of company

characteristics and the organization of the supply chain (Bair and Palpacuer, 2015; Gereffi and Lee, 2012; Ponte, 2019). In particular, GVC theorizes that governance is shaped by the relationships between dominant companies (so-called “lead firms”) and their suppliers, showing that across and within sectors, governance differs due to the supply chain organization, production process, sophistication, and capacity of the actors involved, and the relationship between companies and their suppliers (Bair, 2005; Gereffi et al., 2005; van der Ven, 2018). According to GVC theory, MNCs and other lead firms, such as supermarkets, large retailers, and CGMs frequently exert (disproportional) influence over other actors in agro-food value chains (Grabs and Ponte, 2019; Lund-Thomsen, 2019; Ponte et al., 2019a; van der Ven, 2018), acting as ‘gatekeepers’ (van der Ven, 2018) that define the governance of a particular chain. This places unjust power in the hands of these large actors, meaning that smaller companies and producers must abide by the rules set by these dominant actors to maintain their status in the supply chain (van der Ven, 2018). From a governance perspective, this enables these actors to design, communicate, and enforce sustainability governance criteria aligned with their operations and enforce these across the value chain (Mayer and Gereffi, 2010; Rueda et al., 2017; Thorlakson et al., 2018a). By contrast, non-lead firms, for example, most agro-food commodity producers, have fewer resources and less leverage, and are thus unable to dictate terms, but will have to abide by the “rules” set by the leading actors (Grabs and Ponte, 2019).

In the context of this thesis, I use GVC analysis to help frame relationships and interdependencies between actors that arise out of globalization dynamics and telecouplings along agro-food supply chains. Throughout the thesis, I use “supply chain” to refer to the chains linking production (supply) and consumption (demand) of commodities, while I use “value chains” to stress the notion of “value added” (and extracted) by actors along these chains and how this affects inter-chain relationships. I do not discuss the typological, theoretical, or practical differences between the two concepts. Rather, I use these to illustrate, respectively, commodity-centric (supply chains) or actor-centric (value chains) perspectives on the interactions between

different nodes connected across global, inter-related agro-food production and consumption systems, particularly to understand how company practices along agro-food supply chains shape sustainability outcomes.

STAKEHOLDER THEORY

In a conventional understanding of companies' social responsibility, often expressed as "shareholder theory," companies' primary duty is to maximize share shareholder value (Smith, 2003). Shareholder theory gained particular prominence in the 1970s and 1980s as part of the neoliberal ideas promoted by free-market theorists such as Milton Friedman, who famously exclaimed that the "social responsibility of business [is] to increase its profits" (Friedman, 1970). In opposition to these ideas, Stakeholder Theory exclaim that companies have responsibility beyond the shareholders to actors and constituencies that contribute, either voluntarily or involuntarily, to companies' "wealth-creating capacity and activities, and who are therefore its potential beneficiaries and/or risk bearers" (Smith, 2003). In other words, companies' social responsibility extends beyond shareholders to stakaholders, such as employees, suppliers, local communities, and the broader civil society. Here, I consider only the normative side of shareholder and stakeholder theory, i.e. what companies' responsibility should be. There are also descriptive versions of the theories, which describe actual business outcomes as a result of companies' adherence to shareholder or stakeholder primacy, just as there are prescriptive theories, which predict how companies will fare if they behave in certain ways (Smith, 2003).

Stakeholders include various actor groups such as shareholders, consumers, civil society organizations, media, competitors, financial analysts, academics, and many more (Figure 1-7). Stakeholders are actors, who have legitimate interests in the company's operations, an urgent claim for immediate attention, and the power to influence the company (Mitchell et al., 1997). To companies, its most important stakeholders are its shareholders, suppliers, and consumers, who are often referred to as primary stakeholders (Hall and Vredenburg, 2005). Taking the stakeholder view, NGOs, media, politicians, activists, employees, and other actors are also important stakeholders. These actors are often referred to as secondary stakeholders, and in

contrast to primary stakeholders, it is sometimes difficult for companies to manage these actors' expectations, as they may not be "willing or able to engage, negotiate, compromise or clearly articulate their positions" (Hall and Vredenburg, 2005).

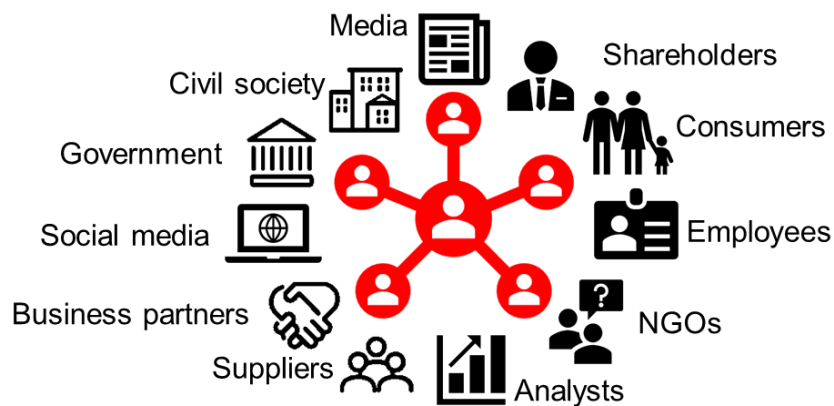


Figure 1-7. Examples of stakeholders, which can shape the sustainability governance response of private-sector companies. Illustration by author.

Stakeholder theorists argue that stakeholder pressure drive companies to act on sustainability problems beyond what is required by regulation to reconcile or manage stakeholder demands, which sometimes conflict with company operations (Darnall et al., 2010; Helmig et al., 2016; den Hond et al., 2015; Mayer and Gereffi, 2010; Shnayder and Van Rijnsoever, 2018). As companies have different characteristics (e.g., operating in different locations and sectors, having different sizes and ownership structures, etc.), they are subject to different stakeholders, and therefore different normative preferences for sustainability (Delmas and Toffel, 2004). Adoption of sustainability initiatives may thus improve company and brand image and reputation in the eyes of sustainability-conscious consumers, shareholders, and other key stakeholders, as there is often a positive relationship between sustainability and reputation (Dauvergne and Lister, 2012; Gomez-Trujillo et al., 2020).

Stakeholders' influence on company sustainability practices vary from company to company and depends on the relative "power" of the particular stakeholder vis-à-vis the company (Mitchell et al., 1997). Not all stakeholders are equally able to coerce

companies into addressing sustainability, though their relative bargaining power vis-à-vis companies will depend on the issue in question. Due to their power, legitimacy, and ability to instil urgency (Mitchell et al., 1997), stakeholders will have a significant influence on some topics, while for other areas, they hold little sway. For example, some NGOs might be important stakeholders in companies' decision to adopt zero-deforestation commitments, but have relatively little influence on their human rights policy, as they might lack legitimacy in this area.

In the context of this thesis, I use Stakeholder Theory to analyse how different actors can shape governance of agro-food supply chains by exerting pressure on companies. NGOs and civil society organizations are particularly important, as they participate in and directly influence several governance approaches. At the same time, Stakeholder Theory helps account for the disparate goals, demands, values, and opinions that different stakeholders hold, which help explain why they interpret the same problem differently (Hall and Vredenburg, 2005), e.g. why they have different attitudes towards and solutions for governing agro-food supply chains to foster sustainability or deliver zero deforestation.

2.3. EMPIRICAL AND ANALYTICAL APPROACH

DATA COLLECTION

The studies that I present in this thesis draw on empirical data collected from a variety of stakeholders and sources. The challenges presented by the Covid-19 pandemic limited my opportunities to conduct fieldwork and in-person data collection. Instead, I had to rely on empirical data that could be collected online and through secondary data sources. One key source to understand sustainability governance is publicly available sustainability-related information provided by private companies. This information is usually available from corporate websites, and include annual reports, sustainability and corporate social responsibility (CSR) reports, marketing material, and other website content. This type of material forms the basis of the paper that I present in Chapter 4 on corporate sustainability efforts in the global coffee sector and is one among several sources for the paper in Chapter 5 on corporate implementation

of ‘zero-deforestation commitments’ (ZDCs). Company-related sustainability information is also available from various repositories, mainly run by NGOs or public actors. Particularly relevant sources for agro-food supply chains, sustainability, and deforestation include the databases collected by CDP, Supply Change by Forest Trends, Forest500 by Global Canopy, and Trase by Stockholm Environment Institute. Other publicly available, written sources include NGO documents and reports and publications by public authorities, including, *inter alia*, legislation, memos, reports, and consultations. I use these sources, along with company documents, as empirical material for the paper presented in Chapter 3 on EU policy options for reducing imported deforestation.

To complement the written material, I also draw on interviews with company representatives and other experts. The interviewees’ perspectives are relevant in their capacities as representatives of different companies and other stakeholders, having in-depth knowledge on issues related to agro-food supply chain governance for that particular actor. The interviews are so-called semi-structured interviews (Flick, 2009), which include several questions prepared in advance and collected in an interview guide, as well as questions that emerge as part of the conversation. The interviews include both ‘open questions’ allowing the interviewee to freely divulge their knowledge and expertise and closed questions aimed at extracting answers to particular topics. Further, the interviews include “theory-driven” and “hypotheses-directed” questions (Flick, 2009, p. 157), which build on the theoretical presuppositions about the problem of deforestation and agro-good commodity supply chains (cf. section 2.2 above) and the specific research hypotheses (cf. section 2.1 above), probing interviewees for answers that confirm (or not) specific theories and hypotheses. Finally, the interviews include questions of a more confrontational or critical character, forcing the interviewees to defend or take a stand on particular topics (Flick, 2009, p. 157), for example explaining why certain approaches were chosen over others. These interviews form the basis of the study on the implementation of ZDCs, which I report in Chapter 5.

I rely on these verbal and written data sources, as they are a rich and varied source of data, which allow for a deeper insight into the behaviour and opinion of actors, which are less frequently studied in academic works on the agro-food sector, primarily companies and NGOs. Collecting primary data allows me to tailor the data collection approach to the research questions and focus in great depth on issues of particular importance. For example, in the coffee study, I was able to collect information on direct trade or transparency issues; both of which we have relatively little quantitative data about. To complement this, the secondary data provide breadth, as it extends across entire sectors or issues. For example, the ZDC data collected by Forest500 (2021a), which I use in my study on implementation (Chapter 5) cover 350 companies and 150 financial institutions, which allows me to compare the companies in my limited sample to a larger sample of similar companies. Except for in-person interviews conducted at an industry conference in November 2019 (before the Covid-19 pandemic), the expert interviews took place online. This naturally places certain limitations on the contextual information that can be obtained from the interviews, as it is difficult to read interviewees' facial expressions and account for the physical setting in which interviewees' work or operate, for example. However, the online format also provides the advantage of interviewing a significantly larger number of experts based in locations, which it would otherwise not be possible to visit for a European-based researcher, such as companies based in South East Asia or supply chain experts working on the ground in Africa.

There are obvious limitations to relying on data collected directly from companies and NGOs. Firstly, it is clear that data reported directly by these actors themselves will contain biases shaped by these actors' predispositions towards certain topics. It is for this reason that, whenever possible, I triangulate the reported or collected data against other sources of information. I also account for this by granting interviewees' anonymity and anonymizing data from individual companies, as it enables these actors to disclose information, which would otherwise be sensitive. Secondly, it is difficult to cross-check the information obtained from these data sources, as most of the data are held exclusively by the actors reporting it or pertain to events that these

actors have proprietary access to. As a researcher, it is impossible to completely eliminate these sources of bias and uncertainty. Instead, I acknowledge that they exist and account for these uncertainties and potential limitations when analysing and drawing conclusions from these data sources. For example, in the coffee study reported in Chapter 4, I acknowledge that the data only identifies whether companies *claim* adoption of specific sustainability practices, not whether companies *actually* adopt these, less so whether this result in changes to sustainability outcomes. Nonetheless, these data sources remain an important source for improving our understanding of companies' and NGOs' efforts to govern sustainability within the agro-food sector, as long as we acknowledge and account for their limitations.

ANALYSIS

To analyse the data, I rely on quantitative and qualitative approaches. All three empirical chapters (Chapter 3, Chapter 4 and Chapter 5) include descriptive and bivariate statistics to extract information about relationships between different variables and summarize and categorize the data. In the study on sustainability in the coffee sector (Chapter 4), I complement this with more advanced statistical approaches, relying on regression analysis to analyse a set of dependent and independent variables. I apply qualitative analytical approaches to analyse written materials (Chapter 3, Chapter 4 and Chapter 5) and to analyse the expert interviews (Chapter 5). Specifically, I apply content analysis to categorize text into categories based on selection criteria for each category (Cape, 2010; Flick, 2009), using this both to categorize policy options in the EU policy options study (Chapter 3) and to define indicators and responses in the coffee study (Chapter 4). To organize and analyse the interviews, I rely on coding (Cape, 2010; Locke et al., 2020), applying both inductive and deductive approaches. Each empirical study contains detailed descriptions of the analytical approach adopted.

Adopting both quantitative and qualitative approaches allows me to build on the respective strengths of each analytical approach. The large samples and quantitative analytical approaches used in the coffee study (Chapter 4) allow me to infer causal links between the variables. The drawback is that the large sample precludes me from

going into much detail on each case and saying with any great certainty whether the general findings also adhere to a particular case. On the contrary, the qualitative analytical approach adopted in the study on deforestation initiatives (Chapter 5) complicates the development of general statements on adoption across the sector. The advantage is that, unlike the coffee study (Chapter 4), I have in-depth knowledge of individual cases and actors and can provide detailed explanations on their particular situations. Throughout the thesis, I try to balance the relative advantages and drawbacks of the two different methods to avoid making unsubstantiated claims.

2.4. FINDINGS AND CONTRIBUTIONS

In this thesis, I address the question of sustainability governance within the agro-food sector from two perspectives, respectively, public and private governance. The main conclusion I offer is that it is not a lack of governance approaches, which hinders sustainability governance of agro-food commodity supply chains, in particular on deforestation. Rather, a confluence of four specific factors, which are not adequately addressed, complicates governance approaches for public and private actors involved. Firstly, the complexity of the problem, in particular the ‘wicked’ nature of agro-food commodity-driven deforestation, causes unclear feedbacks and spatially separated cause-effect mechanisms within opaque and intermingled supply chains that sometimes involve hundreds of actors. Secondly, companies and private sector governance play a crucial, but underappreciated role in delivering agro-food supply chain governance. I show that company characteristics (size, supply chain, stakeholders, etc.) affect governance, while insufficient commitment among laggards and insufficient support for leaders limit the capacity of private sector governance to foster sustainability across agro-food supply chains. Thirdly, public governance plays an increasingly important role by “bringing back” the state to support, engage, and enable private governance efforts. I argue that this takes place in particular through “layered governance;” where companies across the agro-food supply chains are the principal agents of implementation, while public actors establish the regulatory framework and set targets, initiate initiatives, or mandate specific approaches. Fourth and finally, technological advancements can enable governance by aiding

implementation, reducing complexity, increasing accountability, and empowering supply chain actors, but technology is not a silver bullet that solves all issues.

I aim this research at both practitioners and academics. As applied research, it draws upon and is relevant most obviously for companies, but include relevant insights for various stakeholders, such as NGOs and policymakers, with an interest in governing agro-food supply chains, for example to reduce deforestation. I provide practical policy and governance examples and offer insights into both the variety of options available, the practical challenge of implementing these, and the likely effect of this. To companies, my research helps to benchmark sustainability efforts, identify current trends, and point to potential stumbling blocks. To policymakers, I offer insights into two aspects. Firstly, I show how and through what means policymakers can address questions of agro-food supply chain sustainability, in particular on deforestation, and provide concrete policy options. Second, I offer insights into how and where companies struggle, identifying areas where policymakers can guide, assist, or enforce private action to foster improved outcomes. For example, I show that a lack of common reporting frameworks hinders comparison of company efforts and complicates companies' efforts to implement sustainability programmes, indicating that public (regulatory) action within this area could help move sustainability governance forward. For NGOs, I offer a glimpse of the challenges that governments and companies face in governing the various problems caused by agro-food supply chains. This information can hopefully help NGOs target their work and campaigns toward areas, where company action is lacking or government ambition is insufficient.

As an academic piece of work, I aim this work at scholars within the governance, global value chain, and land system science communities. My research does not sit squarely in one field, but cuts across different areas, drawing upon and contributing to theories and frameworks from various social sciences. As concerns the question of governance, I contribute to our understanding of several aspects related to governance of agro-food commodity supply chains and argue that the current governance landscape is one of "layered" governance, which combines public and private governance approaches to maximise scope and efficiency. On public governance, I

show how and using which policies, public actors can address agro-food commodity-driven deforestation. In this, I illustrate that although the issue is complex, it is not a lack of options, which prevents public actors from addressing deforestation. For private governance literature, I provide several contributions. Firstly, I illuminate the actual extent of governance in a sector, illustrating that although sustainability is getting traction across several sectors and stakeholder groups, it is not fully mainstreamed. Secondly, I offer a glimpse of governance “in action” by identifying the practical challenges that companies face in governing agro-food commodity supply chains. Here, I underline the need for scholars to engage with companies to understand how they view and apply various governance approaches.

Importantly, my research advances our understanding of research aimed at and drawing upon companies and company-specific data. With the empirical data collected for this research, I show that companies offer a rich source of data, while also being important stakeholders. To most non-business scholars, especially geographers and other (land system) scientists engaged in questions of agro-food commodity supply chains and their contribution to deforestation, I illuminate the huge gap that exists between the companies operating in and across the commodity supply chains causing deforestation (and thus being able to affect this) and the scholarship undertaken on this field. Companies are obvious stakeholders and natural study subjects, both for matters of identifying problems and culprits and for developing solutions. However, most deforestation- and supply chain-related research focus on biophysical outcomes and the effect of supply chains and governance efforts on upstream producers, particularly in the Global South, and – to a much lesser extent – on consumers and consumer countries. Many scholars largely ignore the companies in between, especially as sources of information and subjects of study. Some critical GVC and political economy literature does concern itself with companies but does so largely to identify their contribution to specific problems, not directly engaging with these actors. With this thesis, I add a small piece to this gap by both drawing on companies as sources of data and insight and by making the governance problems faced by companies the primary focus of one of the empirical studies.

3. THESIS OUTLINE

The thesis is organised into six chapters, including this introduction. While *Chapter 1* has set the stage by providing the contextual background and outlining the research objectives and contributions, *Chapter 2* sets the scene for the empirical work that follows. In this, I address the question of how to govern agro-food supply chains, focusing particularly on the question of reducing agro-food commodity-driven deforestation. I first argue that governance approaches and the instruments used to steer actor behaviour has evolved through three different, but overlapping, “phases.” In the next part, I discuss the more recent approaches to govern agro-food commodities, focusing especially on the recent shift to a combination of public and private instruments in what I term “layered” governance. I end the chapter with a discussion of the different enablers of governance, particularly transparency, traceability, and technology, and how changes within these areas affect governance prospects and potential outcomes. The chapter concludes with reflections on the opportunities and challenges for governing agro-food supply chains to reduce deforestation.

The empirical research unfolds in Chapter 3, Chapter 4, and Chapter 5, each addressing one of the main research questions. In *Chapter 3*, I identify and analyse policy options to address deforestation caused by various agro-food commodities, often referred to as “forest-risk commodities” (FRCs) (Rautner et al., 2013). Here, I show that policy options that are politically feasible policies tend to have a weaker theory of change—the causal chain through which the policies address deforestation—setting up a potential trade-off between feasibility and impact.

In *Chapter 4*, I present an analysis of sustainability strategies in the global coffee sector. Here, I find that despite increasing awareness of sustainability, many companies are still not addressing sustainability, and the sector remains divided in a mainstream market largely not or only weakly addressing sustainability challenges and a smaller market incorporating sustainability concerns. I also show that company type and supply chain position affect the sustainability strategy chosen, showing that

company characteristics are important for understanding sustainability scope and efforts across a sector.

Chapter 5 again turns to the issue of agro-food commodity-driven deforestation. Here, I present an analysis of the implementation of zero-deforestation commitments (ZDCs). Relying on interviews with company representatives and other stakeholders, I show that companies struggle to implement sustainability governance mechanisms, making it difficult to translate corporate pledges into tangible action on the ground. I find several conditions for effective implementation lacking, especially on ensuring a level playing field and supportive market mechanisms.

As such, Chapter 3 and Chapter 5 are cross-commodity studies, assessing the issue of agro-food commodity governance and land use without focusing on a specific sector or commodity, while Chapter 4 takes a commodity-specific focus, analysing the current state-of-play for sustainability governance within the coffee sector. Turning to the regulatory agent, Chapter 3 targets the question of agro-food commodity governance from the perspective of the public sector, using the EU as a case study, while Chapter 4 and Chapter 5 address the question from the private-sector perspective. Thus, the chapters collectively cover the three areas tackled by this thesis, namely public governance efforts, private governance efforts, and approaches, challenges, and solutions for achieving agro-food supply chain governance.

Finally, in *Chapter 6*, I discuss the empirical studies in relation to the overarching question that I tackle in this thesis: how can interventions in agro-food commodity supply chains foster sustainable land use? I draw perspectives to and from other lines of research, relying, especially, on studies from the scientific fields to which this research contribute, namely land system science, particularly telecoupling, environmental and polycentric governance studies, and critical social science, particularly global value chain analysis. I discuss the complexity of the problem of agro-food supply chain governance itself, the role of companies and governments, respectively, and how technology and other solutions can enable sustainable land-use governance. Finally, I summarise the four overarching arguments and conclusions

made within this research, highlight the contributions to literature and the broader society, and discuss perspectives for further research.

Beyond the background chapter and the three empirical studies, I draw on scientific literature and my involvement in other scientific studies, which – while they do not form a direct part of this thesis – also to various extents deal with this thesis’ topics. Below, I list the collaborative research papers to which I contribute. For each paper, I have underlined the lead author and marked my name in bold. Not all papers are published. For those that are not yet published, I provide the citation used in this thesis. For those that are published, the conventional citation rules apply. Conceptually and theoretically, the papers each address different questions pertaining to the themes of this thesis, discussing aspects related to the agro-food sector, value/supply chains, deforestation, technology, and public and private governance. While not all the papers are included in this thesis, I draw on them when discussing various aspects of agro-food supply chain governance and sustainability issues. In Figure 1-8, I have illustrated the links between the background chapter, the three empirical chapters, and the different collaborative papers, placing them according to how they contribute to the theoretical (value chains, public governance, private governance) and topical (agro-food sector, technology, deforestation) foci of the thesis.

Bager, S. L., Düdder, B., Henglein, F., Hebert, J. M. and Wu, H. (2021). Event-based Sustainable Commodity Supply Chains on Blockchain. *Frontiers in Blockchain* (Accepted for Special Issue). Cited here as: Bager et al. (2021b)

Bager, S. L., Singh, C., and Persson, M. (forthcoming) Blockchain is not a silver bullet for supply chain sustainability. *Unpublished*. Cited here as: Bager et al. (2022).

Coenen, J., **Bager, S. L.,** Meyfroidt, P., Newig, J., and Challies, E. (2020). Environmental Governance of China’s Belt and Road Initiative. *Environ. Policy Gov.*, 31 (1), 3-17. <https://doi.org/10.1002/eet.1901>.

Coenen, J., **Bager, S. L.,** Challies, E. and Newig, J. (forthcoming). European Union governance of environmental problems beyond borders. Not cited here.

Köhler, S., **Bager, S. L.** and Pizzol, M. (forthcoming). Voluntary Sustainability Standards and Blockchain Technology – Interactions and Outcomes. *Technological Forecasting & Social Change* (under review). Cited here as: Köhler et al. (2021).

Kehoe, L., dos Reis, T.N.P., Meyfroidt, P., **Bager, S.L.**, Seppelt, R., Kuemmerle, T., Berenguer, E., Clark, M., Davis, K.F., zu Ermgassen, E.K.H.J., et al. (2020). Inclusion, Transparency, and Enforcement: How the EU-Mercosur Trade Agreement Fails the Sustainability Test. *One Earth*, 3 (3), 268-272.

Pedersen, A. E., Nielsen, J. Ø., Mempel, F., **Bager, S. L.**, Jønsson, J. B. and Corbera, E. (forthcoming). The ambiguity of transparency in the artisanal and small-scale mining sector of Tanzania. *Journal of Extractive Industries*. Cited here as: Pedersen et al. (2021).

Reis, T.N.P. dos, Meyfroidt, P., zu Ermgassen, E.K.H.J., West, C., Gardner, T., **Bager, S. L.**, Croft, S., Lathuillière, M.J., and Godar, J. (2020). Understanding the Stickiness of Commodity Supply Chains Is Key to Improving Their Sustainability. *One Earth*, 3 (1), 100–115. <https://doi.org/10.1016/j.oneear.2020.06.012>.

Singh, C., Wojewska, A., **Bager, S.L.**, and Persson, U. M. (forthcoming). Colombian farmers' perceptions about blockchain in coffee value chains. (Not cited in this thesis).

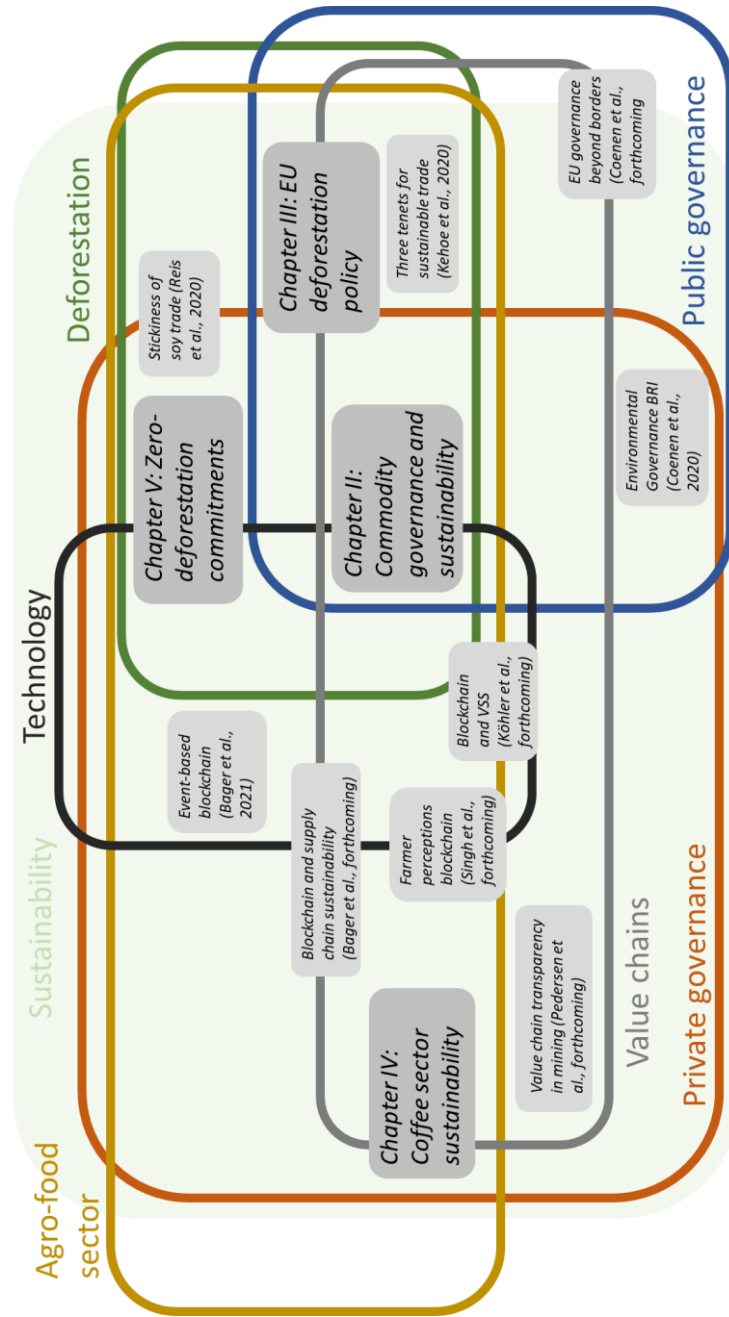


Figure 1-8. This thesis' chapters and the collaborative research papers address various themes related to agro-food supply chain governance and sustainability.



As part of global supply chains, agro-food commodities cross roads, rivers, and oceans on their journey from places of production to places of consumption. Photos: S. Bager.

CHAPTER 2

AGRO-FOOD COMMODITY SUPPLY CHAIN GOVERNANCE

Not previously published.

ABSTRACT

Here, I assess governance approaches across agro-food supply chains, focusing particularly on the question of reducing commodity-driven deforestation. In this, I first argue that governance approaches and the instruments used to steer actor behaviour have evolved through three distinct, though overlapping, “phases.” In the next part, I discuss the more recent approaches to govern agro-food commodities, focusing especially on the recent shift to a combination of public and private instruments in what I term “layered” governance. I end the chapter with a discussion of the different enablers of governance, particularly transparency, traceability, and technology, and how changes within these areas affect governance prospects and potential outcomes. I conclude with reflections on the opportunities and challenges for governing agro-food supply chains to reduce deforestation.

1. INTRODUCTION

The global agro-food system is the primary driver of deforestation (Curtis et al., 2018). To reduce the impact of the agro-food system on deforestation requires governing the actors and processes, which make up the global food system⁴, particularly the global agro-food commodity supply chains and the companies controlling them. However, a number of factors characterizing the global agro-food system complicate governance of agro-food commodity production and consumption and the social and environmental outcomes, such as deforestation, resulting from this.

Firstly, governance of global agro-food supply chains involves “governing at a distance” (Boström et al., 2015). Global agro-food commodity supply chains span multiple actors and countries, connecting producers, intermediaries, and consumers, causing agro-food commodities to often be consumed far from their place of production. These supply chain developments create distance (Clapp, 2015) – spatially, temporally, culturally, structurally, and organizationally – between consumers and the consequences of their consumption. Many activities and impacts take place spatially separate from the governing entity (e.g. the company or government), while the actors involved might further be culturally or economically distant. Further, structural or cultural distances affect the knowledge and understanding actors have about agro-food commodity production practices. These conditions affect the information consumers have about the origin and production practices of the agro-food commodity in question (Garrett and Rueda, 2019), especially for highly commoditized and homogenous commodities, such as soybeans or palm oil. For example, many consumers have limited understanding of and knowledge about the agro-food commodities they consume, how they were produced, and the working and living conditions of the people producing them. Uneven

⁴ The global agro-food system comprises the companies, farmers, governments, consumers, NGOs, and other stakeholders involved in the “production, distribution, and consumption of food, the relations between them, and the regulatory apparatus governing these arrangements” (Rogers et al., 2013)

information access also affects the relative power between food system actors, causing some actors to hold significantly more bargaining power and control over supply chains (Clapp, 2015; Dallas et al., 2019). Different types of distances thus enhance the opacity of global agro-food supply chains, muddling relationships between the system's stakeholders and the impact of agro-food commodity production on the natural environment (Clapp, 2015).

Secondly, the global nature of businesses operating across the global agro-food sector limits the ability of an individual actor or government to tackle problems arising from MNCs' supply chain activities, while it magnifies the power held by MNCs. MNCs and other large actors can leverage the distances created by the globalization and commodification of the global food system, controlling global supply chains by navigating and leveraging complex information, financial, and commodity flows. While MNCs' headquarters are in individual countries, their supply chains extend beyond the regulatory competence of that individual country (van der Ven, 2018; Villiers, 2019). Land-use outcomes in agricultural production landscapes have historically reacted to changes in local circumstances (actors, climate, economic development, etc.), but they are now heavily influenced by MNCs decision-making, as they mobilize technology, credit, and infrastructure to produce agro-food commodities demanded by regional and global markets (Garrett and Rueda, 2019). This makes MNCs extremely powerful agents in the global food system, affecting both land-use outcomes and relationships between different actors. In effect, MNCs become "quasi-regulators" of the commodity production process, exercising influence over prices and production practices (Bartley, 2018, p. 12), but there are numerous direct and indirect means for companies to wield their influence over the global food system. Through lobbying efforts, they shape regulatory policy and governance frameworks, while their investments in research and development (R&D) shape technology use and innovation across the food system (Clapp, 2021).

The concentration and influence of MNCs across the global food system cause information asymmetry between actors (producers, traders, manufacturers, retailers, end-consumers, authorities) along the global supply chains (Boström et al., 2015), in

effect creating instances where “lead firms” (van der Ven, 2018), sometimes in quasi-monopsonistic or oligopolistic markets⁵, shape how the market functions (Clapp, 2021). Certain segments of the agro-food sector, such as the commodities trade, are quasi-oligopolies, as the so-called “ABCDs” control a substantial part of the global trade in agro-food commodities⁶. These actors’ leverage allows them to control the flow of agro-food commodities across their respective supply chains to muddle or even externalize the social and environmental costs of their operations (Clapp, 2015), such as deforestation, without substantial impact on their operations.

Thirdly, agro-food systems give rise to telecoupled impacts, where actions in one system give rise to – sometimes unforeseen – consequences in other systems. The spatial decoupling of production and consumption means that deforestation and other social and environmental impacts of the global food system can be triggered by demands for agro-food commodities consumed in faraway places (Henders et al., 2015; Wiedmann and Lenzen, 2018; Yu et al., 2013) and give rise to unanticipated outcomes as seemingly distant human-environment systems affect each other through telecoupled feedbacks (Friis and Nielsen, 2017a; Liu, 2017).

1.1. GOVERNING AGRO-FOOD SUPPLY CHAINS

The telecoupled nature of many social and environmental problems arising from agro-food commodity supply chains create unclear feedback mechanisms, complicating efforts to govern actors and outcomes. Telecoupled processes often remain “ungoverned” as consequences “emerge beyond the reach of established governance arrangements: governance institutions in one region cannot cope with implications in

⁵ A monopsonistic market is characterised by a single buyer having substantial control as the market’s major purchaser of goods offered by many sellers. An oligopolistic market is characterised by a small group of large sellers, who control the market. A monopoly or duopoly is the extreme version of oligopoly, where only one (monopoly) or two (duopoly) actors control the entire market.

⁶ ABCD refer to the companies Archer Daniels Midland (A), Bunge (B), Cargill (C), and Louis Dreyfus Commodities (D).

distant, linked regions” (Newig et al., 2020). Governing individual systems independently does not solve the problem, but increases the risk of negative outcomes across systems, as systems and actors fail to include (or internalize) the consequences of their actions in other systems (Garrett and Rueda, 2019). Further, absent a global governing body, the heterogeneity and complexity of the agro-food system and the multiplicity of actors involved require coordination of multi-level and multi-scalar systems with large degrees of polycentrism (Oberlack et al., 2018).

Governance is not an alternative to government, nor is it equal to government regulation. Rather, governance is the explicit or implicit ‘rules of the game,’ (Bair and Palpacuer, 2015, p. 3), where public and private actors use a variety of formal and informal instruments in different interventions and approaches (Boström et al., 2015) to foster or hinder particular actors’ behaviour and activities. When such governance approaches pertain to steering environmental and socio-economic actions and outcomes, it can be seen as sustainability governance (Challies et al., 2019). In line with the Brundtland definition, sustainability is understood here as a normative concept that seeks to balance environmental, social, and economic outcomes for present and future generations. In the case of governance of agro-food commodity supply chains and their contribution to deforestation, it thus refers to the interventions and approaches through which various public and private actors modify other actors’ behaviour to reduce deforestation.

Actors apply numerous governance approaches to govern agro-food commodity supply chains. A distinction is frequently made between governance interventions led by public actors (states and governmental entities) and private actors (non-state actors, including companies). These actors can engage in unilateral action or various forms of hybrid or multi-stakeholder arrangements, where several different actors (or actor groups) instate governance approaches. Governance instruments can target areas, such as production sites, jurisdictions, or entire countries, or flows of agro-food commodities across supply chains, as well as different actors operating within these areas or along the various agro-food supply chains (see also Figure 1-5 in Chapter 1).

These different instruments can be applied through various mechanisms, which vary with the degree to which they enforce specific behaviours on their targets. They range from “soft” mechanisms relying on voluntary or collaborative behaviour change to mandatory, legally binding (“hard”) mechanisms. Here, in line with Böcher (2012) and Bager et al. (2021a) (Chapter 3), I define instruments as information-based, cooperative, market-based, or mandatory, ranked by increasing coerciveness.

Governance approaches include a variety of different instruments, such as policies, guidelines, rules, norms, standards, labelling, roundtables, and so forth. Specific sustainability governance instruments include codes of conduct, voluntary sustainability standards (VSS), corporate social responsibility (CSR) programmes, public-private partnerships, management systems, supply chain investments and commitments, producer relations and other forms of direct trade, and disclosure and chain-of-custody initiatives, among others. The governance approaches each have different conceptions and causal assumptions and apply different mechanisms to get actors to change behaviour. In other words, they each build on a different theory of change (Martius et al., 2018).

1.2. SCOPE AND APPROACH

In this chapter, I analyse the governance of agro-food supply chains, identifying governance mechanisms, developments within these, and enablers of governance. I ask how governance approaches and the developments on actors, instruments, and mechanisms within these approaches affect agro-food supply chain governance, and how enablers of agro-food supply chain governance shape this development. I end with a discussion of the opportunities and challenges that affect agro-food supply chain governance.

In the introductory section, I outlined the factors that complicate governance of the global agro-food system and its agro-food supply chains. In the second section, I outline the evolution of agro-food supply chain governance. I argue that agro-food commodity supply chain governance has evolved through three different, yet overlapping phases. I identify key actors and approaches and show that while the most

vocal and influential actors and the most adopted governance approaches differed across the three phases, they should not be seen as wholly distinct and separate units. Rather, they indicate an evolution in the attitudes and solutions towards the problem of agro-food supply chain governance, particular on the issue of deforestation, which affected – and continues to affect – the governance of agro-food supply chains and the outcome of this.

In the third section, I provide a critical look at the most prevalent or ‘hyped’ agro-food supply chain governance instruments. I argue that not all governance approaches and instruments are equally effective, nor equally desirable, for reducing deforestation of agro-food commodity supply chains. The section does not posit to provide a systematic evaluation (as this would be beyond the scope of this chapter), but rather provides an overview of the different approaches, their main features, and the relative benefits and drawbacks of each approach in relation to reducing deforestation.

In the fourth section, I discuss three enablers of agro-food supply chain governance: traceability, transparency, and technology. I identify the main features of each enabler and the potential impact of these on agro-food supply chain governance. I argue that the transformative potential of technological developments in combination with the shift in perspective on transparency and traceability among key stakeholder groups will cause significant changes to the type and outcomes of agro-food supply chain governance.

Finally, in the last section, I reflect on the opportunities and challenges for fostering agro-food supply chain governance, identifying five areas of particular importance. I argue that current developments point to the replacement of entirely public or private instruments by hybrid and “layered” instruments, which adopt various elements from the more pure instruments and are better able to handle the intricacies of agro-food supply chains. In this, I acknowledge the normativity of such an approach (Munroe et al., 2019; Nielsen et al., 2019), as I indeed aim to flesh out potential governance solutions able to move the agro-food sector towards greater sustainability (i.e. less deforestation).

2. THE EVOLUTION OF SUPPLY CHAIN GOVERNANCE

Since environmental issues emerged onto the public stage in the 1960s and 1970s with famous publications, such as Rachel Carson's "The Silent Spring" (1962) or "The Limits to Growth" (1972) published by The Club of Rome, public and private actors have launched various approaches to govern the production, trade, and consumption of agro-food commodities. These mechanisms are constantly evolving in response to developments within global supply chains, expectations from various stakeholders, not least consumers, and the regulatory environment in which they operate. The timeline below (Figure 2-1) shows key events pertaining to governance of agro-food supply chains, placing particular emphasis on the issue of deforestation. It distinguishes between private sector (company), public sector (state), civil society (NGOs), academia, and multi-stakeholder-led initiatives. It is not intended to provide a complete picture of the evolution of agro-food supply chain governance over time. Rather, it is intended to show the diversity of events and the resulting approaches and initiatives taken to influence deforestation and land-use outcomes as a result of agro-food supply chains and to show how different actors and initiatives play different roles over time.

Taking into account the different events shown below (Figure 2-1) and considering how research has conceived of the role of public, corporate, and other non-state actors in influencing sustainable land use governance, I here argue that agro-food supply chain governance has evolved through three distinct, but overlapping governance 'phases' or 'regimes'. Before the mid-1990s, international conventions and territorial public regulations were the primary means of influencing agro-food supply chains and their related land-use outcomes. With globalization processes and neo-liberal agendas of deregulation, the 1990s witnessed a "retreat of the state" (Scherer and Palazzo, 2011) as "non-state market-driven" governance (Cashore, 2002) took hold. This is particularly illustrated through the growth of voluntary sustainability standards (VSS), which were further supported by the various initiatives organizing or supporting market-driven governance approaches, e.g. the UN Global Compact, the Equator Principles, Global Reporting Initiative, and ISEAL Alliance. In the mid-2000s, a

nascent legality regime, focused primarily on avoiding illegal activities, emerged in the timber sector (Bartley, 2014), combining hard and soft governance approaches to govern forest-product supply chains. In tandem with this, NGOs put enormous pressure on companies to take responsibility for actions across their supply chains, shifting attention from governments to the private actors operating across land systems. In the period around 2006-2010, several campaigns targeted companies contributing to deforestation by sourcing unsustainable commodities, particularly focusing on soy, palm oil, and beef. One outcome of these campaigns was the adoption of zero-deforestation commitments and other public pledges by companies (and some public actors) aimed at removing deforestation from supply chains. In the current governance phase, the legality aspects from the forest sector are merging with the market-driven governance approaches, in what I here term “layered governance.” Drawing on approaches and instruments from earlier phases, it combines the supply chain focus of zero-deforestation campaigns and the integration of public and private governance from the legality regime. This provides for a return to the stage for public governance efforts compared to the largely market-driven approaches in the second phase. Further, it places emphasis on flows of agro-food commodities, rather than areas (or territories), as in the first phase. Unlike the legality approaches, the nascent supply chain-regime focus more directly on sustainability, but model many of the governance mechanisms on the legality systems.

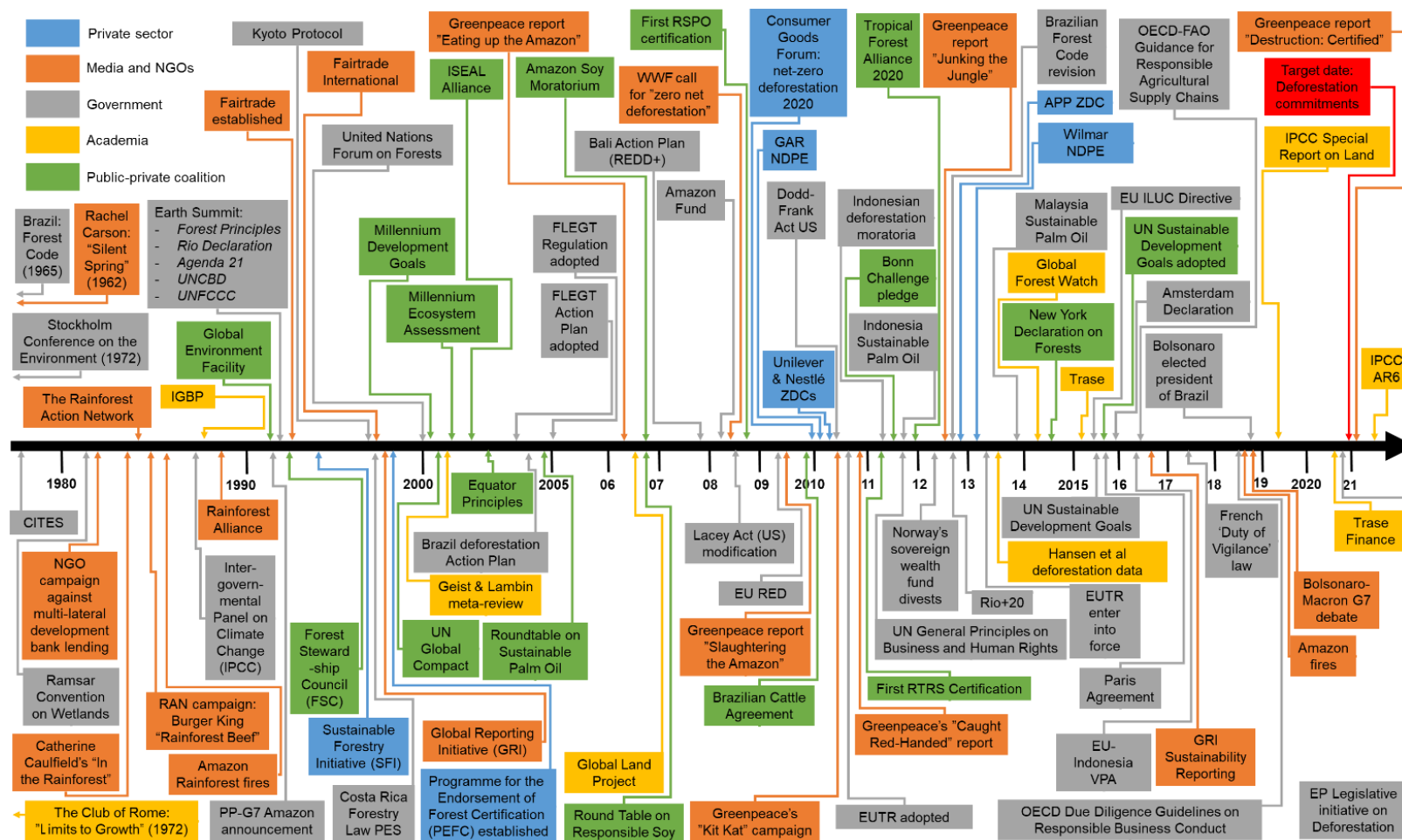


Figure 2-1. Timeline highlighting events of relevance to governance of agro-food commodity supply chains.

Author's illustration. Input from Seymour and Busch (2016, p. 237), Neeff and Linhares-Juvenal (2018), and Schilling-Vacaflo and Lenschow (2021).

2.1. THE PUBLIC PHASE: TERRITORIAL, PUBLIC REGULATION

The starting point for any governance intervention aimed at land use issues, such as deforestation, was historically an area. Land use governance was the primary domain of governments, who governed through regulatory interventions within their jurisdiction. Governance was spatially confined to territories and regions, where central governments exercised power through land use planning and zoning, or local communities and landholders managed their parcel of land. As supply chains were, for the most part, confined to regions or countries, governing land use in a given area had knock-on effects on local supply chains. The most common approach to govern agro-food commodity production and its links to deforestation was to zone land for different purposes, for example, designated agricultural areas, logging concessions, protected areas, non-timber forest reserves, and so forth (IPCC, 2019). Through successful federal and state policies, Brazil's reduction of deforestation in the Amazon in the decade from approximate 2005-2014 provides an example of successful public territorially-based governance for reducing agro-food commodity-driven deforestation (Angelsen, 2010; Azevedo et al., 2015; Nepstad et al., 2014; West and Fearnside, 2021), but it builds on public, regulatory land-use policies instated much earlier, as the first Forest Code was adopted already in 1965.

In territorially-based, public regulation, the respective government (national, state, local, etc.) defines the rules applying to the respective area, including e.g., land use and management practices (Lambin et al., 2014). Public actors apply various policy instruments to steer actors' land use behaviour, relying on "hard," regulatory approaches, such as land zoning laws and protected areas, to set the overall frame for land use in a given area. These approaches are combined with land-specific policies, such as agricultural production support schemes (a market-based instrument), e.g. the EU Common Agricultural Policy, or research and development programs (a cooperative instrument). These are further affected by various policies indirectly addressing land use, such as property rights, fiscal and monetary policies, and trade regimes (Lambin et al., 2014).

In addition to national or territorial governance, states engage in global environmental governance arrangements through multilateral environmental agreements and conventions. In the two decades from the Stockholm Conference on the Environment (1972) to Rio Earth Summit (1992), governments adopted several conventions and agreements, which influence land use, indirectly governing agro-food commodity production and supply chains (see grey boxes in the left part of Figure 2-1 above). However, the existing conventions do not directly cover agro-food commodities and their supply chains, and no international convention directly govern the world's forests⁷. As one of few exceptions, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) does cover illegal trade in certain wood species, while the United Nations Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), and the United Nations Convention to Combat Desertification (CCD) all contain targets directly or indirectly addressing global forest loss, especially through its link to biodiversity loss and climate change. Forests are also indirectly addressed in the UN Declaration on the Rights of Indigenous Peoples and various other international agreements addressing food security and tenure rights, among others (Pasiecznik et al., 2017; Pirlot et al., 2018). However, existing global governance arrangements do generally not have the ability to address deforestation, particularly as it relates to agro-food commodity supply chains and the actors controlling these supply chains, as the limited enforcement capacity enshrined in these approaches means that they are not able to sanction companies or enforce global standards. These problems are further compounded by the absence of state accountability for lack of commitment or implementation.

⁷ The 1992 Rio Earth Summit was scheduled to include the adoption of a global convention on the world's forests. However, governments failed to adopt this, and this outcome influenced private-sector and civil society support, particularly among NGOs, for various market-based alternatives to govern the world's forest. Most prominently, the use of voluntary sustainability standards, particularly FSC, which WWF championed and helped co-found (Bartley, 2018).

From an agro-food commodity perspective, territorially defined governance interventions also face problems dealing with processes that expand beyond the jurisdiction of the specific actor governing the zone, such as agro-food supply chains extending across countries and regions. As has been frequently documented, ecological processes often transcend the scale of the respective jurisdiction, causing a mismatch between the policy approach and the appropriate scale of intervention (Bastos Lima et al., 2019; Folke et al., 2007). The absence of enforcement capacity across jurisdictional boundaries thus reduces effective governance of problems extending beyond spatially defined areas controlled by public actors (DeFries and Nagendra, 2017). Further, even successful policies, such as the Brazilian Forest Code, suffer from the issue of leakage from protected or well-governed areas to non-protected or badly governed areas. Differences in regulatory stringency or inability or unwillingness of landowners to enforce the protection of natural areas can further exacerbate the misfit between ecological scale and governance solution, leading to the expansion of agro-food commodity production systems into natural ecosystems not designated for this use. For example, in an analysis of Gran Chaco and Chiquitano, two deforestation “hot spots” in South America, le Polain de Waroux et al. (2016) analyse how differences in land-use policies affect deforestation rates across different regions, resulting in leakage from strictly governed areas to “deforestation havens.” Similarly, experience from South East Asia shows that increased forest protection in Vietnam and China resulted in increased deforestation in neighbouring Laos and Cambodia (Meyfroidt et al., 2010). A final challenge to public, regulatory governance approaches is caused by regulatory agencies across many countries and regions being understaffed and underfunded, lacking resources to adequately deal with the challenges arising from complex commodity production systems, reducing their capacity to enforce forest protection measures (Lambin et al., 2014; Villiers, 2019).

2.2. THE MARKET PHASE: MARKET-BASED PRIVATE GOVERNANCE

The globalization processes and the growing deregulation of the neo-liberal doctrine in the 1980s and 1990s decreased the role of centralised government-controlled top-

down solutions and ushered in an era of more decentralized governance (Bartley, 2018; Dicken, 2014). This changing governance landscape opened up a space for non-state actors and other market-driven solutions (Bernstein and Cashore, 2007; Cashore, 2002) to shape environmental governance “above and beyond the state” (Scherer and Palazzo, 2011). In this period, several private and public-private governance interventions emerged, particularly various voluntary sustainability standards (VSS), such as Fairtrade and the Forest Stewardship Council (FSC) (see Figure 2-1 above).

Market-based, private governance of agro-food supply chains developed within a discourse of “bypassing the state” (Bartley, 2018). The developments within globalization, general deregulation, and the growing market power of agro-food actors left a “regulatory vacuum” (Scherer and Palazzo, 2011). Proponents argued that private actors should step in to fill the void caused by a retreat of public actors, who were either unwilling, unable, or not allowed to create and enforce sustainability regulations across global agro-food supply chains. As a result, various private governance initiatives emerged, particularly VSS and industry “roundtables”⁸ (Figure 2-1). On the one hand, private governance initiatives substituted for absent or insufficient public governance (Cashore et al., 2021; Overdevest and Zeitlin, 2014), addressing challenges that public governance either could or would not address. On the other hand, critical assessments suggest that companies took advantage of this “regulatory vacuum” to instate governance initiatives that “weaken or capture

⁸ Voluntary Sustainability Standards (VSSs) are “standards specifying requirements that producers, traders, manufacturers, retailers or service providers may be asked to meet, relating to a wide range of sustainability metrics, including respect for basic human rights, worker health and safety, the environmental impacts of production, community relations, land use planning and others” (United Nations Forum on Sustainability Standards, 2015). Roundtables and moratoria are voluntary approaches involving various stakeholders across government, industry and civil society, who represent various stages across the supply chain from production through trade and manufacturing to final consumption. These actors then agree on production practices and sourcing requirements across the supply chain that define the overarching principles for the sustainable production of the commodity in question, including the environmental and social issues addressed – *inter alia*, deforestation, labour exploitation, soil conservation (Lambin et al., 2014) and the principles for enforcement and monitoring.

regulatory institutions” (van der Ven, 2018) or promote business interests ahead of sustainability (Fuchs and Kalfagianni, 2010; Ponte, 2019; van der Ven, 2018). Taking this view, companies primarily adopted (and continue to adopt) private governance interventions to further corporate goals and increase their income and competitiveness, rather than to improve environmental conditions and producer livelihoods (Bitzer et al., 2008; Dauvergne and Lister, 2012; Ponte, 2019; Richey and Ponte, 2020). An alternative displacement hypothesis suggests that emerging private governance approaches in fact further constrained public governance, competing with it by undermining, replacing, or pre-empting it, in the latter case to reduce regulatory risks (Bair and Palpacuer, 2015; Cashore et al., 2021). For example, sectors with a high penetration of private governance initiatives can resist regulatory efforts with the argument that existing approaches already tackle the sustainability challenges faced by the sector.

Academics have identified a number of reasons for the shift in governance from public, regulatory governance to private, market-based governance, which emerged in the latter part of the 1990s. Firstly, globalization and trade liberalization processes within the World Trade Organization (WTO) accelerated global supply chain connections and relationships across and between companies (Bartley, 2018). This reduced trade barriers and made supply chains more ‘mobile’ (Brack et al., 2016), allowing agro-food commodity production to locate in places with the most favourable socio-economic (and climatic) conditions for production (Dicken, 2014). With little local forest protection across many areas and insufficient enforcement of existing regulation, this further enabled foreign (export-driven) demand for agro-food commodities to drive deforestation in multiple locations across the tropics.

Secondly, under the mantra of neoliberal deregulation and the power of markets, public and state-led interventions were greatly reduced, as governments “offloaded” regulation to the private sector (Bartley, 2018), either voluntary or through various Structural Adjustment Programmes and other market-based and economic policies deemed suitable by the “Washington Consensus”. Further, several stakeholders, notably several environmental NGOs, became increasingly frustrated with the lack of

sufficiently stringent, regulatory action by governments and the international community. For example, efforts to adopt a global forest convention at the 1992 Rio Earth Summit failed (Bartley, 2018), as has later efforts to push other intergovernmental action on forests. Instead, environmental NGOs turned to voluntary action by the private sector, spearheading efforts to promote various VSS and roundtables, which NGOs often co-founded or actively participated in.

Thirdly, various NGO campaigns targeted the brands of several companies, beginning already in the late 1980s with Rainforest Action Network's "Rainforest Beef" campaign targeting Burger King's beef imports from Central American rainforest areas⁹. These continued with several campaigns through the 1990s and 2000s focused on corporate connection to and responsibility for deforestation across tropical regions (see key events on the timeline, Figure 2-1) with arguably significant influence on targeted companies' sustainability activities (Bloomfield, 2014; Cisneros et al., 2015; Dauvergne, 2017). A more recent example of the power of these activities is the now infamous Greenpeace KitKat campaign linking the chocolate bar to deforestation (Opal, 2017; Wolf, 2014), which spurred the companies targeted in this to commit to avoid deforestation. At the same time, the growing prevalence of "stakeholder value" (Freeman and Elms, 2018) (as a broader concept than "shareholder value") made companies increasingly sensitive to the opinions of various stakeholder groups, from investors and customers to NGOs and employees. These developments gave NGOs increasing power to target companies with well-known brands to shape the opinion of its stakeholders (Bartley, 2018). In such cases, governance activities are key means to influence public perceptions or push back on claims made towards the company

⁹ As a result of the campaign, the company announced it would use only U.S. domestic cattle, cancelling a \$35 million contract with Costa Rican beef suppliers, which subsequently spurred significant changes to forest governance in that country. For further details, see the case study description at the Global Nonviolent Action Database: <https://nvdatabase.swarthmore.edu/content/us-activists-stop-burger-king-importing-rainforest-beef-1984-1987>.

(Gomez-Trujillo et al., 2020; King and McDonnell, 2015; Scherer and Palazzo, 2011; Tetrault Sirsly and Lvina, 2019).

As companies have embraced private governance mechanisms, some have adopted third-party led standards, such as Fairtrade or Rainforest Alliance, while some industries and even companies have defined specific standards (Lambin and Thorlakson, 2018; van der Ven, 2018). For example, Nespresso has developed its own production standard, the NespressoAAA, as have Starbucks, while sector-specific standards have been developed by the coffee (4C) and the sugar (Bonsucro) industry. In Indonesia and Malaysia, the governments have launched national standards on palm oil production¹⁰. Some companies are foregoing standards, relying instead on company codes of conduct, which are rules defining the norms, responsibilities, and practices for the company, sometimes specified specifically for sustainability or individual supply chains. Others rely on direct trade and close producer relationships (Gerard et al., 2019; Latta and Barbara, 2014; MacGregor et al., 2017). This approach is especially well-established in coffee but infrequently applied across most agro-food commodity supply chains.

The multiplicity of governance approaches and standards in the marketplace weakens interoperability and effectiveness, while it also reduces legitimacy, as stakeholders question credibility and stringency (Judge-Lord et al., 2020; Potts et al., 2014). Striking the right balance between feasibility and legitimacy is difficult, as standards must be stringent enough to ensure that unsustainable producers are excluded while providing sufficient incentives and leniency to ensure uptake among motivated producers (Lambin et al., 2014). A further problem with the proliferation of approaches is that producers risk having to comply with “multiple, possibly

¹⁰ The two national standards, the Indonesia Sustainable Palm Oil, launched in March 2011, and the Malaysia Sustainable Palm Oil standard, launched in November 2013, both cover all production in the respective countries (by a set target date), but contain less stringent requirements than the competing multi-stakeholder led Roundtable on Sustainable Palm Oil standard (Brandi, 2020).

conflicting or overlapping, private standards or codes of conduct” (Koberg and Longoni, 2019).

2.3. THE SUPPLY CHAIN PHASE: LAYERED PUBLIC-PRIVATE GOVERNANCE

As widely adopted private governance approaches failed to reduce deforestation from agro-food commodity supply chains, governance approaches shifted once again. Many of the recent developments build on changes that began in the forest sector in the late 2000s and early 2010s. Here, a legality-based approach to govern forest-product commodity supply chains emerged, focusing in particular on timber imports and illegal harvest practices (Bartley, 2014). This approach has since spread to mineral supply chains and is now increasingly being adopted to govern agro-food commodity supply chains, particularly to reduce sustainability risks, such as deforestation.

The first legality systems were adopted in high-income import markets, such as the EU, US, and Australia. The regulations differ on the specific scope and mechanisms through which they govern timber or minerals supply chains, but all embrace hybrid approaches combining public governance mechanisms, such as import restrictions, disclosure requirements, or due diligence, with various private support measures, such as VSS or risk management systems. Most legality laws also include liability, imposing various penalties or sanctions on non-compliant companies. This approach attains a (supposedly) effective policy mix combining hard and soft instruments often deemed politically unfeasible (Bartley, 2014).

Current legality systems with direct importance for agro-food commodity-driven deforestation use include the European Union Timber Regulation¹¹ and the US Lacey

¹¹ Regulation (EU) no. 995/2010 of the European Parliament and of the Council of 20 October 2010, laying down the obligations of operators who place timber and timber products on the market. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010R0995>

Act¹², which both target imports of illegal tropical timber. Other legality-based governance approaches, which more indirectly influence agro-food supply chains and deforestation, include the EU Conflict Minerals Regulation¹³ and the US Dodd-Frank Act¹⁴, which both target minerals mined in conflict-prone areas. As the timeline (Figure 2-1) illustrates, current approaches to governing agro-food commodity supply chains have taken a remarkable turn towards hybrid “hard” law approaches that combine regulatory approaches with market incentives (Villiers, 2019) and makes the supply chain (and thus the “flow” of commodities) the key subject of governance. In particular, this change manifest as a sudden interest in due diligence-based approaches (Brack and Ozinga, 2020; Cossart et al., 2017; Schilling-Vacaflor and Lenschow, 2021; Villiers, 2019) (see also Chapter 3), which are proposed in several ongoing policy processes to address agro-food commodity-driven deforestation. However, as

¹² The US Lacey Act of 1900 banned trafficking in illegal wildlife and was amended in 2008 to include plants and plant products such as timber and paper. <https://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/lacey-act.html>

¹³ Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R0821>. The Commission’s Delegated Regulation (EU) 2019/429 of 11 January 2019 supplementing Regulation (EU) 2017/821 of the European Parliament and of the Council as regards the methodology and criteria for the assessment and recognition of supply chain due diligence schemes concerning tin, tantalum, tungsten and gold explains the methodology and criteria to assess and recognise supply chain due diligence schemes. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0429>.

¹⁴ The Dodd-Frank Wall Street Reform and Consumer Protection Act is a US federal law regulating the action of US publicly-listed companies. Section 1502 – the “conflict minerals” provision – requires companies, which use “any of the designated minerals” [tin, tungsten, tantalum and gold] to conduct “a reasonable ‘country of origin’ inquiry” and to take steps to address any risks they find in their supply chains, if these minerals originate in Congo or its neighbours. The companies are also obliged to produce a Conflict Minerals Report and to make this publicly available on their websites. Conflict Minerals Fact Sheet: <https://www.sec.gov/opa/Article/2012-2012-163htm---related-materials.html>. Original legal text: <https://www.congress.gov/bill/111th-congress/house-bill/4173/text?overview=closed&r=1>.

of June 2021, no existing due diligence-based policy directly targets agro-food commodity-driven deforestation. Instead, existing examples of due diligence stem from broad due diligence laws addressing both environmental and social aspects, and from timber legality laws. Unlike many public, regulatory efforts, several agro-food companies are fairly forthcoming towards due diligence-based regulatory approaches, and some companies, including several palm oil and cocoa companies operating within the EU, actively support due diligence-based regulations (see statements by Barry Callebaut et al. (2019) and Southey (2020))¹⁵.

In 2017, France adopted the “Loi au devoir de vigilance” (Duty of Care Law)¹⁶, which require companies to exercise due care through “elaboration, disclosure and effective implementation of a ‘vigilance plan’” (Cossart et al., 2017) to ensure companies identify and avoid environment, health and safety, and human rights impacts (Brack and Ozinga, 2020; Cossart et al., 2017). The law does not focus on a specific sector, but apply to all companies above a certain size, and extend throughout the company’s entire supply chain. The law is vaguely formulated, however, giving rise to uncertainty as to what obligations exist and how liability is defined (Brack and Ozinga, 2020). A similar proposal is on the table in Switzerland (the “Swiss Responsible Business Initiative”), requiring companies to exercise human rights and environmental due diligence (Villiers, 2019). The EU and UK also consider deforestation-specific due diligence approaches. The UK law was proposed in 2020 and requires companies to exercise due diligence on forest-risk commodities (UK Department for Food Environment and Rural Affairs, 2020), but was broadly criticised for failing to include a sufficiently large pool of companies and commodities to be effective. The EU is also considering a due diligence requirement to reduce agro-

¹⁵ For further discussion of this, see Chapter 3.

¹⁶ LOI n° 2017-399 du 27 mars 2017 relative au devoir de vigilance des sociétés mères et des entreprises donneuses d'ordre (LAW n° 2017-399 of March 27, 2017 relating to the duty of vigilance of parent companies and ordering companies).
<https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000034290626>.

food commodity-driven deforestation, which unlike the French law and the existing legality regime contained in the EU Timber Regulation focus exclusively on deforestation. The exact details are still unclear, including the type of due diligence required, the companies covered by the law, and the liability and sanctions included (Bager et al., 2021a; Schilling-Vacaflor and Lenschow, 2021). In the French law, liability claims must be pursued by civil society, carrying the burden of proof, while in the Swiss proposal, the burden of proof sits with companies (Brack and Ozinga, 2020; Villiers, 2019).

These developments point to a governance phase characterized by different governance approaches “layered” on top of each other. On the one hand, it maintains the focus on private actors, especially companies across the agro-food supply chains, as the principal agents of governance implementation. To target deforestation by agro-food commodities, these private actors adopt various governance instruments across their supply chains, such as voluntarily adopted zero-deforestation commitments or mandated due diligence requirements. Sometimes, these are combined with yet other instruments, such as VSSs, to ease implementation or reduce costs. On the other hand, the private governance approaches take place within a stronger, regulatory frame, where governments set targets to reduce agro-food commodity-driven deforestation and mandate certain governance approaches to meet these, such as specific VSSs, due diligence obligations, or legality standards. At the same time, public actors provide various carrots and sticks to private actors to enable implementation, such as offering financial incentives, providing information, or punishing laggards. This “layered” governance provides for strong roles for both public and private actors and signals a departure from previous phases, where one actor group and type of approach dominated governance at the expense of other actors and approaches.

3. ASSESSING AGRO-FOOD SUPPLY CHAIN GOVERNANCE APPROACHES

To what extent have various governance approaches addressed deforestation across agro-food commodity supply chains? That is difficult to say with any certainty. The

effectiveness of most governance approaches in reducing deforestation is highly contextual, depending on the supply chain, production landscape, and jurisdiction of implementation, as well as on the interactions with other governance approaches (Auld, 2014a; Garrett et al., 2021; Ingram et al., 2020; Lambin et al., 2014; Lambin and Thorlakson, 2018). Further complicating the assessment, several studies of the effectiveness of deforestation-related governance interventions for agro-food commodities lack clear counterfactuals or baselines, systematic evaluations, and clear causal attribution. Other studies are challenged by specific issues such as selection bias, sample size, or time horizon. Most evidence on deforestation governance concerns the effect of VSS (especially for smallholder farmers), while other approaches remain comparatively understudied.

This section outlines the existing evidence on six governance approaches, which are particularly prominent in current efforts to govern agro-food commodity standards. The detailed description of these six approaches, at the expense of other approaches, stem from the prominence with which various stakeholders within the agro-food sector adopt these, signalling that stakeholders view these as particularly relevant, and thus warranting extra attention. The amount of evidence across the six governance approaches varies widely, as the individual approaches range from the widely studied (VSS) to the barely adopted (due diligence). This short analysis is not (and should not be considered) a thorough evaluation of the different approaches, but rather a snapshot of six of the most prominent agro-food supply chain governance approaches. At the end of the section, Table 2-1 provides a summary of the various governance approaches introduced here, briefly describing each approach and noting the main mechanisms and potential benefits and drawbacks as concerns agro-food commodity supply chain governance.

3.1. VOLUNTARY SUSTAINABILITY STANDARDS

In the past three decades, the number of VSS has ballooned, increasing from a dozen to over 400 (UNCTAD, 2020; UNFSS, 2016), crowding the marketplace with numerous standards competing for market share. Within the broader agro-food sector, VSS cover numerous commodities – either individually or as part of cross-commodity

standards – among others soy, cocoa, coffee, palm oil, sugar cane, as well as fisheries and aquaculture and non-food FRCs, principally forestry and bioenergy. The market share held by VSS across commodities is very uneven. For some, such as coffee, where 53% is produced according to one or more VSS (Grabs, 2018), or forestry, where FSC covers 17% of the global timber market, standards are a mainstay of production. Other commodities with significant market share held by VSS include cocoa, tea and palm oil, which – like coffee – all have high export-shares (Tayleur et al., 2017). For most commodities, however, VSS hold just a few per cent of the total market (Ponte, 2019; Potts et al., 2014).

Concerning deforestation, VSSs differ on two dimensions: the governance setup, including actors, implementation, enforcement, and verification, and the specific requirements of the VSS on deforestation (and other social and ecological aspects) (Lambin and Thorlakson, 2018). Tayleur et al. (2017) reviewed 12 major agro-food standards,¹⁷ finding only two (Rainforest Alliance and Proterra), which prohibit all deforestation, whereas others (e.g. RSPO) “generally prohibit deforestation in high conservation value areas but may permit it elsewhere.”

Several reviews and meta-reviews have assessed the impact of VSS, though few have dealt specifically with deforestation. The evidence that VSS improve sustainability is mixed, often depending on context-specific factors. There is some evidence that VSS can reduce deforestation in some contexts, though results are mixed and inconclusive (Ingram et al., 2020; Rueda et al., 2015; van der Ven et al., 2018). The evidence of impact remains even more limited for company- or industry-led sustainability standards, which are generally more lenient and less frequently third-party verified.

¹⁷ Organic cropland (IFOAM), Rainforest Alliance, Roundtable on Sustainable Palm Oil (RSPO), Fairtrade, Proterra, The Common Code for the Coffee Community (4C), UTZ, Better Cotton Initiative, Cotton Made in Africa, Bonsucro, Round Table on Responsible Soy (RTRS), Roundtable on Sustainable Biomaterials (RSB).

Generally, the combination of low market uptake and moderate effect limits the sector-wide sustainability impacts of VSS across most sectors.

To increase impacts, VSS must overcome several challenges. Firstly, despite rapid growth in recent years, VSS uptake is still not “mainstream” (Smith et al., 2019), and for most FRCs, notably coffee and palm oil, the supply of certified commodities still exceed demand (Grabs, 2018; Panhuysen and Pierrot, 2018; Potts et al., 2014) – “typically between one-third and one-half of total compliant production is actually sold as compliant” (Potts et al., 2014). A persistent critique is that VSS mostly benefits downstream value chain actors, rather than producers, failing especially to benefit marginalized smallholders and lacking incentives for producers (COSA, 2013; Minten et al., 2018; Potts et al., 2014; UNFSS, 2016). In the context of coffee, Samper and Quiñones-Ruiz (2017) argue that VSS further exacerbates power differentials along value chains at the expense of small producers and fails to tackle sustainability challenges. Further, upstream VSS uptake is concentrated among more well-off farmers in more developed regions, primarily Latin America (Potts et al., 2014). This suggests a risk of self-selection bias across VSS, as well-off producers, who require only modest changes to their practices, will be the first to join, meaning that these actors already perform better than average, independent of the VSS, leading to limited additional impact (Lambin et al., 2014; Loconto and Dankers, 2014; Tayleur et al., 2017). VSS implementation also faces several limitations on the ground, as high costs and strict requirements create significant entry barriers, especially for poorer farmers and communities (Dietz and Grabs, 2021). Finally, standards are generally restricted to single commodities and supply chains and, accordingly, ill-equipped to target cross-commodity issues in multifunctional landscapes.

3.2. COMMODITY ROUNDTABLES AND MORATORIA

The potential limitations of unilateral approaches led to increased use of multi-stakeholder platforms (MSP), such as commodity roundtables and moratoria, to address agro-food commodity-driven deforestation. Such approaches became especially popular for highly “commodified” product supply chains with little or no

segregation and product quality differentiation (as exists for coffee, for example) and significant bulk purchases across spot markets, particularly soy and palm oil.

MSPs emerged as a means to ensure balanced representation of various stakeholders across the supply chain, while still enabling decisive action to address deforestation (Wardell et al., 2021). MSPs were spurred on by insufficient public regulation in producer countries and the unwillingness or inability of many private actors to address deforestation – at least in the eyes of many downstream stakeholders in the richer parts of the world, particularly consumers and NGOs. The most notable examples of MSPs are the Roundtable on Sustainable Palm Oil (RSPO), the Round Table on Responsible Soy (RTRS), the Roundtable on Sustainable Biomaterials (RSB), the Amazon Soy Moratoria, and the Amazon Cattle Agreement.

ROUNDTABLES

Roundtable-enabled governance approaches cover a growing share of the market (van der Ven et al., 2018). Since its inception in 2004 and the first certification in 2008, RSPO has grown to cover approximately 20% of the total palm oil market. RTRS has seen a significantly lower market share, covering only 0.7% in 2015 (van der Ven et al., 2018). The roundtables face competition from competing industry- or government-led standards (Brandi, 2020; Ponte, 2014), notably the ISPO and MSPO, covering palm oil production in Indonesia and Malaysia, respectively, the two largest palm oil producers globally. Unlike most unilateral company or industry-led standards, RSPO and other roundtable-led standards include third-party verification, increasing the stringency and overall assurance of the standard (Lambin et al., 2014).

The ability of roundtables to curb deforestation is mixed, though context and commodity naturally matter, and especially smallholder-driven deforestation has not been sufficiently addressed (Garrett et al., 2018a; Ingram et al., 2020; Lambin et al., 2014; Morgans et al., 2018). Lack of systematic evaluations and studies including clear counterfactuals complicate assessment of effectiveness, as individual, site-specific studies show different results. For example, Austin et al. (2017) show that oil palm remains the principal driver of deforestation in Indonesia, and despite increasing

RSPO certification, “deforestation has remained relatively stable since 2005” (p. 47), while Carlson et al. (2018, p. 121) find reduced deforestation risk associated with RSPO certification, but caution that “most plantations contained little residual forest” when receiving certification. Heilmayr et al. (2020b, p. 1) conclude that RSPO reduces illegal deforestation, but facilitates “increased deforestation in areas zoned for agricultural use.” Noojipady et al. (2017) show that certified plantations have significantly lower fire risks than non-certified areas, while Morgans et al. (2018) do not find evidence of significant differences in fire risk between certified and non-certified areas. Cattau et al. (2016) provide an in-between perspective, finding differences in fire risk on some land-use types, though not on peat. Ruyschaert and Salles (2014) conclude that RSPO has not conserved orang-utan habitat effectively, attributing this partly to insufficient uptake, especially among smallholders. Using time-series data dating back to 1984, Cazzolla Gatti and Velichevskaya (2020, p. 4-5) show that RSPO certified concessions are located in previous tropical forest areas, arguing that “due to its recent past of deforestation and habitat destruction”, palm oil “cannot be considered ‘environmentally sustainable’ even if it comes from certified suppliers.”

Even less evidence exists on the impact of RTRS, which is more recent than RSPO. Garrett et al. (2016) examine the potential additionality of RTRS and RSPO, showing that both “offer higher protections for native vegetation than existing policies in all regions where they are adopted” (p. 15). Given RTRS’ very low adoption rate, “RTRS needs higher overall adoption levels to improve standard impact” (Garrett et al., 2016, p. 15). van der Ven et al. (2018) notes that RTRS’ effectiveness is reduced by the standards’ exception to certain types of deforestation and the opportunity to certify only part of a property.

MORATORIA

Moratoria rely on market exclusions or bans and focus on specific commodities or activities in spatially defined areas, such as a country or biome, and cover a limited period (Eduardo et al., 2017; Lambin et al., 2014). They can include both public and private stakeholders, with the stakeholders most important for success being the

companies agreeing to cease particular activities in the given area. However, looking beyond effectiveness to consider questions of legitimacy and equity, moratoria must ensure the representation of local communities and stakeholders beyond agro-food companies and their downstream consumers (Bastos Lima and Persson, 2020). The most prominent and successful example is the Amazon Soy Moratorium (ASM) enacted in 2006. Originally set to last for two years, it has been renewed annually ever since and was extended indefinitely in 2016. Other examples include the Amazon Cattle Agreement (ACA), signed in 2009 by the four main Brazilian beef companies. A government-led example includes the Indonesian deforestation moratorium, first issued in 2011 and renewed biannually, and since permanently extended in 2019 (Jong, 2019). NGOs play a large role in garnering sufficient pressure on companies and other stakeholders to adopt moratoria (Cisneros et al., 2015; Lambin et al., 2014). For the two Amazon moratoria, targeted pressure by NGOs, especially Greenpeace, which published two landmark reports (Greenpeace, 2006, 2009b) on Amazon deforestation, arguably played a key role by singling out companies responsible for deforestation, while other NGOs facilitated discussions between key stakeholders (see the timeline for key events, Figure 2-1).

The impact of moratoria on deforestation is split between solid evidence for the effect of the ASM and limited or no evidence for other moratoria. Lambin et al. (2014) argue that moratoria succeed for commodities and regions with global significance, where signatory actors – mainly MNCs – can control activities across supply chains. Gibbs et al. (2015) label the ASM a success, highlighting its ability to reduce soy expansion on forested areas. Amaral et al. (2021) find a decoupling of soybean farming and deforestation following the ASM, while Heilmayr et al. (2020a) use an econometric approach to isolate the effect of ASM from other conservation policies, showing that the ASM prevented approximately 18,000 km² of deforestation in the first decade after its inception. Silva and Lima (2018) provide some nuance to the praise, showing that although overall effective, numerous producers are non-compliant with ASM, leading to continued deforestation on offending properties. The ACA, to the contrary, shows mixed performance. Analysing the ACA in the Brazilian Amazon state of Pará, Gibbs

et al. (2016, p. 1) show that following the ACA, slaughterhouses “avoid purchasing from properties with deforestation,” further finding that the properties supplying cattle to the slaughterhouses “significantly reduced deforestation rates.” Alix-Garcia and Gibbs (2017, p. 207), however, find “no effect on forest cover across the supply zones surrounding slaughterhouses.”

Moratoria can cause unintended spillovers to other areas and jurisdictions. There is an indication that the ASM increased deforestation rates in neighbouring biomes (Dou et al., 2018; Nolte et al., 2017; le Polain de Waroux et al., 2016), reducing the net effect. Leakage and displacement effects also plague the ACA, as cattle “laundering” from non-compliant to compliant landholders reduce overall effectiveness (Alix-Garcia and Gibbs, 2017; Garrett et al., 2018a). Expanding the ASM to neighbouring Cerrado, as discussed under the Cerrado Working Group (Bastos Lima and Persson, 2020) could reduce deforestation in this biome – potentially preventing up to 3.6 Mha of deforestation by 2050 (Soterroni et al., 2019). However, moratoria are not equally likely to work in all settings, due to differences in existing regulatory frameworks, biophysical conditions, and land ownership, among others. In a study of South American forest frontiers, Nolte et al. (2017) conclude that it is more challenging to adopt similarly effective deforestation governance approaches in the Cerrado, Chaco, and the Chiquitano than in the Amazon due to differences in agricultural sector composition, land tenure regimes, and forest regulations.

3.3. COMMITMENTS AND ASPIRATIONS

The different commitments of companies to end deforestation across supply chains are collectively referred to as zero-deforestation commitments (ZDCs). They arose – among other things – out of a 2008 campaign by the World Wide Fund for Nature (WWF) calling for zero net deforestation by 2020, and took hold with early commitments by companies exposed to NGO campaigning, especially Greenpeace’s notorious KitKat campaign, which linked the chocolate bar to deforestation and loss of Orang-Utan habitat (Opal, 2017; Wolf, 2014). It gathered further speed with the initiative of the Consumer Goods Forum (CGF) (2010) to pledge that its 450+ members (including most MNCs) would commit to zero-net deforestation across their

supply chains by 2020 (Lyons-White et al., 2020; Pasiecznik et al., 2017) (see Figure 2-1). The Tropical Forest Alliance 2020 was established in 2012 to muster further action, and today, more than 450 companies involved in the production, trade, processing, and manufacturing of agro-food commodities have pledged to reduce, halt, or eliminate agro-food commodity-driven deforestation across global supply chains (Forest Trends, 2019; Forest500, 2021b; Jopke and Schoneveld, 2018).

The impact of ZDCs on reducing agro-food commodity-driven deforestation is uncertain, in part due to the variation in scope and stringency, but also because most ZDCs are relatively new with target dates set at the end of 2020, meaning that there is a paucity of studies and evaluations. A few studies model the potential effectiveness of ZDCs under various conditions. Garrett et al. (2019) develop criteria to assess the potential effectiveness of ZDCs, suggesting that “existing ZDCs have the potential to be moderately effective in reducing deforestation within targeted supply chains and regions, but leave substantial room for improvement with regards to achieving global reductions in deforestation” (p. 145). Leijten et al. (2020) show that, when accounting for the different ways ZDCs designate areas for protection – relying on high conservation value (HCV), high carbon stock (HCS) or peatland definitions – as well as differences in forest maps, 34-74% of global forests are potentially protected by ZDCs. They note that effectiveness also depends on leakage to other forest areas not included in ZDCs.

Other studies assess the effectiveness of ZDCs in specific regions or commodities. For example, zu Ermgassen et al. (2020b) evaluate the impact of ZDCs in the Brazilian soy sector and find “no evidence of additional reductions in the deforestation risk of committed actors since making these pledges [ZDCs]” (p. 6). Austin et al. (2017) suggest that the effect of ZDC is contingent on local land use conditions, finding little impact on deforestation in Sumatra, but potential influence in Kalimantan and Papua, due to differences in forest cover and suitable land areas between these locations. The uncertainty over impact is further exacerbated by the lack of reporting by companies on progress (implementation, monitoring, verification, etc.) (Forest500, 2021b) and the lack of transparency on commitment scope and implementation (Pasiecznik et al.,

2017). Given the lack of definitions, it is extremely difficult to meaningfully compare company efforts and to analyse the (potential or actual) effectiveness. Several NGOs collect information on ZDC scope and reporting by companies (Bregman et al., 2016; Forest Trends, 2019; Forest500, 2021b; Lake, 2018), but there is a glaring lack of systematic evaluations, especially studies relying on counterfactuals.

Few, if any, of the collective aspirations set by governments (see Figure 2-1) are on track to be met. While the Bonn Challenge pledges total 170 million hectares (Mha) combined for 2020 and 2030 – above the target of 150 Mha – evidence of restoration exists for only 18% of the target (NYDF Assessment Partners, 2019). As for the NYDF, a 2019 assessment find “little evidence that these goals are on track, and achieving the 2020 NYDF targets is likely impossible” (NYDF Assessment Partners, 2019, p. 13). Similarly, ADP signatories are far from removing deforestation from their supply chains (IDH, 2020) and several recent studies link European agro-food commodity consumption and global deforestation (Rajão et al., 2020; zu Ermgassen et al., 2020a). Arguably, these collective aspirations have remained merely aspirational, generally failing to change deforestation and appearing as “goal setting” (Lambin et al., 2018), rather than initiatives to change outcomes on the ground.

3.4. JURISDICTIONAL AND LANDSCAPE APPROACHES

Most jurisdictional and landscape approaches (JA) are relatively recent features, having emerged in the years since 2015 (von Essen and Lambin, 2021). While often used synonymously, the jurisdictional approach is designated by administrative boundaries (e.g. province, region), whereas a landscape pertains to ecological or socio-cultural features (Denier et al., 2015). These approaches have grown increasingly popular in recent years, with numerous national and sub-national initiatives emerging, often in collaboration with leading MNCs and companies, and supported by large international NGOs (Denier et al., 2015; von Essen and Lambin, 2021; Wardell et al., 2021). These approaches have grown in popularity, as they (supposedly) overcome many of the barriers plaguing other governance approaches and enable secure and low(er)-cost sourcing of sustainable agro-food commodities (von Essen and Lambin, 2021) and facilitate collective action. With the boom in the

number of such approaches, there is great potential for knowledge exchange and learning between the numerous ongoing approaches.

There is scant evidence on the impact of jurisdictional approaches and the conditions for effectiveness (Chervier et al., 2020; von Essen and Lambin, 2021), partly because many are still being implemented or have just begun operating, partly due to a lack of systematic, ongoing reporting and evaluation. The latter is complicated by the lack of suitable counterfactuals, “particularly because of the small pool of potential controls” (Chervier et al., 2020). JAs also face several implementation challenges, including identifying the appropriate scale (national, sub-national, local), facilitating engagement and participation of all stakeholders, land tenure and smallholder access, reconciling different stakeholder needs, priorities, and demands, building trust and managing conflicts, ensuring sufficient autonomy and flexibility, and securing sufficient financial, human, and technological resources (Chervier et al., 2020; von Essen and Lambin, 2021). Chervier et al. (2020) argue that the theory-of-change underlying JAs needs to be strengthened on two aspects. Firstly, the causal link between implementation and effects is unclear, i.e. “how things are supposed to unfold as a result of JA implementation in order to achieve deforestation reduction at the jurisdiction scale” (p. 3). Secondly, the policy mix within which JAs are implemented is largely unknown, i.e. “identifying the mix of interventions associated with a given JA” (p. 3). A final challenge for JAs is to reconcile the jurisdictional interventions and the external conditions affecting local deforestation, such as agro-food commodity supply and demand, international policies, company sourcing strategies, and other governance interventions. This requires that actors implementing JAs consider processes beyond the given jurisdiction (Chervier et al., 2020).

Much of the support for jurisdictional approaches thus rests on the premise that multi-stakeholder led approaches across entire jurisdictions involving public actors to enforce mandatory requirements for production practices can achieve change across landscapes and reduce leakage (Ingram et al., 2020; Mallet et al., 2016). By including most of the relevant stakeholders (government, producers, companies/MNCs, NGOs, etc.) and by operating within government-controlled boundaries (municipality,

province, country, etc.), JAs facilitate collaboration and enable monitoring of outcomes. Further, JAs allow for enforcement – provided the enforcement capacity exists (Denier et al., 2015; von Essen and Lambin, 2021). These aspects theoretically reduces problems of mismatches (Folke et al., 2007; Moss, 2003) and leakage (Bastos Lima et al., 2019; Meyfroidt et al., 2018) between commodity production systems and governance approaches designed to tackle these. As Chervier et al. (2020, p. 7) categorically state, “enthusiasm for jurisdictional approaches to reduce deforestation is mainly based on the promise of effectiveness gains, which are yet to be verified.”

3.5. DUE DILIGENCE APPROACHES

Due diligence approaches are increasingly popular mechanisms for governing deforestation risks in agro-food commodity supply chains. What exactly constitutes due diligence differ between the different laws and proposals. Fundamentally, due diligence is an action taken to avoid committing an offence, but this can be exercised using two different approaches: Due diligence as a continuous process or due diligence as a market obligation (Brack and Ozinga, 2020). In the continuous process, due diligence is a dynamic, ongoing process, where all issues need not be handled upfront, but instead prioritized using a risk-based approach. Some issues are dealt with immediately, while others can be handled later, as suppliers improve their practices (Brack and Ozinga, 2020). The French Duty of Care law applies this due diligence concept, as does the Swiss law (Brack and Ozinga, 2020; Cossart et al., 2017). This is also the approach many companies take to reducing deforestation risks across supply chains (cf. Chapter 5). On the contrary, due diligence as a market obligation requires companies to analyse suppliers up front, taking steps to ensure that suppliers have not committed the identified risks (here, deforestation) (Brack and Ozinga, 2020). This due diligence approach is well-known from financial, legal, and technical due diligence processes, where detailed analyses are performed ex-ante, i.e. before committing to particular decisions, in this case sourcing commodities from a given supplier or region. It is also how due diligence is understood in the EU Timber and Conflict Minerals regulations.

A general risk with due diligence-based approaches is that companies simply ‘tick’ the necessary boxes required by the law, rather than seeking to actually enact change across supply chains (Brack and Ozinga, 2020). The complexity of most agro-food supply chains contributing to deforestation requires that companies carefully design due diligence interventions to ensure stakeholders’ participation and adequate information sharing and risk assessments (Villiers, 2019). This is vital to ensure that companies help suppliers adhere to the requirements, in fact changing practices (i.e. avoid deforesting), rather than companies altogether avoiding high-risk suppliers, who then sell to less demanding buyers (Brack and Ozinga, 2020). This also includes ensuring that suppliers avoid deforestation across their entire production, as this otherwise increases the risk of “dirty” commodities entering leakage markets. In line with this, due diligence approaches need safeguarding mechanisms to ensure that smallholders are not abandoned as part of the due diligence process, for example by companies fearing that these actors do not have the resources (financial, technical, etc.) to adhere to the requirements (Brack and Ozinga, 2020).

The effectiveness of due diligence in reducing deforestation is difficult to ascertain due to the limited application so far. Generally, the combination of hard and soft approaches that the concept enables can potentially be quite effective, as demonstrated by legality-based approaches within the timber sector. However, the effectiveness of due diligence is greatly affected by the exact definitions, requirements, and liability options instated, as well as the coverage across supply chains (see Chapter 3). This also includes the links to other governance approaches, notably timber-legality laws (e.g. EUTR), zero-deforestation commitments, and certification standards. In the EU Renewable Energy Directive, certification standards can be used to demonstrate compliance, which is not the case for timber-legality laws, such as EUTR and CMR (Brack and Ozinga, 2020; Renckens, 2020). Further, the supporting systems put in place to gather information and obtain evidence of any wrongdoing, as well as the enforcement capacity, affect the potential effectiveness of due diligence based approaches (Bager et al., 2021a; Brack and Ozinga, 2020; Cossart et al., 2017; COWI et al., 2018; Schilling-Vacaflor and Lenschow, 2021).

3.6. TRADE AGREEMENTS AND TRADE-RELATED POLICIES

Public actors on a global and supra-national level, especially within the EU, increasingly consider the options for utilizing trade measures to reduce the impact of agro-food commodity supply chains. In the EU, trade agreements now include a sustainability impact assessment¹⁸, which assesses the potential sustainability impacts arising from any trade agreements that the EU enters into. The current debate on the EU-Mercosur Free-Trade Agreement, however, illustrates the complexity of utilizing trade agreements to reduce agro-food commodity-driven deforestation (Baltensperger and Dadush, 2019; Kehoe et al., 2020). Mercosur is arguably the trading bloc contributing the most to the EU's imported deforestation footprint with Indonesia a close second (cf. Chapter 3 and Pendrill et al., 2019a, 2020). Despite more than a decade of negotiations, critics argue that the tentative agreement fails to adequately tackle the risks of increasing imported deforestation through agro-food trade if trade with Mercosur is further liberalized (Kehoe et al., 2020). On the other hand, trade agreements enable “extra-territorial” governance (Scott, 2020), providing the EU with leverage to affect production conditions in Mercosur countries, which is otherwise difficult. It is also an alternative to import-restrictive measures, such as tariffs, which risk conflicting with WTO regulations.

As an alternative to bilateral trade agreements, the EU considers introducing a Carbon Border Adjustment Mechanism (CBAM), which is a type of carbon pricing on products imported into the EU. The intention is to allow the EU to implement strict GHG emission reduction requirements while reducing risks of leakage occurring if activities shift to countries with less ambitious policies (Oharenko, 2021; The National Board of Trade Sweden, 2020). Analyses suggest that CBAM can be adopted

¹⁸ Led by the Directorate-Generale (DG) for Trade, Sustainability Impact Assessments (SIAs) “provide the Commission with an in-depth analysis of the potential economic, social, human rights, and environmental impacts of ongoing trade negotiations”
https://ec.europa.eu/trade/policy/policy-making/analysis/policy-evaluation/sustainability-impact-assessments/index_en.htm

without violating WTO rules and introducing excessive transaction costs, but its effectiveness hinges on the proposed scope and implementation (The National Board of Trade Sweden, 2020). Concerning agro-food commodities, such regulation would likely require fine-grained quantitative footprint analyses (Godar et al., 2015), which entail substantial data collection and analysis.

The EU also adopts other trade-based measures to govern sustainability impacts, though none of these target agro-food commodities. For example, the illegal, unreported and unregulated (IUU) fishing regulation¹⁹ bans illegal fishery products (as defined by the producing country) from entering the EU market, complemented by a ‘carding system’ indicating whether producer countries adhere to the requirements set by the EU (Hutniczak and Delpéuch, 2018; Toonen and Bush, 2020). The current EU negotiations on new deforestation regulation consider similar types of instruments for agro-food commodities, but currently, no such regulation exists. For agro-food commodities, illegal trade is sanctioned within CITES, as part of the legality standards (e.g. Lacey Act, EUTR), and as part of the Forest Law Enforcement and Governance (FLEGT) Action Plan of the EU. FLEGT combine demand-side legality verification and due diligence systems enacted through EUTR with forest governance support to producer countries through Voluntary Partnership Agreements (VPAs) (Brack and Ozinga, 2020; Van Helden, 2012; Lesniewska and McDermott, 2014; Overdevest and Zeitlin, 2014). VPAs are voluntary trade-based agreements negotiated with non-EU countries exporting timber to the EU, which commit the exporting countries to develop a legality licensing system to verify the legal harvest of timber exports (Van Helden, 2012; Lesniewska and McDermott, 2014). Seven countries have signed VPAs with the EU, while nine more are in negotiations, but

¹⁹ Council Regulation (EC) No 1005/2008 of 29 September 2008 establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing, amending Regulations (EEC) No 2847/93, (EC) No 1936/2001 and (EC) No 601/2004 and repealing Regulations (EC) No 1093/94 and (EC) No 1447/1999. <https://eur-lex.europa.eu/eli/reg/2008/1005/oj>.

only Indonesia has ratified and implemented the VPA, allowing it to issue FLEGT export licenses²⁰. The negotiation, implementation, and ratification of FLEGT VPAs have been much slower than expected, as only one country has completed the process, despite a decade passing since adoption. Scholars question the impact of VPAs on deforestation. Some argue that it has improved forest governance and accountability in exporting countries (Carodenuto and Cerutti, 2014; Overdevest and Zeitlin, 2018), while others criticise the lack of sustainability considerations and weak civil society participation (Lesniewska and McDermott, 2014). With the limited success of VPAs, it seems unlikely that this approach will be extended to agro-food commodities.

3.7. SUMMARY OF GOVERNANCE INTERVENTIONS

Table 2-1 below summarizes the main governance interventions covered in this chapter. It includes short examples, a brief description, the main characteristics, and the potential benefits and drawbacks. The approaches differ on the unit governed with some approaches (e.g. jurisdictional approaches) governing a particular area – typically a government-defined legal boundary, such as a province or country, while others govern individual commodities or supply chains. While some extend to only one node in the supply chain, e.g. most VSSs, others, e.g. due diligence, extend across supply chains to all nodes and actors involved. The role of stakeholders also differs across the approaches. Some involve only private companies, sometimes with the support of NGOs, while others are pure public approaches that companies must adhere to and implement. Yet others are hybrid arrangements involving public and private actors in different roles. In many supply chains, several of these approaches operate simultaneously, creating great diversity and polycentrism across the governance landscape. Each approach has benefits and drawbacks, underlining how a combination of different approaches are required to tackle the telecoupled challenge that is agro-food commodity supply chain-driven deforestation.

²⁰ EU FLEGT Facility. <https://www.euflegt.efi.int/es/vpa>.

Policy	Example(s)	Description	Characteristics	Benefits	Drawbacks
Land use zoning	Concessions (logging, agricultural production, etc.),	Divides areas into zones with different rules and regulations for land use & management practices ¹	Area-based. Regulatory instrument with government enforcement and NGO assessment	Can reduce deforestation within areas designated for protection.	Risks of leakage or spillover between protected and non-protected areas, and potential “pollution havens”
Private and industry sustainability standards	4C, Nespresso AAA, Starbuck’s C.A.F.E. Practices	Specific sustainability production requirements	Commodity-based. Market-based instrument voluntarily adopted by companies. Usually first- or second-party auditing	Broad adoption and broad coverage of sustainability.	Limited additionality. Limited or no impact on deforestation
Voluntary sustainability standard / eco-certification	Rainforest Alliance, Fairtrade	Specific sustainability production requirements	Commodity-based. Market-based instrument voluntarily adopted by companies. Usually third-party auditing	Broad coverage of sustainability and widespread adoption.	Limited deforestation impact. Self-selection bias.
Internal policies (Codes of Conduct)	Unilever’s Responsible Sourcing Policy, Nestlé’s Code of Business Conduct	Company defined policies for production, sourcing, etc.	Commodity-based. Voluntarily adopted by companies. Usually no monitoring, but occasionally linked to NGO monitoring	Flexible approach with broad application.	Missing accountability and external verification. Unknown impact on deforestation.
Producer relationships and Direct Trade	Coffee Collective’s Direct Trade	Company defined supply chain configurations	Commodity-based. Cooperative and market-based instrument voluntarily adopted by companies. Usually no assessment, company enforcement through supply chains.	Potential to increase producer welfare and income.	Limited or no effect on deforestation. No uniform definitions and vague criteria.

Policy	Example(s)	Description	Characteristics	Benefits	Drawbacks
Company pledges and commitments	Zero deforestation commitments by Nestlé and Unilever, Wilmar and GAR NDPE	Company sustainability commitment	Commodity- or supply chain-based. Voluntary commitment made by companies. Potential for assessment by NGOs. Company enforcement	Flexible approach with broad application.	Implementation lacking, limited verification. Unknown impact on deforestation. Some risk of leakage. Vague targets, criteria, and definitions.
Collective aspirations	Consumer Goods Forum, 2014 New York Declaration on Forests	Collective sustainability aspirations by a stakeholder group	Commodity- or supply chain-based. Voluntary commitment made by single or collective actors. Potential for assessment by NGO, no enforcement.	Provide broad inspiration across groups of stakeholders. Potential to spur related action.	Little or no effect on deforestation rates. Lacks accountability and unclear how to implement.
Commodity roundtables	Programmes for sustainable production of palm oil (RSPO), soy (RTRS), and biomass (RBS)	Agreement of sustainable production practices to achieve market access or price premiums	Commodity-based. Market-based instrument voluntarily adopted by companies, though some indirect public support. Usually third-party auditing.	Multi-stakeholder participation. Fairly widespread adoption.	Difficult to assess impact on deforestation. Some risk of leakage. Limited adoption by smallholders.
Moratoria	Amazon Soy Moratoria, Cattle Moratoria	Agreement to ban or sanction production or trade of specific commodities or from specific areas	Area- or commodity- and area-based. Market-based instrument (exclusion) voluntarily adopted by companies. Potential assessment by NGOs, no enforcement.	Multi-stakeholder process allow for inclusion. Flexible mechanism.	Risks of leakage to nearby regions or biomes. Insufficient consultation of all stakeholders.

Policy	Example(s)	Description	Characteristics	Benefits	Drawbacks
Due diligence	EU Conflict Minerals Regulation, French Duty of Vigilance law	Action taken to avoid committing an offence. Market obligation or improvement process.	Commodity-, supply chain- or area-based. Market-based instrument with several enforcement options, though usually government enforced. Monitoring by NGOs and/or governments.	Enables exclusion of commodities causing deforestation. Flexible scope and design.	Risks of leakage and smallholder exclusion. Requires supply chain information-sharing and collaboration.
Disclosure requirements	US Dodd-Frank Act, EU Non-Financial Reporting Directive	Requirements to disclose or make available information to certain actors.	Commodity-based. Information-based instrument with several enforcement options, though usually voluntarily adopted or government enforced. Monitoring by NGOs and/or governments.	Fosters company accountability and can be applied across supply chains.	Limited or no effect on deforestation. Complicated to adhere to.
Chain-of-Custody requirements	US Dodd-Frank Act	Establish information on ownership and responsibility of agro-food commodities.	Commodity- or area-based. Information-based instrument with several enforcement options, though usually government enforced. Monitoring by NGOs and/or governments.	Enables accountability and improves information access.	Can be extremely difficult and costly to adhere to. Limited or no effect on deforestation.
Free Trade Agreement	EU-Mercosur Agreement	Trading partners agree to specific terms for trade between countries	Area-based, but usually applied to specific commodities. Market-based instrument with government enforcement.	Facilitates extra-territorial leverage using sustainability clauses.	Can increase trade in FRCs, risking further (embedded) deforestation. Slow implementation.

Policy	Example(s)	Description	Characteristics	Benefits	Drawbacks
Legality standards	EU Timber Regulation, US Lacey Act	Prohibits placing illegal products on market	Commodity- or area-based. Market-based (exclusion) instrument with several enforcement options, though usually government enforced. Monitoring by NGOs and/or governments.	Facilitates extraterritorial impact. Reduce imports of unwanted goods. Can be applied to entire supply chain.	Require collaboration with producer governments. Enforcement vary with legal systems and capacity.
Jurisdictional or landscape approaches	Sabah 100% RSPO by 2025, National Coffee Action Plan Peru, Initiative for Sustainable Landscape Approach Vietnam	Sustainable resources at jurisdictional scale through formalized multi-stakeholder collaboration	Area-based. Market-based instrument voluntarily adopted by stakeholders, but usually formalized. Typically entail government enforcement with monitoring by NGOs.	Reduces risks of leakage across supply chains.	Limited evidence of effect.

Table 2-1. Conceptual overview of governance interventions to address agro-food commodity-driven land use change and deforestation.

Table outline based on Lambin et al. (2014, 2018). Data in table based on references and analysis presented in the chapter.

4. ENABLERS OF AGRO-FOOD SUPPLY CHAIN GOVERNANCE

Across global supply chains, there is a current drive for traceability and transparency²¹, often empowered by advances in technology. Downstream companies

²¹ While sometimes used interchangeably in discussions of supply chains, traceability and transparency denote two different, though interrelated concepts. Traceability is fundamentally about provenance; knowing where things, in this case, agro-food commodities, are produced and establishing the chain of custody between places of production and consumption. Transparency is about divulging information about these products, including their origin (provenance), supply chain configuration, and the conditions under which they were produced.

and other supply chain actors such as traders and logistics operators are under pressure from stakeholders – mainly consumers and NGOs – to establish supply chain traceability and to provide transparency-related information within and across agro-food supply chains. The drive towards traceable and transparent supply chains is shaped – at least in part – by innovative actors along the supply chain taking steps to provide knowledge and transparency on production practices that for most agricultural supply chains remain opaque (Godar et al., 2016).

The increased demand reflects a “responsibility paradox” (Davis et al., 2013). On the one hand, various stakeholders demand increasing traceability and transparency by actors operating along agro-food commodity supply chains. On the other hand, the increasing globalization of the global food system has caused increasingly disaggregated (spatially, legally, temporally, etc.) agro-food commodity supply chains, which reduce companies’ ability to account for the origin of their goods and the practices of their suppliers. This leads to a gap between what governments, consumers, and NGOs demand, and what companies can and will deliver (Kim and Davis, 2016). Two aspects are important for determining whether and how companies respond to demands for traceability and transparency. First, supply chain complexity and company size and diversification influence a company’s *ability* to respond to such demands. Second, stakeholder demands and regulatory requirements shape a company’s *motivation* for doing so (Kim and Davis, 2016).

4.1. TRACEABILITY

Establishing traceability along the supply chain is complicated by opaque and complex agro-food supply chains. Due to the commoditization and complexity of most agro-food commodity supply chains, knowing where and how a commodity is produced and traded is in many cases downright impossible. Even with certifications and labels, new technical systems, and various sustainability claims, tracking the provenance of a product can be almost impossible, and consumers (or downstream actors generally) often have little information about the production and origin of the agro-food commodity (Jarman and Luna-Reyes, 2016). The more complex a company (i.e. internal diversification and international division) and supply chain (size, layers

and diversification of supply base, including number of, differentiation among, and interrelations between suppliers), the more difficult it becomes to establish traceability along the supply chain (Kim and Davis, 2016; Trienekens et al., 2012).

The opacity and complexity of global agro-food supply chains, exacerbated by the lack of regulatory requirements for identifying suppliers, reduce the ability of stakeholders, such as shareholders, NGOs or regulatory agencies, to hold companies accountable for socio-economic and environmental sustainability issues within their supply chains (Godar et al., 2016; Gupta et al., 2020; Kolk, 2008; Mol, 2015). Traceability and trustworthy information on provenance, production practices, and other sustainability characteristics are critical to establishing trust in VSSs, ZDCs, and other governance approaches, which provide various claims on the origin and characteristics of the commodity, and in some cases also fetch premiums.

Companies often do not have the ability or the resources to establish traceability across supply chains (Kim and Davis, 2016). On the one hand, for large MNCs, such as big retailers and CGMs, the level of tier-1 suppliers number in the thousands, while tier-2, 3, etc. likely number in the millions, making full traceability a humongous task. Smaller companies, on the other hand, might lack the resources (financial, technical, human, etc.) to carry out the task. In a study on the conflict minerals reports submitted by companies as part of the US Dodd-Frank Act, Kim and Davis (2016) show companies are not able to trace their supply chains. Even large, well-known companies or those with significant sustainability commitments did not perform significantly better – “a firm’s commitment to environmental issues does not necessarily lead to greater certainty in the knowledge about its supply chain” (Kim and Davis, 2016, p. 1908). This illustrates that even if committed or under regulatory or stakeholder pressure, traceability is very difficult to achieve across complex supply chains like the minerals supply chains. Minerals supply chains share many similarities with agro-food supply chains, such as dispersed production, thousands of suppliers, weak governance in many producer countries, and a multiplicity of downstream (multi-national) companies.

“Our analysis of every conflict minerals report submitted to the Securities and Exchange Commission by over 1,300 corporations found that almost 80% admitted they were unable to determine the country of origin of such materials, and only 1% could certify themselves conflict-free with certainty beyond reasonable doubt. Internationally diversified firms and those with large and more dispersed supply chains were less likely to declare their products conflict-free: complexity reduces the visibility of a firm’s supply chain.” (Kim and Davis, 2016, p. 1896)

They suggest that lack of ability to gather information is the most imminent challenge for achieving traceability (Kim and Davis, 2016), illustrating the difficulty of transitioning to sustainable supply chains, as information is a necessary pre-condition for enacting many of the changes required to remove any unsustainable suppliers (and their practices) from agro-food supply chains.

4.2. TRANSPARENCY

Transparency in agro-food supply chain governance builds on the assumption that information can inform and empower actors to demand or undertake changes to current practices (Gupta, 2008; Villiers, 2019). Transparency can be understood as “a state in which information is made apparent and readily available to certain actors” (Gardner et al., 2019, p. 2) without loss, noise, delay, or distortion (Trienekens et al., 2012). This requires accessible, comprehensible, comparable and transparent information (Villiers, 2019), which can be difficult to obtain across complex and opaque agro-food commodity supply chains, as relevant information might be hard to come by, non-existent, incomplete, or flawed (Gardner et al., 2019; Gupta et al., 2020).

There is a growing interest in supply-chain transparency, evident in both research (e.g., Egels-Zandén, Hulthén, & Wulff, 2015; Gardner et al., 2019; Trase, 2018) and among civil society and public actors (COWI et al., 2018; Pearce, 2015). Arguably, transparency in agro-food supply chains is here to stay, as it supports, influences, or is influenced by many current trends affecting agro-food supply chains (Mol, 2015),

among others, globalization, consumer awareness, NGO campaigning, polycentric governance, and the technological changes sweeping through the agro-food sector. As Mol (2015) puts it: “We are most likely only at an early stage of a development towards more developed, full-fledged, comprehensive, standardized, geographically spread and institutionalized transparency in value chains.” Companies, however, have been somewhat reluctant to embrace transparency, for which we can identify at least three reasons: Firstly, transparency can reduce companies’ competitive advantage as sensitive information becomes available to competitors. While sustainability can help differentiate companies from their competitors, transparency is a double-edged sword, as visible companies are more vulnerable to protests and activism (Dauvergne, 2017; Dauvergne and Lister, 2012). Second, information can undermine their relative bargaining power vis-à-vis suppliers and other supply chain actors (including regulators) and can be used strategically by some actors to strengthen their negotiation position or leverage across supply chains (Gardner et al., 2019). Third, transparency opens up companies to exposure from consumers and regulators, as well as NGOs and other activists (Bateman and Bonanni, 2019). Stakeholders react more strongly (both positively and negatively) towards companies with a reputation for sustainability when they do something that supports or undermines this identity (King and McDonnell, 2015), and companies want to avoid bad publicity and “naming and shaming” campaigns (Bloomfield, 2014; Dauvergne, 2017; Mayer and Gereffi, 2010). They and their shareholders and investors are increasingly aware of the risks for bad publicity posed by sustainability-related issues (van der Ven, 2018).

Transparency carries various benefits, for example reducing risks, increasing trust, and enabling accountability (Bateman and Bonanni, 2019; Gardner et al., 2019; Gupta et al., 2020). Information is unevenly distributed across value chains with larger (downstream) companies holding most of the information (or leverage on this information), enabling them to control the information flow (Villiers, 2019), while consumers know much less about the product they procure. Other supply chain participants (upstream producers, logistics companies, retailers, manufacturers, etc.) all know about only a limited part of the chain, leading to incomplete information

transfer and asymmetry between participants, creating a lack of trust (Boström et al., 2015; Pu and Zhang, 2016). Transparency can potentially reduce information asymmetry and enable public actors and other interested stakeholders (e.g. non-lead actors with less leverage) to hold larger actors, e.g. MNCs and downstream “lead firms” (van der Ven, 2018), accountable for unsustainable practices (Villiers, 2019) by scrutinizing company supply chains. This facilitates “soft enforcement” (Schleifer et al., 2019), meaning that by making information transparent, interested stakeholders can see if companies fail to behave as requested or desired.

At the same time, transparency enables informed decision making by a growing consumer segment wishing to shop sustainably (Gupta et al., 2020). However, transparency can also contribute to information fatigue among decision-makers (Gardner et al., 2019), especially consumers, where too much sustainability-related information in the marketplace can make it difficult for consumers to select among the different options (Iyengar and Lepper, 2000; Sunstein and Reisch, 2013). Similarly, too numerous, comprehensive, complex, or technical disclosures can also do more to obfuscate than to enlighten (Gardner et al., 2019; Villiers, 2019). These developments necessitate a discussion of which actors stand to benefit from growing transparency and how²². Most transparency initiatives are aimed at downstream actors in the Global North, especially consumers (Gupta et al., 2020; Trienekens et al., 2012), potentially influenced by the ‘buyer-driven’ nature of many agro-food commodity supply chains (Grabs, 2017; Ponte, 2019). This also means that these initiatives often ignore or fail to empower upstream actors and producers (Mol, 2015; Vicol et al., 2018). This matters, as the impact of transparency on agro-food supply chain governance depends on how, when, and to whom information is made accessible (Gardner et al., 2019).

²² The paper “The ambiguity of transparency in the artisanal and small-scale mining sector of Tanzania” (Pedersen et al., 2021) (see Figure 1-8) takes up this discussion, arguing that transparency interventions will not necessarily benefit all actors across a commodity supply chain and that the smallholders are at particular risk of losing out.

4.3. TECHNOLOGY

Across the agro-food sector, advances in technological developments create new opportunities – and some potential pitfalls – for governance of agro-food supply chains, particularly as relates to traceability and transparency. These technological advancements have the potential to disrupt existing agro-food supply chain governance approaches (Schmidt and Wagner, 2019), for example by changing power structures, data collection and analytical capabilities, access to information and knowledge, and by enabling radical transparency. Already, civil society, industry, and public actors have developed various tools and frameworks focused, *inter alia*, on supply chain traceability (e.g. Trase, Sourcemap, Chainpoint)²³ and information disclosure and reporting (e.g. CDP, Global Reporting Initiative, Accountability Framework)²⁴. Some of these rely on existing data, while others rely on company reporting, and some feature built-in analytical tools to calculate, for example, carbon emissions of specific commodities. Innovative actors are also piloting or already operating novel technological supply chains solutions, most notably various satellite and remote sensing projects, but also drones, artificial intelligence (AI), Internet-of-Things (IoT), and distributed ledger technologies (DLT), such as blockchain.

Satellite-based technology has received much attention in land system science, partly explained by much of the field building on the analytical possibilities provided by

²³ Trase (Transparency for Sustainable Economies) is a partnership between Stockholm Environment Institute and Global Canopy Programme. <https://trase.earth/>. Sourcemap is a private company enabling end-to-end supply chain insights using software solutions. <https://sourcemap.com/>. Chainpoint is a private company delivering supply chain mapping and traceability services for commodities and products. <https://www.chainpoint.com/solutions/supply-chain-traceability/>

²⁴ CDP (formerly the Carbon Disclosure Project) is a non-profit organization that runs and organizes a disclosure system enabling investors, companies and public entities to manage and report their environmental impacts, primarily carbon emissions. <https://www.cdp.net/en>. Global Reporting Initiative (GRI) is an independent organization, which owns and develops sustainability reporting standards. <https://www.globalreporting.org/>.

satellite-derived images. Recent advances²⁵ with new and better satellites, increasingly ‘open access’ data, improved processing capacity, and the development of new algorithms have made it possible to provide spatially explicit links between agro-food commodity production and the supply chains moving these goods from producers through to consumers (Maus and Giljum, 2020). For example, the Fineprint project²⁶, supported by the European Research Council, has developed a new method for assessing agro-food production and their related impacts using satellite data. The data and analytical tools to utilize these for governance purposes are increasingly becoming available to non-public and non-academic actors. Particularly companies, but also NGOs, increasingly use these tools in their efforts to discover, analyse, or address environmental impacts along agro-food commodity supply chains, especially deforestation. For example, COFCO International, the major Chinese agro-food commodity trader, partners with the World Bank’s International Finance Corporation and the Brazilian company Agrosatélite to monitor and trace the company’s soy supply chain using remote sensing data (COFCO International, 2021).

One of the particularly important advancements concerning deforestation is the ability of companies to map production areas in ‘near real-time,’ enabling them to ensure suppliers’ compliance with zero-deforestation policies and countering deforestation it happens. In combination with drones, this information can also be used for GHG emissions and biodiversity monitoring and other data collection, e.g. fire-related air pollution (Balzarova and Cohen, 2020). Satellite images can also be combined with advances in artificial intelligence and algorithms to forecast areas at risk of deforestation. Microsoft, for example, has co-developed an AI-based tool called ‘PrevisIA’ to predict deforestation hotspots. Based on an algorithm developed by the

²⁵ Given the scope of this chapter and the foci of the thesis, I do not provide an overview of the advances made in remote sensing and geographical information systems (GIS) science. Rather, I discuss what these developments entail for agro-food supply chain governance.

²⁶ FINEPRINT develops methods for assessing global material flows embodied in products using high-resolution data to perform spatially explicit analyses and assess the associated environmental impacts, addressing issues such as deforestation. <https://www.fineprint.global/>.

Brazilian conservation NGO Imazon and satellite images from the European Space Agency the tool identifies high-deforestation risk areas. So far, it has identified 10,000 km² of the Brazilian Amazon as being in imminent danger (Ennes, 2021).

An important precondition for enabling ‘near real-time’ monitoring is traceability; to address suppliers’ behaviour in the fields, companies need to know, which areas they source from. Various technologies aim to increase supply chain traceability, data management, and efficiency with perceived knock-on effects on sustainability. Most attention is paid to IoT and blockchain-based systems, which both are rapidly adopted across supply chains. IoT includes the use of various sensors, such as radio frequency identification (RFID)-tags, GPS trackers, or smart sensors, which track temperature or humidity, for example. With internet access, these sensors automatically transmit data to digital platforms or databases (e.g. a blockchain), which process, store, and analyse this data. This creates a link between the physical agro-food commodity flow and a digital information flow (Kos and Kloppenburg, 2019). Such IoT approaches are already applied across many supply chains to enable real-time data collection.

Blockchain adds a database component to the data collection enabled by IoT, satellites, or other technologies. In essence, blockchain is a database system (Box 1). The main benefit to agro-food commodity supply chains is that it adds a digital layer to a physical commodity flow, as supply chain-related information and metadata, e.g. on transactions, processes, or growing conditions are stored on the blockchain (Tröster, 2020). There are few successful cases of blockchain applications for agro-food supply chains (van Hilten et al., 2020; Risius and Spohrer, 2017), though both academic and commercial applications are emerging²⁷. However, given the dearth of

²⁷ For example, INATrace is an open source blockchain-based traceability solution for agro-food commodity supply chains. Open source code available at: <https://github.com/INATrace/>. More information at: <https://www.nachhaltige-agrarlieferketten.org/en/success-stories/the-traceability-tool-for-sustainable-supply-chains/>. Bext360 is a private company offering blockchain-based Software-as-a-Service solutions for supply chains, focusing particularly on agro-food commodities. <https://www.bext360.com/>.

empirical studies, it is difficult to say much about the potential impact of blockchain on agro-food supply chain sustainability and governance (Bager et al., 2022).

BOX 1. WHAT IS BLOCKCHAIN?

Blockchain is a specific type of database, that enables decentralization, verification, and immutability (Pavlić Skender and Zaninović, 2020). It is managed and fed by a network of distributed ledger technologies, where each user has their own copy of the ledger, meaning no central actor owns or runs the database. Data is added to the blockchain in ‘blocks’ that are linked sequentially with a unique ID called a ‘hash’ and a pointer to the hash of the previous block, forming a continuous ‘chain of blocks.’ (Gammelgaard et al., 2019; Sylvester, 2019). A hash is “a unique cryptographic value containing characters and numbers generated through a complex computational algorithm” (Sylvester, 2019). As data is immutable, it cannot be overwritten, allowing users a full view of historical transactions. Any changes to the information are thus stored in a new block, recording that “X” changed to “Y” in a given location at a certain date and time (Gammelgaard et al., 2019). Figure 2-2 illustrates the basic principle of blockchain for a coffee supply chain.



Figure 2-2. The basic principles of a blockchain for a hypothetical coffee supply chain. Based on data from Bager et al. (2021b).

Crypto N’ Kafe (<https://cryptokafe.io/>) enables blockchain-based trade of coffee, using the Ethereum blockchain, to boost income for small-scale farmers, enable transparency, and eliminate inefficiencies. CoffeeCoin (<https://www.coffeecoin.com.br/>), a cryptocurrency, can be used to trade specialty coffee on a designated platform for the industry (Bryman, 2018).

Blockchain systems change data storage, as new entries do not delete old entries, and as all participants keep a copy of the ledger (Balzarova and Cohen, 2020). This fundamentally changes information access and flow compared to conventional supply chains, where information is usually only transferred between individual nodes and some actors have privileged access through database ownership and control (Figure 2-3). Theoretically, blockchain address this by enabling an ecosystem where all actors can communicate with each other and access the same information, which is vastly different from conventional systems, where information exchange takes place linearly from node to node (Gammelgaard et al., 2019). However, even in centralized systems, lead actors still hold more power, enabling them to anchor blockchain systems to their particular supply chains, which could lead to the creation of several disparate systems at the upstream level, increasing cost and complexity (Bager et al., 2022; Lee, 2018).

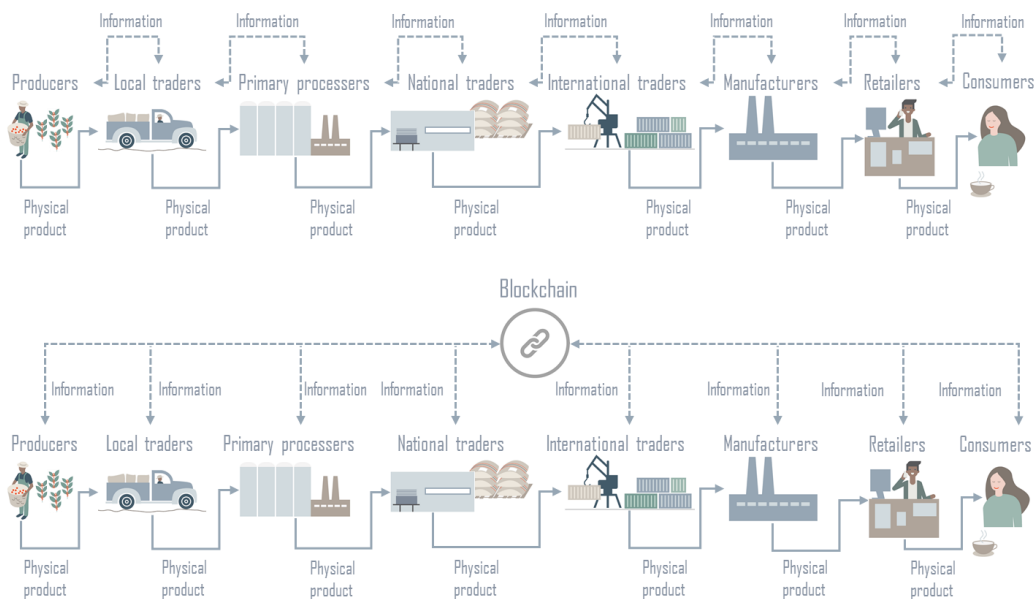


Figure 2-3. Conceptual illustration of the difference between a conventional supply chain (top) and blockchain-enabled supply chain (bottom) where data flows and access change. Illustration by author.

Blockchain systems could, however, alter governance structures for agro-food supply chains by enabling peer-to-peer transactions and automatic contract execution through

smart contracts²⁸, which eliminates the need for middlemen and allows better access to and control over data (Balzarova and Cohen, 2020). This can theoretically ensure “timely and complete payments” to supply chain participants, e.g. smallholders (Kos and Kloppenburg, 2019). While this has obvious advantages, it is important to understand that blockchain does not provide absolute assurance. Blockchain systems enable tamper-proof information storage, but the quality and trustworthiness of the information stored on the blockchain depend on external factors (how was it collected, by whom, etc.) which the blockchain cannot affect (Tröster, 2020). Such data, even if collected using IoT sensors, can still be manipulated, which leaves blockchain challenged by the gap caused by the transfer of the physical reality to the digital supply chain (Gammelgaard et al., 2019; Schmidt and Wagner, 2019). As the old adage goes, “garbage in, garbage out.”

The changes provided by these technological developments affect power structures along agro-food supply chains. Much of the data collection and processing capabilities offered by e.g. drones, sensors, and satellites concern upstream actors, particularly smallholders, but it is unclear how these actors access or benefit from these developments, which risk further disadvantaging them (Kos and Kloppenburg, 2019). Contrary to this, the insights gained from technological advancements could enable NGOs and consumers to hold manufacturers or retailers accountable for practices along their supply chains. However, the most likely beneficiaries are “lead firms”, who will seek to capture any benefits to further their own goals and strengthen their relative market position (Mol, 2015). Unequal analytical and financial capabilities can further exacerbate existing power asymmetries, even in a case with equal data access,

²⁸ Smart contracts are digital transactions that self-execute without human intervention when specific predefined and agreed events occur (e.g. agro-food commodity present at a given location, e.g. as indicated by GPS tracker. When adopted in agro-food supply chains, they allow for multi-step processes and transactions to be executed and verified by several parties automatically (Abeyratne and Monfared, 2016; Lee, 2018; Sylvester, 2019).

as lead actors use their greater capacities to improve their strategic advantage along the value chain at the expense of smaller actors, who lack these assets (Tröster, 2020).

Technological changes can also change practices and relationships along supply chains. Automated and disintermediated transaction processes can reduce the need for clearinghouses and middlemen, reducing transaction costs and integrating upstream actors more closely with buyers (Kos and Kloppenburg, 2019). The increased data collection and access options, especially if combined with the immutability and encryption provided by a blockchain, can also change auditing practices, which will affect VSS systems and company codes of conduct. Data on social and environmental indicators are fed into the system, after which encrypted data can be shared with auditors or third parties (Lee, 2018), as a “complete history of transactions are visible to the network members, allowing for auditability and traceability” (Kouhizadeh and Sarkis, 2018). Naturally, the validity and trustworthiness of the data fed to the system still require verification, meaning in-field auditors will still be necessary (Tröster, 2020). Nonetheless, these developments will inevitably affect existing governance approaches, particularly VSSs, which will see increasing competition from blockchain-based governance approaches, though they could also benefit from adopting these elements into existing governance structures (Köhler et al., 2021).

It remains unclear how these technologies will affect traceability and transparency efforts and what knock-on effects this might have for sustainability governance of agro-food supply chains, particularly for deforestation. Already, they can facilitate ‘radical transparency,’ where certain actors use the technologies to divulge all information by all participants along the supply chain, as is already seen in the specialty coffee sector (Bager and Lambin, 2020). This has the potential to improve smallholders’ access to services and markets, though questions of data access, use, and control remain (Kos and Kloppenburg, 2019). At the same time, they enable increasingly easy end-to-end traceability systems, which offers opportunities for increased branding of certain regions, which has value to both companies and those particular areas. However, this could also disadvantage some regions even further, as they fail to reach the digitalization levels obtained by more advanced competitors.

Much of Sub-Saharan Africa is a case in point here. Even so, knowing the origin – and potentially the social and environmental impacts associated with these products – reduces risks to companies and consumers connected to certain products and provides a key part of designing sustainable agro-food supply chains (Godar et al., 2016).

5. REFLECTIONS: OPPORTUNITIES AND CHALLENGES FOR GOVERNANCE OF AGRO-FOOD COMMODITY SUPPLY CHAINS

In response to the complexity of global supply chains, sustainability governance approaches have diversified to incorporate new actors and instruments. At the same time, the relative role of public versus private approaches is shifting again. The current “layered” and polycentric governance arena, where multiple actors and approaches interact to shape agro-food supply chain sustainability governance is quite different from the situation around the turn of the millennia, where new private schemes were being developed, while public regulation was foregone or dismantled, or even earlier, where agro-food governance was synonymous with public regulation and global governance through multilateral agreements.

With the evolution in agro-food governance approaches stemming from changes in actors’ roles and perceptions of agro-food supply chains, particularly the renewed focus on extending responsibility across value chains, the shift to the current governance phase has blurred the boundaries between public and private governance approaches, which were more clearly defined in the first and second phases. Private actors voluntarily adopt governance approaches for strategic reasons, e.g. competitiveness, legitimacy, or risk mitigation, or become “embedded” (i.e. contained within) public actors’ approaches through the uptake of private approaches in public governance (Challies et al., 2019), for example, when standards *de facto* or *de jure* becomes the primary means to address sustainability issues across agro-food supply chains. Despite the blurred lines between the two, both play an important role in governing agro-food supply chains. Firstly, governments and other public actors ensure the preconditions for companies to operate, securing the rule of law, functioning legal systems, property rights, information collection, and functioning

markets, among others (Horner, 2017; Lambin and Thorlakson, 2018; Lemos and Agrawal, 2006). Secondly, the limited effectiveness of market-driven approaches in stemming deforestation illustrates a need for public, regulatory intervention, particularly to engage those actors, who do not voluntarily adopt governance approaches. Public actors provide the ‘shadow of hierarchy,’ (Héritier and Eckert, 2008), i.e. the threat of legislation that prompts private actors to adopt governance approaches. Public governance also brings enhanced enforcement capacity – at least where a strong state exists (Lambin and Thorlakson, 2018; Vogel, 2010), while lending credence and legitimacy to private approaches (Lemos and Agrawal, 2006). At the same time, agro-food governance needs initiatives from private companies. Private governance is more innovative, faster to adopt (Héritier and Eckert, 2008), and generally more flexible to changes in circumstances. Compared to many public actors, especially in the Global South, private governance also brings additional resources (financial, technical, etc.). Most importantly, MNCs’ leverage allows for interventions grounded in company supply chains to reach across boundaries.

Thus, while both public and private actors do much to govern agro-food commodity-driven deforestation, there are still issues to address. On the one hand, there are several causes for optimism. Companies pledge to reduce deforestation, participate in roundtables, buy certified commodities, and implement traceability systems. Governments set collective aspirations, help to raise the global ambition level, and increasingly mandate actors to disclose activities or ensure due diligence across supply chains. Collectively, actors pursue jurisdictional approaches, develop moratoria, and engage in traceability efforts, as the third phase has ushered in an era of increased engagement between public and private actors, which both the first and second phases lacked. On the other hand, there is also cause for concern. The collective efforts have not managed to reduce deforestation across several frontiers, as most efforts remain voluntary and limited in extent. Pledges, commitments, actions, and approaches have so far had not managed to buckle the trend of tropical forest loss (Hong et al., 2021; NYDF Assessment Partners, 2019, 2020) with civil society and academia pointing out that companies’ adoption of and reporting on deforestation

efforts remain insufficient (Forest Trends, 2019; Forest500, 2021b; Greenpeace, 2019). While leakage markets absorb unsustainable agro-food commodities (Bastos Lima et al., 2019), consumer demand for sustainable products remain low across most markets. Changing these perspectives require grappling with five interrelated issues that affect the prospects of agro-food supply chain governance: Information asymmetry and transaction costs; knowledge deficits; legitimacy; coherence; and policy interactions.

Firstly, a key part of the challenges agro-food supply chain governance face stem from information asymmetry and high transaction costs along supply chains. These result from unequal power relationships and interactions along spatially disaggregated supply chains involving numerous actors. Transaction costs for agro-food supply chain governance are much higher than for “local” issues and likely even higher than for global governance, as many agro-food governance approaches lack the established institutions that international organizations provide (Challies et al., 2019; Newig et al., 2020). The increased fragmentation of private governance with multiple competing approaches further increases information asymmetries. Producers, downstream businesses, consumers and other stakeholders are confronted with competing claims about products’ sustainability features by multiple private governance approaches. As it is unclear to most stakeholders how private governance approaches compare in terms of the stringency and scope of their standards, internal governance procedures, or compliance and verification processes, these competing claims lead to additional information asymmetry (Renckens, 2020).

Secondly, collectively, actors lack knowledge about and evidence of many governance approaches with the potential impact of the different approaches on reducing deforestation – and the empirical evidence of this – differing widely. VSSs have been widely studied (although less so in the context of deforestation), while the knowledge base is shaky (at best) for disclosure requirements or zero-deforestation commitments, for example. There is also fairly solid evidence that moratoria can reduce deforestation (Gibbs et al., 2015; Heilmayr et al., 2020a), though leakage to other biomes and regions remain a challenge (Dou et al., 2018; Gollnow et al., 2018; le Polain de

Waroux et al., 2016). However, the knowledge base is incomplete for several approaches, where it is unknown or uncertain what effect it has on deforestation. Most importantly, there is limited evidence of the effectiveness of collective aspirations and zero-deforestation commitments, though drawing definite conclusions require additional and more systematic studies, e.g. counterfactuals and baselines. Similarly, the impact of due diligence on agro-food commodity-driven deforestation has received scant attention (Bager et al., 2021a; Schilling-Vacaflor and Lenschow, 2021). As these approaches grow increasingly popular among stakeholders, there is an urgent need to more clearly articulate how these approaches (should) work and study their effect in-situ. While governance approaches grow increasingly numerous and complex, it does not necessarily lead to a greater ability to address agro-food commodity-driven deforestation (Wardell et al., 2021). The first requirement to address impacts across agro-food supply chains is to know what cause-and-effect relationships exist across supply chains and how approaches address these. In other words, to establish a clear “theory of change” for the most prevalent governance approaches (see Chapter 3). However, establishing causality is complicated, as supply chains span large distances, involve numerous actors, and cross jurisdictions, which impedes information feedback (Newig et al., 2020). Addressing these challenges requires more and better data and an ability to link specific chains to outcomes on the ground, e.g. using satellite images. If impacts cannot be traced along supply chains to the responsible actors, governance responses will remain local and thus of limited impact (Challies et al., 2019).

Thirdly, polycentric agro-food supply chain governance efforts often lack legitimacy. Multi-stakeholder efforts are often controlled by powerful actors, typically big companies and international NGOs, who control governing bodies and steer rules and information flows. At the same time, they lack representation of stakeholders from the Global South, with many of those subjected to outcomes of the governance approach (especially smallholders) excluded from participation or decision making (Newig et al., 2020; Siegel and Bastos Lima, 2020). Further, those actors with very strong (negative or positive) attitudes towards public, regulatory action on a topic tend

to not participate in these approaches (Challies et al., 2019). The absence of public actors in certain governance constellations further challenges these approaches' legitimacy and accountability, as public actors can only indirectly hold private decision-makers accountable for governance outcomes (Newig et al., 2020). Unilateral, private governance structures might include opaque definitions and operational criteria, unclear implementation practices, and lax auditing and reporting requirements, making them even less legitimate (Challies et al., 2019). Many private instruments, particularly private standards, have their legitimacy further eroded, as they fail to deliver actual improvements on the ground (Boström et al., 2015). While these challenges include all multistakeholder and unilateral private approaches, telecoupled problems, such as deforestation driven by agro-food commodity supply chains, present particular legitimacy challenges. In such cases, it is unclear which actors (if any) can legitimately govern the distant impacts arising from supply chain activities (Lenschow et al., 2016). While public actors in producing regions claim sovereignty over the area, public and private actors across the supply chain have a legitimate interest in affecting the socio-economic and environmental outcomes of their activities to align with their stakeholders' interests. Mandating transparency in governance approaches could address this by making it clear which actors (seek to) affect change, but greater legitimacy will also require formalizing or institutionalizing agro-food governance approaches (Lenschow et al., 2016).

Fourthly, given the distance (spatial, cultural, economic, etc.) across agro-food supply chains (Clapp, 2015), governance approaches often lack coherence. The stakeholders involved in agro-food commodity governance have widely different interests, capabilities, and leverage, and are unlikely to share values. This is problematic, as successful governance in part requires a degree of coherence among the involved stakeholders, both vertically to coordinate actors in polycentric systems along supply chains and horizontally to align different institutions (e.g. with national policies or WTO rules) (Newig et al., 2020). The solution is not likely to be global governance institutions, but rather a diversity of tailored approaches addressing specific agro-food supply chains or outcomes, "where each 'solution' is targeted at a limited

phenomenon rather than having to capture ‘globalization’ in its entirety” (Lenschow et al., 2016). While this polycentrism may appear to undermine public governance, spelling a return to the market-driven phase, this is not necessarily the case. Rather, the policy instruments and proposals emerging in the third phase rely on both private and public governance. Private instruments, such as VSS, play a key role in ensuring the effectiveness of public regulation. For example, private standards can be used as proof of adherence to the European Renewable Energy Directive (RED) (Partzsch, 2020a; Renckens, 2020). At the same time, as the analysis above showed, states, such as France and Switzerland, as well as the EU, adopt regulations that extend along supply chains, moving beyond the “shadow of hierarchy” to actual legislation. Further, public regulation can reduce the information asymmetries and fragmentations that reduce private governance approaches’ effectiveness (Renckens, 2020).

Fifth and finally, there is a need for better understanding (and governing) the outcomes that result from increasingly mixed and intermingled governance approaches. Interactions can lead to trade-offs or spillovers, but also foster opportunities for novel governance “designs,” implementation pathways, and collaborations outside the scope of individual governance approaches. Approaches can strengthen each other if they work towards similar targets, just as they can undermine each other if they have opposing goals or compete for attention and adoption (Lambin et al., 2020; Nagendra and Ostrom, 2012). As the explosion in the number of VSSs illustrates, proliferation does not necessarily equal effectiveness. At the same time, competition from private or hybrid approaches can undermine or weaken public interventions (Biermann and Pattberg, 2008; Scherer and Palazzo, 2011). For example, producer countries can view private standards led by northern actors as rival approaches that undermine national governance efforts (Lambin and Thorlakson, 2018) leading public actors to actively undermine private governance to promote national standards. In the palm oil sector, for example, Indonesia has publicly opposed the multistakeholder-led RSPO standard, instead preferring to push a (more lenient) government-led standard, the Indonesian Sustainable Palm Oil (ISPO) standard (Brandi, 2020; Hospes, 2014; Partzsch, 2020a). Different approaches also

risk (unintentionally) excluding different actors or causing harm to certain groups, leading to effectiveness being attained at the expense of other important outcomes, such as human rights, fairness, justice, or equality (gender, racial, social, and otherwise). The different approaches and the polycentric governance landscape require that actors combine approaches in ‘smart’ mixes including public, private, and hybrid approaches, working across jurisdictions and value chains to prevent problems from leaking to other sectors or areas. It also requires substantiated knowledge on how different approaches work by establishing clear theories of change and analysing the effectiveness of interventions both alone and in various combinations.

In conclusion, the changing governance landscape for agro-food commodity supply chains offers many promising developments. Gone is the unwavering faith in the market, which characterized the globalization era of the 1990s and 2000s, as well as the “siloeed” top-down approach of the first phase, where each area was governed without a view to interactions with other systems. Instead, public and private actors are growing increasingly aware of telecouplings and distant impacts caused by globally connected actors and land systems, seeking to govern commodity flows, rather than particular actors or areas – as exemplified by zero-deforestation commitments and due diligence approaches. Similarly, increasing technological advancements and growing demands for transparency and traceability enable (and require) actors to govern across supply chains, tracing individual commodities or production systems. However, as this analysis also showed, some challenges still need tackling, particularly as concerns the markets where actors (public and private alike) are yet to adopt governance approaches to reduce deforestation caused by agro-food commodities. Further, the five challenges described above illustrate that even committed actors face substantial work to foster agro-food supply chain governance.

BRIDGE: EMBEDDED DEFORESTATION

One of the problems that sustainable land use governance approaches must tackle is that of deforestation embedded in agro-food commodities produced in one region but consumed elsewhere. For example, the deforestation caused by European imports makes Europe indirectly responsible for the forest loss that occurred in other regions to produce these agro-food commodities. Wood et al. (2018) estimate that the material use displaced from one region to another through trade grew from 23% to 32% from 1995 to 2011 with land-use displacement growing from 20% to 26%.

Countries with high consumption or limited land areas are particularly prone to displace land in other countries. Yu et al. (2013, p. 1178) show that “33% of total U.S. land use for consumption purposes is displaced from other countries,” while Japan – with a large population and limited land, displaces 92% of land use for consumption purposes. As a high-income region with limited land areas, Europe is also particularly prone to displacing its land footprint outside the region (Yu et al., 2013). In 2007, more than half of the EU’s total demand for cropland, grazing land and forestland was displaced to other countries (Yu et al., 2013).

High consumption patterns and limited land makes Europe indirectly responsible for the environmental impacts, such as deforestation (Henders et al., 2015) and biodiversity loss (Lenzen et al., 2012), caused by food production in other countries, particularly in tropical and sub-tropical regions. This has caused critics to argue that Europe is “living on emission and resource credits provided by other parts of the world” (Tukker et al., 2016, p. 179). Rajão et al. (2020) investigate the interlinkages between illegal deforestation in the Brazilian Amazon and Cerrado and EU imports of Brazil’s soy and beef. They find that “roughly 20% of soy exports and at least 17% of beef exports from both biomes to the EU may be contaminated with illegal deforestation,” meaning that, annually, as much as 2 Mt of soy traded with the EU is potentially embedded with deforestation (Rajão et al., 2020, p. 246).

This prompts a reflection on how to reduce the deforestation caused by the import and consumption of agro-food commodities in the EU. The problem has been on the EU's agenda for more than a decade, but to the disappointment of many, especially NGOs, little has happened. This appears to be changing, as policy developments indicate that the EU plans to enact policies to target agro-food commodity-driven deforestation. In the following chapter, my co-authors and I identify and assess different policy options available to the EU to reduce imported deforestation; some of which are on the drawing board for the upcoming legislation.



The EU imports various agro-food commodities that contribute to deforestation, such as timber (Cote d'Ivoire, top-left), banana and coffee (Colombia, top right), beef (South Africa, middle), palm oil (Ghana, bottom right), and cocoa (Cote d'Ivoire, bottom left). Photos: S. Bager.

CHAPTER 3

EIGHTY-SIX EU POLICY OPTIONS FOR REDUCING IMPORTED DEFORESTATION

Based on:

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ABSTRACT

Despite the importance of tropical forest conservation in achieving global sustainability goals and the key role of forest-risk commodity trade in driving deforestation, consumer country policy options for reducing imported deforestation have received limited scholarly attention. Drawing on grey literature and a European Commission public consultation, we identify 86 policy options for the European Union to address deforestation. We assess the political feasibility and map the ‘theory of change’ (TOC)—the causal chain through which the policies address deforestation—for each of these policy options, identifying a trade-off between feasibility and potential impacts: information-based and cooperative policies, which dominate our sample, typically exhibit high feasibility, but mostly lack convincing TOCs, while more stringent regulatory and market-based policy options generally have lower feasibility. We propose three principles for overcoming the feasibility-impact dilemma: (1) build policies on proven TOCs, (2) use policy mixes, and (3) work with key stakeholders, supply chains, and regions.

1. INTRODUCTION

About 200 million hectares of forests – just under a tenth of the total forest area – have been lost across the tropics since the turn of the century (Hansen et al., 2013a), and even greater areas have been degraded (IPCC, 2019). As a result, deforestation is the second-largest source of greenhouse gas emissions after fossil fuels (IPCC, 2019) and the primary driver of terrestrial biodiversity loss (IPBES, 2019). The forest fires in Brazil (Barlow et al., 2020; Berenguer et al., 2020), which were particularly critical in 2019-2020, have again put the spotlight on the plight of tropical deforestation, increasing public awareness of this issue across the world.

Protecting the remaining tropical forests is key to meeting several of the United Nations (UN) Sustainable Development Goals (SDGs) (Seymour and Busch, 2016), through tropical forests' provision of climate mitigation, water circulation, climate regulation, biodiversity protection, and livelihood support. Several international agreements aim to reduce deforestation. From SDG target 15.2 to “halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally”, to the New York Declaration on Forests (NYDF) and the Paris Agreement. Unfortunately, none of these pledges are on track to be met (NYDF Assessment Partners, 2019). Despite public and private conservation efforts, tropical deforestation rates remain high – or even accelerate – as new deforestation frontiers are opening in Africa and parts of Latin America previously spared from deforestation (FAO, 2020; NYDF Assessment Partners, 2019).

Production of forestry and agricultural commodities is the main driver of deforestation across the tropics. Expanding cropland, pasture and forest plantations account for approximately 60% of total forest loss (Pendrill et al., 2019b). This expansion is, in turn, driven by increased demand for forest-risk commodities (FRCs) from consumers in rapidly growing urban areas in the countries of production and international markets (Defries et al., 2010).

The European Union (EU) is among the leading international consumers of deforestation embodied in trade (Pendrill et al., 2019a), due to limited production of

most FRCs, high per-capita consumption levels, and the presence of large food and feed industries (IDH, 2020). From 2015-17, EU imports of FRCs were associated with an estimated annual deforestation risk of 190,000 ha (Pendrill et al., 2020). This embodied deforestation was largely due to the imports of palm oil, soybeans, forest products, cocoa, and coffee from a handful of countries (Figure 3-1). For some FRCs, EU imports constitute a large share of global trade, especially cocoa and coffee, where the EU imports more than 50% of global production, but also for beef, rubber, palm oil, soy, and wood pulp (IDH, 2020). Although the EU's relative import share of many FRCs has declined in recent years—in part due to growing demand by the Asian market, especially China—EU imports have been increasing in absolute numbers (IDH, 2020).

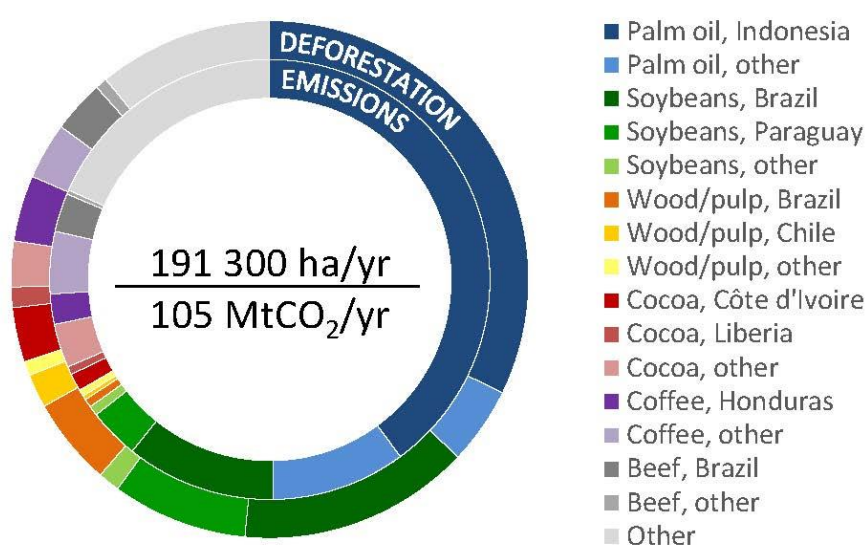


Figure 3-1. Deforestation risk and associated carbon emissions for EU imports of agricultural and forestry commodities in the period 2015–2017

The EU does not have direct regulatory competence on forests and currently no EU policy specifically addresses deforestation caused by FRCs (Pirlot et al., 2018). Deforestation is only partially covered through the EU Timber Regulation (EUTR), the Forest Law Enforcement and Governance (FLEGT) Action Plan and related

Voluntary Partnership Agreements (VPAs) with producer countries, which aim to reduce imports of illegally harvested wood. The Renewable Energy and Indirect Land Use Change Directives indirectly address deforestation by targeting the deforestation-risk associated with EU bioenergy demand. The EU also supports efforts to address deforestation through REDD+ (*Reducing Emissions from Deforestation and forest Degradation*) activities.

There is, however, an ongoing process to formulate a deforestation-specific EU policy. This process began in 2008, when the European Commission's (EC) first Communication on deforestation was adopted (European Commission, 2008a), guiding the EC's efforts, though not constituting an official mandate to act. This was followed by studies (COWI et al., 2018; Cuypers et al., 2013; Devriendt et al., 2013b, 2013a), public consultation processes (European Commission, 2019a), and workshops (European Commission, 2017a), which have resulted in a Roadmap on Deforestation (European Commission, 2018) and an updated Communication (European Commission, 2019b). In 2019, the European Council adopted conclusions on the main principles of future EU actions to reduce tropical deforestation resulting from EU consumption, an essential milestone in the process of the EU identifying if and how to regulate this topic. These conclusions gave the EC a mandate to develop policies and revise existing ones across its many policy areas affecting deforestation, including, among other, consumers, agriculture, development cooperation, research, trade, and finance. These principles also provide a clear sense of direction for EU Member States (MS) considering unilateral steps related to reducing deforestation for a particular commodity, industry, or geography. France (Ministère de la Transition Écologique et Solidaire, 2018) and Germany (Bundesministerium für Ernährung und Landwirtschaft, 2016) have adopted broad policy plans for addressing tropical deforestation. In 2020, the European Parliament published an own-initiative legislative report calling on the EC to take legislative action on deforestation (Burkhardt, 2020), following up with a European added value assessment (EAVA) analysing four demand-side regulatory policy options at EU level (Heflich, 2020). As a follow-up to the recent EU Communication (European Commission, 2019b), a

public consultation of potential regulatory options is ongoing. This will feed into an EU Impact Assessment investigating various demand-side measures to address deforestation and forest degradation associated with EU consumption. The Impact Assessment is expected during the first-half of 2021 with the eventual adoption of a proposal for regulation later that year.

With the issue firmly set on the EU agenda, there is currently a ‘policy window’ (Kingdon, 1984) for addressing deforestation. Still, the role of consumer governments in reducing commodity-driven deforestation has so far received limited scholarly attention (Schilling-Vacaflor and Lenschow, 2019), despite the contribution of internationally-traded FRCs to overall deforestation (Pendrill et al., 2019a, 2019b). This paper aims to fill this research gap and inform the EU policy process by identifying and analysing policy options for the EU and MS to reduce tropical deforestation.

First, we map the option space for EU action on deforestation by compiling an extensive database of over 1,100 policy proposals from public consultations and grey literature. Using a proponent, instrument type, and target actor typology (see methods for details), we consolidate this database into a smaller set of 86 unique policy options. Second, we assess these policy options based on two key determinants of potential policy impact: political feasibility and ‘theory of change’ (Figure 3-2).

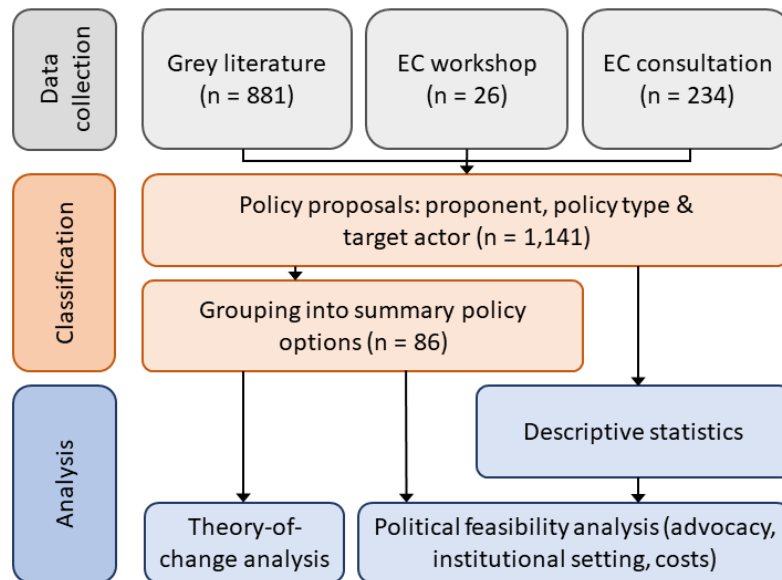


Figure 3-2. Methodology used to identify, classify and analyse policy options

Understanding the political feasibility of policy options is crucial for facilitating sustainability transitions (Fesenfeld et al., 2020; Jewell and Cherp, 2020). Here, we empirically assess three different determinants of political feasibility (Majone, 1975; Skodvin, 2007): ‘advocacy’, which measure the support for a policy across different actors; ‘institutional setting’, which captures the institutional complexity of defining and adopting a given policy; and ‘costs’, which express the magnitude and distribution of societal costs resulting from policy implementation.

A theory of change (TOC) explains how and why a given policy intervention is expected to achieve change, detailing “who will do what differently and why” (Martius et al., 2018, p. 19). A clearly elucidated TOC not only improves the chances that an intervention affects deforestation (Garcia et al., 2020), by helping to “identify assumptions, enabling factors and stumbling blocks” (Martius et al., 2018, p. 19), but builds policy legitimacy by engaging stakeholders in a discussion on how to best achieve a given end (Garcia et al., 2020; Sullivan and Stewart, 2006). Here, we draw upon theoretical and empirical evidence to map the TOC underlying each of the

identified policy options to facilitate a discussion of the potential impact of the identified policies to reduce deforestation.

By contrasting the TOC and feasibility assessments, we aim to identify feasible and impactful policy options for the EU to reduce deforestation. We end by discussing the implications of our findings for the EU policy agenda on deforestation and propose three principles to increase the feasibility and impact of policy action on deforestation.

2. MATERITAL AND METHOD

Here, we outline the methods for: collecting data on potential EU policy interventions for reduced tropical deforestation; classifying these according to the proponent, target actor, and policy instrument; and assessing the political feasibility and theory of change of the identified policy options.

2.1. IDENTIFYING EU POLICIES FOR REDUCING DEFORESTATION

To identify EU policy options to address deforestation, we follow a three-pronged approach. First, we review grey literature sources to identify policy options presented by various stakeholders for addressing land use changes and deforestation. We apply a snowballing approach to identify reports and policy briefs by NGOs, business associations and industries, consultancies and knowledge institutions, and public entities since the publication of the first EU Plan for Deforestation (2008-2019). Secondly, we review the suggestions presented during a 2-day workshop held in Brussels in June 2017 (European Commission, 2017a) as part of the “EU Action Plan to address drivers of deforestation” project. Lastly, we review submissions to the EU Commission’s “Public Consultation on Stepping up EU Action against Deforestation and Forest Degradation”, open in the period January 12 – February 25, 2019 (European Commission, 2019a), excluding submissions by individual citizens. We do not include peer-reviewed articles, as the process for publication of scientific research differ substantially from that of other reports, which allow stakeholders to voice their “opinion” on a given topic.

We note that the proposals from the EU Commission’s “Public Consultation” and “Workshop” does not necessarily come from a representative sample of actors, as not all stakeholders have the means to participate in such events. It is, for example, likely that indigenous groups and stakeholders without a presence in Brussels or the EU are underrepresented in our sample. However, this is balanced by the grey literature review, which makes up the bulk of our data material. We also acknowledge that the sampling does not directly take into account large-scale advocacy campaigns and boycotts orchestrated by civil society to raise awareness of a particular issues, including deforestation. Such advocacy campaigns can play a role in shaping political awareness of deforestation (Dauvergne, 2017; Sethi, 1994) and thus affect feasibility. Our assessment indirectly captures this, as it features publications by prominent civil society organizations, which often refer to related campaigns.

For all sources, we restrict the search to policy options for public, consumer country (e.g., EU) interventions, excluding options for producer country governments or private-sector actors. This sampling strategy results in 907 policy options from literature and the workshop, and 234 suggestions from the public consultation. We classify each option as being proposed by one of five proponent groups: (i) NGO, (ii) industry, (iii) knowledge institution (*e.g.*, academic institutions or think-tanks), (iv) public authority (*e.g.*, ministry, agency), or (v) multi-stakeholder organization (or multi-proponent submission).

2.2. CLASSIFYING TARGET ACTORS AND POLICY INSTRUMENTS

We classify each of the 1,141 identified policy proposals based on two attributes: the actor targeted and the type of policy instrument proposed. This classification primarily serves a heuristic purpose, allowing us to group proposals in themes (actor-instrument combinations) and making it easier to summarize them into a smaller set of unique, non-overlapping policy options. However, this classification also facilitates an analysis of differences in the types of policies proposed by different actors—informing the policy feasibility assessment—as well as a discussion on the theory of change underlying each proposal.

For the classification of actors targeted by the intervention, we distinguish between eight different groups of actors (Figure 3-3). Producers (and sometimes producer-country governments) represent the proximate (direct) drivers of deforestation, e.g., through agricultural, forestry, infrastructure activities (Geist and Lambin, 2002; NYDF Assessment Partners, 2019). Other actors jointly shape the underlying economic, institutional, demographic and technological drivers that affect deforestation: Consumers create the demand for FRCs, which supply-chain actors meet, sometimes enabled by finance actors who provide credit to actors along supply-chains (Galaz et al., 2018b). Producer governments set the regulatory environments that enable or restrict deforestation. They use legislation, monitoring and enforcement of land-use and forest conservation policies (Busch and Ferretti-Gallon, 2017). Consumer-country governments (*e.g.*, the EU), in contrast, shape the regulatory space that consumers and supply-chain operators operate in. Finally, multi-stakeholder actors enable interaction between different actors, e.g., facilitating roundtables, fora, or joint organizations, while multi-lateral institutions, among other things, affect cross-national conduct of business.

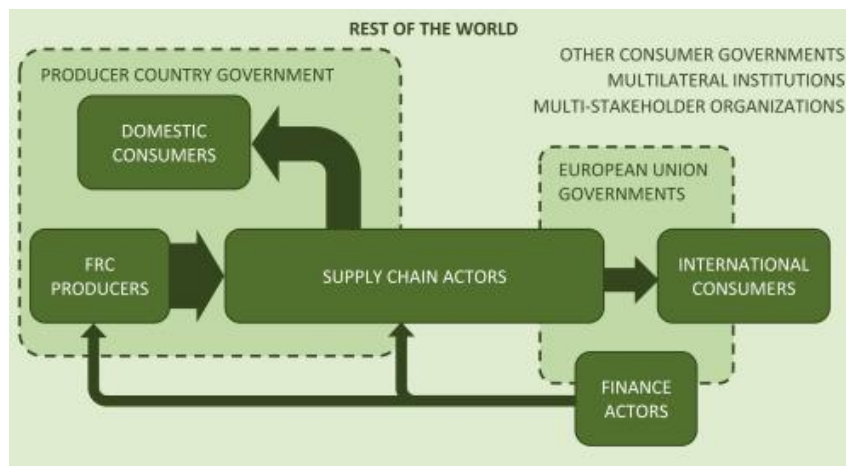


Figure 3-3. Identification and interaction of target actors for deforestation policy options

Actors of relevance to commodity-driven deforestation are displayed in green boxes of different shades and the arrows denote the links between these. FRC producers are producers of forest-risk commodities (FRCs), e.g., loggers, cattle ranchers, and farmers. Producer country governments include national and sub-national governments and agencies in countries subject to deforestation. Supply-chain actors across the FRC supply chains include, for example, slaughterhouses, oil palm mills, soy traders, feed producers, consumer goods companies, retailers, and other actors connecting the producers of FRCs to the final consumers. Consumers of FRCs include private individuals and public entities, both within the EU and outside. EU governments include both joint EU institutions (e.g., the EC Directorates-General, the European Council, and the Committee of the Regions) and MSs' governments and institutions, including ministries, agencies, and sub-national and regional governments. Finance actors include private and public entities, such as banks, investors, insurance companies, asset managers, and pension funds. Multi-stakeholder actors include multi-stakeholder arenas, such as commodity roundtables and multi-stakeholder organizations. Multilateral institutions include international and supranational organizations, such as the United Nations, the World Bank, and the World Trade Organization.

Policy instruments are the tools by which regulators implement policies. They can be classified by the means with which policy makers seek to change the behaviour of the actor targeted by the policy. A classic definition distinguishes between 'sticks' (regulation), 'carrots' (incentives), and 'sermons' (information) (Bemelmans-Videc et al., 1998). However, various classifications, mainly from public policy literature, include additional categories, e.g., "planning", "co-operative" (Juerges and Hansjürgens, 2018), "Partnering", and "Hybrid" (Steurer, 2011) to accommodate the specific policy process of various sectors (Supplementary Table 1). For example, in the context of forest governance, Gupta et al., (2013) include "management" to account for processes in the field. Beyond sector specific issues, instruments rely on different mechanisms to "influence collective action as a means of realizing political

objectives” (Böcher, 2012, p. 14) and thus vary in the degree of state/legislator intervention required. Further, as noted by Agrawal et al. (2018) different instruments require “varying forms and levels of resources to be adopted and implemented”, which means that some instruments are more costly (economically or technically) than other. To classify the policy instrument espoused by various proposals, we draw on these typologies to distinguish between four broad types of policy instruments, which each rely on different mechanisms to affect actor behaviour: (i) information-based, (ii) cooperative, (iii) market-based; and (iv) regulatory policies (Supplementary Table 2).

The authors divided the work of classifying policies on target actors and policy instrument types between them. However, the results were cross-checked, and classification disagreements resolved. We excluded from further analysis policy options that were too unclear, vague, or incoherently expressed to be assigned to an actor and a policy type. We summarized the remaining 1,141 policy suggestions into unique policy suggestions by each actor-instrument combination (8x4). We grouped together similar policy interventions targeting different commodities (*e.g.*, due diligence). Two of the authors (SLB & UMP) jointly carried out this grouping process, resulting in 86 unique policy options for the EU to address deforestation.

2.3. ASSESSING POLITICAL FEASIBILITY

A policy suggestion must be feasible to implement and likely to affect change to have an impact on the EU’s contribution to deforestation, but assessing political feasibility and policy impact *ex-ante* is fraught with difficulties. Assessing these two aspects is highly dependent on policy-specific design factors. For example, policy scope, *i.e.*, geographical, temporal and sectorial, and policy stringency, understood as the relative internalization of environmental externalities compared to the counterfactual, affect both feasibility and impact, yet depend on policy-specific design factors. This also includes selecting which biomes the policy targets, including defining what constitutes ‘a forest’ and ‘deforestation’, respectively. Further, the specific context (*e.g.*, political, cultural, historical and technological) in which the policy is implemented also shapes policy outcomes (Galeotti et al., 2020; Pahle et al., 2018;

Wilson and Buller, 2001). However, there are determinants of political feasibility and policy impact that are independent of these design and contextual factors.

While there are hard constraints (e.g., laws of nature or logic) that rule out infeasible policy proposals, most policy constraints are soft (or malleable) and by their nature contextual. Thus, to ask if a policy proposal is feasible requires specifying: feasible for whom, where and when? (Gilabert and Lawford-Smith, 2012; Webber, 1986) Here, we assume that the acting agent (*whom*) is an EU institution or MS, acting either individually or jointly to implement EU policies to address deforestation embodied in FRC trade (*where*). We further assume that the context (*when*) is near-term action (pre-2030), implying that we will take institutional arrangements (formal and informal) and socio-technical constraints to be more-or-less fixed. While relaxing social, regulatory, or institutional constraints could have an impact on future feasibility of EU action on deforestation, we leave this issue aside for future analyses.

To compare political feasibility across different policy options, we assess three different determinants of feasibility (Majone, 1975; Skodvin, 2007): ‘Advocacy’, *i.e.*, actors supporting a given policy option; ‘institutional setting’, *i.e.*, the institutional rules for defining and adopting a given policy; and ‘costs’, *i.e.*, magnitude and distribution of societal costs resulting from policy implementation. For all summarized policy options, we award a score (low, medium, high feasibility) for each of the three determinants, according to the following (mostly qualitative) criteria (Supplementary Table 3):

Advocacy:

We assess advocacy by quantifying the support for a given policy option among and across different proponents in our sample. The more widespread support is—measured as the strength of support for a policy across different proponent types—the higher its advocacy score. We acknowledge that this measure of policy support is crude; it only measures support, not opposition, to a policy and does not account for differences in political clout between actors, for example. As such, the measure

highlights where there is broad positive support for a given policy proposal, as it is not based on stated policy preferences among all actors.

Institutional setting: Institutional setting aims to capture the procedural and technical constraints of policy-making, including defining and implementing the policy. We use the institutional involvement required by different actors during policy development and implementation to assess the institutional setting. The capacities required to design a policy and the political institutions able to define and implement it differ across policy options. In one form, a policy might be institutionally complex, while only minor adjustments to the policy can reduce the complexity significantly – and vice versa. Defining institutional setting involves subjective judgement and is reflective of the scope and context yet, it remains an important metric to gauge the political feasibility of a policy.

Monetary costs: We take a qualitative approach to assessing policy cost, assuming that the impact cost has on feasibility can be proxied by the type of costs a policy incurs, and the magnitude of the cost streams affected by the policy. These include not only direct costs (costs for implementing or complying with the policy), but also indirect societal costs (e.g., impacts on prices of goods and services, or increased transaction costs) (Renda et al., 2013). Policies incurring only direct costs are more likely to be feasible than policies having potentially high indirect (economy-wide) costs, unless these direct costs are very substantial. The larger the monetary streams affected, the more likely it is that the policy will incur high indirect (economy-wide) costs. Moreover, higher absolute costs also risk having larger distributive effects, thus affecting political feasibility (cf. Jewell and Cherp, 2020a). Similarly, while some policies may be societally efficient (e.g., through potential double dividend effects), they can incur considerable political resistance due to their redistributive effects on the economy.

2.4. THEORY OF CHANGE

Devising an optimal strategy for reducing imported deforestation requires an understanding of how different interventions lead to a reduction in deforestation– i.e.,

the causal chain through which the specific policy should reduce tropical deforestation – what is often called a *theory of change*. As illustrated by Martius et al. (2018) for the case of REDD, TOCs are often implicit, and different actors may have different conceptions of the TOC for a given intervention. To infer TOCs for our identified policy proposals (where they are not explicated in the data material), we draw on the extensive theoretical and empirical literature on what drives and stops tropical deforestation (Angelsen, 2010; Busch and Ferretti-Gallon, 2017; Curtis et al., 2018; Ferretti-Gallon and Busch, 2014; Geist and Lambin, 2002). The starting point for this TOC mapping is the notion that there are two main ways in which commodity-driven deforestation can be reduced: 1) by protecting forests (analogous to increasing the forest conservation rent (Angelsen, 2010)) and 2) by reducing the demand for forest land for FRC production (analogous to reducing the rent of extensive agriculture (Angelsen, 2010)). We further identify three main sub-categories for reducing the demand for forest land: 2a) by reducing overall demand for FRCs, 2b) by increasing the demand for deforestation-free FRC production, or 2c) by increasing the supply of deforestation-free FRCs. By drawing up our classification of policy type and actor targeted, we are able to group policies based on the different ways in which they adhere to the specific strategies for achieving reductions in deforestation. We also identify policy options that do not clearly work through one of the two main ways of reducing deforestation. Mapping the TOC for deforestation is done for the 86 different policy options. The thickness of the line connecting the different boxes (see Figure 3-6 in results for details) correspond to the number of proposals working through the given TOC, allowing us to identify the main TOCs proposed by the various stakeholders.

3. RESULTS

3.1. POLICY OPTIONS

In reviewing the collected data, we identify 1,141 individual policy proposals put forward by the five types of proponents (Figure 3-4). By grouping these by target actor and policy instrument, we summarize the individual proposals in 86 unique policy

options, which are proposed anywhere from one to sixty times (Table 3-1, Table 3-2, and Table 3-3). The most frequently proposed option is to introduce mandatory due diligence regulation for companies importing FRCs, followed by support for multi-stakeholder fora, partnerships, and processes; capacity building for good governance in producer countries; and access to technology for FRC producers.

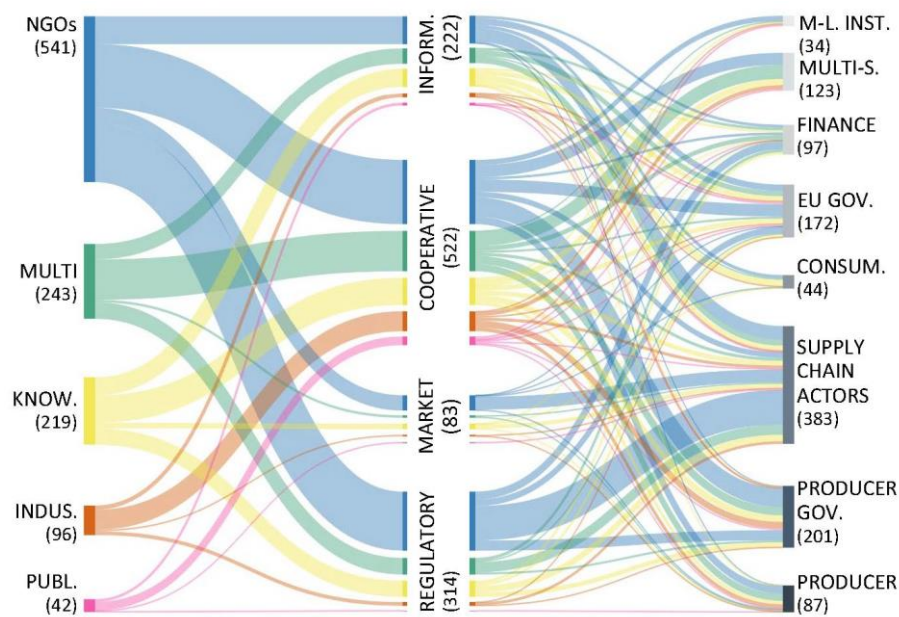


Figure 3-4. Graphical overview of the policies proposed by different actors, the types of policy instruments used, and the actors targeted by the policy

The left section displays the different actors (NGOs, non-governmental organizations; MULTI, multistakeholder groups; KNOW, knowledge institutions; INDUS, industry actors; and PUBL, public organizations). The middle section displays the policy instruments applied (information-based, cooperative, market-based, and regulatory). The right section displays the actors targeted by the policies (PRODUCER, FRC producers; PRODUCER GOV, producer governments; CONSUM, consumers; EU GOV, EU institutions and member states' governments; FINANCE, financial sector actors; MULTI-S, multistakeholder groups; M-L INST, multilateral institutions). Numbers in parentheses indicate the total number of policy proposals for a given category.

Information-based instruments (Table 3-1) constitute 30% of the 86 summary options and 19% of the individual proposals, and mostly target supply-chain actors and consumer country governments. These proposals call for research, data collection, transparency, guidelines, and general information gathering and sharing by actors.

Cooperative policies (Table 3-2) are the most commonly proposed type across proponents, constituting 46% of the individual proposals and 37% of the summary options. Generally, these are measures to support various actors technically, financially, or procedurally, and except for consumers they target actor-groups equally.

At the other end, market-based policies (Table 3-3) are proposed the least often across all proponents, constituting only 7% of the individual proposals and 13% of the summary options. Proposals overwhelmingly target supply-chain actors and include the use of taxes and subsidies, import tariffs, and reforming the EU's Common Agricultural Policy (CAP).

Regulatory measures (Table 3-3) cover 28% of the individual proposals and 21% of the summary options, with almost half the summary options aimed at supply-chain actors and another quarter at the financial sector. They include proposals for due diligence and transparency regulations, application of standards, and trade regulations. Together, market-based and regulatory policies make up less than a third of the summary options and only slightly above a third of the individual proposals.

Table 3-1. Summary policy proposals classified as information-based, by actor targeted

Policy proposal	No.	A I C
<i>Forest-risk commodity producers:</i>		
IP1: Advocate for a reduced amount and increased environmental efficiency of FRC production.	2	1/3/3
<i>Producer governments:</i>		
IG1: Identify conservation hotspots.	3	1/3/3
IG2: Monitor and identify jurisdictional/national progress towards zero deforestation.	2	1/3/3
IG3: 'Carding' system with countries exporting FRCs to the EU, issuing yellow or red cards to countries failing to act effectively to combat deforestation and illegal behaviour in the supply-chain.	2	1/2/3
<i>Supply-chain actors:</i>		
IS1: Encourage reporting, transparency, and public disclosure and access to information.	24	2/3/3
IS2: Monitor progress on corporate commitments, pledges and initiatives for deforestation.	6	1/3/3
IS3: Define industry-wide sustainability criteria, such as zero-deforestation and 'sustainable' forestry and agricultural practices	14	1/3/3
IS4: Encourage the use of voluntary sourcing guidelines, certification and joint/individual commitments.	20	2/3/3
IS5: Encourage the use of residues, waste and by-products and reduction of (food) waste.	3	1/2/3
IS6: Promote Due Diligence for FRCs.	1	1/3/3
IS7: Developing a Blacklist of supply-chain operators not confirming to sustainability criteria.	3	1/3/3
IS8: Develop Whitelist for suppliers who demonstrate and adhere to best practices for sustainability.	2	1/3/3

IS9: Develop label for origin, forest/carbon footprint, deforestation-free, etc.	12	1/2/3
<i>Consumers:</i>		
IC1: Increase citizens' awareness to reduce consumption of meat & FRCs, and promote local, vegetable-based diets.	28	2/3/3
IC2: Increase citizens' awareness to reduce food waste.	6	1/3/3
IC3: Increase citizens' awareness to increase support for forest & climate policies.	1	1/3/3
IC4: Use nudging, choice architecture, and behavioural approaches to promote sustainable consumption.	4	1/3/3
<i>EU governments:</i>		
IE1: Increase knowledge, research and data collection.	31	3/3/3
IE2: Promote sustainability criteria in public procurement & dietary guidelines.	14	2/3/3
IE3: Increase transparency, information & sharing of public data on land use & deforestation.	10	1/3/3
IE4: Provide information and transparency on trade agreements.	2	1/2/3
IE5: Increase international public commitments on climate (e.g. NDCs) and land use (e.g., REDD+).	7	1/2/1
<i>Finance actors:</i>		
IF1: Encourage traceability and transparency on financial flows involved in commodity production, trade, and consumption, e.g. using monitoring and reporting tools.	6	1/3/3
IF2: Encourage due diligence for financial institutions.	2	1/3/3
IF3: Encourage voluntary commitments on sustainability standards by financial actors.	7	1/3/3
IF4: Provide guidelines, standards or labels on sustainable or responsible investment, divestment or green financial products.	10	1/3/3

No. refer to the times each policy was proposed in our sample. Political feasibility (1 = low; 2 = medium; 3 = high feasibility) is displayed for three determinants: advocacy (A), institutional complexity (I) & cost (C).

Table 3-2. Summary policy proposals classified as cooperative, by actor targeted

Policy proposal	No.	A I C
<i>Forest-risk commodity producers:</i>		
CP1: Provide access to technology, technical support, and training for better practices, sustainable intensification, climate-smart agriculture, and sustainable forest management	43	3/3/3
CP2: Provide access to finance and credit lines	8	1/3/3
CP3: Support alternative livelihoods and production systems	18	2/3/3
CP4: Support and scale-up cooperation, conflict resolution, and community monitoring	5	1/3/3
<i>Producer governments:</i>		
CG1: Support capacity building for good governance, policy coordination and enforcement of existing laws and regulations	59	3/3/2
CG2: Support forest conservation & restoration through technical capacity building, monitoring, research & data collection, etc.	36	3/3/3
CG3: Support sustainable agriculture in producer countries through technical capacity building (e.g., through Official Development Assistance (ODA))	13	1/3/3
CG4: Support tax & tariff reform in exporting countries to promote sustainable production of FRCs	6	1/3/2
CG5: Make ODA and other financial support mechanisms conditional on sustainable production and deforestation targets	3	1/3/2
CG6: Support establishment and enforcement of tenure and land rights, human rights, and FPIC	20	2/3/3
<i>Supply-chain actors:</i>		
CS1: Support uptake & implementation of existing production standards (e.g. sustainability criteria, certification, zero-deforestation)	22	2/3/3
CS2: Support the development of new guidelines, criteria, standards and roadmaps	8	1/3/3

CS3: Support for traceability & transparency	6	1/3/3
CS4: Support & improve access to finance for alternative business models, product service systems & sharing platforms	8	1/3/3
CS5: Support the uptake of and compliance with procurement policies and other sourcing guidelines	4	1/3/3
CS6: Support industry commitments through technical capacity building for monitoring, data collection, etc.	8	1/3/3
<i>EU governments:</i>		
CE1: Mainstream deforestation concerns in EU policies & promote synergies between policy areas	32	3/2/3
CE2: Improve implementation of existing EU policies (e.g., FLEGT, RED I & II) related to deforestation	21	2/2/3
CE3: Formulate & implement an EU Action plan (on deforestation, sustainable agriculture)	8	1/3/3
CE4: Strengthen institutional capacity and cross-ministerial cooperation	11	1/2/3
<i>Finance actors:</i>		
CF1: Support the development of a responsible investment framework (e.g., ESG criteria) and mechanisms for internal monitoring and external compliance	3	1/3/3
CF2: Support innovative financial mechanisms for sustainable production, including blending instruments, public-private-, results-based- & up-front financing	14	2/3/3
CF3: Provide insurance, guarantees, and reinsurance mechanisms to de-risk investments in sustainable land use	9	1/3/3
<i>Multi-stakeholder:</i>		
CM1: Promote dialogue and cooperation with other producer and consumer countries	29	3/3/3
CM2: Alignment and harmonization of international, national and private-sector definitions, targets & commitments	9	2/3/3
CM3: Support multi-stakeholder fora, partnerships, and processes (jurisdictional or commodity roundtables, moratoria, etc.).	61	3/3/3

CM4: Facilitate data collection and information sharing among stakeholders	15	2/3/3
CM5: Strengthen certifications (e.g., through robust auditing and monitoring system, and effective complaints mechanisms)	9	1/3/3
<i>Multilateral institutions:</i>		
CI1: Support reform of WTO rules based on sustainability considerations	4	1/3/1
CI2: Support implementation of existing commitments, treaties, and initiatives (e.g. Paris Agreement, REDD+, CBD)	12	2/2/1
CI3: Support additional sustainability efforts within multi-lateral institutions (e.g. World Bank, UN)	12	1/2/3
CI4: Support development of binding international treaties and regulations on business and sustainability	6	1/2/3
<i>No. refer to the times each policy was proposed in our sample. Political feasibility (1 = low; 2 = medium; 3 = high feasibility) is displayed for three determinants: advocacy (A), institutional complexity (I) & cost (C).</i>		

Table 3-3. Summary policy proposals classified as market-based (M) and regulatory (R), by actor targeted

Policy proposal	No.	A I C
<i>Forest-risk commodity producers:</i>		
MP1: Use results-based payments (e.g., carbon and ecosystem services markets such as REDD+, EU Emissions Trading Scheme (ETS), Verified Emissions Reductions (VERs)) to promote sustainable production	11	1/2/3
<i>Supply-chain actors:</i>		
MS1: Lower/raise import tariffs for sustainably/ unsustainably produced commodities	14	2/2/1
MS2: Reform economic incentives (e.g., taxes & subsidies) for FRCs based on sustainability impacts	28	2/2/1
MS3: Introduce carbon pricing along the supply-chain, incl. deforestation for FRCs	2	1/1/1

MS4: Reform EU CAP to reduce imported deforestation and promoting sustainable agricultural production	18	2/2/1
MS5: Introduce subsidies for 'imperfect' food products to reduce food waste	2	1/2/3
<i>Consumers:</i>		
MC1: Introduce consumer taxes that reflect environmental impacts (e.g., deforestation, carbon emissions)	5	1/3/1
<i>EU governments:</i>		
ME1: Environmental tax revenues for actions to reduce deforestation	1	1/3/1
<i>Finance actors:</i>		
MF1: Introduce a tax on investment in companies linked to deforestation	1	1/2/2
MF2: Subsidize investments in sustainable/deforestation-free projects	1	1/2/2
<i>Producer governments:</i>		
RG1: Include sustainability criteria and complaint mechanisms in current and future trade agreements	32	2/1/1
RG2: Negotiate partnership agreements (e.g. FLEGT-like VPAs) with producer countries	25	2/1/2
<i>Supply-chain actors:</i>		
RS1: Mandatory Due Diligence regulation for companies importing FRCs	60	3/2/2
RS2: Mandatory transparency and reporting requirements	19	2/3/3
RS3: Mandatory regulatory standards (e.g. sustainability criteria, certification, HCS approach)	28	2/2/1
RS4: Regulate imports, e.g., through quotas, bans or preferential access agreements	21	2/2/1
RS5: Apply sanctions or prosecute companies not adhering to sustainability criteria	8	1/2/1
RS6: Limit EU bioenergy demand and strengthen sustainability criteria on bioenergy	30	2/2/1
RS7: Mandatory labelling of origin, forest/carbon footprint, deforestation-free, storage, etc.	6	1/2/2

RS8: Extend sustainability criteria for bioenergy to non-energy uses of the same commodities	6	1/2/1

EU governments:

RE1: Include land use and deforestation in the Product Environmental Footprint regulation	1	1/2/3
RE2: Sustainability criteria and targets in public procurement policies	29	2/2/2
RE3: Review or amend EU competition law to allow businesses greater freedom to collaborate for sustainability purposes	2	1/2/3
RE4: Introduce food waste reduction goals and regulations	3	1/3/1

Finance actors:

RF1: Mandatory transparency and deforestation proofing for investments in agricultural and forestry supply-chains	12	1/2/3
RF2: Mandatory due diligence requirements for EU financial institutions	9	1/2/3
RF3: Introduce regulation standards and criteria that ensure that finance from EU operators do not contribute to deforestation	19	1/2/2
RF4: Divest public funds from companies linked to deforestation and/or increase investments in sustainable consumption	4	1/3/2

No. refer to the times each policy was proposed in our sample. Political feasibility (1 = low; 2 = medium; 3 = high feasibility) is displayed for three determinants: advocacy (A), institutional complexity (I) & cost (C).

3.2. POLICY PROPONENTS AND TARGET ACTORS

Of the 1,141 proposals, NGOs propose about half (47%), knowledge institutions (19%) and multi-stakeholder groups (21%) propose a fifth each, while industry (8%) and public authorities (4%) provide the fewest suggestions (Figure 3-4). Proponents make use of the four types of policy instrument to different degrees. At one end, Industry and Public authority proponents overwhelmingly provide proposals based on cooperative instruments and very few of the other policy instruments. At the other end, NGOs often suggest regulatory policy options. As the only group, knowledge-

based proponents propose a greater-than-average number of policies relying on market-based or regulatory instruments and fewer relying on cooperative instruments.

Overall, supply-chain actors are the target of most policies (about a third of both individual proposals and summary options), followed by producer country governments and EU institutions. However, there are differences in the type of policies targeting different actors. Most cooperative policies are directed at producer governments, while most voluntary, market-based and regulatory policies are directed at supply-chain actors.

Different proponent-groups also target their proposals at different actor-groups. Knowledge institutions direct information-based policies mostly at consumers and target EU institutions more often than other proponents. Public authorities direct information-based proposals mostly at EU actors, market-based proposals at producers, and cooperative proposals at multi-lateral institutions, but provide no proposals aimed at consumers and relatively few aimed at finance and supply-chain actors. Industry proponents' proposals target upstream actors (producers and producer governments) more often than other proponent groups' proposals. NGOs provide few proposals aimed at producers and consumers, targeting instead producer governments and especially supply-chain actors. Multi-stakeholder proponents provide proposals aimed at multi-stakeholder groups, producers and finance actors, but infrequently target consumers and multi-lateral institutions.

3.3. POLITICAL FEASIBILITY

The tables above (Table 3-1, Table 3-2, and Table 3-3) present the assessment of the political feasibility of each of the 86 policy options across the three dimensions of feasibility assessed: advocacy, institutional setting, and costs. Overall, limited advocacy across proponent groups is the most significant barrier to feasibility, with 56 proposals classified as low support, 22 as moderate, and only eight as high support, compared to a 3/32/51 split for institutional setting and 15/11/60 for costs.

To guide the assessment of feasibility, we divide the 86 summary options into clusters with similar combinations of feasibility across the three dimensions. One such cluster

is policies that have an overall high level of feasibility ($n = 21$), defined as having one or more high feasibility scores, and no low feasibility score across all three determinants. These can be contrasted with policies that face multiple feasibility barriers ($n = 21$), classified as either medium to low across all feasibility scores, or having at least two low scores across all three dimensions. The third and largest cluster contains policies facing advocacy barriers ($n = 44$), defined as having low feasibility score on advocacy, but one of (or both) cost and institutional feasibility scoring high and the other medium (Figure 3-5).

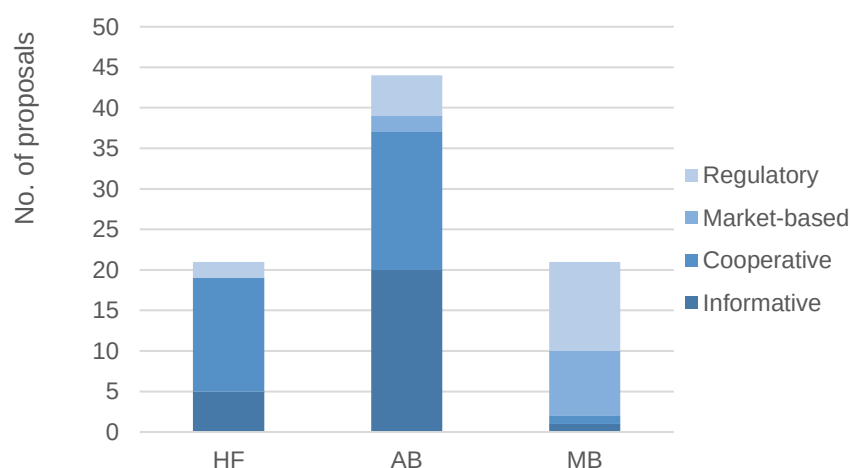


Figure 3-5. Clustering policies by political feasibility

Clustering of policies based on feasibility scores, differentiating between policies with overall high feasibility (HF), policies where advocacy is the main barrier (AB), and policies with multiple feasibility barriers (MB).

The clusters are split almost entirely along policy instrument lines. The multiple-barriers cluster almost exclusively include market-based and regulatory policies, such as trade policy, e.g., negotiating VPAs [RG2], trade provisions, e.g., tariffs, bans, quotas, sanctions, preferential access [MS1; RG1; RS4], or amendments to existing or development of new free-trade agreements (FTAs) [MG1] or to the WTO rules [CI1]); supply-chain and finance regulations, e.g., mandatory labelling [RS7] or sustainability standards [RS3,5,8; RF3]); and various economic incentives, e.g.,

taxing deforestation in supply-chains [MS2-3; MF1; MC1] or reforming subsidies and incentives in the CAP [MS4].

The two clusters of policies with high feasibility or advocacy as the main barrier mainly consist of information-based and cooperative policies. The high feasibility cluster contain three overarching type of policies. Firstly, policies suggesting capacity building for FRC producers and producer countries [CP1,3; CG1,2,6, CM1]. Secondly, policies aimed at EU actors' policy development and implementation [IE1; CE1,2] and EU consumption patterns [IC1; IE2]. Thirdly, policies targeting supply-chain actors, espousing, e.g., transparency, knowledge-sharing, and certification and standards [IS1,4; CS1; CM1,2,4; CI2], and supporting multi-stakeholder processes [CM3]. Notably, mandatory supply chain due diligence [RS1] and transparency [RS2] policies also show high feasibility.

The advocacy-as-a-barrier cluster mainly include policies targeting supply-chain and, in particular, finance actors to foster corporate sustainability practices (e.g., standards and guidelines [IS3; IF3-4; CS2,5-6; CM5], transparency [CS3; IF1], due diligence [IS6; IF2], or access to finance and technology [CS4,6; CF1,3]). Finance sector regulation, including mandatory due diligence and transparency [RF1,2] is also included in this cluster. A separate group of policies seek to raise consumers' awareness [IC2-4] and provide information to various stakeholders (e.g., monitoring progress on public and private deforestation targets [IG1,2; IS2]; sharing data [VE3-4], or developing labels [IS9]). Two market-based options, results-based payments [MP1] and subsidies to incentivize consumption of imperfect food [MS5] are also in this cluster, and notably both involve subsidies, rather than taxes or penalties.

3.4. THEORIES OF CHANGE

Figure 3-6 displays the mapped TOC for each of the 86 summary options. This mapping is largely inferred, as proponents rarely explicate their TOCs. For example, individual policy proposals for food waste reduction targets or CAP reform do not describe what actions to implement and how this would reduce deforestation. Also,

some proposals seem to conflate means (*e.g.*, increase transparency) with ends (*i.e.*, reducing deforestation), thus providing normative statements as policies.

Overall, three-quarters of both individual proposals and summary options rely on reduced demand for forest land as a means of reducing deforestation. Only a tenth aims to reduce deforestation by protecting existing forests. To some extent, this finding is expected, as tropical forest protection is not within the purview of EU policy, while factors influencing the demand for land for FRC production are. Finally, for about an eighth of the policies, it is unclear how their implementation would reduce deforestation, as the stated policy means ability to address the desired ends can be only vaguely or indirectly inferred.

Our mapping indicate three overall TOCs for reducing the demand for new forest land for FRC production: reducing overall demand for FRCs, increasing the demand for deforestation-free FRCs, and increasing the supply of deforestation-free FRCs. The least prevalent of these TOCs is to reduce overall demand. It is proposed to be achieved by limiting the EU bioenergy demand [RS6], shifting from meat to vegetable-based diets [IC1;4], reducing food waste [IC2; IS5; MS5], and reforming the EU CAP [MS4]. However, the specific causal mechanisms for decreasing deforestation are seldom explicated.

The distinction between the TOCs aiming to increase, respectively, demand or supply for deforestation-free FRCs—constituting 30-40% of all policy proposals each—is not always clear-cut. For example, proposals for supporting multi-stakeholder processes [CM3], developing new standards and certifications [CS2], or increasing the uptake of existing ones [CS1], may work to increase either supply or demand of deforestation-free FRCs.

Proposals to improve farmers' capacity [CP1-3] or the system in which they operate [CG1,6; CP4] have more evident TOCs. For example, promoting alternative production systems, training, technical assistance, and access to finance, or establishing good governance, ensuring land rights, or resolving local conflicts clearly aim to reduce deforestation by promoting the supply of deforestation-free FRCs. The

same holds for policies seeking to ensure that investments are not directed to deforestation-related production.

Other policies aim to increase the demand for deforestation-free FRCs through different channels. A large group of policies aim to increase information or awareness on deforestation, e.g., through transparency [IS1; RS2; IF1; FR1; CS3], blacklists and whitelists [IS7,8], or monitoring capacity [IS2; CS6; IE1,3], with the (largely implicit) assumption that this will cause changes in corporate practices and consumer behaviour. There are also suggestions for more directly shifting FRC consumption patterns, e.g., through sustainability criteria for public procurement [IE2; RE2] or by trade measures of various degrees of scope and stringency, such as negotiating VPAs [RG2], applying sustainability trade provisions (tariffs, bans, quotas, sanctions, preferential access) [MS1], or amending existing FTAs or WTO rules [RG1; CI1]. Included here is also the popular option to use due diligence [RS1; IS6] to hold importers accountable for actions in their supply-chain to increase demand for deforestation-free FRCs.

Most policies seeking to reduce deforestation by protecting existing forests do so by increasing capacity among local authorities and stakeholders, through technical and financial assistance [CG1-2; CP4]. These policies espouse good governance and enforcement of laws, various forms of technical support, e.g., forest monitoring, and initiating funds to finance forest protection. Another set of policies provide financial incentives to preserve forests, either by directly paying landowners for forest conservation [MP1] (similar to or referring to REDD+) or by making development assistance to exporters of FRCs contingent on halting deforestation [CG5].

While the TOCs displayed in Figure 3-6 outline “who would do what differently”, they do not always clearly elucidate “why”. Partly because this is not always explicated in the policy proposals, partly because there are sometimes different answers to that question. For example, uptake of certifications, standards, transparency, and due diligence can either be supported or mandated. The difference between how these TOCs are realized have implications for their validity and eventual impact on reducing imported deforestation, which we discuss below.

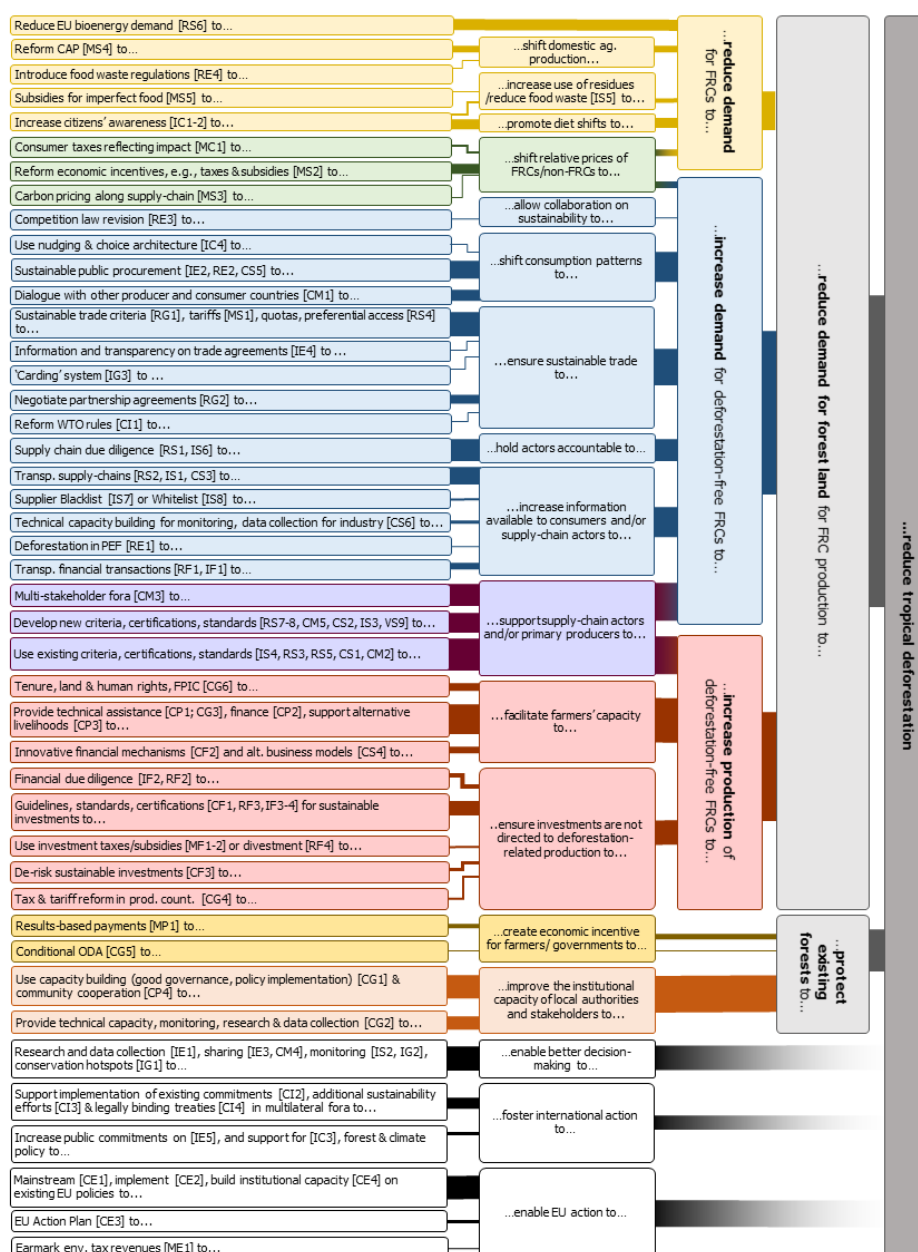


Figure 3-6. Visualization of the theory of change (TOC) underlying each of the 86 identified policy options

4. DISCUSSION

The lack of clearly elucidated TOCs for most policy proposals is striking. Still, our attempt to infer underlying TOCs should only be regarded as a first step in informing the EU policy debate on tropical deforestation. As stressed by Garcia et al. (2020), TOCs need to be constantly revisited in “a dynamic process, [where] the TOC can support the collective testing of assumptions” (p. 423). This idea articulates a need to deepen the deforestation policy debate to enable informed discussions on how to design optimal policies. Here, it is critical to draw on the extensive evidence produced on drivers of tropical deforestation (Busch and Ferretti-Gallon, 2017; Geist and Lambin, 2002; Meyfroidt et al., 2014; Pendrill et al., 2019a), addressing both the underlying drivers (*e.g.*, consumption, technology) and the proximate causes (*e.g.*, agricultural expansion, logging). Drawing upon empirical and theoretical literature we discuss the inferred TOCs, with an eye to the relation between potential impact and our assessment of political feasibility.

4.1. REDUCING DEFORESTATION BY SHIFTING EU FRC DEMAND

Several TOCs rely on information to shift demand—both intermediate and final—either away from imported FRCs completely, *e.g.*, through diet shifts [IC1], or to sustainably produced FRCs, *e.g.*, through voluntary or mandatory supply-chain transparency [IS1, RS2]. Overall, these suggestions show high feasibility, though advocacy is a potential barrier for some information-based policies (*e.g.* [IS1-2,7-8; IC3; IF1; RS2]). However, the assumed causal link between information-provision and impact is questionable: Information-based policies are highly dependent on context and phrasing (Pollitt and Shaorshadze, 2011; Sunstein and Reisch, 2013), necessitating careful design to achieve change. “Nudging” and behavioural designs [IC4] address this issue, but is yet to be proven impactful on a large scale (Reisch et al., 2013). Gardner et al. (2019) also caution that increased supply-chain transparency can be used strategically by strong actors to strengthen their position or increase information fatigue. Information overload is already an issue for consumers (Iyengar and Lepper, 2000) and there is strong empirical evidence that information alone does not shift consumption patterns (Horne, 2009). Negative information typically has

broader impacts on consumer choices (Van Dam and De Jonge, 2015; Vanclay et al., 2011), but requires mandatory labelling [RS7], which show scant support in our data.

Another way to realize demand-shifts is by pricing deforestation embodied in FRC products (or their associated carbon emissions) [MS1-2]. These proposals face several feasibility barriers and are likely to have limited impact on deforestation, at least if implemented as consumption taxes. Carbon taxation of food show relatively modest consumption changes due to low demand elasticities (Säll and Gren, 2015; Springmann et al., 2017). As most FRCs are intermediate inputs to processed products (e.g., palm oil, soybeans, rubber, wood products), consumer price changes are comparatively lower, making FRC-taxes more effective if levied on supply-chain actors. Importantly, to have an impact, tax-levels on FRCs must be differentiated by the relative contribution to deforestation, which complicates implementation and raises information needs tremendously.

Reforming CAP-regulations (European Commission, 2013b, 2013a) [MS4], which include market- and trade-distorting provisions such as import tariffs and sector aid (COWI et al., 2018; Matthews, 2008), could address deforestation by incentivising increased EU production of FRC substitutes, primarily livestock feed, but also vegetable-based protein to substitute meat. However, reforming the CAP is institutionally complex (Elliot and Heath, 2000; Matthews, 2018) and faces strong opposition from some actors, making this a difficult option for reducing FRC demand.

Trade measures [MS1; RG1-2; RS4; CI1] provide an obvious avenue for addressing FRC imports, but these options face substantial feasibility barriers. Amending existing trade measures to consider deforestation—e.g., reducing tariffs for deforestation-free agricultural commodities (Brack and Bailey, 2013; COWI et al., 2018)—could ease feasibility concerns, but show limited impact due to the low tariffs on most agricultural products. There are critical legal and financial constraints to generally-applied, stringent trade measures on FRCs, such as tariff increases, sanctions, and bans, imposed by WTO rules and existing EU law (Brack and Bailey, 2013). Including strict sustainability criteria in FTAs [RG1] can reduce deforestation, but the current Mercosur agreement illustrates the difficulty of utilizing this option (Baltensperger

and Dadush, 2019; Fuchs et al., 2020; Kehoe et al., 2020). Similarly, negotiating FLEGT-style VPAs for FRCs [RG2] would enable the EU to target forest governance and production practices in tropical countries, but the cumbersome negotiation process and slow implementation (TEREA, 2016) provides a barrier to near-term impacts. However, VPAs could be attractive in cases where the EU constitute the main trading partner, e.g. for cocoa from West Africa.

Trade-based discrimination can be implemented under certain conditions (Brack, 2013, 2015). For example, the Illegal, Unreported and Unregulated (IUU) Fishing Regulation (European Commission, 2008b) applies a scheme to ‘validate’ products entering the EU market and impose bans on imports [RS4, RG1], if exporters fail to implement required reforms promptly. It also operates a ‘carding system’ for countries—similar to [IG3]—to incentivize cooperation and governance reforms (European Commission, 2020). The similarities between IUU-related issues and deforestation makes it obvious to draw on this policy. However, in addition to low feasibility, the geographically-limited production of some FRCs, e.g. palm and cocoa, provides a barrier to red-lists and import bans by reducing the number of trading partners available, while leakage remains an issue (Hutniczak and Delpeuch, 2018).

4.2. REDUCING DEFORESTATION USING SUPPLY-CHAIN INTERVENTIONS

Our results clearly illustrate an increased focus on supply-chain sustainability interventions as a critical component of reducing deforestation, reflected also in the zero-deforestation commitments made by a growing number of companies (Garrett et al., 2019; Lambin et al., 2018; NYDF Assessment Partners, 2019). Notably, using new or existing standards and certifications [IS3-4; IF3-4; CS1-2,5; CM5] to drive change among FRC producers, supply-chain actors, and financial institutions collectively account for the largest share of policy proposals. There is some empirical evidence that certification improves sustainability outcomes at farm-level (DeFries et al., 2017; Lambin et al., 2014), including on farm tree cover (Carlson et al., 2018; Rueda et al., 2015; Rueda and Lambin, 2013; Takahashi and Todo, 2013). However, overall impacts on deforestation have been limited by certification leniency and

insufficient market uptake (Bager and Lambin, 2020; Lambin and Thorlakson, 2018; Morgans et al., 2018; van der Ven et al., 2018). At present, demand for certified products trails supply for most FRCs (Potts et al., 2014). To reduce deforestation, a viable TOC need to explicate how stringent standards would move from niche to mainstream, overcoming the fundamental trade-off between impact and uptake for voluntary standards (Borck and Coglianese, 2009; Dietz et al., 2018). Our analysis suggest this will be difficult, as proposals for making standards mandatory [RS3,7-8] face multiple feasibility barriers.

Multi-stakeholder processes [CM3] can foster synergies between policies and is a strongly supported, high-feasibility option. Although there is limited empirical evidence of how interactions between private and public governance regimes affect conservation policy (Lambin et al., 2014), incipient evidence show that sector-wide standards resulting from multi-stakeholder dialogues—such as the Brazilian Soy Moratorium (Gibbs et al., 2015)—can reduce deforestation, especially when combined with government support (Lambin et al., 2018). As illustrated by the Soy Moratorium, the impact of multi-stakeholder interventions depends on their ability to establish clear and stringent rules on deforestation, and implementing monitoring and enforcement mechanisms to ensure accountability (Gibbs et al., 2015), even in the absence of supportive public governance frameworks. However, leakages risk undermining the overall impact of multi-stakeholder interventions by displacing deforestation to other territories (Arima et al., 2011; Bastos Lima et al., 2019; Gollnow et al., 2018; Silva and Lima, 2018), companies with less reputational risks (Heron et al., 2018), or commodities (e.g., beef) with lower frontier entry costs (Garrett et al., 2018b; Moffette and Gibbs, 2021).

Due Diligence-requirements introduce accountability provisions for supply-chain actors [RS1, IS6] and is the most common proposal in our sample, receiving widespread support across proponents. The support for mandatory adoption is crucial to achieving impact, as a recent evaluation found voluntary measures ineffective in encouraging companies to identify, account for and mitigate negative environmental impacts in their supply chains (Smit et al., 2020). While mandatory due diligence-

regulation faces moderate feasibility barriers on institutional setting and costs, the EUTR (European Commission, 2010) and Conflict Minerals (European Commission, 2017b) Regulations (CMR) both apply due diligence and transparency measures, providing precedence that these barriers are surmountable.

Due diligence was included in the EP's EAVA-report (Heflich, 2020), and the EC is expected to introduce a legislative proposal for mandatory human rights and environmental due diligence for EU companies in 2021. As the 2020 UK due diligence consultation (UK Department for Food Environment and Rural Affairs, 2020) illustrates, the requirements and sanctions placed on key actors, such as large traders and producer groups, and the commodities included, affect overall impact. The French 'duty of care' law (*Loi de Vigilance*) instates due diligence for all companies of a specific size. While it does not focus on a specific sector or issue, it includes a civil liability regime (Cossart et al., 2017), holding companies accountable for breaches of the regulation.

Proposals for due diligence and increased transparency in finance [VF1-2; RF1-2] typically exhibit lower support (especially from industry and public authorities). Evidence from the Brazilian Amazon suggests that environmental criteria for restricting rural credit can effectively reduce deforestation (Assunção et al., 2020). This measure, together with evidence of substantial ownership by EU-based financial actors and foreign investment flows into FRC-operations, e.g. in the Amazon (Galaz et al., 2018b, 2018a), suggest that including the finance sector in prospective EU regulations can reduce deforestation rates beyond that embodied in EU imports of FRCs. Within the EU process, options for regulating the financial sector include introducing investment standards for deforestation [RF3], taking broader action on ESG in the financial sector [VF3; CF2-3], and implementing a Sustainable Finance taxonomy [CF1; VF4].

4.3. REDUCING DEFORESTATION BY SUPPORTING FRC PRODUCERS

While most policy options identified target actors within the EU, some prevalent TOCs target actors in producer countries. Firstly, these include supporting FRC producers—financially [CP2; CS4; CF2], technically [CP1,3; CG3] or regulatory [CP4; CG4,6]—to shift production practices and increase deforestation-free FRC production. While these policies exhibit high feasibility, the causal links between support for FRCs producers and reduced deforestation are far from straightforward and highly context-dependent. There is ample evidence that “trade-offs and win–lose between forest conservation and technological progress in agriculture in areas near forests appear to be the rule rather than the exception” (Angelsen and Kaimowitz, 2001, p. 9). This implies that supporting sustainable intensification may not have an impact on deforestation, especially if driven by demand for FRCs traded on global markets. Empirical evidence on the TOC for increased tenure security [CG6] is also mixed, generating increased or decreased deforestation depending on context (Blackman et al., 2017; Liscow, 2013; Probst et al., 2020; Robinson et al., 2014, 2017), although interventions can reduce deforestation, if well designed. However, these policies risk creating stronger incentives for forest clearing for producers supplying international markets.

Options focusing on capacity building for FRC producer governments [CG1-2, 4] have a lot in common with what has become the reality of REDD. However, direct references to REDD is surprisingly scant in the sampled data. This gap probably reflects a shift in the debate from government-led conservation policies promoted under REDD, to supply-chain sustainability interventions and private sector action. While exhibiting high feasibility overall, there is mixed empirical evidence of REDD policies reducing deforestation (Duchelle et al., 2018; West et al., 2020), although they have reduced deforestation in specific cases (Roopsind et al., 2019). Martius et al. (2018) argue that one reason for the failure of REDD to produce tangible reductions in deforestation is precisely the lack of—or different conceptions of—a theory of change. REDD was initially conceived as a system to leverage international carbon

markets to compensate tropical countries for reducing deforestation, but has evolved into a mostly aid-funded program with multiple objectives beyond forest conservation, where payments are seldom conditional on outcomes (Angelsen, 2017; Duchelle et al., 2018; Olesen et al., 2018; Wunder et al., 2020). This suggests that moving towards the original REDD-idea of conditional payments could increase impact (Wunder et al., 2020). However, there are also multiple challenges in implementing this (including feasibility), regardless if it is through results-based payments-programs targeting farmers [MP1] (Börner et al., 2017) or making development aid conditional [CG5] (Angelsen, 2017).

4.4. RESOLVING THE FEASIBILITY-IMPACT DILEMMA

The discussion above suggest a potential trade-off between feasibility and ability to reduce deforestation: The most feasible policy options – such as increased information, voluntary certification and standards, or technical capacity building – typically have relatively weak TOCs, while proposals with more viable TOCs (i.e., TOCs supported by both theoretical and empirical evidence) – mandatory certification and standards, trade measures, and supply-chain and finance regulations – appear less politically feasible. The apparent disjoint confirms the common perception of a trade-off between political feasibility and stringency (and assumed impact) in environmental policy interventions (Fesenfeld et al., 2020).

One way to overcome this dilemma is through policy mixing (Börner et al., 2015; Fesenfeld et al., 2020; Howlett, 2004): combining policy options with varying cost, support, and institutional structure—and thus different implications for affected stakeholders—to create synergies that both increases policy acceptance and improve overall impact (Lambin et al., 2014). Existing examples of policy mixing include private zero-deforestation initiatives and public policy support (Lambin et al., 2018), REDD-efforts and FLEGT-VPAs in producer countries (Muir et al., 2016), or combinations of costly and beneficial food policies (Fesenfeld et al., 2020).

Designing optimal policy mixes requires identifying the ‘low hanging fruits’, *i.e.*, feasible policy proposals building on viable TOCs, while finding ways to overcome

the feasibility barriers that make policies with convincing TOCs currently unfeasible. This includes actions that increase support (e.g., mixing ‘carrots’ and ‘sticks’ (Bemelmans-Videc et al., 1998)) or reduce costs or complexity (e.g., limiting the FRCs included in the policy), to overcome resistance from key stakeholders. This also suggests that the assessment of feasibility and impact of individual policy interventions provided here must be complemented by studies on how to policy mixing affects overall feasibility and impact (Howlett, 2004).

From a policy mixing perspective, support to producer countries can help legitimize more stringent interventions, by establishing the foundations on which such interventions rest. As such, broader support to producer country governments for better governance, tenure reform (Robinson et al., 2018), and adequate access to technical support, training, finance, etc., are important prerequisites for demand-side interventions (Martius et al., 2018; Minang et al., 2014). Existing EU policies, e.g., FLEGT and the IUU and Minerals Regulations already apply collaborative efforts with producer countries as part of stronger, demand-side action. Supporting producer countries can also facilitate the successful implementation of industry supply-chain and jurisdictional initiatives currently ongoing in producer regions (Garrett et al., 2019; Lambin et al., 2018), making private-sector actors more supportive of such interventions. Note, however, the importance of including marginalized (e.g., small-holders or indigenous communities) groups in such deliberations, to assure that they are not side-lined in the process (Bastos Lima and Persson, 2020; González and Kröger, 2020).

EU’s deforestation footprint arises from imports of just a handful of FRCs (Figure 3-1), so targeting these likely have the most significant immediate contribution to reducing deforestation and increases the legitimacy of policy action. Working with key FRC producer countries also avoids the pitfall of good actors leaving bad places, resulting in deforestation-risks merely shifting to less scrupulous traders, importers and consumers. However, such a narrow policy approach is less resilient to changes in deforestation drivers, across commodities or countries, over time. Analysing the “stickiness” of supply-chains (Reis et al., 2020) provides an option for mitigating this

risk. Gradually extending regulations to other FRCs and regions over time, a process known as ‘policy sequencing’ (Pahle et al., 2018), and coordinating efforts with other consumer countries procuring large quantities of FRCs can mitigate the risk of deforestation leakage to other commodities or regions (Bastos Lima et al., 2019). Finally, the low feasibility of most options to reduce FRC demand highlights that many stakeholders perceive it as undesirable to interfere with consumer choice, possibly due to questions of agency (Creutzig et al., 2018), the direct perceptibility of such measures (Fesenfeld et al., 2020), or fears of tackling their own base.

Our results also illustrate that policy support must be analysed in a broader context than public acceptability alone (Fesenfeld et al., 2020). Industry, knowledge institutions, and multi-stakeholder groups play a central role in formulating and advocating for policy options, underscoring the need to understand opposition and support from these stakeholders as a critical component of political feasibility. The development of the EUTR shows that mutual interests and alliances between NGOs and industry groups are conducive to the development of regulatory interventions with policy change resulting from “competition and collaboration among coalitions” (Sotirov et al., 2017). Similar coalitions exist for deforestation action, e.g. in the cocoa sector, where prominent industry actors and NGOs jointly voiced support for mandatory due diligence regulation (Barry Callebaut et al., 2019), and in the European oil palm industry (Business & Human Rights Resource Centre, 2020). In the UK, 22 companies recently urged the government to strengthen and tighten the proposed due diligence requirements for FRCs (IDH - the Sustainable Trade Initiative, 2020). Identifying and working with such coalitions is crucial to ensure broad policy support and building legitimacy.

Building on our analysis, we suggest three principles for mitigating the apparent trade-off between feasibility and impact in EU deforestation policy:

- i. *Implement policies based on clearly elucidated and proven theories-of-change.* Policy makers should employ policies proven to be successful in reducing imported deforestation—*e.g.*, multi-stakeholder action enforced through strict accountability (Gibbs et al., 2015; Nepstad et al., 2014), restrictions on credit (Assunção et al., 2020), and VPAs (Jonsson et al., 2015)—and tailor policy design to the context, as the drivers of deforestation— and thereby the most optimal policy response—are affected by location, commodity production system, forest type, and socio-economic and cultural context-dependent factors (Geist and Lambin, 2002; Nagendra and Ostrom, 2012).
- ii. *Use policy mixes to create synergies and increase impact.* Understanding how different policy options complement and reinforce one another is critical for maximizing policy impact on deforestation, a perspective that is largely missing from existing policy proposals.
- iii. *Work with stakeholders in key supply-chains and regions, broadening scope over time.* Broad political and financial support in both producer and consumer countries is necessary to build the foundation for strong policy action and effective implementation of deforestation policies. Sequencing policies and gradually expanding scope over time can facilitate acceptance and reduce risks of leakage.

5. CONCLUSION

From a sample of 1,141 policy proposals, we identified 86 unique policy options for the EU to reduce imported deforestation. Most of these build on information-based and cooperative measures, while market-based and regulatory options are less favoured. Policies overwhelmingly target supply-chain actors, with due diligence, transparency, and certifications as preferred policy options. Our feasibility assessment shows advocacy as a main barrier across policy types, with institutional and cost barriers mainly affecting market-based and regulatory policy options. On the other

hand, policies exhibiting high political feasibility typically lack a clear TOC for how the specific intervention contributes to the reduction of deforestation, suggesting a trade-off between political feasibility and policy impact. Still, there are policies, which our analysis suggests are both politically feasible and able to reduce imported deforestation, in particular, mandatory due diligence for supply-chain (and finance) actors and interventions supported through multi-stakeholder processes. These and other policies identified here should be considered by EU and national policy makers. Building on the analysis and policies identified here and applying the three principles can help policy makers introduce policies with greater impact on deforestation, while ensuring political feasibility.

BRIDGE: WHAT ARE COMPANIES DOING TO TACKLE SUSTAINABILITY CHALLENGES?

Increasingly, companies are expected to take responsibility for the sustainability impacts occurring as a result of their own and their suppliers' activities along their supply chains (Dauvergne and Lister, 2012; Ponte, 2019; Scherer and Palazzo, 2011). As a result, across the agro-food sector, many companies adopt sustainability governance initiatives beyond what is legally required (Carlson et al., 2018; Grabs and Carodenuto, 2021; Lambin et al., 2018; Thorlakson et al., 2018a, 2018b).

Sustainability governance research from a corporate social responsibility perspective focus on understanding, *inter alia*, the role of private company efforts vis-à-vis public governance (Eberlein, 2019; Scherer and Palazzo, 2011), while research founded in geographic or economic traditions focus on, *inter alia*, understanding the outcome of various governance interventions on the environment (Meemken et al., 2019; Mitiku et al., 2017; Rueda et al., 2015). Less research focuses on if and how private sector actors adopt sustainability governance approaches or practices and what explains this adoption. However, the extent to which companies adopt various governance approaches and the type and design (stringency, verification, enforcement, etc.) of these approaches affect the impact that private governance has on sustainability outcomes, whether these are broader environmental improvements on water, soil, air, or greenhouse gas emissions, or specific (narrow) outcomes, such as reduced deforestation. Using the coffee sector as a case study, the next chapter aims to provide a better understanding of how companies approach sustainability and what factors explain this.



The USD\$200+ billion coffee sector spans everything from smallholder farmers farming a few hectares to multinational corporations with thousands of employees. It also faces substantial sustainability challenges, and is one of the agro-food commodities linked to deforestation. Photo: S. Bager.

CHAPTER 4

SUSTAINABILITY STRATEGIES BY COMPANIES IN THE GLOBAL COFFEE SECTOR

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ABSTRACT

The coffee sector is facing several sustainability challenges. We ask whether addressing these is transforming the entire coffee sector or rather leading to market differentiation. Drawing on stakeholder theory and global value chain analysis, we analyse how the coffee sector approaches sustainability by examining the sustainability efforts of a random sample of 513 companies. We also identify the factors shaping the adoption of sustainability strategies. A third of companies report no commitment to sustainability, whereas another third report vague commitment. The final third of companies report tangible commitments to sustainability. Company characteristics and stakeholders affect the scope and type of sustainability strategy chosen. Large, risk-aware companies tend to conduct 'hands-on' governance, adopting internal sustainability practices along their value chain. Small, consumer-

facing companies and producers rely on 'hands-off' governance, adopting external voluntary sustainability standards. Several sustainability issues remain under-addressed by most companies, including climate change and deforestation. We found indications of potential greenwashing by some companies. Addressing sustainability is not yet fully mainstreamed in the sector, though ambitious commitments by sustainability leaders and large actors signal increasing importance of sustainability as part of corporate social responsibility efforts. We observe market differentiation through sustainability with progressive companies adopting sustainability strategies that align with their stakeholders, depending on value chain characteristics. Our results indicate a notable reliance on internal sustainability practices. There is a need for common coffee sustainability indicators relevant for all actors along the value chain, which are consistent with the Sustainable Development Goals, and a transparent, mandatory reporting framework.

1. INTRODUCTION

Coffee is a globally traded commodity and an integral part of many people's daily life. The coffee sector is a multi-billion dollar global business, involving thousands of companies and several million farmers, most of which are smallholders (Daviron and Ponte, 2005; Samper et al., 2015). The sector is facing several sustainability challenges, including water pollution, biodiversity loss, soil erosion, agrochemical use, deforestation, waste generation, and labour exploitation (Meyfroidt et al., 2013; Panhuysen and Pierrot, 2014). Other issues include low prices, ageing farmers, and climate change (Panhuysen and Pierrot, 2018; Pham et al., 2019). The latter will complicate production across many current coffee-growing areas, with negative impacts on livelihoods (Hannah et al., 2020; Ovalle-Rivera et al., 2015; Pham et al., 2019). Climate change and deforestation also cause the loss of natural, non-commercial varieties with potentially useful properties for adaptation (*e.g.*, drought-tolerance) (Davis et al., 2019; Imbach et al., 2017).

To address sustainability challenges, companies rely on governance mechanisms that variously combine codes of conduct, voluntary sustainability standards (VSSs), corporate social responsibility (CSR) programmes, direct relations with producers, etc. Progressive companies across the coffee sector (Bitzer et al., 2008; Giovannucci and Ponte, 2005; Jaffee, 2012; Millard, 2017; Ponte, 2019) and the wider agro-food sector (Dauvergne and Lister, 2012; Glasbergen and Schouten, 2015; Thorlakson et al., 2018a) voluntarily adopt sustainability strategies to reduce regulatory risk, fill a policy vacuum, meet stakeholder expectations, increase income, protect their brand and reputation, or differentiate themselves from competitors (Auld et al., 2008b; Cashore, 2002; Dauvergne and Lister, 2010, 2012; Ponte, 2019; Vogel, 2008).

The shift from state-centred to polycentric governance, and the increased reliance on non-state market-driven governance (NSMD) (Bernstein and Cashore, 2007; Cashore, 2002) to achieve sustainability is particularly visible in the coffee sector. With the stringency and enforcement of government regulations varying between countries, VSSs, such as Organic and Fairtrade, emerged to tackle environmental and socio-

economic sustainability challenges in the coffee sector (Auld, 2014b; Grabs, 2018) – soon followed by other NGO-, industry/company-, and multi-stakeholder-led VSS. The potential of VSS initiatives to become not only viable alternatives to government regulations, but the *modus operandi* of sustainability governance created significant interest in the topic – both hopeful (Auld, 2010; Bernstein and Cashore, 2007), cautious (Auld, 2014a; Auld et al., 2008a; Stratoudakis et al., 2015) and sceptical (Hatanaka and Busch, 2008; Raynolds, 2009; Waldman and Kerr, 2014). The aim of our research is to assess how sustainability governance currently unfolds within the coffee sector and to understand the factors that shape the sustainability efforts of the companies involved: which companies adopt which sustainability strategy and why?

1.1. SUSTAINABILITY GOVERNANCE IN THE COFFEE SECTOR.

Sustainability governance mechanisms are constantly evolving, and the coffee sector has historically been at the forefront of implementing private and multi-stakeholder approaches to address sustainability (Daviron and Ponte, 2005; Giovannucci and Ponte, 2005; Grabs, 2018; Panhuysen and Pierrot, 2014)—although recently, sustainability innovation has also been rapid in other sectors such as cocoa (Thorlakson, 2018). VSSs, especially third-party certification standards, have been widely used to address sustainability concerns in coffee, although internal standards and various supply chain interventions have emerged to form important parts of the NSMD sustainability governance of the coffee sector (Grabs, 2017; Millard, 2017; Ponte, 2019; Raynolds, 2009; Raynolds et al., 2007). More recent initiatives to address sustainability include direct trade, single origin and value chain transparency, which first emerged as differentiation and sustainability strategies in the coffee sector among a group of small roasters (Bitzer et al., 2008; Daviron and Ponte, 2005; Grabs, 2017; Latta and Barbara, 2014; Ponte and Gibbon, 2005) and are now spreading to other sectors. Direct trade—the commercialization of coffee from farmers to roasters without intermediaries—can bring benefits in the form of higher prices for producers, increased connection to global markets and improved agro-ecological production practices (Hernandez-Aguilera et al., 2018; MacGregor et al., 2017; Middendorp et al., 2020; Rosenberg et al., 2018; Rueda et al., 2018). Single origin—marketing of

coffee from specific farms, regions or countries, sometimes through Geographical Indications—is used by roasters to brand coffee and by producer countries to protect their reputation and increase value capture (Barjolle et al., 2017; Rueda et al., 2017; Samper and Quiñones-Ruiz, 2017). Transparency fosters accountability by facilitating “soft enforcement” (Schleifer et al., 2019), enabling public scrutiny and informed consumers decision making based on company disclosures, while also facilitating increased sales, as it “improves consumer willingness-to-buy” (Egels-Zandén and Hansson, 2016).

The sustainability outcome of adopting VSSs depends on the value chain structure, the specific VSS applied, and the socio-economic context (Bray and Neilson, 2017; COSA, 2013; Meemken, 2020; van Rijsbergen et al., 2016). Most current knowledge on the impacts of VSSs is based on NGO-led standards, while less is known about the impacts of industry- and company-led standards (*e.g.*, 4C and NespressoAAA). The evidence remains mixed (Blackman and Rivera, 2011; DeFries et al., 2017), but VSSs are often associated with direct or indirect socio-economic and environmental benefits (COSA, 2013; Lee et al., 2012; Mitiku et al., 2017). While VSSs are promoted as means to improve smallholder farmer livelihoods through higher prices and higher household incomes (Meemken, 2020), a critique remains that standards primarily benefit well-off producers, ignoring the weakest, marginalized smallholders and failing to ensure that price premiums reaches them (COSA, 2013; Minten et al., 2018). Trade-offs between socioeconomic and environmental outcomes exist (Vanderhaegen et al., 2018) and concern about the “mainstreaming” of certification is widespread (Kolk, 2013; Lernoud et al., 2017; Raynolds, 2009; Sexsmith and Potts, 2009). Comparing competing VSSs, Dietz et al., (2018) found that, overall, more stringent VSSs achieved smaller market share in the coffee sector than in comparable sectors, as the growth of weaker, industry-/company-led VSSs constrained the rise of the more stringent VSSs. In recent years, the production of coffee certified under VSSs has expanded rapidly. In 2015, 23% of the worldwide coffee exports complied with a VSS compared to 7% in 2008 (Dietz et al., 2018). Including double and triple certification, 40–53% of all coffee produced in the late 2010s was certified (Grabs, 2018), over half

by 4C, which has been developed and promoted through value chains by large actors (Dietz et al., 2018).

1.2. HOW STAKEHOLDERS AND VALUE CHAIN ORGANISATION INFLUENCE SUSTAINABILITY GOVERNANCE

According to stakeholder theory, how companies choose to address sustainability concerns can be understood as a response to “demands” from stakeholders (Freeman, 2010; Wheeler et al., 2003). In addition to creating shareholder value (Friedman, 1970), the social responsibility of business becomes creating stakeholder value (Freeman et al., 2004). Stakeholders vary by company characteristics, value chain position, size, market, ownership structure, consumers, etc. Companies with different characteristics are exposed to different stakeholders, who impose different normative preferences for sustainability (Delmas and Toffel, 2004). Stakeholder theory explains how and why companies deal with sustainability (Schaltegger et al., 2019). When deciding if and how to adopt sustainability strategies, companies consider stakeholders’ sustainability expectations (Darnall et al., 2010; Esty and Winston, 2006; Perrini and Tencati, 2006; Schaltegger et al., 2019). However, stakeholders do not have equal influence on company practices, and the response of companies to their demands differs according to stakeholder type and status, and company characteristics (Darnall et al., 2010; Goodman et al., 2017; Perrault and Clark, 2016; Shubham et al., 2018). Stakeholders have been found to affect, *inter alia*, corporate disclosure (Chithambo et al., 2020; Gallego-Alvarez et al., 2017; Liesen et al., 2015; Roberts, 1992), sustainability innovation (Zhang and Zhu, 2019), strategy (Shnayder and Van Rijnsoever, 2018), practices (Alda, 2019; Graham, 2020; Shubham et al., 2018), and their implementation (Helmig et al., 2016).

Complementary to stakeholder influence, the Global Value Chain (GVC) framework centres on the power relations between actors along value chains (Gereffi, 1999; Gereffi et al., 2005; Gereffi and Lee, 2012; Ponte et al., 2019a), often distinguishing between producer-driven and buyer-driven chains. The global coffee value chain is characterized as buyer-driven, as large roasters and brands owned by multinationals exercise enormous influence and capture most of the added value (Daviron and Ponte,

2005; Grabs, 2018; Grabs and Ponte, 2019; Ponte, 2002, 2004). The collapse of the International Coffee Agreement in 1989 resulted in decreasing influence of state-driven coffee boards and organisations (Daviron and Ponte, 2005) with increasing wealth capture by large roasters. Producers' share of the total value of the global coffee market decreased from 20% in 1989 to 13% in 1995 (Ponte, 2002) to less than 10% in 2015 (Samper et al., 2015). Specialty roasters and traders have increased their share of the total market through market differentiation and capture of intangible capital, while a handful of multinationals have further increased sector consolidation through absorption of more innovative actors – *e.g.*, the acquisition by JAB of Stumptown Roasters, or Nestlé's absorption of Blue Bottle Coffee (Grabs and Ponte, 2019; Panhuysen and Pierrot, 2018). This development runs in parallel to record-low world market prices and oversupply of both VSS-compliant and conventionally grown coffee (Grabs, 2018; Voora et al., 2019), further exacerbating the concentration of the sector (Panhuysen and Pierrot, 2018) and the influence of leading actors (Folke et al., 2019; Grabs and Ponte, 2019).

1.3. RESEARCH HYPOTHESES

Samper and Quiñones-Ruiz (2017) concluded that the coffee industry is “at a crucial moment” in defining “the best sustainability strategy going forward”, calling for a revisit, re-evaluation and improvement of coffee sustainability efforts, especially considering coffee producing countries. Despite the growth in VSS-compliant coffee production, the proliferation of industry-/company-led sustainability standards, and the increased focus on sustainability and other differentiation strategies across the sector, our knowledge of sustainability in the coffee sector remains incomplete.

When analysing sustainability efforts and strategies, some key questions include: (i) How are sustainability efforts structured? (ii) Who defines the sustainability activities undertaken? (iii) Where in the value chain are these applied? (iv) Who verifies their implementation? Sustainability efforts can be based on standards or undertaken through individual practices. While standards prescribe a coherent set of activities, individual practices allow actors to target specific socio-economic and environmental sustainability issues through different means – *e.g.*, specific requirements imposed on

suppliers or targeted internal projects. Both standards and practices can be defined internally, *i.e.*, by the company itself, or externally, *i.e.*, by an actor external to the company. Internal standards, *e.g.*, Nespresso AAA, are thus company-defined. By contrast, external standards, *e.g.*, Fairtrade, are defined by NGOs, multi-stakeholder initiatives or other external parties. Similarly, individual practices can be defined internally – *e.g.*, company-specific sustainability projects – or externally – *e.g.*, industry best-practice benchmarks. Sustainability efforts can be applied “in-house”, within the premises of the company, or to suppliers, as “sustainable sourcing” practices imposed along the value chain. While “in-house” practices, such as recycling, may be more visible to consumers, as much as 95% of the socio-economic and environmental impacts of agro-food companies occur upstream in the value chain (Thorlakson et al., 2018a). Finally, sustainability efforts can be verified by external actors (3rd party verification), which is a requirement for many external standards, by affiliated parties (2nd party), by the company itself (1st party), or not at all.

Based on a large sample of companies, we assess sustainability governance within the coffee sector. We identify the extent to which various sustainability practices and standards are adopted by companies across the coffee sector. We then analyse the factors that influence adoption of sustainability practices to characterize companies’ sustainability efforts. When assessing how a small number of coffee roasters disclosed their sustainability work, Bradley & Botchway (2018) found that the sustainability indicators used by companies corresponded to the sustainability challenges identified by scientific research. As scientific findings inform the priorities of several stakeholders, we hypothesize that coffee companies adopt multiple practices addressing the sustainability challenges confronting the sector (Hypothesis 1). Consistent with stakeholder theory, we expect a company’s stakeholders to influence adoption of sustainability practices (Bullock and van der Ven, 2020; Shubham et al., 2018; Waldman and Kerr, 2014). We expect company location, ownership, business type, and customer engagement to affect adoption of practices. We further expect that a risk-averse attitude to sustainability challenges lead to increased adoption of practices (Mayer and Gereffi, 2010) (Hypothesis 2).

GVC research has demonstrated how leading companies exert influence over other actors in value chains (Grabs and Ponte, 2019; Ponte et al., 2019a; van der Ven, 2018). Thus, we hypothesize that differences in size and value chain position affect adoption of sustainability practices and strategies (Mayer and Gereffi, 2010; Rueda et al., 2017; Thorlakson et al., 2018a). As coffee is a buyer-driven value chain, we expect that large, downstream companies define internal sustainability practices and apply these across the value chain. Exercising control over their suppliers (Lund-Thomsen, 2019) provide downstream actors with flexibility to design, communicate, and enforce criteria aligned with their operations and use these to differentiate themselves from competitors (Rueda et al., 2017). By contrast, we expect that, with fewer resources and lower enforcement capacity, non-lead companies rely on external standards to address sustainability (Hypothesis 3). Given that adoption of sustainability efforts is voluntary and costly, we hypothesize that a small number of progressive companies pioneer adoption of sustainability innovations to differentiate themselves from mainstream actors (Hypothesis 4) (Reinecke et al., 2012; Rogers, 1962).

Analysing the state of sustainability governance within the coffee sector sheds light on how companies strategically tackle sustainability challenges and also points to future developments in other sectors, where sustainability efforts have built on developments within the coffee sector, *e.g.*, wine (Scholer, 2018), cocoa, or the wider agro-food-sector (Auld, 2014b; Ponte, 2019). We explore whether sustainability is mainstreamed across the entire sector or rather a differentiation strategy adopted by some actors with specific characteristics. More broadly, our findings contribute to the understanding of the rapidly expanding realm of transnational private governance and its contribution to sustainable development.

2. METHOD

2.1. SAMPLING

We began by using a snowballing-approach to identify companies in the global coffee sector from web search, reports, and literature for a sub-population of more than 2,500

companies – the total number of companies active in the global coffee sector is not known in detail. We cleaned the data (deleting duplicates, excluding sector organizations, NGOs, consultancies, service, equipment and packaging companies, training centres, and legal subsidiaries), which brought the total sub-population to 1706. We then randomly selected about a third ($n = 587$) of the companies for which we collected information on company characteristics and sustainability commitments. During data collection, 74 companies were excluded for various reasons (*e.g.*, faulty websites, lack of data, etc.). This brought the final sample to 513 companies (*Supplementary Material*).

2.2. CODING OF COMPANY CHARACTERISTICS

We collected information on company characteristics and stakeholders, including size, headquarter location, market, ownership, value chain position, customer engagement, and risk awareness (Table 4-1). For size, we used information on number of staff or turnover to categorise each company. Location was defined by company headquarter. For value chain position, we coded companies as producer, trader, roaster, processor, and/or café. We recorded whether the company sold directly to consumers (B2C), to other businesses (B2B), or both, and whether it was publicly listed. Each company was also coded as serving only local, or also regional, or also global markets. To evaluate consumer engagement, we coded company presence on social media channels. Finally, we coded the effect of reducing the risk of exposure to stakeholder complaints by whether or not the company mentioned reducing risk, when communicating on sustainability practices (*Supplementary Material*).

Table 4-1. List of independent variables used in regression analyses

Variable	Explanation
Region	Company HQ location in Europe, USA/Canada, Asia (incl. Russia and Turkey), Latin America, Africa or Oceania.
Size	Company size (XS, S, M, L, XL), defined by number of employees or revenue
Market	Local: Company selling/operating only in country of HQ location; Regional: Company selling/operating in region of HQ; Global: Company selling/operating in more than one region.
Publicly-listed	Company is publicly-listed (1/0)
Type	B2C: Company is consumer-facing B2B: Company is business-facing
Producer	Company is producing coffee (1/0)
Trader	Company is trading coffee, <i>i.e.</i> , exporting and/or importing coffee (1/0)
Roaster	Company is roasting coffee (1/0)
Processing	Company is processing coffee, <i>i.e.</i> , producing pods, instant coffee, ready-to-drink coffee, and other types of processed, non-whole bean/ground coffee (1/0)
Café	Company is operating one or more cafes (1/0)
Risk	Company mentions risk reduction as part of sustainability work (1/0) – proxy for risk-averse motivation to sustainability, <i>i.e.</i> , a reduction of the risk of exposing the company to sustainability-related risks
Consumer engagement	Company active on three or more Social Media platforms (1/0) – proxy for engagement with stakeholders

We then conducted primary document analysis of companies' website pages (as of 2018), statements, and published reports (if any) to identify their commitments and public communications regarding sustainability practices, standards, and other relevant activities, using an approach similar to Thorlakson et al. (2018). We used content analysis to extract information – *i.e.*, a qualitative method to categorize text into categories based on selection criteria for each category. To capture the diversity of activities undertaken by companies and evaluate whether these covered the sustainability challenges facing the sector, we searched the literature for sustainability practices relevant to address these challenges (COSA, 2013; Dietz et al., 2018; Panhuysen and Pierrot, 2014; Raynolds et al., 2007; Samper and Quiñones-Ruiz, 2017; Toledo and Moguel, 2012). We identified 21 environmental and 14 socio-economic sustainability practices and eight certification schemes of production standards (Table 4-2).

We assigned binary scores (1/0) to these practices and certifications, based on company adoption of the specific environmental and socio-economic sustainability practice. For standards, we coded both whether companies adopted a given standard and whether it was adopted for all coffee products. We also collected information on the use of codes of conduct – defined as a set of rules outlining the norms and responsibilities of and proper practices for the company – and third-party auditing. We also collected information on whether the company collaborates with NGOs on sustainability efforts. To assess how alternative practices are adopted across the coffee sector, we also coded whether the company engaged in direct trade practices. We collected information on coffee products sold, availability of information on product characteristics (provenance, sustainability information, farmer, variety, and quality), and any mention of the Sustainable Development Goals (SDGs) as part of sustainability efforts. Finally, to assess company motivation and risk of greenwashing, we coded whether the company claims to be sustainable or act sustainably (*Supplementary Material*).

Table 4-2. Environmental and socio-economic sustainability practices and standards included in this study

Environmental practices	Socio-economic practices	External Sustainability and Certifications [†]	Voluntary Standards
1. Carbon Footprint / Reduction in GHG emissions □ 2. Energy use target or policy □ 3. Carbon Offsets □ 4. Renewable Energy □ 5. Climate mitigation programmes or policies ~ 6. Climate adaptation programmes or policies ~ 7. Life-Cycle Assessment □ 8. Biodiversity conservation programmes or policies ~ 9. Soil protection programmes or policies ~ 10. Zero Deforestation policy ~ 11. Shade-tree programmes or policies ~ 12. Tree Planting programmes or policies ~ 13. Food waste target or policy □ 14. Waste target or policy □ 15. Recycling target or policy □ 16. Composting target or policy □ 17. Water consumption target or policy ~ 18. Water pollution target or policy ~ 19. Pesticide use target or policy ~ 20. GMO target or policy ~ 21. Building or facility certifications □	1. No child labour programme or policy 2. Gender equality programme or policy 3. Health & Safety policy 4. Social employment programme or policy 5. Education programme for employees 6. Education for suppliers 7. Minimum wage 8. Donations 9. CSR report 10. Minimum price 11. Supply Chain transparency 12. Price transparency 13. Investments in Supply Chain 14. Training of farmers	1. Organic ‡ 2. Fairtrade § 3. Rainforest Alliance (RFA) 4. Utz 5. Biodynamic 6. Demeter 7. Smithsonian Birdfriendly 8. 4C (Common Code for the Coffee Community)	

[†]Internal sustain-ability standards (incl. Starbucks C.A.F.E. Practices and Nespresso AAA) are not included here

[‡] All certification systems for organic farming were grouped as “organic” (EU plus national standards)

[§] Includes both Fair Trade USA and Fairtrade Labelling Organisation, FLO)

Detailed explanation of the sustainability practices and external standards included in Supplementary Material. □ “In-house” practices ~ “Sustainable sourcing” practices

2.3. DATA ANALYSIS

First, we analysed descriptive statistics related to the number and type of sustainability practices adopted by each company. We analysed these by company characteristics, testing for significant differences.

Secondly, using negative binomial regression analysis with step-wise elimination, we tested the association between company characteristics and the number of practices adopted. We also computed simplified regressions by converting “size” and “region” to binary variables. To interpret model outputs, we calculated Average Marginal Effects and estimated confidence intervals using bootstrap samples (n=1000) (*Supplementary Material*).

Thirdly, using logistic regression, we identify the characteristics of companies that address sustainability challenges by adopting internal sustainability practices versus those that rely on external standards. We created a binary dependent variable describing whether a company commits to five or more sustainability practices among the 35 practices included in the study (“SP”) and another binary dependent variable describing whether a company adopts one (or more) external standard(s) for all coffee products (“CO”). We computed logistic regressions with step-wise elimination with the variables “SP” and “CO” successively as dependent variables, and company characteristics as independent variables. We also tested the characteristics of the companies using different thresholds for the dependent variables, and simplified regressions using binary variables for size and region. To interpret model outputs, we calculated Average Marginal Effects and estimated confidence intervals using bootstrap samples (n=1000) (*Supplementary Material*).

3. RESULTS

Our sample includes diverse companies: large global roasters; producers; processors; small national roasters; global café chains; large trading houses; and everything in between. Several companies are vertically integrated along the coffee value chain. 60% of the companies specialize in one supply chain function, while a third of the

companies undertake two – most typically roaster and café. 25 companies undertake three functions, while just three companies undertake four functions. No company undertakes five functions.

3.1. ADOPTION OF SUSTAINABILITY PRACTICES

Company adoption of sustainability practices varies greatly (Figure 4-1). Companies adopt 4.21 practices on average, of which 1.89 are environmental and 2.32 socio-economic. The median adoption is 2, indicating a small number of companies adopt a high number of practices, while most companies adopt no or few practices. Our sample of companies is divided into three tiers of approximately equal size. A third of the companies do not adopt any sustainability practice, thus forming a large group of laggards. The second third adopts 1-4 practices, which makes them relatively weak participants to sustainability efforts. The final third is formed by companies that adopt five practices or more.

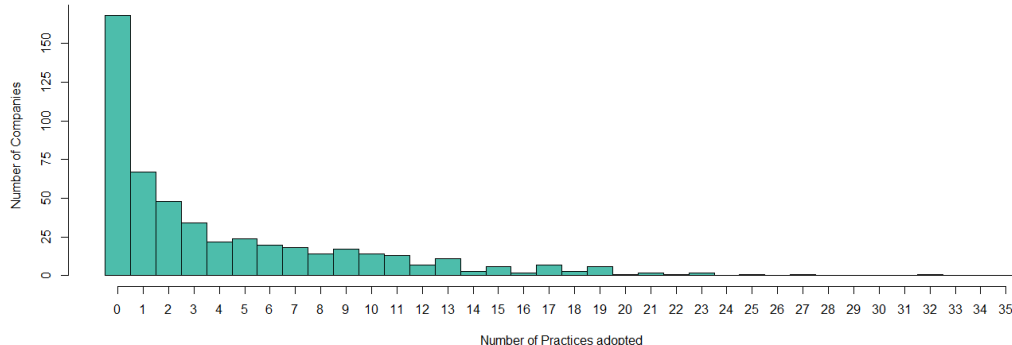


Figure 4-1. Number of sustainability practices adopted by companies

The number of practices adopted varies based on company characteristics, such as supply chain position, size, region, etc. (Table 4-3). Among value chain participants, producers and processors adopt the most practices, while cafés adopt the least. Traders and roasters adopt a similar number of practices in total, but roasters adopt more environmental practices than traders do. A consumer-country versus producer-country divide between companies is not observed. Rather, companies in Europe,

North America, and Latin America adopt a similar and higher than average number of practices. Companies from Africa adopt just below the average rate, while companies from Asia and Oceania adopt about half the average amount of practices. Differences are much more pronounced for company size: very large companies adopt on average five times as many practices as very small companies, three times as many as small companies, and twice as many as large companies. This pattern is even more skewed for environmental practices.

Table 4-3. Adoption of practices by companies by value chain position, size, and location

Adoption of practices	Environmental	Socio-economic	Total
All	1.89	2.32	4.21
Value chain position			
<i>Producer</i>	3.07	3.09	6.15
<i>Trader</i>	1.70	2.79	4.50
<i>Roaster</i>	2.12	2.50	4.62
<i>Processor</i>	3.41	3.27	6.68
<i>Café</i>	1.63	2.01	3.64
Size			
<i>XS</i>	0.99	1.35	2.34
<i>S</i>	1.46	2.37	3.84
<i>M</i>	2.28	2.31	4.59
<i>L</i>	2.45	2.66	5.10

<i>XL</i>	5.32	5.00	10.32
<i>Location</i>			
<i>Oceania</i>	0.84	0.94	1.78
<i>Asia (incl. Russia)</i>	0.90	1.31	2.20
<i>Africa</i>	1.21	2.11	3.32
<i>Europe</i>	2.06	2.41	4.46
<i>US/Canada</i>	2.26	2.71	4.96
<i>Latin America</i>	2.13	3.00	5.13

Additional details in Supplementary Table 5 in Bager and Lambin (2020).

Companies that work with NGOs on sustainability adopt significantly more practices than those that do not, as do companies that consider themselves sustainable (Figure 4-2). However, 9% of the companies claim to be “sustainable”, while adopting only three or fewer sustainability practices and no external standard. They are thus at risk of “greenwashing,” as their sustainability claim is not matched by actual implementation measures (Supplementary Table 6 in Bager and Lambin (2020)).

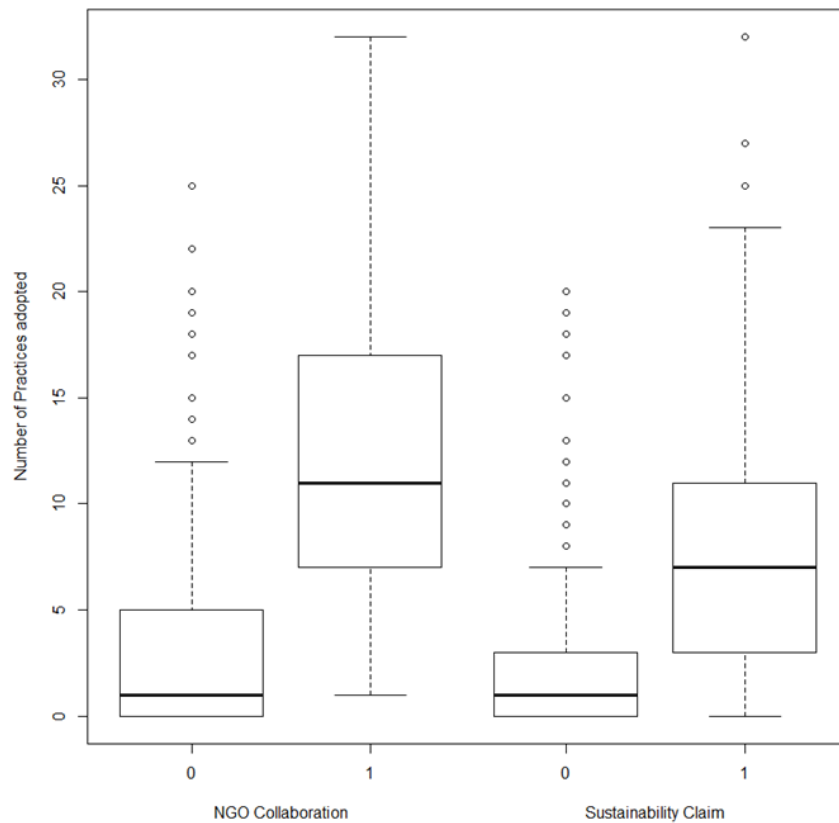


Figure 4-2. Number of practices adopted by companies collaborating with nongovernmental organizations (NGOs) (left panel) and companies claiming to be sustainable (right panel). The black line denotes the median, whereas the box indicates the 25/75th percentile

Companies' adoption of environmental practices varies widely. More than half of all companies do not adopt any practice to decrease their environmental impact, and five out of six companies adopt fewer than five environmental practices. The remaining companies are the environmental leaders who concentrate the effort toward ecological sustainability by adopting multiple environmental practices. Very small companies adopt just one environmental practice on average, while very large companies adopt more than five (Table 4-3). Adoption differs across the value chain, with processors and producers adopting the most practices and traders and cafés adopting the fewest. Some environmental practices are more frequently adopted than others (Figure 4-3).

At the one end, 19% of companies have a recycling policy or target. At the other end, only 10 and 14 companies in our sample have a policy on GMOs and deforestation, respectively. The adoption of specific practices also varies across the supply chain, and companies generally adopt practices of importance to their segment. Processers and cafés adopt significantly more “in-house” practices – *e.g.*, a recycling programme or reducing energy consumption – than “sustainable sourcing” practices – *e.g.*, reducing water pollution, establishing shade trees, or adopting biodiversity measures. The opposite is observed for traders, who apply more “sustainable sourcing” practices. For roasters, there is no significant difference in adoption between “in-house” and “sustainable sourcing” practices (Supplementary Table 7 in Bager and Lambin (2020)). For coffee producers, this distinction becomes irrelevant, as all practices are applied on-farm.

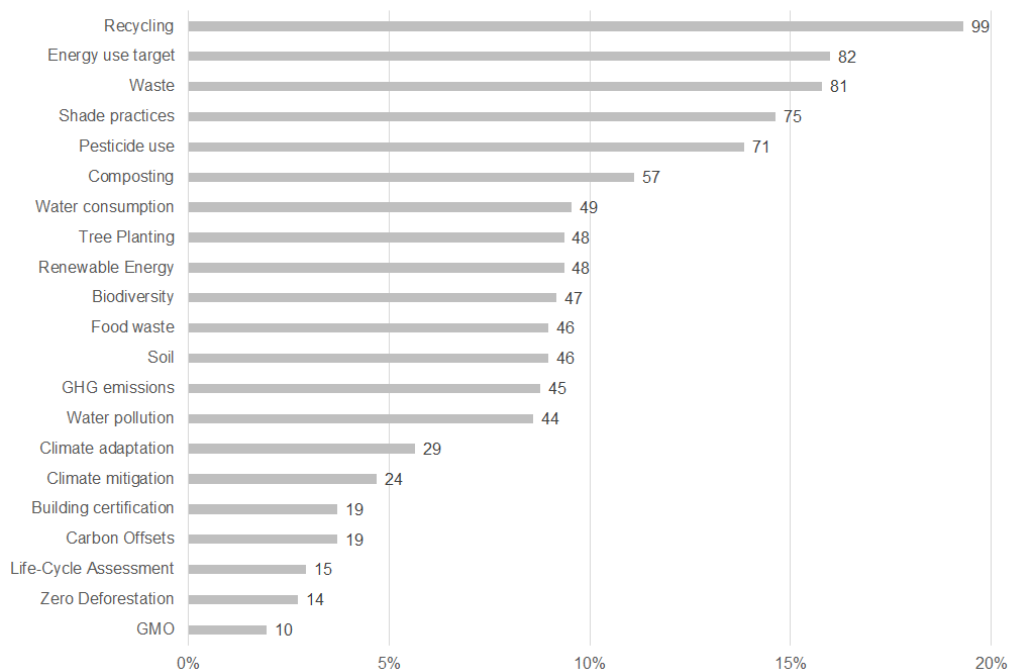


Figure 4-3. Adoption frequency by companies of environmental practices and total number of companies adopting the specific practice

Companies adopt more socio-economic practices than environmental practices. However, more than a third of all companies do not adopt any socio-economic practice, and 80% adopt less than five. The top-20% adopts two-thirds of all the practices adopted by companies, indicating that socio-economic sustainability efforts are also concentrated among a small group of companies. The practice most frequently adopted is donations, followed by paying producers a premium (*i.e.*, above minimum market price), though only 2% of the companies do this across all products. Only 13% of all companies have an explicit policy on child labour. It is uncommon for most companies to publish a CSR report (Figure 4-4). In contrast to environmental practices, there is no clear difference in the number of socio-economic practices adopted across the value chain. However, larger companies adopt more – and different – practices than smaller companies do. Large companies are significantly more likely to have implemented a code of conduct, published a CSR report, and invested in their value chain. On the contrary, smaller companies – especially small traders, roasters and cafés – are more likely to be (partly) transparent on supply-chain partners and prices, and to pay producers a price premium.

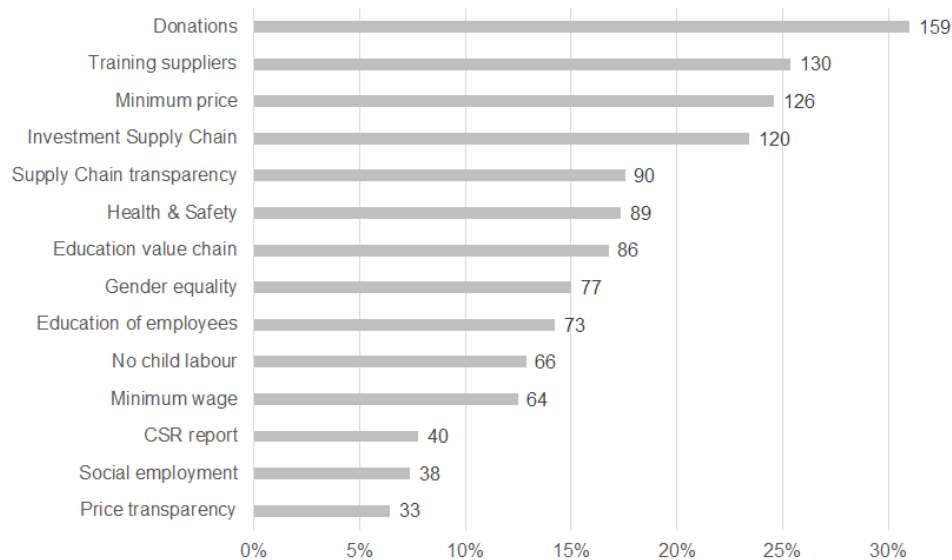


Figure 4-4. Adoption frequency by companies of socio-economic practices and total number of companies adopting the specific practice

The negative binomial regression reveals that company size, value chain position and several stakeholder characteristics are significantly associated with predicted adoption of sustainability practices. Consumer engagement through social media and risk awareness are both significantly and positively associated with predicted adoption of practices, while business-facing companies are significantly and negatively associated with predicted adoption of practices. Being a publicly-listed company is not significantly associated with the adoption of practices (Supplementary Table 9 in Bager and Lambin (2020)). Reducing region and size to binary variables show similar results, although the effect of size and location become more pronounced. All else being equal, companies that are large, located in Europe, North America, or Latin America, or producers, are predicted to adopt three additional practices on average. Companies that are traders or roasters are predicted to adopt two additional practices on average, while cafés are predicted to adopt one practice less. Companies that are risk-aware or engage on social media are predicted to adopt on average about 5 and 2 additional practices, respectively (Figure 4-5, Table 4-4).

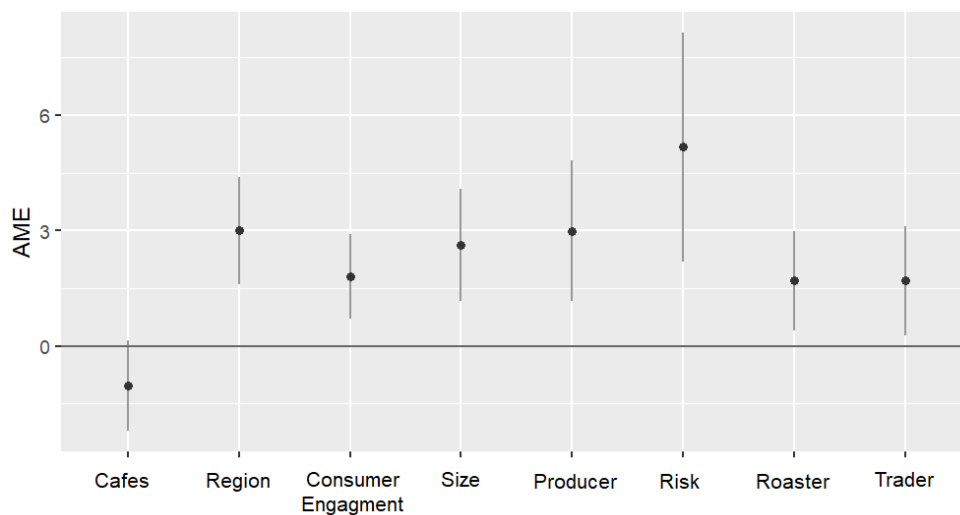


Figure 4-5. Average predicted change in the number of sustainability practices adopted, when moving from 0 to 1 for the binary variables, all else being equal. The black lines denote the 95% confidence interval, computed using bootstraps.

Excluding producers (*i.e.*, focusing only on supply chain actors) yields results that are similar to the full sample, though the average predicted change in the number of practices adopted changes slightly (Table 4-4). Analysing only upstream actors (producers and traders) reveals that large size still is significantly and positively associated with predicted adoption of practices, while other characteristics are not significantly associated. For downstream actors (roasters, processors, and cafes), location in Europe, North America, or Latin America, consumer engagement, and risk awareness are significantly and positively associated with predicted adoption of practices, while other characteristics are not. Analysing adoption of environmental practices for all companies show that roasters and producers are significantly and positively associated with predicted adoption, while traders are not. Other variables show similar associations as for all practices. For socio-economic practices alone, results are similar to that of all practices, except that cafés are no longer significantly associated with a predicted reduction in adoption of practices (*Supplementary Material*).

Table 4-4. Average marginal effect for negative binomial regression—adoption of sustainability practices

Independent variable	All companies		Excluding producers	
	Average Marginal Effect	95% Confidence Interval	Average Marginal Effect	95% Confidence Interval
Cafes	-1.03*	-2.18; 0.11	-0.88	-2.04; 0.27
Region (EU, US/CA, LA)	3.00***	1.44; 4.56	3.18***	1.46; 4.90
Consumer Engagement	1.80***	0.79; 2.81	1.89***	0.89; 2.90
Size (L, XL)	2.62***	1.44; 3.81	2.32***	1.16; 3.49

Producer	2.99***	1.17; 4.81	<i>Excluded from model</i>	
Risk	5.17***	3.79; 6.55	5.06***	3.74; 6.38
Roaster	1.70***	0.49; 2.90	1.88***	0.56; 3.20
Trader	1.69**	0.39; 2.99	2.20***	0.73; 3.66

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The confidence intervals are computed using bootstraps. All variables are binary. The results can be interpreted as the average predicted change in the number of sustainability practices adopted, when moving from 0 to 1 for binary variables, all else being equal.

3.2. INTERNAL PRACTICES VERSUS EXTERNAL STANDARDS

External standards are widely adopted among companies, especially organic and Fairtrade. 51% of all companies include organic coffee in their product assortment, 39% include Fairtrade, while RFA (29%) and Utz (17%) are also often included. Note that figures reported here are frequencies, not volumes of coffee. In absolute quantities of coffee produced, 4C-certification is by far the largest (29%) – suggesting it is primarily adopted by very large companies – followed by Utz (9%), Fairtrade (7%), and RFA (5%) (Grabs, 2018). Some companies adopt an external standard for all coffee carried, especially Organic and Fairtrade. About 15% of the companies in our sample adopt one or more external standards for all coffee products carried.

About a third of the companies adopt five or more sustainability practices. Among these, 81 companies (16% of all companies) adopt 10 practices or more, which places them among the most progressive companies. Only 4% of all companies (18 companies) adopt half or more of all the practices, making them sustainability leaders.

The logistic regression reveals that the probability of a company addressing sustainability through adoption of internal practices significantly increases when companies are large, aware of sustainability risks, engage with consumers on social

media, or are located in Europe, US/Canada or Latin America. Being a producer, trader or roaster is also significantly associated with an increased probability of adopting the strategy (Figure 4-6, Table 4-5).

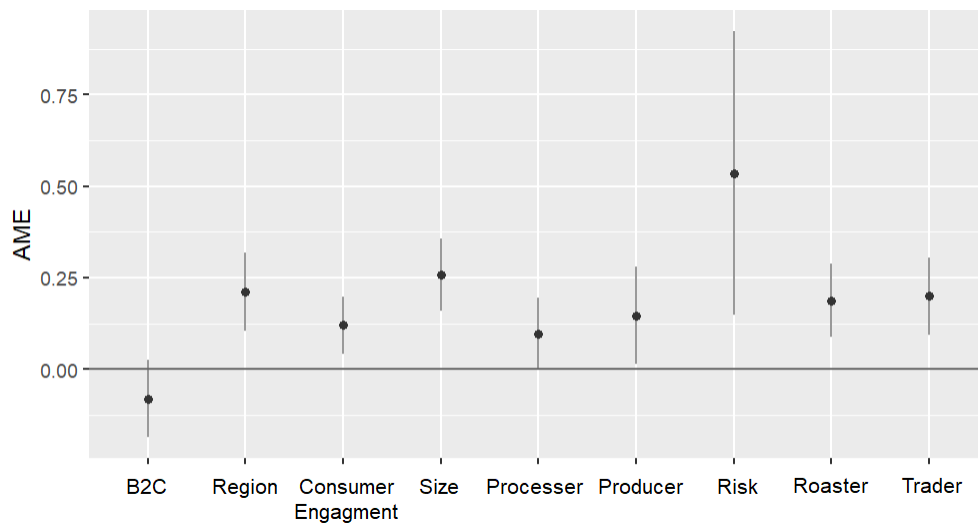


Figure 4-6. Average predicted change in probability of adopting internal practices as sustainability strategy, when moving from 0 to 1 for the binary variables, all else being equal. The black bars denote the 95% confidence interval, computed using bootstraps

Table 4-5. Logistic regression results—companies addressing sustainability through adoption of internal practices

Independent Variable	Adoption of internal practices	
	Average Marginal Effect	95% Confidence Interval
Region (EU, US/CA, LA)	0.21***	0.10; 0.32
Size (L)	0.26***	0.16; 0.36
B2C	-0.08	-0.18; 0.02

Producer	0.15**	0.00; 0.29
Trader	0.20***	0.08; 0.32
Roaster	0.19***	0.10; 0.28
Processor	0.10*	0.00; 0.20
Consumer Engagement	0.12***	0.04; 0.20
Risk	0.54***	-1.84; 2.91

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The confidence intervals are computed using bootstraps. All variables are binary. The results can be interpreted as the average predicted change in probability of adopting internal practices as sustainability strategy, when moving from 0 to 1 for binary variables, all else being equal.

The probability that a company relies on external standards to address sustainability significantly increases for producers but is significantly reduced for traders and cafés. Being consumer-facing or located in Europe, US/Canada, or Latin America is also significantly associated with increased probability of adopting the strategy while being business-faced decreases this probability (Figure 4-7, Table 4-6).

Table 4-6. Logistic regression results—companies addressing sustainability through adoption of external standards

All External Standards		
Variable	Average marginal effect	95% Confidence Interval
Region (EU, NA, LA)	0.14*	-0.01; 0.30
Size (S, M)	0.05	-0.01; 0.11

B2C	0.07*	-0.01; 0.16
B2B	-0.07*	-0.14; 0.00
Producer	0.14***	0.04; 0.24
Trader	-0.10**	-0.20; 0.00
Cafe	-0.16***	-0.24; -0.08

*, **, and *** denote significance at the 10%, 5% and 1% level, respectively. The confidence intervals are computed using bootstraps. All variables are binary. The results can be interpreted as the average predicted change in probability of adopting external standards as sustainability strategy, when moving from 0 to 1 for binary variables, all else being equal.

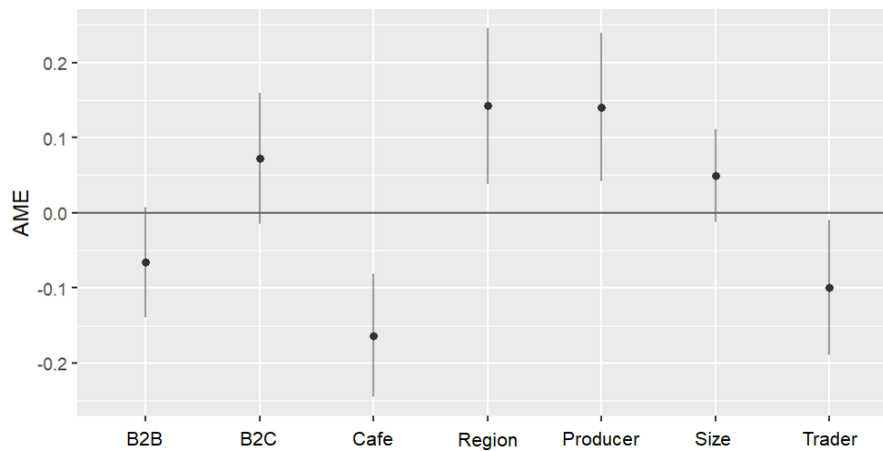


Figure 4-7. Average predicted change in probability of adopting external standards as sustainability strategy, when moving from 0 to 1 for the binary variables, all else being equal. The black bars denote the 95% confidence interval, computed using bootstraps.

3.3. PIONEERS IN DIRECT TRADE AND TRANSPARENCY

A sixth of the companies in our sample engage in direct trade. Direct trade companies adopt significantly more socio-economic (but not environmental) practices than the rest (Supplementary Table 11 in Bager and Lambin (2020)). Some companies invest in increasing transparency on the provenance of coffee, farmer operations, supply chain actors, and pricing. A group of – primarily small – companies present producer information for all their coffee products and some also indicate provenance, sustainability information, and/or farmer information on the package itself. A small fraction of companies (3.9%) discloses all actors of the value chain, while a sixth provide some information (*e.g.*, some partners). A minority (2.5%) discloses prices paid to value chain actors (*i.e.*, farmers, cooperatives, and/or traders) for all coffee bought, while 6.5% provide this information for certain products only. The “radically transparent” companies, which have either full price transparency (2.5%), full traceability (3.9%), or use technological solutions, *e.g.*, blockchain (0.6%) to facilitate transparent value chains, consist of a small group of 23 companies, which are mid-size or smaller, from the EU or US, and mostly consumer-facing roasters. This group adopts significantly more sustainability practices than non-transparent companies (Supplementary Table 12 in Bager and Lambin (2020)).

4. DISCUSSION

4.1. ADOPTION OF SUSTAINABILITY PRACTICES

Our results show that the efforts of companies in the coffee sector to address sustainability vary widely. A third of the companies show dedicated commitment to sustainability, while two-thirds show no or only little commitment. The relatively low adoption of sustainability practices reflects the low total spending on sustainability, estimated in the early 2010s to be only \$350 million across the entire sector, less than 0.15% of total sector size greater than \$200 billion (Panhuisen and Pierrot, 2014). Sustainability efforts are concentrated among a small portion of the sector. A small

group of 18 companies, the sustainability leaders, comprised of both small and large companies, have adopted half or more of the practices assessed in this study.

Contrary to our first hypothesis, several sustainability issues remain under-prioritised by the majority of companies. This is particularly the case for climate change, which is expected to make large coffee-producing areas unsuitable for future production (Ovalle-Rivera et al., 2015; Pham et al., 2019), and deforestation, which contributes to the loss of natural varieties (Davis et al., 2019). By contrast, efforts to reduce the impact of coffee processing and consumption, which also generate cost-savings – *e.g.*, recycling, waste management, and energy reduction programmes – are more widely adopted.

Consistent with our second hypothesis, companies with different stakeholders adopt different sustainability practices. This is likely affected by stakeholders' normative concern for and knowledge about sustainability impacts. For example, regional differences in the adoption of practices are significant and likely influenced by varying degrees of prominence of sustainability issues across different regions. In line with Thorlakson et al. (2018), we find a positive association between European companies and adoption of sustainability practices and a negative association for Asian companies. However, the more geographically diverse sample in our study shows that producer regions – especially Latin America – also embrace sustainability (mainly through standards). Companies in Oceania are negatively associated with adoption of sustainability, while American and Canadian companies are positively associated. The significant association between adoption of practices and risk awareness by companies also suggests that managing exposure to risks from stakeholders' awareness of sustainability issues is a driving force behind adoption of sustainability practices (Mayer and Gereffi, 2010; Thorlakson et al., 2018a). Business-facing companies are negatively associated with adoption of practices, while consumer-facing companies are significantly associated with adoption of standards, showing that company-type influences sustainability efforts.

4.2. CONTRASTING SUSTAINABILITY STRATEGIES

Howard and Jaffee (2013) found an inverse relationship between company size and commitment to sustainability for coffee companies, based on a small sample consisting only of US-based roasters. Other studies found that financial power or value chain leverage facilitates adoption of sustainability practices by larger firms (Bradley and Botchway, 2018; Brammer and Pavelin, 2008; Dauvergne and Lister, 2012; Ponte, 2019). Drawing on Ponte (2019), we identify two strategies for addressing sustainability: “hands-on” and “hands-off” governance. Adoption by a company of internal sustainability practices can be seen as a “hands-on” approach to sustainability governance, where companies directly decide which sustainability areas to target within their company and value chain. By contrast, adoption of one or more external VSSs can be seen as a “hands-off” approach, as the specific sustainability efforts of the company are defined by external actors through the scope of existing standards.

Consistent with our third hypothesis, large companies have greater financial-, human resources-, and enforcement capacity to apply “hands-on” governance, designing internal sustainability practices and implementing these along their value chain. By contrast, small, consumer-facing companies adopt fewer sustainability practices and are more likely to rely on external certification standards to ensure that sustainability issues are addressed beyond their own company. Similarly, producers have little bargaining power in a market-driven value chain like coffee and therefore rely on external standards to increase their leverage towards buyers.

A central issue for “hands-off” governance is to ensure that existing standards address the major problems facing the sector, promote an ambitious sustainability agenda, and improve farmer livelihoods. All external certification standards are not equally effective at addressing sustainability (Dietz et al., 2018). Selection of a specific standard often depends on preference for socio-economic versus environmental sustainability. While certification is not a silver bullet to achieving sustainability (COSA, 2013; DeFries et al., 2017; Vanderhaegen et al., 2018), our results show that certification standards remain a crucial component of the toolbox available to

companies seeking to become more sustainable. However, risks of value-added capture by actors further down the value chain should be addressed to ensure benefits also reach producers (Daviron and Ponte, 2005; Samper and Quiñones-Ruiz, 2017).

For those relying on “hands-on” governance, a central challenge is to ensure that the sustainability practices adopted are implemented effectively and across the entire value chain. When not relying on external standards, it can be difficult to assess the extent and impact of the adopted practices – especially with limited third-party verification and without consistent, sector-wide indicators. Previous research in fact showed that some companies adopted sustainability efforts for only a fraction of their value chain (Howard and Jaffee, 2013). This reduces overall impact and further makes these companies liable to claims of greenwashing. We found 9% of the companies at risk of greenwashing. Without audits, transparent application, strict enforcement, and publicly assessable goals, “hands-on” sustainability governance could fail to produce substantial changes in outcomes. Further, the adoption of “in-house” practices more visible to downstream stakeholders carries a risk of not adequately addressing the most critical sustainability challenges at origin (Samper and Quiñones-Ruiz, 2017), *e.g.*, child labour, water pollution, and deforestation. In this regard, collaborative programmes across individual companies to address, for example, climate change are encouraging, as is the work of a few, mainly large companies, to link their sustainability commitments to the SDGs.

4.3. MARKET DIFFERENTIATION AND SUSTAINABILITY LEADERSHIP

Consistent with hypothesis 4, we found that the most progressive companies are differentiating themselves through innovative sustainability practices, such as direct trade or increased transparency on suppliers and pricing. Direct trade is associated with adoption of practices mostly for greater socio-economic rather than environmental sustainability. Critiques of direct trade as a private governance practice highlight the focus on optimizing quality rather than decreasing environmental impacts, or the risk of co-optation due to a lack of a commonly accepted definition (MacGregor et al., 2017). Transparency is addressed through programmes by

predominantly small companies, *e.g.*, “The Transparent Trade Initiative”, a project for single-origin, direct trade coffee, and “The Pledge: A Common Code for Transparency in Coffee Buying”. We also found that transparent companies adopt more sustainability practices.

The 18 companies that belong to the sustainability leaders group consist of three types of companies, each catering to different stakeholders (Supplementary Table 13 in Bager and Lambin (2020)). The “global” group consists of large, well-known, publicly-listed roasters with global reach, known for communicating sustainability efforts widely, probably to differentiate themselves from mainstream competitors. These large, dominant actors can influence sustainability strategies adopted by the whole sector through their global reach and influence on smaller actors across the value chain. However, if action is taken only by the most progressive of the large companies, sustainability efforts increase differentiation of the sector. The “conscious-consumer” group is formed by mid-sized, mainly northern European roasters, who adopt the most practices of the three groups. They serve well-off consumers and remain limited in reach by their relatively narrow stakeholder base. Thus, one cannot expect mainstreaming of sustainability to spread from this group. The “specialty” group consists of small roasters from North America and Europe, who focus on quality and relationships with producers. They adopt fewer practices than the other two groups, but are more transparent and often rely on direct trade. With their small size and more adaptive stakeholder base, they adopt innovative strategies, which the rest of the sector can adopt later on if these strategies are successful. The sustainability leaders adopt 21.2 practices on average, mostly those visible to downstream stakeholders. Only one of the sustainability leaders has a clear no-deforestation policy with a quantitative target, and less than half have policies on soil and biodiversity. Most have adopted actions to promote climate mitigation and adaptation, mainly in the form of research or pilot projects. There are only one trader and one producer among the 18 sustainability leaders. That sustainability leadership emanates from downstream actors emphasizes coffee’s buyer-driven value chain,

which entails a risk that sustainability aspirations of upstream stakeholders in producer regions are not adequately represented (Samper and Quiñones-Ruiz, 2017).

Following Rogers' theory on the diffusion of innovation (Rogers, 1962), sustainability leaders could be seen as innovators in a general industry transition towards sustainability. By acting more sustainably, these actors can induce "laggards" to enact higher sustainability ambitions (De Mendonca and Zhou, 2020), facilitating sector mainstreaming. However, these companies could also use sustainability to differentiate themselves from mainstream competitors, appealing to sustainability-conscious stakeholders. Whether increased sustainability in coffee value chains will affect overall sector practices or remain a niche activity will depend on stakeholder demand and whether it becomes institutionalized in activities of lead firms.

4.4. THE FUTURE OF SUSTAINABILITY IN THE COFFEE SECTOR

The use of "hands-on" governance by large actors to push sustainability through their own value chains signals a departure from the institutionalization of certification (Auld, 2014b; Grabs, 2018). Rather than relying on existing certification schemes, several coffee companies implement sustainability through direct trade, internal standards and practices, and codes of conduct. At best, this development can directly address sustainability challenges within coffee value chains; at worst, it fosters greenwashing and undermines effective regulatory action. "Hands-on" strategies can be viewed as a "reinterpretation of sustainability" efforts (Grabs, 2017), where maintaining control of the value chain while appealing to the company's stakeholders and maximizing market share, becomes more important than the branding value provided by certifications. At the same time, the use of "hands-off" governance by smaller, consumer-facing actors underlines the important role that certification standards plays for companies unable to exercise power through value chain governance. To survive in an increasingly consolidated sector, smaller actors must remain innovative, while relying on the authority and reach held by the certification bodies to achieve sustainability beyond their own gate.

Sustainability efforts in the coffee sector are thus accompanied by a growing market differentiation, not only between the sustainable versus non-sustainable actors, but also within the sustainable segment, between those adopting “hands-on” versus “hands-off” strategies. Conversely, with sustainability strategies being adopted by a third of all companies and new differentiation strategies – *e.g.*, direct trade and transparency – embraced by the most innovative actors, mainstream companies and brand owners face increasing pressure from stakeholders to also adopt sustainability policies to reduce risks and increase competitiveness. This leads to a convergence around sustainability, which becomes one of the “rules of the game” in the coffee sector (Reinecke et al., 2012). Sustainability convergence at the sector-level and differentiation at the company-level, with actors tailoring sustainability actions to their needs and stakeholders, signals a need for common coffee sustainability indicators, which are consistent with the SDGs (Bradley and Botchway, 2018; Samper and Quiñones-Ruiz, 2017). In addition, mandatory reporting requirements (Kareiva et al., 2015) would increase transparency and enable comparison of company efforts. Only when sustainability governance becomes fully mainstreamed will the coffee sector as a whole become more sustainable.

4.5. LIMITATIONS

Our study builds on data collected from companies and is thus contingent on companies’ accurately reporting their sustainability efforts. The ability to, and resources expended on reporting company sustainability efforts thus affect results. Small companies likely have fewer resources to maintain websites and produce annual reports, leaving potential efforts unreported. Further, reporting is not necessarily reflective of actual sustainability impact (Delmas and Blass, 2010). Given that the information is self-reported, there is a risk of greenwashing. The study potentially misrepresents producers, as most producer-groups do not have an online presence and those that do tend to be the better-organized and wealthier ones. It should also be stressed that our research evaluates neither the effectiveness nor the impact of the sustainability efforts of companies. Further, the data do not allow for an assessment of the quality, nor the extent of the individual practices adopted.

5. CONCLUSION

Sustainability issues are not evenly addressed across the coffee sector, as a third of all companies do not engage at all with sustainability and another third adopts only a few sustainability practices. The final third shows tangible commitment to sustainability exercised through different approaches. A few companies even see it as their core business. Large, risk-aware companies prefer “hands-on” governance through adoption of internal practices. Producers and small, consumer-facing companies prefer “hands-off” governance to address sustainability, relying on external standards. The coffee sector still has a long way to go in ensuring sustainability across the entire sector, but a few progressive companies lead the way. Increased adoption of standards by those less able to engage across the value chain could stimulate demand for certified products. Audits, standardized indicators, mandatory reporting, and increased transparency of those adopting practices would ensure that commitments result in greater sustainability.

Most companies fall short on several important areas, such as climate change and deforestation, signalling that sector mainstreaming of sustainability is yet to occur. Instead, our results highlight a differentiation between a mainstream market largely not or only weakly addressing sustainability challenges and a smaller market incorporating sustainability through “hands-on” or “hands-off” governance. With increasing stakeholder awareness of sustainability challenges and new information technologies, sustainability innovations are likely to continue to transform the coffee sector.

BRIDGE: AVOIDING DEFORESTATION

Several interlinked global trends and processes affect companies' approach and contribution to governing sustainability and, in particular, agro-food commodity-driven deforestation. Firstly, businesses are under substantial pressure to reduce deforestation across their operations. Conventional activists, such as NGOs, play a key role in this, as illustrated by numerous campaigns and reports singling out single sectors, companies, or countries (Greenpeace, 2009a, 2019, 2020, 2021; Higonnet et al., 2018; WWF, 2016; WWF UK, 2011, 2017), see also Figure 2-1 in Chapter 2. These activists' findings are further complemented by reports from watchdogs, consultancies, multi-stakeholder organizations, and other stakeholders working on agro-food commodities and deforestation, which show companies' inadequate ability (or effort) in turning "lofty pledges" (such as ZDCs) into tangible action. See, among others Bregman et al. (2016); Forest500 (2021b); Global Canopy Programme (2016); Haupt et al. (2018a), (2018b); Lake (2018); Lam et al. (2020b); Streck et al. (2016); Taylor and Streck (2018) and Trase and Forest500 (2019).

Consumers are also increasingly expecting companies to address deforestation, illustrated for example with the interaction of EU citizens with the public consultation on the proposed deforestation policy action (see also Chapter 3) and the European Parliament's and European Commission's interest in advancing this agenda (Burkhardt, 2020; European Commission, 2018, 2019b). Further, investors and shareholders put pressure on companies. As relative latecomers to the party – as shown for example in reporting data on ZDCs collected by Forest500 (2021a) and numerous NGO reports (Forest Trends, 2020; Forest500, 2021b; Global Canopy Programme, 2016) – the financial sector has so far played a limited role in reducing deforestation (more often negatively contributing to this through financing expansion into forest areas) (Forest500, 2021b; Galaz et al., 2018b; Picken et al., 2017). However, the sector is slowly beginning to take action on deforestation. For example, the investment firm BlackRock updated its environmental, social, and governance

(ESG) practices to encourage the companies it invests in to “publish ‘no-deforestation’ policies and strategies” (BlackRock, 2021), while shareholders (including BlackRock) pressured Procter & Gamble to eliminate deforestation in its supply chain (Belmaker, 2020). Finally, companies (i.e. their executives and boards) are aware of the material risks posed by deforestation. Not only does deforestation pose a potential risk to their brand or public-image, there is also financial and – in a few cases – regulatory risk from contributing or being exposed to deforestation.

This has led companies to adapt so-called zero-deforestation commitments (see also Chapter 2, section 3.3), pledging to eradicate deforestation from supply chains of certain commodities. Uptake is widespread, albeit patchy, and NGOs have repeatedly pointed out that companies insufficiently (report on) their progress on implementing and effectuating these commitments (Bregman et al., 2016; Forest Trends, 2015; Forest500, 2019; Haupt et al., 2018b). While NGO reports descriptively account for the overall progress on ZDCs, little evidence exist on how companies approach the task of turning a public pledge into specific changes within the company and across its supply chains. It is these choices, setbacks, and solutions that I take aim at in the following chapter, hoping to gain a better understanding of companies’ efforts to implement private governance approaches.



Figure 4-8. Clear-cut forest, South Africa. Photo: S. Bager

CHAPTER 5

THE COST OF SUSTAINABILITY: WHY COMPANIES STRUGGLE TO IMPLEMENT ZERO-DEFORESTATION COMMITMENTS

Not previously published nor submitted.

ABSTRACT

More than 500 companies engaged in forest-risk commodity (FRC) supply chains have adopted zero-deforestation commitments (ZDCs) pledging to reduce deforestation risks. Through the lens of corporate social responsibility (CSR) strategy and public policy implementation theory, I analyse the processes and conditions for ZDC implementation, building on 35 semi-structured interviews with company representatives and various sector actors, publicly available ZDC data, and company reports. Companies apply different processes and mechanisms to implement ZDCs and see implementation as a journey, requiring iterations and re-assessments of scope, approach and activities. They build implementation off the back of standards, aligning strategies and Key Performance Indicators (KPIs) to these, but also engage directly in the supply chain, conducting projects “on-the-ground.” ZDCs started as CSR, but implementation requires the involvement of procurement and upper management and collaboration within and between companies. Companies define implementation processes suited to their particular needs but rely on service providers for in-depth knowledge and on-the-ground action. Companies use monitoring tools and technologies, such as satellite data, to aid implementation and

see supply chain traceability as a prerequisite for implementation. Companies face numerous implementation challenges. Internally, companies lack leadership, struggle to align the organization and manage suppliers, especially smallholders, and allocate insufficient resources. Externally, they lack of common standards, sufficient stakeholder support, and face unfavourable regulatory conditions, especially missing market incentives, an uneven playing field, and the presence of leakage markets. Companies identify leadership, technology and pre-competitive collaboration as potential solutions. As companies' policy implementation and the resulting effectiveness are inescapably interwoven, zero-deforestation commitments cannot be expected to meaningfully contribute to reducing deforestation until implementation processes, mechanisms, and conditions are in place.

1. INTRODUCTION

Production of agro-food commodities is the main driver of tropical deforestation (Curtis et al., 2018; Hong et al., 2021; Pendrill et al., 2019a), directly contributing to climate change and biodiversity loss (IPBES, 2019; IPCC, 2019). The sector's negative impact could further increase, as economies and the global population grow and non-food commodity use expands (Alexander et al., 2015; Godfray et al., 2010b, 2010a; Krausmann et al., 2013), though intensification, reduced food waste and losses, increased efficiency, and diet changes, especially reduced meat consumption, could ease pressure on forests (FAO, 2019; Foley et al., 2011; Hong et al., 2021; Poore and Nemecek, 2018; Springmann et al., 2018). New agricultural production areas often replace tropical forests (Curtis et al., 2018; Gibbs et al., 2010), with agriculture accounting for 60-80% of total forest loss (Hosonuma et al., 2012; Kissinger et al., 2012; Pendrill et al., 2019b). Beef, soy, palm oil, rubber, cocoa, coffee, pulp and paper and other forest-risk commodities (FRC) are crucial drivers of forest loss (Curtis et al., 2018; IDH, 2020; Rautner et al., 2013; zu Ermgassen et al., 2020a).

Agro-food commodities are produced, distributed, and consumed within global supply chains involving thousands of companies and millions of producers. These supply chains, and the global trade arising from them, are largely controlled by multinational corporations (MNCs) and other large public- and private-sector actors, though smallholders supply significant portions of many commodities, notably coffee, cocoa, and palm oil. These dominant actors shape agricultural production and supply chain governance through investments in, collaborations with, and leverage over global supply chains (Davis et al., 2020; Folke et al., 2019; Lenzen et al., 2012; Ponte, 2019; Thorlakson et al., 2018a; Wood et al., 2018).

1.1. ZERO-DEFORESTATION COMMITMENTS

MNCs and other agro-food companies are under significant pressure from consumers, civil society, and governments to address deforestation risks associated with the production and consumption of agro-food commodities (Dasgupta, 2021a; Garrett et

al., 2019; Greenpeace, 2019; Haupt et al., 2018a). NGOs in particular put pressure on companies to end tropical deforestation (Dauvergne, 2017; Lyons-White et al., 2020). Responding to this pressure, in 2010, the Consumer Goods Forum (2010), an organization of more than 400 Consumer Goods Manufacturers (CGMs) and retailers, pledged that its members would achieve zero deforestation across supply chains by 2020. Various public and private actors subsequently embraced deforestation policies and targets (Brown and Zarin, 2013), cf. for example, the New York Declaration on Forests, the Amsterdam Declaration, and the EU's current process to adopt deforestation-related legislation (Amsterdam Declaration Partnership, 2015; Bager et al., 2021a; NYDF Assessment Partners, 2019).

Collectively known as “zero-deforestation commitments” (ZDCs), these pledges’ common denominator is the intention to eliminate deforestation from FRC supply chains by a target date (Lambin et al., 2018). There are great variations in the nature, scope, stringency, level of transparency, and potential effectiveness of the ZDCs, but as more companies join and individual companies expand the scope to cover more commodities, the breadth and depth of ZDC coverage expands (Forest500, 2019, 2021b; Garrett et al., 2019; Jopke and Schoneveld, 2018; Lambin et al., 2018; Taylor and Streck, 2018). In 2019, Forest Trends (2019) tracked 865 companies with forest-risk exposure. Of these, 484 (56%) had set sustainable commodity commitment(s), though only 72 had ZDCs for at least one FRC. Of the 350 companies assessed by Forest500 (2021b), another NGO, 66% have “at least one deforestation commitment.”

Though research is emerging, the jury is still out for the long-term impact of ZDCs on deforestation. Several NGOs report that companies fail to adequately adhere to (see e.g. Rainforest Action Network (2021)) or report on (see e.g. CDP (2021)) their ZDCs and publish frequent updates on companies’ progress (or lack thereof) (Bregman et al., 2016; Forest500, 2019; Haupt et al., 2017, 2018a). For example, just four companies follow best-practice in disclosing their ZDC efforts (CDP, 2021). Systematic evaluation of ZDCs is largely absent, as most academic studies focus on the coverage, criteria and potential effectiveness of ZDCs. Garrett et al. (2019, p. 145) suggest that ZDCs are “moderately effective in reducing deforestation within targeted

supply chains and regions”, while Lyons-White et al. (2020) argue that ZDCs lack supporting frameworks and accountability measures. Given different definitions adopted by companies, only 34-74% of global forests are potentially protected by ZDCs (Leijten et al., 2020). A study from Indonesia suggests that the effect of ZDC is contingent on local land use conditions (Austin et al., 2017), while zu Ermgassen et al. (2020b, p. 6) find “no evidence of additional reductions in the deforestation risk of committed actors” within the Brazilian soy sector after ZDC adoption. There is a particular paucity of research on ZDC implementation. Lyons-White and Knight (2018) analyse implementation among companies across a palm oil supply chain, showing that supply chain complexity impedes implementation and urge for increased collaboration and advances on definitions, standards, and regulations. Broadly assessing ZDCs, Jopke and Schoneveld (2018) find implementation mechanisms “particularly ill-developed”, while Lyons-White et al. (2020) identify four mechanisms for implementation: supply chain traceability, certifications, jurisdictional approaches, and sanctions. In a recent report, Forest500 (2019), conclude that “companies must put more focus on implementing their commitments.”

Despite ZDCs and public pledge, global tropical deforestation levels remain at unsustainable levels (IDH, 2020; NYDF Assessment Partners, 2020) and companies have largely missed the 2020 ZDC deadline (Lyons-White et al., 2020; NYDF Assessment Partners, 2019). This paints a stark contrast between forest loss on the ground and lofty pledges made by companies, prompting a necessary reflection as to why companies have been unable to remove deforestation from FRC supply chains. In this article, I argue that the ability of companies to implement and act on these commitments is a significant factor in the outcome of ZDCs. Currently, little is known about the ZDC implementation process. Hence, the study of implementation adds a new dimension to the analysis of ZDCs, allowing a better understanding of how companies succeed or fail in translating vague policy concepts into tangible action.

1.2. ANALYTICAL FRAMEWORK FOR ZDC IMPLEMENTATION – STRATEGIC AND POLITICAL PERSPECTIVES

ZDCs outline specific sustainability objectives that companies pledge to voluntarily meet. In this sense, ZDCs can be conceived of in two ways: as public expressions of corporate social responsibility (CSR) strategies or as voluntarily adopted deforestation policies similar to those adopted by governments as part of the Amsterdam Declaration or NYDF. This duality allows flexibility in analysing a concept that remains ambiguous (Jopke and Schoneveld, 2018; Lyons-White et al., 2020), also to those applying it, and which fits neither classic CSR nor public policy definitions. From a CSR and a strategic management perspective, a ZDC is a specific business strategy. Like other corporate strategies, it includes two phases (Mintzberg and Waters, 1985): Formulation (specifying scope and target) and implementation (defining the specific activities required for translating the strategy into action) (Engert and Baumgartner, 2016; Epstein and Roy, 2001). From a (public) policy perspective, implementation is a stage in the policymaking cycle (Jann and Wegrich, 2007). After a problem is identified (agro-food commodity-driven deforestation) and put on the agenda (NGOs target companies), a policy is formulated (ZDCs) after which companies decide to adopt it, and subsequently take action to meet the policy objectives (Howlett, 2018; van Meter and van Horn, 1975; Sabatier and Mazmanian, 1979), in this case, avoiding deforestation. Finally, the success of the policy is evaluated (Figure 5-1).

Neither CSR nor public policy include an overarching theory on implementation (Engert and Baumgartner, 2016; Howlett, 2018). However, both schools provide useful empirically- or theoretically-derived propositions of various important “characteristics” for implementation. Public policy provides a theoretical perspective on the relationship between policy and performance, i.e. do outcomes correspond to the objectives set forth (van Meter and van Horn, 1975), and identifies implementation “stages” and the broader conditions required for policies to succeed (Hill and Hupe, 2002; Pressman and Wildavsky, 1973; Sabatier, 2005; Sabatier and Mazmanian, 1979).

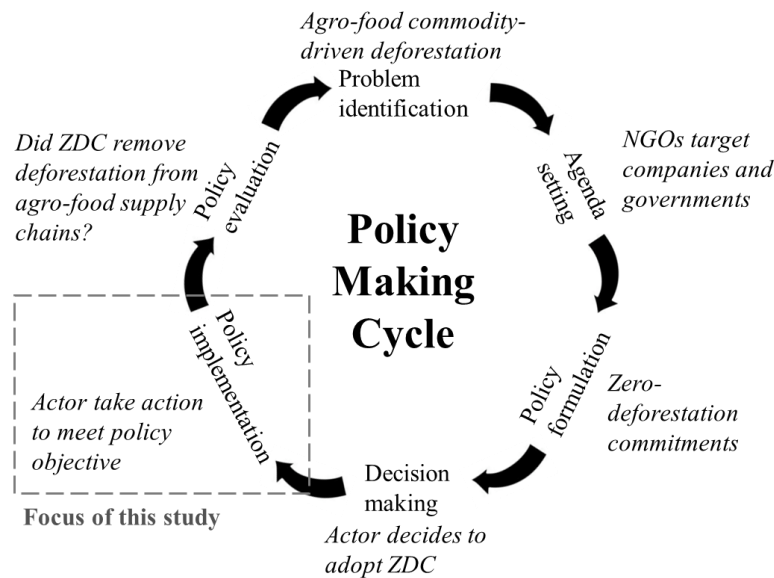


Figure 5-1. The policy making cycle adapted to zero-deforestation commitments. Graphic by author after policy cycle framework by Jann and Wegrich (2007).

Public policy theorists also emphasize the importance of basing implementation upon a valid theory of change, i.e. how will our actions lead to changes in outcome (Hogwood and Gunn, 1984; Sabatier, 2005). Strategic management and CSR, to the contrary, provide insights into the organizational aspects, which affect implementation (Crosby, 1996; Engert et al., 2016; Klettner et al., 2014). These theorists note the importance of organizational culture, leadership, stakeholder engagement, incentive structures, and corporate commitment (Crosby, 1996; Engert et al., 2016; Klettner et al., 2014; Nathan, 2010) and the development of plans and processes (Engert and Baumgartner, 2016; Epstein and Roy, 2001). Analytically, I argue that the various characteristics identified by these diverse implementation theories and frameworks (see Supplementary Table 4) take one of two forms, respectively, implementation processes (systems, mechanisms, design, etc.) and conditions (factors, characteristics, drivers, etc.). I use this to construct an analytical framework for implementation of ZDCs, illustrated in Figure 5-2. In this, I view implementation as a result of the processes and supporting mechanisms that

companies have in place, i.e. *how to implement?*, and the wider conditions in which companies operate, i.e. *what affects implementation?*.

Processes define and structure policy implementation (Figure 5-2 right). This includes specifying how, who (with what legitimacy), using which resources, and through which activities, companies carry out implementation. Processes define how companies measure, monitor, and communicate on impact (Crosby, 1996; Epstein and Roy, 2001), which requires, *inter alia*, setting targets and priorities (e.g. key performance indicators, KPIs), collecting data, and reporting. Processes are supported by mechanisms, such as systems and tools, which enable implementation, e.g. using guidelines, standards, and technological applications. Some of these are defined by the company, e.g. Codes of Conduct, while others are external, e.g. voluntary sustainability standards (VSS). Processes include “developing appropriate measures” (Epstein and Roy, 2001) for resource mobilization (how, when, where, and whom to execute activities, including defining which division is in charge) and resource allocation (human, technical, and financial), as well as ensuring incentive structures to facilitate the various processes (Crosby, 1996).

Conditions are external and internal factors that influence implementation (Figure 5-2 left). Externally, it includes wider industry and stakeholder aspects, regulatory and market forces, and the causal mechanisms underlying the desired change (Hogwood and Gunn, 1984; van Meter and van Horn, 1975; Sabatier, 2005). Internally, it concerns company structure, culture, and characteristics, including, for example, available resources and the skills and qualifications of employees (Engert and Baumgartner, 2016; van Meter and van Horn, 1975). Further, implementation requires management and leadership (Crosby, 1996; Engert and Baumgartner, 2016), particularly a “policy champion” (Crosby, 1996) to bring the issue forward and garner support.

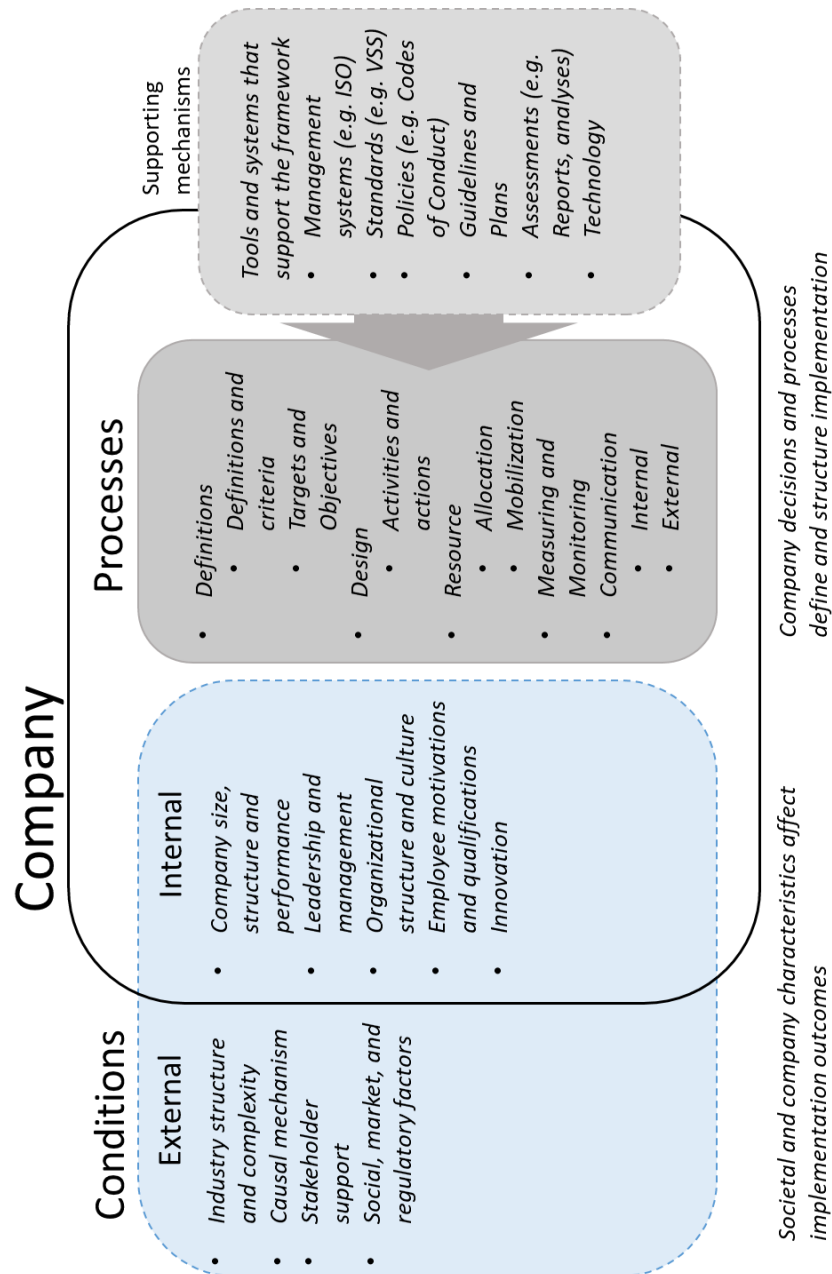


Figure 5-2. Analytical framework for analysing implementation of ZDCs. Developed by the author on the basis of implementation theories and frameworks from strategic CSR and public policy (see Supplementary Table 4).

1.3. SCOPE AND RESEARCH QUESTION

The objective of the study is to understand how companies implement ZDCs and what facilitates or hinders this. Arguably, formulating and deciding to adopt a commitment is easier than implementing it, but without implementation, a commitment remains “just talk” (Hammer, 1996). I specifically address the overarching question of how private-sector companies approach ZDC implementation, further asking two specific questions: How do the processes and mechanisms, which companies rely on to implement ZDCs, facilitate implementation? What conditions enables or hinders companies’ ZDC implementation?

I argue that successful implementation (or not) is contingent not only on features directly attributed to the commitment itself, but also to the company implementing it and the wider context in which it is implemented. Implementation is a necessary – but not sufficient – condition for meeting policy objectives (van Meter and van Horn, 1975), in this case, reducing deforestation. In this, it must be recognized that a zero-deforestation commitment can be implemented without having any substantial impact on deforestation because it was ill-conceived or because of issues external to it, just as deforestation can be reduced even if a commitment fails to get implemented. However, effectiveness and implementation are inescapably intertwined (Hill and Hupe, 2002; Nicholson-Crotty and Carley, 2015; Pressman and Wildavsky, 1973).

The aim is to foster increased understanding among private sector actors, consumers, NGOs, policymakers, and others engaged within this field on the reality of “translating” ZDCs into tangible action within companies – which can then lead to actual change on the ground. With this, I stress that studying ZDC implementation does not resolve the question of on-the-ground impact (*i.e.*, do ZDCs reduce deforestation?). Thus, this article does not posit to explain the ultimate outcomes of the ZDCs, but rather shed light on the processes and conditions that shape companies implementation of ZDCs.

2. METHODS

For this analysis, I conducted 25 interviews with company representatives, including experts within CSR and sustainability, procurement, corporate affairs, and at the executive level. The semi-structured interviews (Flick, 2009) took a starting point in an interview guide containing topics and specific questions that all interviewees were asked, but interviewees were also asked unprepared questions as these emerged from the conversation. The interviewees represent a range of supply chain actors, regions, commodities, and individual positions within the companies, as well as different company sizes (Figure 5-3). I selected the interviewees among Forest500-listed companies, excluding financial institutions, specifically reaching out to companies across all commodity sectors and regions, but required interviews to be held in English. I contacted more than 150 companies; several did not respond and more than 50 declined to participate, even when granted anonymity. Most did not provide a reason, but of those that did, several cited time constraints or fear of the company being identified. To understand the role and perspective of external stakeholders, I also conducted 10 semi-structured interviews with specialist NGOs and consultancies working on ZDCs, which I selected based on their publication records and companies' reference to their work (Figure 5-4). To contrast and complement the interviews, I collected reports and policies published by companies and NGOs on ZDCs – involving companies beyond the sample interviewed – and analysed ZDC data on commitment scope, implementation, and reporting collected by Forest500 (2021a), which I obtained explicit permission to use. The analysis concerns only corporate commitments related to deforestation, while other sustainability commitments, e.g. greenhouse gas reduction, are not included (Figure 5-4).

The interviewees were all involved in work on supply chain sustainability, commodity sourcing, and/or deforestation. The interview guide and the information introducing each interview explicitly stressed that the questions were about the implementation of zero-deforestation commitments and the company's supply chain sustainability efforts. I conducted interviews using semi-structured interview guides, either in person or using Skype/video-conference, and recorded and transcribed all interviews.

Interviewees were briefed about the content of the interview and the purpose of the research in an advance email, asking for prior informed consent to participate, record, transcribe and subsequently analyse interviews, or, if a prior exchange was not possible, when initiating the conversation. To ensure a frank and open conversation, all participants were granted anonymity (most interviewees demanded this as a pre-condition for their involvement). Each interview lasted from 45-90 minutes, though one interview lasted only 20 minutes. Supplementary Table 5 lists all interviewees.

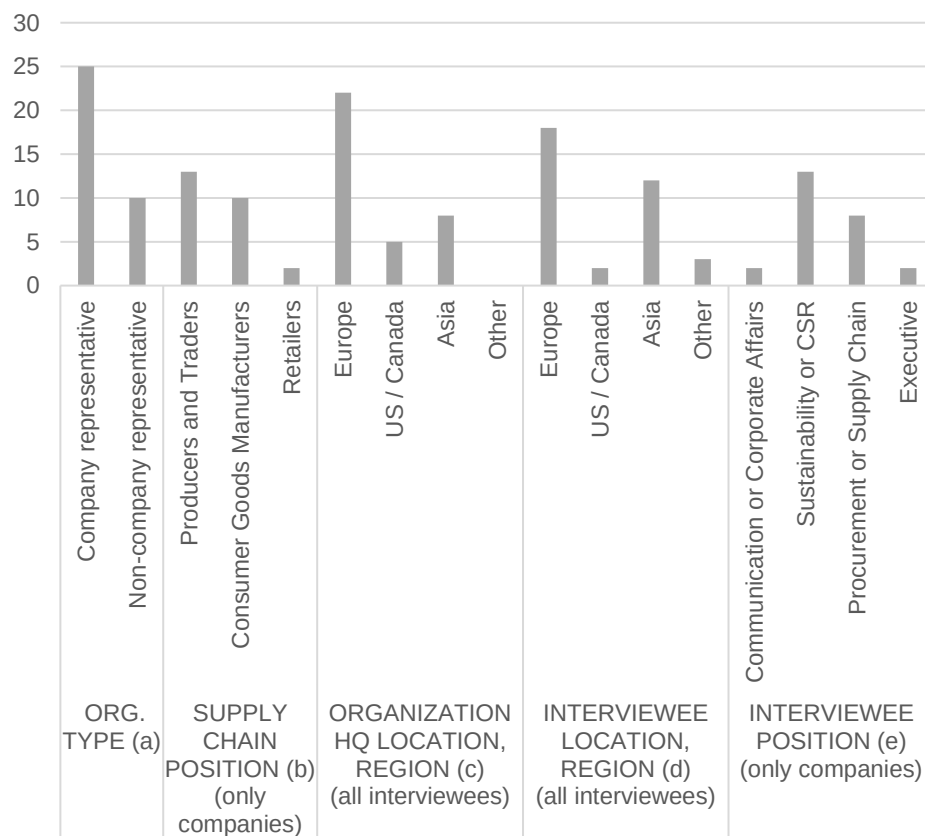


Figure 5-3. Organization type (a), supply chain position (b) and location (c) and interviewee location (d) and position (e) for the interviewees included in this study. See also Supplementary Table 5 for details.

I coded the interviews to identify commonalities and differences, and to classify different responses (Locke et al., 2020; Skjott Linneberg and Korsgaard, 2019). I used the software MaxQDA for the coding and coded the interviews over two rounds, an initial round of deductive coding identifying themes from literature, and a second inductive approach, identifying themes from responses and placing these in corresponding categories (Figure 5-4).

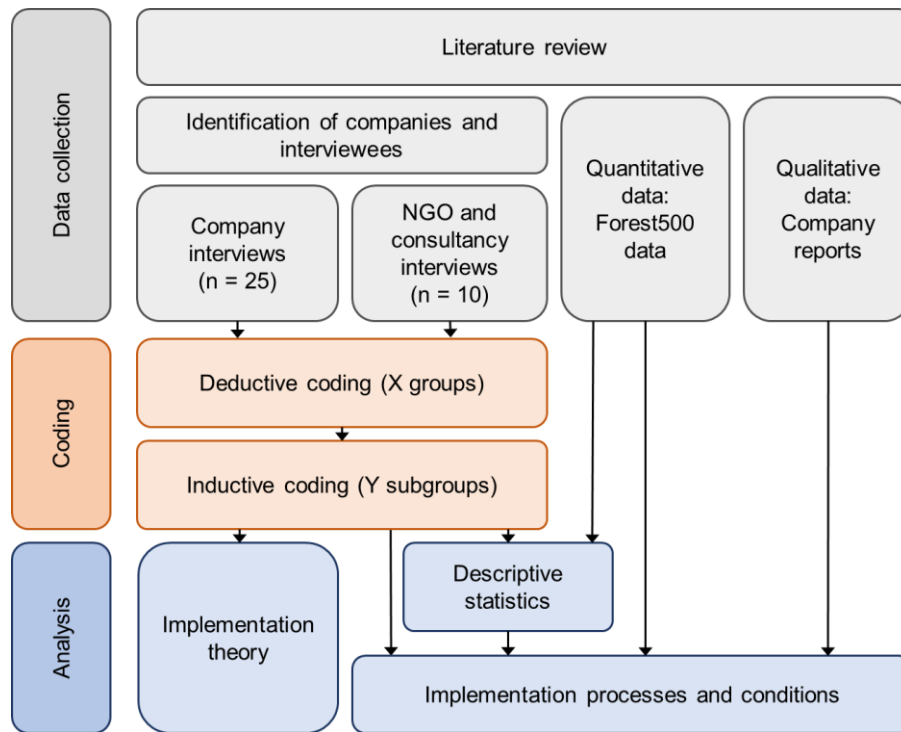


Figure 5-4. Flow diagram illustrating the method adopted for the study

3. IMPLEMENTATION OF ZERO-DEFORESTATION COMMITMENTS

In this section, I present the analysis of private-sector experiences with ZDC implementation. I first identify companies' scope, motivation and organizational alignment, then the implementation mechanisms applied. Lastly, I describe the specific challenges and solutions for fostering implementation.

3.1. ORGANIZATIONAL PROCESSES

All 25 interviewees represent companies having adopted ZDCs, though these vary in scope and strictness. Two companies have only recently pledged, while the remaining companies are in various stages of implementation. Forest500 (2021a) data shows that of the 350 agro-food companies tracked by Forest500, 60% do not have any ZDCs, while 20% have set one or more commodity-specific ZDC and 20% have ZDCs for all relevant commodities (Figure 5-5). Having adopted a ZDC, the companies interviewed are among the more committed. However, most of the companies have commodity-specific ZDCs and none have zero-conversion for all commodities, placing them in the average category for companies that actually have ZDCs.

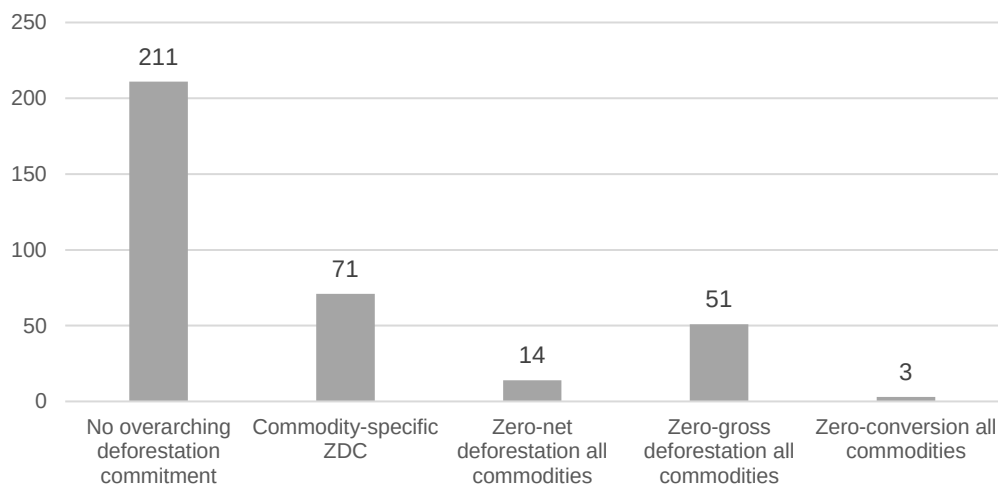


Figure 5-5. Company-wide commitment to achieve deforestation-free production and/or procurement across commodity supply chains. Figure based on data from Forest500 (2021a).

As of this writing (June 2021), most companies missed the widely acknowledged 2020-deadline, as some admitted would be the case: *“It has been challenging. Personally, I do not think we are going to meet our timeline targets”* (A18). 60% of the companies interviewed have not set a new target date or still stick to 2020. Two have set short-term targets, while the rest have target dates between 2025 and 2030.

Across the sector, Forest500 (2021a) data is generally consistent with the findings here, though specifics vary across commodities, indicating that most companies have not (yet) revised ZDC timelines (Figure 5-6).

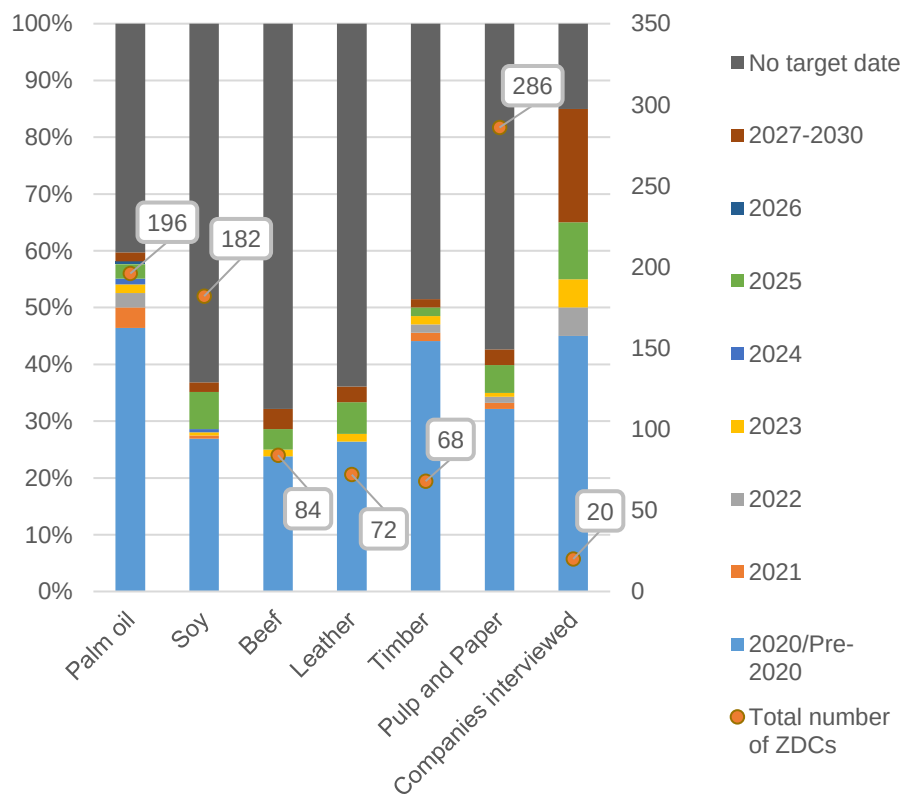


Figure 5-6. Percentage of zero-deforestation commitment with given target dates (left axis) out of the total number of ZDCs pledged for the given commodity (right axis). Based on data from Forest500 (2021a) (column 1-6 from left) and interviews (column 7 from left).

Early on, companies struggled to define forest areas included in commitments. Today, companies apply High Carbon Stock (HCS) or High Conservation Value (HCV) to delineate forest boundaries, with 80% of the companies interviewed adopting these definitions, while the rest use various unspecified definitions. Forest500 (2021a) data show similar patterns.

Across the companies interviewed, different motivations for adopting ZDCs exist (Figure 5-7). These are driven by internal (company-specific) or external (various stakeholders) forces and motivated by values (reducing deforestation as an end in itself) or rewards (reducing deforestation to increase profits or reduce risks), respectively. Generally, extrinsic factors drive companies with greater brand exposure, shaped by NGO campaigns and stakeholder pressure (values) or consumer boycotts and general business decisions (rewards). Value shape most intrinsic drivers, as companies note that removing deforestation is “*the right thing to do*” (A8).

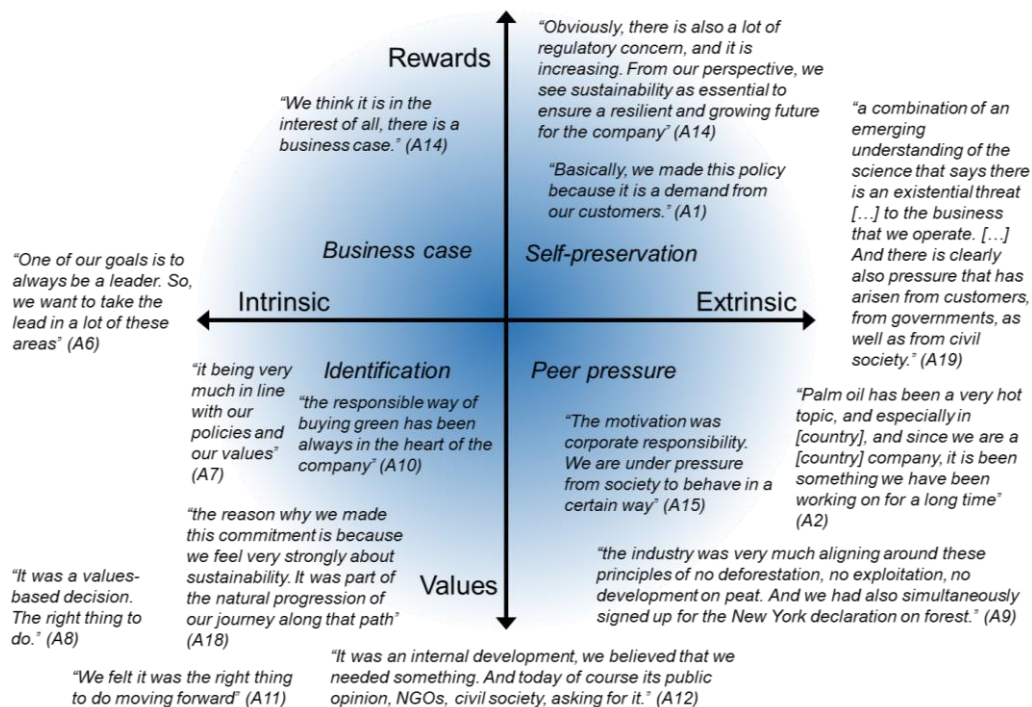


Figure 5-7. Motivations for adopting ZDCs are shaped by a combination of, on the one hand, company values and rewards and, on the other hand, internal and external pressure, creating four different types of motivations: identification (intrinsic pressure and company values), business case (internal pressure and company rewards), peer pressure (external pressure and company values), and self-preservation (external pressure and company rewards). Quotes from interviewees categorized by their alignment to the four values.

Company leadership plays an important role in driving ZDC adoption and implementation. *“The key is top-level commitment. If you do not have that it will never be a success. The whole company, starting with the top CEO, the management group, everyone needs to be on board. Then you can actually do something and achieve something.” (A4).* More than half the companies explicitly express leadership engagement as imperative for implementing changes across the organization: *“The leadership needs to 100% be behind this vision. If it is just a sustainability person who has a small sustainability budget, it will never achieve anything.” (A14).* Beyond making change, leadership commitment ensures financial backing, as non-company interviews corroborate. *“It is a long-term investment, you have to put people and money, so you need a very strong engagement from the board of the company.” (A23)*

While management sets the vision, “steering committees” – often guided by advisory panels or high-level experts – set the direction. Among Forest500 companies, 29% have established steering committees or high-level management positions focused on ZDC, often reporting directly to the board or the executive director.

“We have a sustainability committee, which is chaired by our executive director, that [decide] about which actions to take on various sustainability matters. And that committee reports to the chairman and the board.” (A17)

In all but two companies, execution falls on sustainability or procurement departments: *“Operationally it sits within the responsible sourcing team, which is part of the procurement division” (A7).* Most commonly, sustainability sets the strategy and procurement supports implementation. *“It sits with sustainability, but it is embedded within the commercial teams” (A8).* 60% of the companies interviewed use roadmaps outlining e.g. targets, deadlines, ownership, and instruction for rolling out implementation: *“We have a specific roadmap with KPIs, deadlines and clear ownerships” (A20).* Companies generally use roadmaps for internal purposes, though three companies make these available for public communication and accountability: *“Our roadmap is on the website, and that is how people could measure our progress. So far, nobody has contacted us and asked us, how far have you got, where are you going?” (A11)*

The companies interviewed generally argue that revising remuneration and KPIs to align with ZDC objectives is key to implementation. 70% of the companies interviewed have KPIs for ZDC implementation. However, defining these can be challenging: *“We are working on the KPIs. [...] It is pretty difficult.”* (A15). Linking KPIs directly to remuneration of employees increases internal uptake and incentivizes employees to reach targets: *“The procurement team has this in their KPIs, that is connected to their bonuses, and that has been a quite critical component too”* (A7). However, only five companies interviewed link KPIs to remuneration, and across the sector, less than 5% of Forest500-companies link executive compensation to deforestation-related issues.

3.2. IMPLEMENTATION MECHANISMS

Companies are aware of the complexity of the problem, with many interviewees acknowledging that deforestation is a “complex” or “wicked” issue where no simple solutions exist. Thus, companies see implementation as a journey, requiring iterations and re-assessments of scope, approach and activities. Companies apply different mechanisms to implement ZDCs.

ZDCs can ‘trickle up’ supply chains, as downstream actors ‘push’ sourcing guidelines or codes of conduct specifying specific requirements onto suppliers (60% do this).

“Most of our suppliers would have a comparable no-deforestation policy to ours and then many of their suppliers would as well. So over time the policy cascades further upstream.” (A7)

“Helping and monitoring our suppliers and ensuring that they meet our commitments. And empowering them to take accountability for cascading this through their supply chain.” (A9)

Certifications are widely used for implementation, as 80% of companies interviewed build implementation off the back of these: *“The foundation sits on RSPO principles and criteria”* (A22). Companies also align strategies and KPIs to existing standards: *“Certifications are good to have because it is a third party and objective assessment.*

That is why it is very easy for us to use certifications as KPIs” (A4). This especially concerns commodities with strong and established standards, mainly palm oil, timber and soy. Forest500 data corroborate this, as 68% of all soy-specific commitments refer to RTRS, 85% of all palm oil-specific commitments refer to RSPO, and all timber-specific commitments refer to FSC or PEFC, while only 20% of beef-specific ZDCs refer to certifications: *“We have grounded our sustainability commitment and the way that we implement things into the RSPO process” (A18).* 50% of the companies acknowledge that certifications alone are insufficient in implementing commitments, but in many cases see certifications as a stepping stone for further action.

“We see certification as a starting point and somewhere to build from. Of course, it depends on which certification you look at and how strong they are within the deforestation area. But it is a good starting point” (A2)

Due to standards’ limitations, weak or non-existing standards for some commodities (e.g. rubber), or commodity-specific challenges, e.g. smallholder-driven deforestation (palm oil, cocoa), companies increasingly go “beyond” certification: *“Certification mechanisms do only to a certain extent ensure a no deforestation, but cannot drive that for us as the way forward. We need to be much more specific on how we go in to set up a supply chain.” (A21).* Initially, companies believed standards could be pushed through supply chains, but today see suppliers and producers as key enablers of ZDCs.

“When we see that we have higher risk categories and more complex supply chains, we try to work deeper into our supply chains and more actively engage with our first-tier suppliers” (A2)

“[We] help and monitor our suppliers and ensure that they meet our commitments. And empower them to take accountability for cascading this through their supply chain.” (A9)

As a result, all but three companies engage directly in the supply chain, for example working with suppliers and farmers to conduct trainings or workshops: *“We have people embedded on the ground in the various different regions to be able to actually carry out the day to day practices.” (A18).* Companies claim to take an active role in

implementing activities across the entire supply chain and engaging with producers on the ground: *“We realized that to be able to make changes you need [...] to be more active, to engage; you need to have people on the ground [being] part of the discussion.”* (A20). This is challenging for companies that traditionally have had little engagement with on-the-ground practices (e.g., retailers and consumer goods manufacturers (CGMs)): *“We need to touch the ground. It is really tough for us as a retailer, we do not go to ground traditionally.”* (A6). Companies’ engagement levels differ, as some engage only tier-1 suppliers and expect them to handle further upstream engagement, while others are ‘on-the-ground’ themselves.

“We are active on the ground, we are going there, we are talking to them [producers] directly.” (A20)

“We expect suppliers to engage their upstream suppliers as well. If an upstream supplier is found to be involved in deforestation, then we would expect our tier-one supplier to be managing that” (A14)

Traceability is essential. Companies want to know who and where they source from, especially those working through direct engagement. Mapping and tracing supply chains through tier 1-2-n take up a significant portion of companies’ efforts, and 85% consider this among the first and most important tasks. The complexity and opaque nature of many supply chains and commodification of most FRCs make mapping and tracing extremely complex tasks, but it is seen as a prerequisite for implementation.

“One of the most challenging things is of course the traceability and the monitoring aspects of implementing the deforestation commitments.” (A6)

“The biggest challenge is traceability. If you don’t know where your commodity is coming from, you can talk about deforestation, but you’re not aware.” (A23)

The “first mile” – from farm or plantation to aggregation point or mill – presents a particular challenge and traceability is often only possible to a certain level. Companies use numerous different tools to provide traceability, spending large sums

on technological development to aid implementation. *“Technology is important for monitoring, [...] because it is impossible to keep track of everything that is happening on the ground for all your suppliers” (A24).* 80% rely on various geospatial tools, especially Global Forest Watch Pro, while some large actors also employ in-house Geographical Information Systems (GIS) experts to map concessions and supply regions. Companies use satellite monitoring *“for land use purposes, specifically risk protection” (A14)* and to identify *“potential clearings quicker and more frequently” (A18).*

To aid implementation, companies *“are involved in many different collaborations to both access external expertise and create scale,” (A9)* engaging external *“service providers, [who] all specialize in something” (A21).* In general, they *“provide expertise and knowledge and inspiration to companies that want to ensure that their production is responsible [...], but do not have the knowledge to be able to do it themselves.” (A14).* From the companies’ description, I identify three types of service providers. At the most basic level, *Operators* provide additional resources, allowing companies to extend their reach without in-house expertise. As the strategic partner, *orchestrators* have ZDC-specific expertise and local, context-specific knowledge on specific regions or commodities, allowing them to collaborate with companies to scope and design ZDC implementation. *Organizers* ensure buy-in and legitimacy across their network, reaching across the supply chain to connect businesses to stakeholders, such as consumers and local governments (Table 5-1). All companies rely on service providers, but the roles and responsibilities vary, *“depending on the skill set for which we are employing them” (A19).*

Operators help companies’ *“collect and compile data and analyse it” (B2).* They implement specific programs and projects, e.g., smallholder engagement, production standards, or farming practices. Operators also shape ZDC communication, *“making sure that what they are communicating is interpreting the reality correctly” (B1),* as they know *“the requirements from external stakeholders along the supply chain [...] and [are] plugged into the wider network of actors and sustainability initiatives” (B1).*

Table 5-1. Service providers provide companies with different types of knowledge and services to foster ZDC implementation.

Type	Operators	Orchestrators	Organizers
<i>Role</i>	Technical	Strategic	Cooperative
<i>Description</i>	“technical knowledge provider” (A19), “operational support” (B9)	“thought partner” (A19) “knowledge partner” (B4)	“endorse what we are doing” (A6).
<i>Who</i>	Technical and sustainability consultancies	Specialised consultancies and organizations	International and local environmental and humanitarian NGOs
<i>Expertise</i>	Technical aspects Operations and projects	Strategic insights Local knowledge On-the-ground, field presence	Stakeholder management Partnerships
<i>Tasks</i>	Solutions, reviews and assessments (e.g. satellite monitoring, life-cycle assessment) Capacity building, trainings and workshops	Strategy and execution Implementation plans, roadmaps, and guidelines Diagnostics and analytics Capacity building, trainings and workshops	Establish partnerships and networks Build legitimacy Stakeholder and public relations (e.g. governments, producers, consumers)

Orchestrators are strategic “*partners working with the companies*” (B4), who “*act as the facilitator*” (B10) by using their “*on-the-ground capacity to inform corporate-level strategy development*” (A19). They scope commitments and set overall goals, define roadmaps and guidelines, and steer execution and implementation. They often work directly with suppliers and producers, bringing “*perspective on what is possible and what is not because they have ears to the ground and see what other retailers or other supply chain actors are capable of or have already started doing*” (A5). As experts on specific commodities or regions, they “*are on the ground doing either assessments, capacity building, training, a range of interventions, supporting around remediation, that kind of thing*” (A19). This helps companies “*move forward [...], but also supports us in how to get there*” (A5) and provide “*third party confirmation of what you are doing is correct*” (A24).

Organizers are not technical experts, but mostly collaborative NGOs, who provide networks and partnerships and “*endorse*” (A6) what companies do, which is crucial for public engagement and stakeholder management. They cooperate with stakeholders, including local governments, producers, and multi-stakeholder bodies, for example, to facilitate or establish projects, especially jurisdictional and other landscape approaches, which around half the companies interviewed are engaged in.

3.3. OVERCOMING CHALLENGES TO FOSTER IMPLEMENTATION

Companies face numerous implementation challenges. Internally, they struggle to align the organization and secure buy-in. Externally, managing suppliers, especially smallholders, challenges companies, while the lack of common standards, an uneven playing field, and the presence of leakage markets hinder implementation. Interviewees identify both internal and external conditions for fostering implementation. Internally, companies view leadership, collaboration, resources, and technology as crucial, while external conditions include pre-competitive collaboration and market incentives.

For implementation to succeed, companies need to align goals and collaborate, especially between procurement and sustainability divisions, who face opposing

incentives and typically sit in separate locations within the company. *“In general, it is a partnership. [...] It has to be a joint exercise”* (A8). At least half struggle to design organizational processes across business silos, allocate tasks and responsibility, especially between sustainability and procurement, and link implementation to relevant KPIs. It *“is really about good communication between the different businesses, [...] that flow of information and alignment across the supply chain”* (A9).

More than a third of companies find it challenging to engage stakeholders, both internally and externally. *“There is a difficulty in getting [our] colleagues to understand what this [ZDC] really means and how it can be done”* (A15). *“It can be tricky, to motivate people to work with this, especially when there is not always clear KPIs and targets”* (A2). Almost half mention that to move the agenda forward and ensure that implementation has teeth requires ‘internal champions’ (cf. Crosby, 1996), i.e. ZDC advocates with sufficient ‘sway’, ideally at C-level. *“When there is a strongly committed leader in the company who has true leverage in the company, a lot can happen.”* (B4). Leaders can help form a vision and set the direction, ensuring that implementation is *“seen as a business imperative across all stakeholders, both internally and externally”* (A8), while providing tools and resources for sustainability and procurement to execute on this. Externally, convincing shareholders and other key stakeholders of the need to address deforestation is hard. *“When you are a listed company, you have shareholders. There is an expectation that your entire KPI is geared around profitability”* (B4). Companies are focused on short-term profits and up-front implementation costs are not matched by increases in revenue. *“It is quite huge, this investment. Deforestation-free is not for free”* (A23): *“For a strong commitment, you really need to spend money”* (A12).

For the responsible departments to actually implement change require *“staffing and resources; they need to actually have people to do this work.”* (A7). Companies generally underestimate the scale and cost of ZDC implementation and almost half find that *“the financial cost is a challenge”* (A11). Companies do commit financial, human and technical resources to implementation, but the ability of smaller

companies to invest sufficient resources and conflicting priorities and demands from shareholders worrying about *“the cost of sustainability”* (A13) hamper this. *“Internally there is often a conflict between profitability and doing this”* (A15). Meanwhile, companies have little opportunity to recapture costs through added value on products. As several interviewees expressed, consumers demand this but do not want to pay extra – *“they want these additional guarantees, but at the same price”* (A1). *“We have to do this on our own internal budgets. Nobody helps companies do this. And that is a crying shame, because everybody wants it, but the burden falls once more on the producer.”* (A11)

“The supply chains and value chains are getting more and more complex,” (A3) complicating implementation. Smaller companies often lack enforcement capacity and leverage across supply chains – *“we simply do not have the power, if I may say so to say, to say to [a large supplier] you need to do so and so”* (A1) – while large actors face enormous complexity: *“We have around 23,000 1st tier suppliers. So, you can only imagine the second tier, how many that is”* (A2). Working with smallholders and reducing smallholder-driven deforestation is an issue that about half the companies grapple with, particularly those sourcing from smallholder-dominated sectors, such as cocoa and palm oil. *“One of the challenging areas [...] that we are spending the most time on is how to balance smallholders, to ensure that we are achieving inclusion and [...] economic development for the farmers”* (A7). To reach smallholders, companies conduct extensive supply chain mapping and adopt certification: *“We have used certification to try and support smallholders and encourage them, incentivize them, to also come on the journey with us. And to be honest, we have had a mixed bag of results”* (A18). On the one hand, due to the lack of uptake, using standards is difficult, as it *de facto* leads to exclusion of smallholders from these supply chains. On the other hand, companies source from thousands of smallholders, which makes active engagement and enforcement of sourcing guidelines difficult – cf. *“There are tens of thousands, independent smallholders that are providing our supply chain”* (A22) or *“we buy from around 5 million smallholders globally”* (A15).

Companies take different approaches when deciding whether to exclude or sanction suppliers. On the one hand, companies can achieve “clean” supply chains by excluding dirty suppliers. On the other hand, when excluding suppliers, companies lose control and indirectly support leakage markets: *“We have never believed in straightforward boycotts. Boycotts make you absent from the debate. And all that will happen is that these groups will join the leakage market” (A11)*. 80% prefer to work with suppliers as long as possible and only exclude if suppliers are unwilling to change or repeatedly violate agreements, but all but one company have excluded some suppliers. *“They wished us to suspend and then engage. We decided that we would engage, then suspend. [...] You cannot draw the line if you do not give them a way back” (A11)*. *“Suspension is not the end goal. The end goal is to get them compliant and coming back in [...], to get them to be committed” (A24)*.

There are ample examples of how companies employ technology (novel or existing) to drive implementation. Most frequently focused on monitoring (e.g., satellites, drones, sensors) (80% do this) or tracing supply chains (e.g. databases, blockchain) (55% do this), but there is also innovation on production and harvest practices (e.g. robots) and in streamlining and improving audit, grievance, and compliance processes (e.g., AI, devices and apps). Second- or third-party auditors audit companies’ general sustainability work, especially the larger companies. However, less than half have independent well-established verification systems in place for zero-deforestation commitments. Some point to external monitoring and traceability systems (e.g. Starling, GFW, TRASE), which more than half use, as crucial for verifying that ZDCs are actually implemented. A few point to internal frameworks or developments with the Accountability Framework initiative (AFi), which 15% use, for aligning implementation approaches.

While technology was a barrier at the onset of ZDCs, more than half exclaim that technology has progressed so rapidly in recent years that the cost and availability of technological assistance is not a barrier. Some companies have a firm belief that technological innovations can aid implementation, with around half expressing ‘techno-optimism,’ believing that real-time satellite data, for example, will spell the

end of deforestation. *“Technology is really what is needed to drive this agenda faster and to the deliver upon that commitment that everybody sets out”* (A21). However, there is disagreement as to the transformational role that technology plays in meeting commitments with another half being more cautious. *“For driving impact, technology might not really help that much. And that is for many companies, not always in an easy message, because we all hope to have an easy solution that you can apply from behind the desk.”* (B2). The sceptical actors acknowledge that technology alone will not address the problem. *“My onset is that the tools are telling you the past. They are not preventing the future.”* (A23).

Current regulatory conditions do not foster implementation. More than a third of the companies, likely the more progressive actors, suggest that governments need to regulate this field *“to create an enabling atmosphere”* (A9). *“We need to engage the legislators, to push them on increasing, improving, and enforcing the local legislation”* (A20). Especially the lack of producer government regulation undercuts ZDC implementation: *“You need good governance of land use in the origin regions for the raw material. Without that, you will never succeed.”* (A14). Some suggest regulatory measures should be built on existing VSSs, like RSPO, while others suggest due diligence schemes, support for local governments, or international frameworks. Further, higher costs disadvantages companies implementing ZDCs. Even some of those not arguing for additional regulation are worried about (unfair) competition from actors unwilling to implement ZDCs and thus contributing to (or benefitting from) leakage markets. A third directly note that without addressing leakage, their efforts will only reduce, but not halt, deforestation. *“The real challenge is the leakage market. [...] So far as there is no real recognition that it is really a two-tier market – the sustainable, and the non-sustainable – we are not really going to address this problem”* (A24). Some suggest that establishing markets for deforestation-free products and creating broader incentives to drive impact at scale, including *“revamping the commodity trading system to trade commodities on sustainability criteria”* (A14) could ease these barriers.

Finally, companies emphasize that *“stopping deforestation is not something you can do on your own”* (A21). All but three companies view collaboration within companies and with supply chain actors, service providers, and even competitors, as key to implement ZDCs, as these all facilitate cross-sector, cross-supply chain action: *“[We need] to engage in more collaborative efforts [...]. Because I do not think this is a commitment that we can reach on our own.”* (A2). Companies enter into collaborations across supply chains to address sourcing issues that are not captured by standards or to implement specific policies: *“We have heavy emphasis in our strategy implementation on cross-collaboration. Both within the industry and across industries”* (A9). As part of this, companies participate in roundtables and multi-stakeholder fora to align their work, lobby, and extend action beyond individual companies: *“We also see a need to collaborate with other industries to move beyond sector thinking. To have those dialogues, both formal networks and initiatives and informal dialogues with other companies that face the same problems”* (A20).

Progressive companies point to the need for these venues to bring together *“the government, NGOs, the industry, and smallholders [to define] new global standards”* (A13) for zero-deforestation across the industry, acknowledging that to move the agenda forward require common approaches and definitions. *“No one actor controls everything, so you have to have complex alignment between a big network of actors, both private and public* (A14). 60% talk about the need for *“pre-competitive targets”* (A10) and collaboration or *“collective action agendas”* (A19) with companies engaged in similar businesses, *“the basic realization being that if you are alone, if you are one company, you are not going to be able to achieve the impact you want because supply chains are very complex. They are global.”* (A14). The aim is that such collaboration – with actual or indirect competitors – could streamline the ZDC approach and its definitions, ensure a level playing-field, reduce leakage, and scale impact. However, the fear of being accused of ‘cartelling’ or colluding is often mentioned and there is a need to find *“ways that we can overcome commercial confidentiality and anti-competition restrictions”* (A17), allowing *“everyone to act in concert without breaching anti-trust”* (A8).

4. DISCUSSION

Above, I showed which mechanisms and processes companies use to implement ZDCs and how internal and external conditions affect this. Despite the concept of ZDCs being ‘clear, concise and intuitive’ (Lyons-White et al., 2020), I showed that companies struggle to convert ambitious pledges into practical activities within the company and across supply chains to foster tangible changes across production landscapes, but also that opportunities exist for making the “business case” for change. In this section, I reflect on these challenges and opportunities using the analytical framework outlined in section 1. I identify both processes and supporting mechanisms (Figure 5-8 right) and conditions (Figure 5-8 left), which require attention, if ZDCs are to be effectively implemented. I conclude with possible explanations for why companies have largely failed to meet the 2020 ZDC-targets, as widely reported (Forest500, 2021b; NYDF Assessment Partners, 2019).

Company structure, commodity and supply chain characteristics affect companies’ approach to implementation. Some companies take an active and direct approach to implementation, engaging suppliers and producers across supply chains and “going to the ground.” Others intervene less with suppliers or upstream actors and implement through company sourcing policies and existing VSS, especially on palm oil and timber. For the former, service providers deliver crucial on-the-ground presence, context-specific knowledge, facilitate stakeholder representative, and provide additional resources (Cadman et al., 2017), often taking part in actual implementation (Hayward et al., 2017). Nonetheless, aligning actors and actions across supply chains pose a challenge to implementation (Bateman et al., 2021).

Companies engage suppliers rather than exclude them, in line with due diligence approaches and guidelines (Brack and Ozinga, 2020; OECD, 2018). This suggests a tolerance for non-compliance and a desire to avoid non-compliant suppliers entering leakage markets, while reducing the risk that ZDC implementation excludes smallholders (Pasiiecznik et al., 2017), at the expense of stringently enforcing commitments. Implementation through standard-compliant production and sourcing drive much of the market, providing advantages such as established processes for

stakeholder engagement, auditing, and grievance (Mallet et al., 2016), which company-defined processes might lack. Strengthening the standard-based approach requires improving standards' ability to deliver reduced deforestation rates and increase deforestation-free production premiums to incentivize upstream actors to comply.

Companies rely to very different degrees on technology, but development in satellite and supply chain technology (Moran et al., 2020; Sarzynski et al., 2020) generally aids implementation, increasingly allowing companies to monitor concessions or track specific supply chains. Especially monitoring is well-developed through various cross-sectoral technology-enabled services (e.g. Global Forest Watch, Starling). Traceability and transparency depend largely on supply chain complexity and the position of the company, but some actors and commodities – especially within palm oil – forge ahead on this, publishing supplier lists and grievance reports, which fosters accountability and assessment. However, other sectors, e.g. cattle, are far behind (Alix-Garcia and Gibbs, 2017). Here, technology also opens new options (cf. blockchain, sensors, etc., as also discussed in Chapter 2) (Köhler and Pizzol, 2020; Tripoli and Schmidhuber, 2018). However, there is limited evidence of technology-enabled forest protection, e.g., satellite-enabled deforestation alerts do “not significantly change deforestation outcomes” (Moffette et al., 2021). Further, the risk that technology-enabled progress drives additional sales, e.g. delivering on consumer demands for traceability, rather than reducing deforestation levels (Dauvergne, 2020), require further investigation. Finally, verification, audit systems and reporting on the impact of ZDC implementation require increased attention, as recent Forest500 (2021) data demonstrate.

Company size and commodity supply chain affect implementation. Larger companies have more clout, can spend more on sustainability governance (Drempetic et al., 2020), and have greater leverage across supply chains (Dallas et al., 2019; Ponte, 2019; van der Ven, 2018). For example, Nestlé has developed their own monitoring system for ZDC implementation (Askew, 2020). At the same time, large companies are more likely to face complex supply chains (Kim and Davis, 2016). Small

companies are more likely to be captive or embedded in large companies' supply chains (Bager and Lambin, 2020; Sako and Zylberberg, 2019; van der Ven, 2018), limiting the scope of implementation choices. Successful implementation also requires committed and skilful employees (Galpin and Lee Whittington, 2012; Lacy et al., 2009). Here, large, wealthy companies are probably more likely to attract skilful employees, but an individual employee's ability to affect change also reduces with company size and complexity; it is much easier to change the operation of a 50-employee company than that of Nestlé.

Countervailing narratives of profit challenge the legitimacy of ZDCs, as companies balance implementation costs with reputational costs (Bloomfield, 2014; Dauvergne, 2017; Tetrault Sirsly and Lvina, 2019). Interviewees acknowledge that implementation requires resource allocation, but also that these are often missing. This indicates that companies fail to "walk the talk," i.e. back commitments with tangible investments. A recent NGO report suggests that costs of ZDC implementation are "significant but not excessive for large companies, although possibly beyond the capacity of smaller companies" (FERN, 2017). Consultants suggest that costs for most major CGMs and retailers are less than 1% of annual operating profits (Rijk et al., 2020), making the required investment manageable. The failure to invest sufficient resources mirrors findings from other CSR programs. For example, a recent survey on supply chain sustainability initiatives identifies a similar gap between companies' commitments and the investments required to fulfil these (Bateman et al., 2021).

Tellingly, interviewees found internal alignment and commitment challenging, e.g. lacking sufficient incentive structures and KPIs. Without funds and commitment, ZDC implementation becomes an add-on performed by sustainability, rather than a change of core business practices cutting across organizational lines, which is required for fully "embedding" ZDCs into corporate strategy (Baumgartner, 2009; Esty and Winston, 2006). Knowing that executives can affect corporate sustainability outcomes (Chatterji and Toffel, 2019; Chithambo et al., 2020; Shahab et al., 2020), driving implementation forward and helping secure resources require active executive-level engagement. For example, Unilever's green profile was for long synonymous with its

CEO (The Economist, 2017). In a broad study of supply chain sustainability (SCS), Bateman et al. (2021) show that executive-level engagement is strongly correlated with sustainability commitments, “suggesting that when executives champion the cause, companies commit to improving SCS performance,” further noting that without executive-level champions, a company is less likely to take action (Bateman et al., 2021). This aligns with the theoretical proposition that companies need a “policy champion” (Crosby, 1996) to drive implementation; a finding which is echoed here.

Beyond the company, I argue that for successful implementation, collaborative engagement is crucial to address the underlying deforestation drivers and tackle leakage (Lyons-White et al., 2020; Pasiecznik et al., 2017). The proposals for pre-competitive collaboration to address the limitations of companies’ implementation illustrate that companies are aware of the implementation challenges posed by the structure and complexity of global agro-food commodity supply chains. Deforestation is a complex, “wicked” problem with no simple solution (DeFries and Nagendra, 2017), requiring companies to collaborate to identify solutions. Even so, companies do not point to any immediate solutions, but engage in various collaborative governance interventions, most notably jurisdictional approaches. The empirical evidence that this solution can address deforestation is limited (Chervier et al., 2020; von Essen and Lambin, 2021; Reed et al., 2020), pointing to a need for companies to engage in other approaches as well.

Interviewees stress the lack of support from key external stakeholders, notably public actors, especially in producer countries, but also from consumers and shareholders. Public actors have several options for supporting implementation (Bager et al., 2021a; McCoy and Servent, 2017), e.g. working through private-sector embraced jurisdictional-, trade-, or VSS-based approaches, and the analysis point to a clear need for public actors to embrace a ‘catalytic’ (Reinecke and Ansari, 2016) or enabling (Chapter 2) role by supporting existing private-sector implementation efforts. One way to do this is to establish sufficient market and regulatory conditions. Currently, weak market incentives and insufficient government regulation lead to an uneven playing field. As a result, actors implementing ZDCs are put at a disadvantage relative

to those ignoring the problem or free-riding on other companies' actions, while the lack of market-wide uptake of ZDCs create leakages.

While challenges are plentiful, solutions to resolve the failure of ZDCs to reduce deforestation do exist. The paucity of company-specific frameworks highlights the importance of the Accountability Framework initiative and similar efforts. Beyond producing guidelines and specifying definitions and implementation approaches, these initiatives help companies "speak the same language", making it faster and easier to ensure alignment and deliver on commitments to avoid another lost decade. While the variation in scope, definitions, targets and timelines provides flexibility to companies, it entails extra work and open companies to criticism of cherry-picking convenient definitions suitable to their situation (Pasiecznik et al., 2017), while it complicates comparison and analysis. Alignment to specific criteria (especially HCV and HCS) address this, but these are not uniformly adopted and does not adequately cover all forests (Leijten et al., 2020).

Companies are learning to implement ZDCs but need external support to meet their objectives (Weber, 2020). Facilitated by collaborative multi-stakeholder approaches involving especially local and producer-country stakeholders, actors must determine rules for standards, roundtables, and other mechanisms' contribution (Garrett et al., 2019; Leijten et al., 2020; Pasiecznik et al., 2017) and set requirements on transparency, monitoring, and reporting. Finally, effective implementation requires public governance interventions to provide a level playing field, spur market incentives, and induce laggards. While much criticism has rightly been aimed at companies, they are bound to fail unless supported by public actors. While not included here, the financial sector must also take action on deforestation, as it lacks behind other supply chain actors (Forest500, 2021b).

There are limitations to the conclusions that this study draws. It builds on a limited number of interviews and particularly lacks company representation from Latin America and Africa (partially caused by headquarters being overwhelmingly located in Europe, America and Asia). Undoubtedly, the twenty-five interviewees only capture some of the implementation experiences, but as it includes both some of the

largest companies in the sector and smaller actors, and as it includes companies across the entire supply chain, it represents different experiences across commodities and regions. The use of external data and reports allows for a broader picture, but furthering our understanding of companies' efforts to implement ZDCs require additional inquiries, both large-n studies across the sectors and in-depth studies on single companies or supply chains. Engaging companies in scientific research is notoriously difficult, but both parties stand to gain if relationships can be improved. Companies must trust scientists to accurately report their experiences, while scientists must acknowledge the experience and knowledge held by private actors.

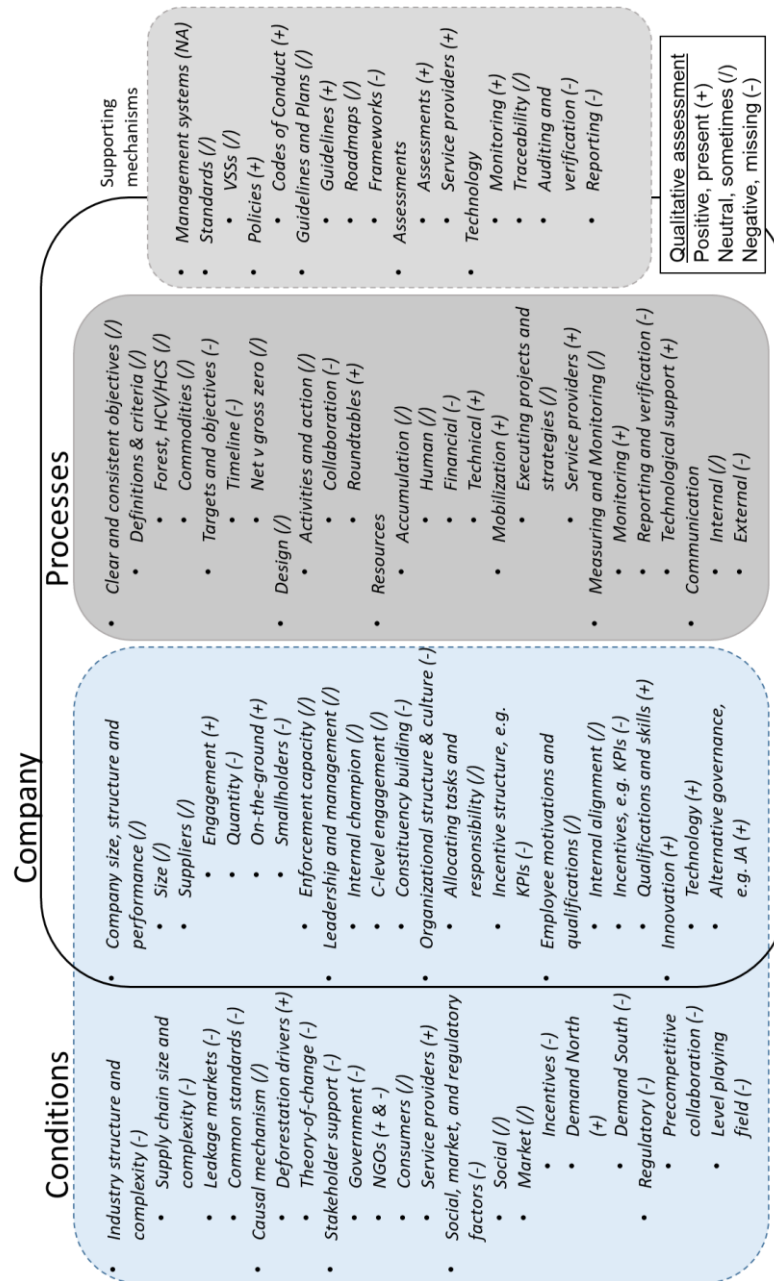


Figure 5-8. Qualitative assessment of implementation processes, supporting mechanisms, and internal and external conditions for ZDCs. Based on interview responses, company documents, and various literature sources

5. CONCLUSION

Here, I argued that companies' inability to sufficiently implement ZDCs is one reason companies have largely missed ZDC targets to reduce deforestation. When adopting ZDCs, few companies grasped the complexity of deforestation and the scale of change across companies and supply chains required to actually address this problem. This realization is slowly dawning, as companies' ramp up implementation efforts, especially on the technological front, but it has taken time, causing timelines to shift towards 2030. Still, companies face several implementation challenges. Processes are generally insufficient, though improving, as organizations adapt to accommodate the required activities and mechanisms. Company leadership have not adequately aligned organizational structures and allocated sufficient resources to support the implementation. Innovative solutions enable implementation but require supportive frameworks. While companies are responsible for several implementation mishaps, it is also clear that blame is not theirs alone. Insufficient regulatory and market conditions cause an uneven playing field. Inadequate support from key stakeholders and unclear theories-of-change behind implementation activities further hamper implementation. As policy implementation and the resulting effectiveness are inescapably interwoven, ZDCs cannot be expected to meaningfully contribute to reducing deforestation until implementation processes, mechanisms, and conditions are in place. Despite recent developments, unclear strategies for turning aspirational pledges into tangible outcomes continue to hamper ZDCs.

CHAPTER 6

DISCUSSION

In what follows, I discuss the results and implications of previous chapters in the context of other academic articles and the general development within agro-food commodity supply chain governance. In the first part, I discuss the findings with a view to the complexity of the problem, while I delve into the perspectives and contributions of companies in the second section. In the third, I discuss the role of public actors as both adopters and enablers of governance. Finally, in the fourth section, I discuss the findings in light of recent technological progress and innovations, which play an increasing role in agro-food commodity governance.

1. COMMODITY-DRIVEN DEFORESTATION – A WICKED PROBLEM?

Deforestation is difficult to address because of the interdependencies and multi-causalities interacting across telecoupled agro-food production and consumption systems and the global supply chains linking these systems. This means that any governance intervention to address deforestation must understand and acknowledge this complexity. As all deforestation takes place in a specific landscape with a confluence of interests and stakeholders, each intervention must be able to account for the context in which it operates, acknowledging that as places differ, so do drivers and effective interventions. Even so, actors must be able to take action on governance in the face of complexity.

1.1. ACKNOWLEDGING THE COMPLEXITY

Deforestation is not confined to well-defined areas, such as a state, a watershed, or a biome, but cut across jurisdictional, environmental, organizational and other natural

or man-made boundaries (Dou et al., 2018; Meyfroidt et al., 2018; Moffette and Gibbs, 2021). Stakeholders acknowledge this, increasingly adopting polycentric governance approaches that cut across supply chains, jurisdictions, or commodities, moving beyond top-down hierarchical or area-based approaches towards a combination of public and private instruments in layered governance (Chapter 2). As the EU policy study (Chapter 3) shows, multi-stakeholder approaches are popular across actor groups, while commodity- and supply chain-based approaches, such as due diligence, gain increasing traction. Further, the ZDC study (Chapter 5) shows how companies acknowledge the complexity of the system, operating beyond company boundaries and seeking to avoid leakage.

The complexity of the problem demands that actors have a clear idea about – and ideally evidence of – how the proposed governance intervention will lead to the desired outcome. In other words, to have a clear and proven theory of change for the desired solution. As discussed in the EU policy study (Chapter 3), however, actors frequently lack conceptions of the causal link between a proposed agro-food commodity supply chain governance intervention and its potential impact on deforestation. Several studies point to the need for identifying, testing, and revisiting the specific theory of change that each governance approach relies on (Börner et al., 2020; Chervier et al., 2020; Garcia et al., 2020; Martius et al., 2018; Meyfroidt, 2019). This would help increase effectiveness and avoid or reduce unintended or unanticipated consequences (Bager, 2016; Bastos Lima et al., 2019; Palmer, 2012).

The lack of or unclear conceptions about the underlying theory of change for many policy options presents an interesting conundrum. On the one hand, there are options, where the relevant stakeholders (academics, policymakers, companies, NGOs, etc.) possess the knowledge to address this, but where the issue possibly is that the collective knowledge does not adequately flow from one field or sector to another. For example, while the evidence of the Amazon Soy Moratorium reducing deforestation is quite strong (Heilmayr et al., 2020a), it is less clear what makes moratoria work (or not work) in some places and not in others. On the other hand, knowledge about the different steps in the causal chain from adoption to outcome on

the ground varies and there are definitely areas where the actors involved need more knowledge. While there is ample evidence on the drivers of deforestation, it is less clear how to induce behaviour change among actors, especially consumers. We also lack knowledge about how the different governance approaches can and cannot affect the underlying drivers. For example, are VSS merely treating symptoms (e.g. poverty), but failing to address causes (the low commodity prices)? Similarly, we need more knowledge about how various approaches interact with and affect each other when adopted in polycentric settings. For example, what happens when jurisdictional approaches are combined with due diligence requirements? For other instruments, the issue seems to be that the theoretical foundation and the real-life application do not match. As I discuss in the EU study (Chapter 3), the ToC of REDD builds on conditional payments provided to tropical countries for reducing deforestation, but is applied mostly as an aid-funded program with multiple objectives where payments are seldom conditional on outcomes (Angelsen, 2017; Duchelle et al., 2018; Olesen et al., 2018; Wunder et al., 2020).

The numerous stakeholders involved in the governance of agro-food commodity supply chains have different perceptions of the problem and solution. For example, the governments of, say, Brazil and France have very different opinions on the problem of deforestation, as evidenced by the disputes between the two countries' leaders, Emmanuel Macron and Jair Bolsonaro, over the Amazon deforestation and fires in 2019 (Fouquet, 2019). Similarly, deforestation looks different in the eyes of a smallholder farmer in the Global South than it does to a wealthy consumer in the Global North, which again has a different perspective than MNCs. The study on EU deforestation policy options (Chapter 3) also confirms that the perceptions of the problem – and the solutions to address it – diverge among stakeholders. It shows that different groups, most notably NGOs and industry, diverge in their perspective on and preferred solution for deforestation. Similarly, the ZDC study (Chapter 5) shows how stakeholders within a company have divergent opinions and attitudes towards addressing deforestation. This diversity of opinions is why multi-stakeholder and polycentric approaches are relevant, as they bring together diverse actors and foster

dialogue. However, it is important to understand and account for the power differentials within (Chapter 5) or between (Chapter 4) companies, as well as among stakeholders generally (Bastos Lima and Persson, 2020; Dauvergne, 2017; Dauvergne and Lister, 2012; Ponte, 2019). As discussed in both the ZDC (Chapter 5) and coffee (Chapter 4) studies, the capacity of actors to embrace, engage in, or shape these polycentric approaches differ between stakeholders. Clarifying and acknowledging these differences in perceptions and capacities would also help address uncertainties over the theory of change behind and the motivations for adopting specific governance approaches, as actors would have to explicate how and why they undertake the intended actions.

1.2. ACCOUNTING FOR CONTEXT

Addressing deforestation requires solutions that take into account the specific context in which the deforestation occurs (DeFries and Nagendra, 2017; Meyfroidt et al., 2014; Nagendra and Ostrom, 2012), acknowledging that while agro-food commodities drive deforestation ‘at large’ (Ingram et al., 2020), the specific conditions and mechanisms causing deforestation in a given context vary between commodities and regions. As the EU deforestation policy options study (Chapter 3) discusses, this contextual diversity leads to different theories of change, even for similar policy approaches. This suggests that to design policy approaches to reduce deforestation, it is necessary to understand the intricate links and feedbacks between instrument, mechanism, and outcome, and to tailor solutions to the context in which they are applied (Seymour and Harris, 2019). Along these lines, DeFries and Nagendra (2017) suggest that complex, ecological problems, such as deforestation and biodiversity loss, require incremental and adaptive governance approaches, as they are resistant to “easily identifiable, predefined solutions.” This means that these problems require policies that can adapt to and account for the context while making incremental changes as the context and understanding evolves.

Rather than “one size fits all”, the complexity and interdependencies of the problem likely mean that “one size fits none.” The contextual differences also show up in the relative success of different governance approaches. While the Amazon Soy

Moratorium has been a success (Heilmayr et al., 2020a), so far, replication to other biomes or commodities has largely failed (Chapter 2). In the context of ZDCs (Chapter 5), the likelihood of successful implementation (and thus eventual impact) also to some extent hinges on the commodity system in question. The usefulness of various monitoring technologies, the ability to track and trace commodities across supply chains, and the “commodification” of each individual agro-food commodity differ, changing the starting point for each sector, and requiring the companies to factor in these effects when designing governance approaches and implementation strategies.

1.3. ADAPTING TO COMPLEX PROBLEMS

Designing solutions to complex or ‘wicked’ problems such as commodity-driven deforestation is a difficult affair. As shown by the governance (Chapter 2) and the EU policy (Chapter 3) studies, there are several governance mechanisms available to private and public actors seeking to reduce deforestation across agro-food commodity supply chains. But as both chapters make clear, these are not equally effective, neither theoretically nor empirically demonstrated, and the evidence of different governance approaches on reducing deforestation options vary – depending on the policy options, enforcement mechanisms, and the context and commodity to which they are applied. Andersson (2021) suggest that when trying to identify policy solutions to wicked problems, the goal is not to find technical or regulatory fixes, but to include real-world experimentation and collective learning approaches that allow for “continuous adaptation and reformulation of knowledge.”

In line with Andersson's (2021) last point, Garcia et al. (2020) argue that there is a need to constantly re-assess and revise the knowledge base to keep up with the evolution of the problem. Ingram et al. (2020, p. ii) find “strong variation in the discourses about the drivers and solutions to deforestation, each making different causality claims and proposing different solutions,” which reduce overall effectiveness and robustness. This underscores the point discussed above and in the EU policy study (Chapter 3); there is a need to clearly articulate the theory of change underlying most deforestation governance approaches to increase overall impact. This

requires articulating, mapping, and testing different approaches using empirically grounded, in-situ research. As the EU policy study (Chapter 3) demonstrate, many policy suggestions indeed rest on technical (e.g. “monitor deforestation”) or regulatory fixes (e.g. “carbon tax”), for which there is either limited evidence or unclear theories of change.

In a discussion on the wicked problem of indirect land-use change, which shares many characteristics with agro-food commodity-driven deforestation, for example, the problem of leakage, Palmer (2012) argues that policy solutions benefit from drawing on diverse types of knowledge, including non-scientific. This resonates with calls within especially political ecology-based research to also include Indigenous Peoples’ and other actors’ experience and knowledge when designing policy, as these can also contribute to effective forest protection (Blackman et al., 2017; FAO and FILAC, 2021; González and Kröger, 2020). Further, the normative aspects require considerations, as the moral and ethical implications of different options must be included (Palmer, 2012). This requires acknowledging that as different stakeholders have different perceptions of the problem (causes, responsibilities, values, etc.), they also have different perceptions of the proposed policy options, including whether a solution is fair, moral, effective, and so forth (Reinecke and Ansari, 2016). Reinecke and Ansari (2016) go on to argue that this means that “‘wicked’ problems cannot be ‘solved’ as there are no formulas or objective criteria to judge a solution as right or wrong;” an argument also reflected in the original article that coined the term ‘wicked problem’ (Rittel and Webber, 1973). This points to the need for fostering governance approaches able to adapt to local contexts, which also recognize the interlinkages between global processes and local outcomes and the numerous actors involved along agro-food supply chains (Ingram et al., 2020).

1.4. TAKING ACTION IN THE FACE OF COMPLEXITY

This necessarily raises the question of how to then address agro-food commodity-driven deforestation, considering the complexity and contextual nuances of the problem. DeFries and Nagendra (2017), discussing this in the broader context of ecosystem protection and management, identify two traps to avoid: falsely assuming

simple (or what they call ‘tame’) solutions, which are not able to actually address the problem at hand, and to avoid inaction in the face of complexity. Similar points are raised by Underdal (2010), who also cautions against simple, unilateral ‘quick-fixes’.

The first point resonates with the argument on the clarity and evidence of the different theories of change underlying the proposed policy options to reduce deforestation. Several governance approaches are relatively straightforward and well-supported, but it could be argued that many of these constitute ‘tame’ solutions. For example, certification standards were frequently proposed as key policy measures to reduce deforestation in the EU policy study (Chapter 3) and the study on sustainability in the coffee sector (Chapter 4) also highlights the ubiquity of standards as a means to address sustainability issues. However, a recent report by Greenpeace (2021) questions the ability of certification standards to reduce deforestation, stirring some debate on the merits and utility of such governance mechanisms. While the report draws some hasty (and potentially unsubstantiated) conclusions, it nonetheless raises an important point: most standards were not designed to reduce deforestation, but to further various social or ecological indicators, meaning that any impact on deforestation is a desired side-effect, rather than an expected outcome. Further, the general theory of change has certain flaws, e.g., the lack of uptake across many commodities, the limited incentives for producers, and the potential self-selection bias. Such upstream impact aside (i.e. does it change environmental and social outcomes?), certifications arguably work better for products made for end-consumers, e.g., cocoa and coffee, and where there is strong consumer demand for sustainable products and an ability to pay premiums (Bush et al., 2015). Castro-Nunez et al. (2020), in a study on deforestation in post-conflict Colombia, raise the point that places where demand is primarily locally driven and does not involve international supply chains and global brands require different policy options, and argue that certification programs, for example, are likely to be inadequate when aimed at small-scale producers catering to local markets.

Without turning this into a discussion of the pros and cons of certification standards to address deforestation, it is clear that there is a need to consider the theory of change

behind the governance mechanism and the context in which it is applied – no matter what approach is adopted – as failing to do risks propelling ‘tame’ solutions, i.e. simple, but ineffective, solutions. DeFries and Nagendra (2017) suggest that explicitly recognizing that the problem “occurs in a particular geographic, institutional, and cultural setting” helps identify suitable solutions while avoiding oversimplification or inaction. This also resonates with the point on context and normative views discussed above.

On the second point, lack of action has indeed riddled deforestation governance of agro-food supply chains for many years, for a long period especially public governance intervention (Chapter 2). As both the EU policy study (Chapter 3) and the ZDC study (Chapter 5) show, public authorities struggle to tackle commodity-driven deforestation. The EU has debated the problem for more than a decade without taking substantial regulatory action, while the lack of a ‘level playing field’ for ZDC implementation illustrates the lack of consistent and stringent regulatory requirements on deforestation. Further, the complexity has also hampered many private governance approaches from taking off. The ZDC study (Chapter 5) shows that complexity is among the factors precluding sufficient company action on ZDCs, as complex supply chains and the inability to trace and monitor these, for example, were among the barriers to implementation. Further, complex settings and supply chains can undermine the impact of otherwise promising interventions (Kim and Davis, 2016). Finally, as discussed by several studies (Garrett et al., 2019; Jopke and Schoneveld, 2018; Leijten et al., 2020; Neeff and Linhares-Juvenal, 2018), the inability to define and delineate ZDCs and related concepts (net/gross, HCV/HCS, forests, etc.) also reduce actors’ ability to act and the likely effectiveness of ZDCs.

A potential solution to overcome the trade-off between individual ‘tame’ solutions and lack of action is to embrace a combination of different approaches, e.g. combining public and private, top-down and bottom-up, local and national, commodity-specific and landscape-wide, etc. approaches. The EU policy study (Chapter 3) specifically highlights the potential of policy mixes as a means to overcome opposition against some policies and the limited impact of other policies. Embracing a mix of approaches

also enables drawing on the different strengths of respective stakeholders, pointing to the need for considering multi-stakeholder approaches. Similarly, mixes must include both public and private approaches, as well as a mix of supply and demand interventions. The pendulum seems to be shifting towards a phase of layered governance with increased demand-side interventions and an increasing role of MNCs as implementers of governance with consumer governments as enablers of this (c.f. the proposed due diligence approaches discussed in Chapter 2 and Chapter 3). Even so, to succeed requires supply-side interventions focused on supporting producers, land tenure, and other good governance reforms, which still have widespread support (Chapter 3). A key point is thus to identify the optimal (or at least sufficient) mix of policies. Naturally, this depends on the context and commodity (Chapter 2), but crucially it also requires evidence of the performance of different mixes of governance approaches. Unfortunately, there is a dearth of such evidence (Lambin et al., 2014), pointing to a clear need for rigorous comparative analysis of different governance approaches for reducing deforestation across agro-food supply chains.

2. COMPANIES' CONTRIBUTION TO SUSTAINABLE LAND USE

In a polycentric governance system, private actors play an important role both individually and through multi-stakeholder action. Arguably, this is also the case for reducing agro-food commodity-driven deforestation. Here, I discuss three aspects of particular relevance to companies' contribution to sustainability governance in general and to deforestation-related governance in particular: the adoption and scaling of sustainability governance approaches, the implementation and impact resulting from this adoption, and finally, to hold companies accountable to deliver on this.

2.1. ADOPTION AND SCALING

As the governance review (Chapter 2) and the ZDC implementation (Chapter 5) studies show, hundreds of companies have committed to reducing deforestation across their supply chains and many are making tangible progress. However, there are also too many companies not taking action. If the findings from the coffee sector study

(Chapter 4) can be transferred to other sectors, results indicate that most companies are still not taking action on sustainability across supply chains. As the coffee sector has historically been more engaged in sustainability than most other sectors, if anything, the situation is even bleaker outside the coffee sector. A silver lining is that the study shows that larger companies generally adopt more practices, meaning that although (in absolute terms) only one-third of all companies take action, it is likely that sustainability efforts cover more than one-third of the global market.

Action specifically on deforestation trails far behind most other sustainability indicators, at least within the coffee sector (Chapter 4). While coffee is less linked to deforestation at a global level than other agro-food commodities, it nonetheless drives deforestation in some locations (Meyfroidt et al., 2013; Pendrill et al., 2019a), meaning that coffee companies serious about sustainability should begin considering deforestation risks. Results from the coffee sector likely cannot be transferred one-to-one to other sectors when discussing deforestation, given that some sectors are much more focused on (and linked to) deforestation, especially palm, soy, and cocoa. Nonetheless, there is growing evidence that many companies exposed to agro-food commodity-driven deforestation across their supply chains are not taking sufficient action to remedy this. For example, as the study on ZDC implementation (Chapter 5) discuss, data on public commitments made by companies and reporting by NGOs (Forest500, 2021a, 2021b; Haupt et al., 2018a) show that several companies with exposure to deforestation in their supply chains are yet to commit to reducing deforestation, e.g. adopting ZDCs.

Both the coffee (Chapter 4) and ZDC (Chapter 5) studies show that companies facing stakeholder pressure are more likely to adopt sustainability governance interventions, an observation also made by other studies (e.g. Graham, 2020; Mayer and Gereffi, 2010; Thorlakson et al., 2018a). NGOs have specifically targeted large companies

exposed to deforestation, pushing them to adopt ZDCs²⁹. In the case of ZDCs, the first adopters were large, consumer-facing MNCs with well-known brands, such as Nestlé and Unilever, and most of the early adopters of ZDCs were exposed to NGO campaigning (see Figure 2-1 in Chapter 2). NGOs also helped shape the concept of ZDC and its key definitions (Lyons-White et al., 2020) and they support implementation through various data collection efforts and technological mechanisms. As I show in the ZDC study (Chapter 5), companies that do take action on deforestation complain that several of their competitors, especially those that serve markets with less regulatory and consumer attention, are not committed to zero deforestation. As made clear by interviewees, consumer awareness of deforestation and demand for sustainable or certified products remains largely confined to high-income markets and niche segments. This illustrates that NGOs can play a role in raising awareness and pushing actors in non-committed markets, especially China, to also address deforestation. While sustainability is far from mainstream in emerging markets (Yifan, 2021), there are signs that this is slowly changing, increasing demand for certified products in these markets (Neo, 2021).

The coffee sector study (Chapter 4) shows that beyond stakeholder pressure, company characteristics, including company size, location and supply chain position affect companies' sustainability strategy. The ZDC implementation study (Chapter 5) generally supports this conclusion, adding that commodity and sector affect strategy adoption and implementation. Who can do what, how much, when, and where is largely a result of the company's size and reach across the sector and supply chain, and the assistance it can get from service providers and through collaboration with other stakeholders. The coffee sector study (Chapter 4) clearly illustrates this,

²⁹ For example, Forest500's approach to deforestation is to collect information on the 500 largest companies (350 agro-food sector companies and 150 financial institutions) exposed to deforestation. Greenpeace's reports also often single out specific companies – see, for example, Greenpeace (2019, 2020) – while WWF's scorecards, Forest Trends' Supply Change, and various other ZDC approaches specifically report based on individual company action.

indicating how approaches differ with company size and supply chain position. This opens up space for both small and large companies to shape agro-food supply chain sustainability governance. Small companies can pioneer efforts to demonstrate viability (c.f. the novel governance approaches adopted within the coffee sector, such as direct trade or radical transparency), while larger companies can absorb and scale the successful efforts (Lambin et al., 2020). In line with the broad view on sustainability provided by the coffee sector study (Chapter 4), there is a need to better understand whether the companies who commit to zero-deforestation also adopt other sustainability governance approaches, e.g. disclosing information about sourcing practices and origin or participating in multi-stakeholder partnerships.

Studies on CSR related practices also show that large companies are more likely to engage in sustainability practices (Darnall et al., 2010; Drempetic et al., 2020; Gallo and Christensen, 2011; Schreck and Raithel, 2018). In the case of deforestation, the adoption of ZDCs remains higher among large companies than among small (Forest500, 2021b). In a recent survey of supply chain sustainability efforts, Bateman et al. (2021) use machine learning with k-means clustering on a large-N sample to classify companies by sustainability efforts. Similar to the findings of both the coffee (Chapter 4) and ZDC (Chapter 5) studies, they conclude that large, public-facing companies are more engaged in supply chain sustainability (SCS), devoting substantial resources to these initiatives, while small, private companies are less engaged, likely because they “may not have the time or resources to achieve significant progress toward SCS” (Bateman et al., 2021). This to some degree contrasts with the oft-made notion that sustainability largely is confined to niche markets (Jaffe and Bacon, 2008; Kolk, 2013; Lernoud et al., 2017; Linton, 2008; Manning et al., 2012; Voora et al., 2019). However, the increasing consumer awareness and the general interest in sustainability likely means that large companies can no longer afford to not pay any attention to this, as this would put them at a competitive disadvantage, as well as at risk of NGO campaigns and regulatory interventions. The regulatory risk seems to be greater for large companies, as mandatory public policies are more likely to target large companies, as seen for

example with the recent due diligence proposals across European countries and the EU (Chapter 2 and Chapter 3).

2.2. IMPLEMENTATION AND IMPACT

Polycentric governance of agro-food supply chains implicitly builds on companies and other actors assuming responsibility for governance, not only by adopting various governance approaches but by actually implementing these and demonstrating tangible results. While some potentially “greenwash” (Chapter 4), stakeholder expectations, public governance efforts, and the ability to measure, verify and report make it increasingly hard for companies to engage in mere “window dressing.” Various stakeholders expect companies “to report and provide reliable accounts of policies actually implemented on the ground” (Graz, 2021, p. 2). At the same time, ZDC implementation (Chapter 5) shows that companies, which have adopted private governance mechanisms struggle to implement these and turn pledges into practical change across supply chains. However, the coffee study (Chapter 4) shows that it is difficult to distinguish between mere window dressing and actual impact. The study is based on reported adoption of sustainability – thus, it does not assess whether companies actually follow through on these promises and whether they actually have an effect – and it is much harder to measure the impact of adoption than it is to measure adoption itself. As the study notes, overcoming this requires consistent and mandatory reporting frameworks (Kareiva et al., 2015), which include science-based targets and indicators that allow for comparison across companies. There is some development on this front, cf. the Global Reporting Framework, UN Global Compact, and other initiatives, but these are still voluntary and adopted somewhat ad-hoc. Nonetheless, it is an area that needs attention. While it is one thing to formulate standards, define codes of conduct, issue sourcing guidelines, or make lofty pledges, it is quite another thing to implement these across the organization (Chapter 5) and ensure compliance on the ground and across supply chains (Boström et al., 2015). To check that companies actually achieve this requires collective comparable data and conducting detailed, empirically-based studies.

In a globalized world of telecoupled agro-food supply chains, MNCs operate and compete on a global field (Scherer and Palazzo, 2011), which gives them enormous leverage to affect change but also makes them prime targets of sustainability governance requests and stakeholder pressure. With a polycentric and layered approach to governance, where governments rely on companies to implement governance approaches, MNCs become “attractive targets” through their global reach and influence, which transcend jurisdictional and spatial barriers (Reinecke and Ansari, 2016). As discussed in Chapter 2, Chapter 4, and Chapter 5, as well as in literature, e.g. Thorlakson et al. (2018a), these dynamics force companies to take responsibility beyond their own gate – as many already do. On the one hand, these changes allow for a large degree of self-regulation, as companies can tailor their governance approaches to fit their particular supply chains and stakeholder requirements (Chapter 4). On the other hand, such dynamics place an enormous emphasis on the role of companies in governing agro-food supply chains, which require that public governance adds the coercive and supportive “layers” that spur laggards into action, e.g. requiring due diligence, and enable leaders to use their reach and leverage to affect change across supply chains. This ties to the general need for sustainability to become thoroughly integrated into companies’ operations, rather than being treated as a nice-to-have issue. As the coffee (Chapter 4) and ZDC (Chapter 5) studies discuss, companies use different strategies when adopting sustainability; some rely on external standards or existing approaches, while others define internal codes of conduct. One strategy is not necessarily better than the other, as there are pros and cons of all governance instruments and approaches (Chapter 2) and the outcome largely depends on the scope of the strategy and the context in which it is applied. However, it is important that companies thoroughly integrate sustainability into business processes and increase collaboration across the company and with external stakeholders, as the ZDC study highlights (Chapter 5), rather than treating it merely as a box-ticking exercise necessary to fulfil the requirements set by public actors or expected by stakeholders.

Do stakeholders prefer certain governance approaches and do their preferences change over time? The indication seems to be yes and yes. In the governance review (Chapter 2), I argue that agro-food supply chain governance has evolved through three distinct, yet overlapping phases. As the third phase matures, actors adopt a “layered” approach in which public actors provide the regulatory “frame” while private actors are the principal agents of implementation. This also leads to a shift in governance approaches with an increased focus on governing across specific actors and supply chains (and thus governing commodity flows), rather than governing specific areas. For example, as the EU study (Chapter 3) shows, there is confluence around due diligence as the preferred approach – potentially noting a shift away from VSS, which as a result of the market-driven approach in the second phase, remains widely adopted (Chapter 2). Further, the coffee study (Chapter 4) shows that many large companies adopt “internal standards,” either Codes of Conduct or company-led governance approaches, likely at the expense of third-party verified, NGO-led VSS. Thorlakson (2018) find similar evidence of this in the cocoa sector, showing how the sector is moving beyond certification, relying largely on industry-led supply chain mechanisms and multi-stakeholder partnerships, such as the Cocoa and Forest Initiative (CFI). These findings all indicate a shift in the attitude towards and approaches through which actors seek to govern agro-food supply chains. With increased consumer awareness and stakeholder pressure, governance become *de facto* mandatory in certain segments and sectors, which could explain why some companies favour public, regulatory intervention in agro-food supply chains (as discussed in Chapter 3 and Chapter 5). Public actors offer support mechanisms and build legitimacy, which benefits those already undertaking governance anyway, while regulation forces their competitors to also take action. In that sense, to those companies operating in sectors with *de facto* mandatory governance, instating mandatory governance *de jure* could be a win-win situation, reducing their own regulatory burden and increasing that of their competitors.

2.3. HOLDING COMPANIES ACCOUNTABLE

Enabling civil society actors and consumers to hold companies accountable for any deforestation or other sustainability-related violations occurring in their supply chains play a role in addressing the problem by getting more actors to commit to tackle sustainability issues and hold those who have already committed to their words. The complexity, commoditization, and general opacity of many supply chains could explain why companies struggle to account for supply chain practices. Kim and Davis (2016) suggest that “organizational and supply chain complexity are the dominant factors hindering supply chain accountability and sustainability.” Here, developments, for example on technology, that allow NGOs to act as “watchdogs” and engage in “name and shame” campaigns play an important role (Chapter 2). Various reporting and accountability mechanisms and approaches, such as CDP, Forest500, and SupplyChange, play another key role, allowing companies to report efforts consistently and consumers and NGOs to gather information on companies’ efforts or lack thereof. As both the ZDC (Chapter 5) and coffee sector (Chapter 4) studies discuss, consistent, sector-wide, mandatory reporting formats (Kareiva et al., 2015) would further facilitate this, and technological developments (e.g. on supply chain collection and visualization) could also play a role in the efforts to increase reporting and accountability.

The coffee sector study (Chapter 4) showed that relatively few companies adopt transparency-related practices, but showed that smaller companies were significantly more likely to be transparent. However, the situation in the coffee sector differs from most other agro-food commodities, especially within the specialty coffee segment, given its heavy focus on direct trade relations, microlots, and quality-segmented supply chains (Discua Cruz et al., 2020; Hernandez-Aguilera et al., 2018; MacGregor et al., 2017; Vicol et al., 2018). Such segmentation of the market does not exist in palm oil, soy, or rubber supply chains, for example, but while findings cannot be transferred one-to-one, they nonetheless lend credence to the notion that supply chain composition affects companies’ ability and willingness to account for supply chain practices. The increased interest in transparency is also seen in the EU policy study

(Chapter 3), where several stakeholders, most notably NGOs, embrace transparency-related policies. The ZDC study (Chapter 5) shows that companies are still struggling with transparency on deforestation-related issues though, illustrated for example by the low levels of reporting on ZDC implementation, and several studies find transparency-related issues surrounding deforestation-risks in companies' supply chains and ZDCs (Garrett et al., 2019; Jopke and Schoneveld, 2018; zu Ermgassen et al., 2020b, 2020a). However, transparency is merely a precondition; fostering accountability and governance across agro-food supply chains require the uptake and use of that information by actors and within governance approaches (Godar et al., 2016).

Transparency should not be uncritically embraced, however. Increased transparency across supply chains will not benefit all actors equally, and especially commodity producers and those without leverage across supply chains are at risk of losing out (Kos and Kloppenburg, 2019; Vicol et al., 2018). This necessarily raises questions as to who benefits from transparency and to what extent (Gupta et al., 2020; Mol, 2015). Several governance approaches, for example due diligence mechanisms, rest on increased insight into and oversight over traceable and transparent supply chains (Chapter 2 and Chapter 3). If approaches are to not only be considered effective, but also ethical or just, it is necessary to further assess how traceability and transparency affect actors' relationships and relative power across supply chains. For example, the power asymmetries across the global coffee sector (Chapter 4) are huge (Fischer, 2017; Folke et al., 2019; Grabs and Ponte, 2019; Panhuysen and Pierrot, 2020), leading to fears that some actors would benefit from transparency initiatives at the expense of others, exacerbating already uneven relationships. There are also different types of and dimensions to transparency (Gardner et al., 2019), which benefit different stakeholders depending on where and how such interventions are implemented (Gupta et al., 2020). For example, while provenance-related information could benefit consumers, it does not necessarily add value to producers, unless they can reap a benefit through premiums or increased sales (Bager et al., 2022).

3. THE STATE IS DEAD – LONG LIVE THE STATE

The role of public actors in governing sustainability in a globalizing world of complex supply chains and growing corporate influence is a long-standing and ongoing discussion. Some claim that the rise of private governance did not mean the decline of public governance, but instead embedded public actors in an increasing interplay with many other regulatory actors, leading to a *re-centring of the state* (Bartley, 2014; Djelic and Sahlin-Andersson, 2006). Others claim that public actors were largely absent from the sustainability governance space for several years (either voluntarily or because it was actively undermined), and only now, as the governance regime is shifting, re-engages in governing sustainability problems, meaning we are witnessing a *return of the state* (Partzsch, 2020b).

This thesis and the arguments I present here are positioned somewhere in between the two positions. On the one hand, public actors did take a step back relative to private actors – as witnessed, *inter alia*, by the market-driven governance phase documented in Chapter 2, as well as in the prevalence of VSS and other private governance instruments across the coffee sector (Chapter 4) and the adoption of ZDCs (Chapter 5). However, while neoliberal deregulation and globalization processed undermined state authority, the state never formally left sustainability governance and was not as dead as some actors pronounced it. For example, the legality regime that took off in earnest in the early 2000s (Chapter 2) shows that both the EU and the US played key roles in governing the world's forest, although the governance interventions were limited in scope (to legality rather than sustainability) and extent (to timber rather than all agro-food commodities driving deforestation). At the same time, the research presented here does indicate that the state (and thus public governance) is in a sense “returning” to former prominence, as governance of agro-food commodity supply chains moves from “the shadow of hierarchy” (Héritier and Eckert, 2008) to states actively regulating agro-food supply chains through, for example, interventions in trade (cf. the Mercosur agreement (Kehoe et al., 2020)), production, and consumption of agro-food commodities (Chapter 2 and Chapter 3). As the EU policy paper (Chapter 3) shows, several options exist for public governance to reduce deforestation across

agro-food supply chains with many of the (potentially) more effective governance options requiring or benefitting from government intervention. This does not mean that regulatory state-led governance should replace private, market-driven efforts. Rather, it means that public and private governance co-exist in a common space that, if managed correctly, can lead to substantial co-benefits and better governance outcomes.

3.1. LEVELLING THE PLAYING FIELD

When action is lacking, public governance can coerce or mandate actors not sufficiently engaged. Crucially, public governance can provide a level playing field on which private governance interventions can operate. At present, companies who do not adopt sustainability practices or measures to reduce deforestation enjoy an unfair commercial advantage, free-riding on the efforts made by their more responsible counterparts (Larsen et al., 2018; Prakash and Potoski, 2007), which disincentivizes companies from further investing in sustainability practices (Larsen et al., 2018). The study on ZDC implementation (Chapter 5) also highlights this, as the companies interviewed expressed how unscrupulous actors without ZDCs benefitted from leakage markets while enjoying the benefits that arise from the sector generally moving towards more responsible practices. As the results from the coffee sector (Chapter 4) show, voluntary sustainability efforts do not lead to sector-wide uptake. Similarly, not all companies exposed to deforestation has adopted ZDCs (Chapter 5), and insufficient uptake generally limits the impact of many voluntary approaches, as the EU policy study (Chapter 3) discusses. Private governance has not fully mainstreamed sustainability but remains adopted mainly by ‘sustainability leaders’ (Chapter 4) and other front-runners (e.g. ZDC adopters, Chapter 5) across industries. Regulatory interventions might thus be required to get the ‘laggards’ on board to remove their commercial advantage over ‘sustainability leaders’ and to ensure that sustainability efforts get mainstreamed (Pasiiecznik et al., 2017).

Public governance can further adjust a fragmented private governance market by correcting market failures and information asymmetries. These occur as different private governance interventions provide various sustainability claims, which

consumers and other downstream actors cannot verify, due to differences in stringency and scope among the different approaches (Renckens, 2020). As the coffee sector study (Chapter 4) poignantly illustrates, companies adopt numerous different sustainability governance approaches, not all of which include third party verification, making it difficult to assess the actual impact of the specific governance approach. Similarly, the lack of definitions and regulatory guidelines on ZDCs (Chapter 5) complicate evaluations of the extent and effectiveness of such approaches (Garrett et al., 2019). Here, governments can step in to harmonize the market by defining frameworks, aligning timelines, or setting common targets and indicators (Nepstad et al., 2014).

To adequately address deforestation require more than just effort by public actors in high-income countries. It also requires public governance by China, India and other emerging markets, as well as by FRC producer countries, in particular those with a large production of FRCs, such as Brazil or Indonesia. Both the EU deforestation paper (Chapter 3) and the ZDC implementation study (Chapter 5) discuss the role of emerging markets and public deforestation governance by low- and middle-income countries. Chapter 5 shows how lacking regulatory standards and insufficient demand in these countries contribute to the creation of leakage markets, which actively reduce the efforts of companies to achieve ZDCs. For palm oil, for example, China and India are the world's two largest markets, followed by the EU, yet certification struggles to take off there. RSPO signed a Memorandum of Understanding with China in 2013, while the RSPO together with WWF and several MNCs formed the China Sustainable Palm Oil Alliance in 2015 (Yifan, 2021). However, most of the members are MNCs already committed to sourcing certified palm oil, while Chinese companies use minimal amounts of certified palm oil (Yifan, 2021). This means that certified palm oil is far from mainstream in China; RSPO had a target of 10% market share by 2020, but the actual figure was closer to 2% (Yifan, 2021). As the EU deforestation paper (Chapter 3) discuss, public governments can collaborate to mainstream standards, definitions, approaches, and overall targets, while motivated public actors can pressure less motivated actors to take action. In a case study based on manufacturing

industries in Pakistan, Bux et al. (2020) find that it is not a lack of concern for the environment or insufficient consumer demand that prevents companies from taking action to address sustainability, but rather a lack of resources, regulations, standards, and policy incentives. This suggests that public governance interventions by emerging market governments and FRC producer countries could spur the private sector in these countries into action.

3.2. ENABLING FURTHER ACTION

When private sector governance is already underway, public governance can support existing private initiatives. For example, the case of ZDCs (Chapter 5) shows that private actors can benefit from state support on several levels, both to implement governance approaches, such as tracing supply chains or monitoring deforestation, and to increase impact by, for example, providing incentives or restricting or increasing market access. Public governance thus plays a key role in furthering the impact of private governance initiatives. At the same time, public governance, being limited to specific jurisdictions, lack authoritative control across global commodity supply chains, limiting the options to exercise governance in complex, telecoupled systems (Di Lucia, 2017; Meadowcroft, 2002), such as those characterizing the agro-food system. However, companies, especially MNCs and “lead firms,” can exercise power across value chains (Gereffi et al., 2005; Ponte, 2019; van der Ven, 2018), as both the coffee sector (Chapter 4) and ZDC study (Chapter 5) demonstrate. Unfortunately, as these studies also show, private governance is limited in scope and stringency, as only some companies adopt voluntary governance approaches and some adopt approaches as mere window dressing, reducing private governance approaches’ ability to affect change. Thus, while private governance addresses issues in individual companies and supply chains (Chapter 2 and Chapter 3), public governance interventions could scale these across the entire sectors or jurisdictions. In line with a “shifting rather than a shrinking role” of public governance that the layered governance phase also indicates (Chapter 2), Reinecke and Ansari (2016) suggest that states embrace a “catalytic role,” leveraging the complementary aspects of both public and private approaches and creating “enabling conditions” rather than steering or

enforcing behaviour. By acting as enablers of private governance efforts, public governance can help scale them up and out (Lambin et al., 2020).

Further, the catalytic role also allows public actors to shift parts of the problem-solving and implementation onto private actors, especially MNCs within and beyond their immediate control (Reinecke and Ansari, 2016). Due diligence efforts (Chapter 2 and Chapter 3) embrace this concept, putting the onus on private actors to exercise due diligence and on the public actor to support this – allowing room for civil society to hold both actors accountable. As Lambin and Thorlakson (2018) demonstrate, public and private governance do not operate in two different silos. Rather, they exist in an ecosystem where different approaches “complement, substitute, or compete against each other”, meaning that catalytic approaches do not start from scratch, but can rather build on existing “coordination mechanisms beginning to arise” (Lambin and Thorlakson, 2018, p. 369). Enabling governance approaches include policies that facilitate implementation of existing private governance interventions, which the ZDC study (Chapter 5) demonstrate the clear need for, or – as discussed above – regulatory or market-based approaches that get laggards on board while supporting or incentivizing leaders (Lambin et al., 2020). As the EU deforestation paper (Chapter 3) shows, there are several options available to public actors wishing to adopt an enabling role.

Finally, as evident from the ZDC study (Chapter 5), public governance should incentivize collaboration. Private governance in some ways resembles a prisoner’s dilemma: Anyone who adopts governance approaches risks losing out if others fail to adopt approaches, and so nobody adopts. Neither public nor private governance approaches can achieve significant impact through unilateral action, requiring multi-stakeholder approaches and other collaborative efforts. This also requires bringing in the financial sector, which plays a big role in financing deforestation (Forest500, 2021b; Galaz et al., 2018b; Picken et al., 2017), for example by instilling due diligence, transparency, or regulatory requirements on these actors (Chapter 3). Public and private actors play different roles according to the governance approach and the stage in the policy cycle (Lambin et al., 2014, 2020), requiring all actors to contribute,

but also to collaborate across the different stages. A central problem is that too many interventions have been made ad-hoc without coordination across actors and supply chains, as clearly illustrated by the different approaches to implementation of ZDCs and the general lack of frameworks and definitions. As brought up in the ZDC study (Chapter 5), collective action is crucial for enabling further action, as the complexity of agro-food commodity-driven deforestation require that multiple actors take action across different scales (e.g. supply chains, sectors, or jurisdictions). Here, public governance has a key role in setting the framework for this, mitigating risks of cartels and collusion, while ensuring facilitative conditions for companies to tackle problems collectively.

3.3. LAYERED GOVERNANCE

In a world of transnational, polycentric governance, public governance is not replaced by, nor does it replace, private governance. Instead, for mutual benefit, public and private governance engage in and interact with one another across various layers and at multiple scales (Djelic and Sahlin-Andersson, 2006). Private actors provide reach and leverage, and companies remain the principal agents of implementation, while public actors, through various approaches (Chapter 3), provide a framework for private actors to operate within, e.g. setting targets or mandating certain governance approaches. Public actors are uniquely placed to provide a contextual framework for governance to operate within, as they can shape market access, institutions, and actors within their borders (Bartley, 2014). Private actors widen this framework as they govern “beyond borders” by adopting governance approaches or strategies that they push across supply chains (Chapter 4 and Chapter 5). Such “layering” can leverage the strengths of both types of governance, as it, on the one hand, emphasises the unique role of public actors in establishing the framework for and enabling private governance, yet, on the other hand, leverages the strength and reach of private actors to implement across supply chains, while granting them the flexibility to do this according to the context in which they operate. In contrast to pure public or private governance, layering approaches can help realise co-benefits. For example, due diligence requirements on deforestation put forward by public actors (Chapter 3) and

company pledges to remove deforestation from supply chains (Chapter 5) have overlapping objectives, so supporting one approach automatically benefits the other. A development towards layered governance of agro-food supply chains thus provides opportunities for public and private actors to view their respective governance efforts not as competitors, but rather as different layers within a common framework.

4. TECHNOLOGICAL PROGRESS AND INNOVATION

In this thesis and in the academic papers it refers to, there are two recurring themes discussing how the advances and opportunities – and potential pitfalls – provided by technological development affect agro-food supply chain governance. Firstly, how technology can reduce supply chain complexity, for example through monitoring and verification, particularly through satellite-based approaches and advancements in supply chain traceability systems. Secondly, how these advances empower supply chain actors, for example by reducing information asymmetries and power imbalances, and enabling collective action.

4.1. REDUCING COMPLEXITY

The complexity and opacity of global agro-food commodity supply chains complicate governance, as discussed above (Chapter 61), as well as in the governance review (Chapter 2) and the empirical chapters (especially Chapter 3 and Chapter 5). An obvious solution to this is to provide tools to increase knowledge about supply chains through monitoring and data collection. As discussed in Chapter 2, there are numerous technological developments, from hardware, such as satellite monitoring, IoT devices, and in-field sensors, to software, such as AI, machine learning, and blockchain. The technologies are rapidly progressing, bringing the cost to a level where even relatively low-cost products, such as most agro-food commodities, can include tools, such as blockchain, satellite monitoring, or IoT devices across supply chains (Herrero et al., 2020; Lin et al., 2020; Sylvester, 2019).

Especially the advance of satellite technology has huge implications for the governance of agro-food commodity-driven deforestation, as it allows companies,

governments, and NGOs, among others, to monitor the world's forests with increasing detail. The empirical studies included here show that companies rely on monitoring systems to govern deforestation, e.g. being a cornerstone in their efforts to implement ZDCs (Chapter 5). The development of Global Forest Watch (GFW) by the World Resources Institute (2014) is the most prominent example of this. Beyond remote sensing images, GFW includes built-in alert systems and tools (e.g. Global Land Analysis and Discovery, GLAD) which allow companies to monitor and detect incidents in near-real-time and reduce the need for in-house specialists. This benefits in particular small companies, who are unlikely to have the resources to develop sophisticated systems in-house, while large companies frequently have specialised systems. Nestlé, for example, in collaboration with Airbus and the Earthworm Foundation, has developed "Starling", a system specifically tailored to its zero-deforestation efforts (Nestlé, 2018).

As the cost of high-resolution data and systems further reduces, both researchers and companies will be increasingly able to draw on these resources for detailed assessments of agro-food commodity-driven deforestation. For example, advancements will allow companies and NGOs to monitor particular concessions in real-time, or facilitate an increased understanding of the "big picture" and the relative role of different direct and underlying drivers. However, better satellite data alone is unlikely to halt deforestation. For example, Moffette et al. (2021) show that deforestation alerts do "not significantly change deforestation outcomes," and Nestlé's monitoring system has not prevented deforestation from occurring within its sourcing areas (Idle, 2021). Thus, it is important to use such data in combination with other efforts and keep the local context in mind. Knowing where deforestation occurs does not tell you why it happens and who is responsible. As the ZDC study (Chapter 5) discusses, monitoring helps illustrate that deforestation occurs, but it does not prevent it, and it must be combined with contextual data on land ownership and sourcing areas, for example, to enable better decision-making. Better data is a means to achieve better governance, not an end in itself.

Supply chain data collection efforts, notably Trase, show the power of increased information across agro-food commodity supply chains to tackle deforestation. For example, Trase data has been used to study the origin and deforestation risk of the Brazilian beef supply chain (zu Ermgassen et al., 2020a) and the stickiness of the Brazilian soy supply chain (Reis et al., 2020), among others providing insights into how supply chain configurations and patterns affect deforestation risks and governance opportunities. Gathering supply chain-related information, particularly to establish traceability, is a key part of private sector sustainability governance efforts, particularly for deforestation. As the coffee study (Chapter 4) showed, several companies engage in practices to establish a greater connection to source, either through direct trade efforts or by tracing coffee to particular countries, regions, or cooperatives. Traceability also provides an important part of companies' ZDC implementation efforts (Chapter 5); knowing where products are sourced enable downstream companies to take action to rectify any problems discovered upstream. Currently, developments are ad-hoc with many companies applying company-specific solutions. Third party-led traceability tools with minimal or no need for self-reporting by companies (Moran et al., 2020) would enable sector-wide uptake, reducing barriers especially for producers and smaller companies. Establishing supply chain traceability is extremely costly (Kim and Davis, 2016), as also noted by several actors in the ZDC implementation study (Chapter 5), but collective efforts and uniform frameworks for collecting and reporting data would probably reduce these costs. For example, supply chain data could be tagged with Harmonized System codes (Moran et al., 2020), as is currently done for customs data; the data type that Trase, for example, builds on. Companies and various sustainability initiatives could also be encouraged (even incentivized or mandated) to share data open access (Moran et al., 2020), which some companies have already started doing, e.g. publishing supplier lists.

Another aspect related to improving traceability and reducing supply chain complexity is the development of more novel technologies, in particular AI, blockchain, drones, and IoT devices. Innovative coffee companies have already begun to rely on supply chain tracking solutions based on blockchain and distributed ledger

technologies (Chapter 4), setting up systems across individual supply chains or establishing wider platforms (Bager et al., 2021b; Itten et al., 2020; Thiruchelvam et al., 2018). Companies are also experimenting with blockchain for ZDC implementation, both for traceability and grievance reporting (Chapter 5). As blockchain systems develop and become more integrated into agro-food supply chains, it seems likely that they will complement or be used in conjunction with existing governance approaches, most notably VSS. Blockchains can potentially address existing shortcomings of VSS, particularly related to data sharing and auditing (Köhler et al., 2021)³⁰.

Drones can be used for monitoring and rapid deployment, particularly for concessions and forest fires, as some companies are already doing (Chapter 5), but also show potential for production-related applications, e.g. monitoring forest diseases (Velásquez et al., 2020). Other technological innovations include AI, which some companies already apply as part of the ZDC efforts (Chapter 5). For example, chocolate company Barry Callebaut uses machine learning combined with remote sensing to identify HCS forests (Barry Callebaut, 2021). IoT devices, such as mini-computers and sensors, also provide novel opportunities for tracking agro-food commodities across supply chains. Sensors built into transport units, for example, coffee bags, would theoretically facilitate tracking between certain nodes in the supply chain, while also monitoring conditions such as temperature and humidity, reducing risks of spoilage (Antonucci et al., 2019; Astill et al., 2019; Bager et al., 2021b; Bakker and Ritts, 2018).

³⁰ In an article led by Susanne Köhler of Aalborg University (Köhler et al., 2021), we examine the interactions and outcomes between blockchain technologies and voluntary sustainability standards. We show that the two systems mostly co-exist alongside each other, but also that synergistic relationships, where the systems can reinforce each other, exist. However, we also identify potential risks of antagonistic developments, where the two systems compete to become the preferred governance approach across a particular supply chain. As blockchain-based systems are still in early adoption phases, we need more research to identify the long-term impact of blockchain on governance approaches, such as VSS.

4.2. EMPOWERING SUPPLY CHAIN ACTORS

Technological development can empower supply chain actors. As discussed in Chapter 2 and the coffee study (Chapter 4), actors across agro-food supply chains face severe power imbalances, as especially smallholders and other small-scale actors hold little leverage, while large manufacturers and retailers dominate supply chains. Similarly, consumers also often lack abilities to hold companies accountable for their actions due to missing information or inability to act on this information. The developments within technology can potentially address some of these power imbalances by providing actors with greater access to information and the ability to leverage this. Technology can also empower upstream producers and other local actors to actively participate in governing agro-food commodity supply chains. For example, Slough et al. (2021) show that equipping Indigenous Peoples' communities with technology-enabled remote monitoring of forests can reduce deforestation by identifying instances of illegal logging and mining.

Currently, actors across agro-food supply chains have vastly different access to and control over information about commodities. Giving consumers or regulators access to information about production practices and supply chain risks, as Trase for example does, gives them a much larger ability to hold companies accountable for the activities in their supply chains. Similarly, consumers currently have to trust various eco-labels, but, in fact, have very little information about upstream actors and practices involved in these schemes. Connecting supply chain actors, as certain transparency and traceability systems do – enabled by for example blockchain and IoT – allow consumers or other downstream actors to reward producers for specific practices, which provide producers with tangible benefits for adopting certain practices, e.g. avoiding deforestation. Along these lines, technology could for example be used to facilitate a sustainable commodity marketplace that would link producers to consumers through end-to-end traceability (Stanbury and Webb, 2021). Theoretically, such a platform could reduce sourcing costs (and thus transaction costs) for companies wanting to buy sustainable commodities (e.g. as part of their ZDC) and provide tangible economic benefits to producers, who struggle to reap the benefits of adopting

sustainable production practices, while providing the final consumer with increased information about their purchase, allowing them to forgo actors who continue to source products that violate sustainability standards, such as engaging in deforestation. In reality, there are of course numerous obstacles to establishing such systems, but technological developments and the reduced costs of using IoT devices and systems to trace commodities nonetheless make such solutions increasingly feasible.

If they have the means to utilize these, technology offers companies numerous possibilities, but it can also put already marginalized actors (producers, small companies, actors in the Global South, etc.) at a further disadvantage if they cannot afford the technologies adopted by richer actors. This resonates with the point made above that sustainability governance efforts must account for the different capabilities of companies, providing a role for other actors (NGOs or public) to step in to aid those actors lacking financial, technical, or human resources to adopt technology-enabled governance tools. Supporting technological development thus provide another means for public actors to foster governance of agro-food supply chains and empower smaller actors. As the EU policy study shows (Chapter 3), support for producer countries is politically feasible and could be combined with targeted supply chain traceability or monitoring efforts using various technological options already explored within various supply chains. Many agro-food supply chains are still largely paper-based which cause inefficiencies, high transaction costs, and information asymmetries. Advancing digitalization efforts could potentially reduce these problems, while better-integrating actors along supply chains. However, there are several obstacles to digitally integrating poor or marginalized areas, such as low internet connectivity and little ownership of digital assets, such as smartphones (Mehrabi et al., 2021). Tackling these problems requires broad-scale investments in social and economic development, which extends beyond the agro-food sector.

CONCLUSIONS

This section concludes the work presented in this PhD thesis. I begin by outlining the general findings and contributions made and then provide four specific arguments concluding on the work presented. Looking ahead, the next section provides perspectives on this research and point to future developments and research needs before providing policy recommendation.

1. FINDINGS

In this thesis, I addressed the question of sustainability governance within the agro-food sector from two perspectives, respectively, public and private governance. I presented an analysis of governance approaches for agro-food commodity supply chains (Chapter 2), an empirical investigation of policy options for the EU to reduce imported deforestation (Chapter 3), a sector-wide assessment of sustainability strategies in the global coffee sector (Chapter 4), and an in-depth analysis of companies' implementation of zero-deforestation commitments (Chapter 5), as well as a discussion of the various aspects affecting governance of agro-food commodity supply chains (Chapter 6). In the following, I offer my conclusions on the research presented here.

Analysing sustainability governance across the agro-food sector, I argued that approaches and instruments have evolved through three distinct, but overlapping “phases.” I focused especially on the recent shift to a combination of public and private instruments in what I termed “layered” governance, which I argued draws on the strengths of both public and private actors. It maintains the focus on private actors as the principal agents of governance implementation able to leverage change across agro-food supply chains, while placing this within a strong, regulatory framework, where governments enable governance by setting targets, mandating approaches, and providing support.

From a public governance perspective, I argued that to reduce deforestation resulting from activities across agro-food commodity supply chains, public actors must implement policies based on clearly elucidated and proven theories of change, taking the policy implementation context into account. In other words, policymakers and other public actors should employ policies proven to be successful in reducing deforestation and tailor policy design to the context. Using the EU as a case study, I identified 86 different policy options, but highlighted a potential trade-off between the political feasibility of the option and the potential impact on reducing deforestation. To overcome this trade-off, public actors can use policy mixes to create synergies and increase impact, as different policy options complement and reinforce each other. Further, I argued that as not all agro-food commodities contribute equally to deforestation, public actors should work with stakeholders in key supply chains and regions, broadening scope over time, as broad political and financial support in both producer and consumer countries is necessary to build the foundation for strong policy action and effective implementation of deforestation policies. Finally, I also emphasized the crucial role that public actors play in fostering agro-food supply chain governance. Public governance can enable private sector action by supporting, incentivizing, or mandating private sector governance initiatives and establish the framework within which private governance actors operate.

From a private-sector perspective, I argued that sustainability efforts are not yet mainstreamed across the agro-food sector. Sustainability problems are yet to take centre stage and many companies still pay lip service to sustainability – either failing publicly to pledge to address sustainability or struggling to implement their pledge and turn sustainability governance initiatives into tangible outcomes. Using the coffee sector as a case study, I showed that the sector remains divided in a mainstream market largely not or only weakly addressing sustainability challenges and a much smaller, sustainability-oriented niche market incorporating various sustainability governance approaches. I also showed that companies take different approaches to sustainability governance depending on their characteristics. At the same time, I found a glaring lack of action, as a third of all companies take no action to address sustainability and

several sustainability issues remain under-addressed. In this context, the lack of action on deforestation and climate change is particularly illustrative. I further showed that those companies taking action on deforestation face various challenges in implementing governance initiatives, while the characteristics of the companies and the role of different actors within and beyond companies affect governance outcomes. Different stakeholders shape companies' incentives for adopting governance approaches and the means with which they carry these out. On the one hand, companies fail to align the organization towards achieving the objective and do not commit sufficient resources, while leadership and external stakeholders do not provide adequate support. On the other hand, I argued that service providers support implementation, while NGOs' and civil society actors' ability to hold companies accountable is important for fostering governance – not only through coercive pressure and campaigning, but also by providing data and technological solutions that support efforts and provide traceability and transparency. In this regard, I argued that technology plays a key role in fostering deforestation governance, but that its role should not be overstated – it is not a silver bullet for solving all problems.

Following this, I conclude that it is not a lack of governance approaches, which hinders sustainability governance of agro-food commodities, in particular on deforestation. Companies adopt several different approaches, and governments have a vast array of options to choose from. While the amount (or relative share) of companies adopting governance approaches should increase, those that adopt can choose between several different options. Instead, I identified five specific challenges that complicate governance interventions and reduce overall effectiveness: information asymmetry and transaction costs; knowledge deficits; legitimacy; coherence; and policy interactions. In conclusion, I argue that the limited success of public and private actors to govern sustainability issues across agro-food commodity supply chains, in particular deforestation, is rather caused by insufficient attention to and a confluence of four specific factors: the complexity of the problem, the role of companies in contributing to governance, the role of states in framing governance, and the impact of technological progress and innovation in shaping governance.

Firstly, the complexity of the problem means that “one size fits none”, which require actors to pay close attention to the implementation context and adapt governance approaches to the specific case. Location, commodity production system, socio-economic factors, cultural context, and many other factors affect the drivers of deforestation. This makes it difficult to identify appropriate governance responses and analyse the resulting impact of implementing this, as public and private actors alike are likely to encounter indirect effects and other unintended or unanticipated consequences. The governance responses must account for these context-dependent factors when selecting the policy mechanisms and implementation pathways.

Secondly, companies play a crucial role in fostering sustainable land use governance, but there are obvious limits to voluntary efforts. There is widespread adoption of several governance approaches, and judging from the recent trend, an increasing share of companies choose to address sustainability risks, partly due to material and regulatory risks, partly due to stakeholder pressure. However, judging from adoption rates of sustainability across the coffee sector (Chapter 4) and among companies adopting ZDCs (Chapter 5), the scale of voluntary sustainability governance by companies is insufficient to address agro-food commodity-driven deforestation. Sustainability is not fully mainstreamed – neither within specific commodity supply chains nor across sectors and landscapes – and companies face serious challenges in implementing sustainability, i.e. turning governance pledges into tangible outcomes. There is thus a need for scaling up adoption while ensuring that it leads to implementation and eventual impact. To do this, stakeholders must hold companies accountable to their pledges, while supporting them when they face challenges. Here, both civil society and governments can make clear contributions. At the same time, company and supply chain characteristics’ influence sustainability adoption and expected outcomes. Thus, requirement of and support for private-sector action must take into account company characteristics. For example, small companies and large companies approach sustainability challenges differently. On the one hand, large companies have greater resources at their disposal but can face tremendously complex supply chains with engagement in multiple landscapes. On the other hand, while small

companies have limited resources, they can act faster and likely face less complex supply chains. Thus, while there is a need for regulation to provide a level playing field and ensure that free-riders or laggards take action, it must also be acknowledged – and here I paraphrase the climate change governance credo – that companies have common, but differentiated capabilities and responsibilities to govern agro-food supply chains.

Thirdly, public governance plays a crucial role in addressing deforestation, particularly by levelling the playing field and enabling further action. The advent of private, “market-driven” governance put public sustainability governance on the back-burner. Although the state never formally left sustainability governance, the findings of this thesis indicate that “bringing back” the state (and thus public governance) is important to foster governance. This does not mean that regulatory state-led governance should replace private, market-driven efforts. Rather, it means that public and private actors should engage in “layered” governance to build on the strengths of both approaches. Private actors are the principal implementation actors and can leverage change across agro-food supply chains, but they require support from public actors able to shape markets and institutions. When private sector governance is already underway, public governance can support existing initiatives. When action is lacking, it can coerce those actors not sufficiently engaged to ensure sector-wide uptake of governance efforts. Private approaches can thus be placed within a strong, regulatory framework, where governments enable governance by setting targets, mandating approaches, and providing support and ensures that private governance approaches contribute to meeting public objectives and vice versa.

Finally, technological progress and innovation can reduce the complexity of agro-food supply chains and aid actors’ efforts to implement governance approaches. Technological development enables new ways of collecting and analysing data across agro-food supply chains, and there is a clear need to advance these, particularly to further understand how these technologies affect supply chain actor relationships and what implications these technologies will have for supply chain sustainability outcomes. Increased capacity to monitor or trace supply chains, for example, are

necessary preconditions for governing complex supply chains. At the same time, technology can empower actors along supply chains, e.g. by increasing information access and reducing information asymmetries and power imbalances. Although technology can address some existing governance challenges, it is no silver bullet for achieving supply chain sustainability. It is important to separate techno-optimism from “true” governance benefits actually achieved across agro-food supply chains by studying where, how, and to whom technology can make a difference.

While it will not solve all sustainability problems facing agro-food supply chains, I argue that considering these four factors can help foster governance of sustainability issues across agro-food commodity supply chains. Doing so requires future research to address knowledge gaps and additional action by private and public actors. In the final two sections of this thesis, I address these aspects. First, I outline the contributions made in this thesis and identify the future research needs and policy implications that it gives rise to. I end by providing several policy recommendations for public and private actors.

2. CONTRIBUTIONS

This thesis is undoubtedly applied or, for lack of a better term, policy-oriented. Nonetheless, I provide some academic contributions, both theoretically and methodologically, which I briefly outline below. The work is aimed particularly at scholars from two disparate fields. GVC and other social science scholars, who are interested in the environmental implications of (agro-food) supply chains, which much GVC literature tend to ignore, and land system scientists, who are interested in understanding how the evolving understanding of land system dynamics can inform tangible policy changes or “real-life” outcomes. As the only academic group, who has a stake in each camp, economic and development geographers will hopefully also find this interesting, but as I do not directly draw on any of the theoretical schools within this field, I claim no direct contribution.

For scholarship on GVC and corporate sustainability, I contribute to our understanding of the extent to which companies adopt sustainability practices and how differences in company structure and stakeholders affect sustainability strategy selection and implementation. On the first point, I show that although sustainability is getting traction across several sectors and stakeholder groups, it is not fully mainstreamed. Even in a “progressive” sector, such as coffee, sustainability can in many ways still be analysed as a niche phenomenon, even if widely discussed. I also show that regional differences matter, indicating that it is not enough to think about “niche” and “mainstream” markets, but that location should also be factored in. As such, in two different studies, I show that companies’ stakeholders shape adoption of governance. In this, it becomes clear that stakeholders, most notably consumers and NGOs, actually have the power to influence company actions; at least among certain companies, though the results indicate that stakeholders’ influence is part of a wider assessment of the risk that the company is exposed to (regulatory risk, stakeholder pressure, etc.). Unlike much research on this topic, I take this a notch deeper by also focusing on how companies implement specific sustainability strategies. A surprisingly scant amount of evidence exists on this topic. With the in-depth analysis of companies’ rationale for tackling governance problems using particular solutions or approaches, I hope to inspire other researchers to delve further into the link between governance solutions, implementation structures, and eventual real-world outcomes. In this, I show that while companies can share a governance objective (e.g. reduce deforestation), their respective company characteristics, including value chain position and stakeholders, affect how they seek to meet this objective (how, with what resources, and using what instrument). I also show that the most adopted instrument, VSS, is seeing increasing competition from private approaches, and could face even further competition from due diligence regulation, depending on how regulators decide to design this. This echoes a finding by Thorlakson (2018), who also identifies a move beyond certification. This has important implications, both for the various institutions owning these standards, but also for the internal relationships and power structures across supply chains. Bringing instrument ownership into the hands of

already powerful (downstream) lead firms could further strengthen their leverage over the supply chain; a risk, which require further examination.

For land system scientists, my research does not directly advance our collective understanding of drivers or outcomes of deforestation but rather identifies various research gaps related to deforestation dynamics (see next section). In this, I show that for several governance approaches, we lack a thorough understanding of how they affect change, i.e. what the so-called ‘theory of change’ for each approach is. I also show that though much research has been conducted on the drivers and responses to deforestation, there are several approaches for which we lack systematic assessments and evaluations of impact. Especially, my research points to the need for assessments of novel public governance approaches, such as due diligence mechanisms and popular private sector approaches, such as voluntary zero-deforestation commitments. On this topic, I also illustrate that a key condition for achieving reductions in deforestation is to ensure that companies implement their various governance commitments.

Unrelated to land system science, but sitting squarely within governance literature more broadly, I highlight a gap in our understanding of implementation. I address this by showing the importance of understanding implementation as inextricably linked to effectiveness and real-life outcomes, as well as the significant challenges that companies face in this. In this, I point to implementation as an area that requires further studies, also beyond agro-food supply chains and deforestation. On governance, I also show that feasibility is an important determinant of policy adoption and thus outcome, but that it is extremely difficult to quantify or measure this.

Not directly placed within any of the above fields, I contribute to the discussion on how the technological advances within agro-food supply chains affect governance approaches and outcomes. Companies are rapidly adopting various technological solutions, fuelling risks of techno-optimism, but also opening up possibilities for addressing problems, which hitherto seemed either unsurmountable or ungovernable. A notable example is the possibility of using technology to trace commodities across supply chains in great detail, enabling both accountability and a greater understanding

of the way supply chain structures affect biophysical outcomes, such as deforestation. On this topic, several research fields, particularly within social science and engineering, can hopefully benefit from the various discussions and considerations that I present here.

Throughout this thesis, I deliberately sought to avoid distilling or developing a grand theory or framework for agro-food supply chain governance. Rather, I highlight the numerous different governance approaches that actors adopt to shape agro-food system outcomes and the various theoretical lenses through which one can analyse the conditions for and enablers of agro-food supply chain governance (Boström et al., 2015). Adopting this theoretically “pluralistic” approach has pros and cons. On the one hand, I become more aware of the theoretical biases that (in my view) risk affecting research very clearly belonging to a particular school of thought. By always seeing the world in a particular way, for example through a “Global Value Chains” or “Telecoupling” lens, such research risks putting the cart in front of the horse, i.e. forcing the problem to adapt to the theory, rather than choosing the theory that best explains the problem. A pluralistic approach also enables me to distil learnings from several areas that directly or indirectly contribute to research on agro-food supply chains. For example, a telecoupling approach helps identify the different systems that agro-food supply chains link and frame the understanding that governance approach must account for these, while a GVC approach illustrates the power differentials among the actors operating across these supply chains and the implications that these differences give rise to. On the other hand, by drawing on multiple theories, it becomes more difficult to clearly identify the theoretical contributions that I make. Both because it is harder to cover several rather than one set of literature and because the research risks appearing as ad-hoc fragments that lack a proper scaffolding to support the arguments presented.

3. FUTURE RESEARCH

Here, I provide a final reflection on what this thesis' contributions imply for future research needs on the governance of agro-food supply chains. While the collective knowledge and understanding constantly evolve – an outcome I hope this work has contributed to – it is also clear that there are areas where further work should engage. I point to five particular areas, where – despite the contributions made here – there is still a need of further advances: i) data availability, access, and coverage of agro-food supply chains and commodity-driven deforestation; ii) agro-food sector company-specific research; iii) regulatory and market conditions for governing agro-food supply chains and deforestation; iv) empirical evidence and theoretical support for particular governance approaches; v) multidisciplinary approaches and collaboration; and vi) policy relevance and applicability of agro-food supply chain deforestation and sustainability governance-related studies.

Firstly, this research illustrates a need for better availability of, access to, and coverage of data linked to agro-food commodity supply chains and sustainability impacts, such as deforestation. Here, I relied on company-specific data for two studies (Chapter 4 on coffee and Chapter 5 on ZDCs), which both take company actions as a starting point to show that company- or sector-specific studies can help further the understanding of agro-food supply chain governance. In both cases, collecting data on companies and sectors was very difficult and cumbersome, and was hampered by a lack of central repositories with common indicators. This lack of company-specific data and commonly agreed-upon sources for collecting this makes it difficult to study the role of specific companies in driving and governing, respectively, agro-food commodity-driven deforestation and other sustainability-related issues. One solution to this, as also explicitly mentioned in the coffee study (Chapter 4), is to establish common, mandatory reporting frameworks, enabling comparison across companies and sectors. Kareiva et al. (2015, p. 7375) also advocate for this, arguing that “corporate reporting frameworks need to develop scientifically informed standards that consistently consider land use and land conversion.” Within ZDCs, initiatives such as the Accountability Framework initiative have begun to address this, but as the

ZDC study (Chapter 5) and data collected by NGOs (Forest500, 2021a) showed, company reporting on this remains ad-hoc and inconsistent and largely dependent on individual company preferences.

Getting better data on companies' efforts – be it on deforestation or sustainability in general – would enable researchers to conduct studies comparing and contrasting companies, identifying where and how improvements could be made and attributing specific issues to individual companies. The specificity and coverage of data are important to gain a better understanding of specific agro-food commodity supply chains and the companies operating these. Most existing approaches have various limitations that reduce their applicability for studying agro-food commodity supply chains and their environmental impacts. For example, life-cycle assessments rely on samples or averages, which makes it very difficult to consider geographical differences in production systems or risk of deforestation, for example, while footprint analyses and similar approaches are spatially coarse due to their reliance on national data and sector averages, which limits their applicability for specific supply chain assessments (Godar et al., 2016). Telecoupled problems, such as deforestation, vary between regions, commodities, and supply chains, making spatially-, temporally- and commodity-explicit data necessary to attribute outcomes to different actors. As such, high-resolution geospatial data in combination with supply chain-specific information plays a central role in linking specific commodity supply chains (and their actors) to changes in forest cover and furthering the understanding of the interactions between agro-food commodity production, trade, and deforestation (Godar et al., 2016; Ortiz et al., 2021).

Important initiatives, such as Trase, have made great strides toward this and already supported many important research outputs, among others Green et al. (2019); Reis et al. (2020); and zu Ermgassen et al., (2020a, 2020b), as have several other related studies also relying on trade data to study commodity-driven deforestation, for example, Henders et al. (2015); Kastner et al. (2011); Pendrill et al. (2019a); (2019b); and Persson et al. (2014). However, most assessments are made at the macro-scale, as much data are still only available at a national level (Godar et al., 2016). This lack of

data makes sub-national or local analysis difficult, and the links between specific companies and commodity-driven deforestation are only now starting to be uncovered, for example using Trase data; see e.g. zu Ermgassen et al. (2020a).

Secondly, the research I present here further underscore the point that company- and sector-specific research is crucial to further our collective understanding of agro-food commodity supply chain governance. Companies offer a rich source of data, but they are also obvious stakeholders and natural study subjects. As I showed here, studying companies can help to identify problems (“only a third of companies address sustainability”; Chapter 4), confirm (or reject) theoretical presuppositions (“stakeholders affect sustainability strategies”; Chapter 4), or help identify solutions (“levelling the playing field facilitates ZDC implementation”; Chapter 5). However, there is a paucity of studies studying companies’ sustainability efforts, especially as empirical subjects, rather than as object targeted by study results. While the distinction is obviously blurry, the difference between the two types of study is that in the former, companies are the empirical subjects (e.g. sources of data, cases, etc.), and in the latter, they are a collective object affected by the study (e.g. identified as the sources of a problem or as agents who can affect change).

Goldstein and Newell (2019) reviewed almost 11,000 studies related to supply chains and private companies. Only 57 focused on individual companies, and only 27 were academic papers, while the rest came from NGOs. This is also illustrative of much current research on agro-food supply chains and deforestation. Cross-sector and company-specific knowledge mainly come from NGO reports and initiatives, such as Forest500 (2021a) or Supply Change (Forest Trends, 2019). While they are useful for accountability purposes, they often lack the rigour and depth of academic work, as NGO reports remain fairly descriptive, thus failing to uncover the causal mechanisms behind their findings. Particularly, understanding of ZDC efforts and limitations would benefit from large-n studies like the coffee sector study included here (Chapter 4) or the systematic evaluation of supply chain sustainability efforts reported in Thorlakson et al. (2018a). Naturally, quantitative approaches must be complemented by case-based research diving into specific commodities, companies,

or sectors, similar to the chapter on ZDC implementation included here (Chapter 5). Conditions vary within and across commodities, companies, or sectors, and there is a need to better understand the motivations, barriers, opportunities, and context-specific issues that prevent or foster sustainable land use and reduced deforestation within these. Given the scale and scope of companies' operations across the agro-food sector, companies have profound impacts on adoption and outcomes of governance approaches, making studies of companies a potent, but vastly underexplored area (Goldstein and Newell, 2019).

Thirdly, the research presented here highlight the importance of understanding the regulatory and market conditions for governing agro-food supply chains to reduce sustainability challenges, such as deforestation. To effectively govern commodity flows across supply chains requires enabling regulatory conditions and market incentives, but as the ZDC study (Chapter 5) showed, existing conditions do not sufficiently foster agro-food supply chain governance. There is a large literature on forest governance focusing on issues such as community governance and tenure, just as scientists have studied climate and global environmental governance for decades, but we need to broaden this perspective to include the link between agro-food commodity supply chains and forest and land-use outcomes on the ground. This requires further assessing the broader regulatory and market conditions for governing agro-food supply chains and in particular the relationship between public policies and private governance efforts (Munroe et al., 2019). This requires tackling questions such as how public efforts can support private approaches or which regulatory interventions would strengthen voluntary private efforts. Here, I began unpacking these questions through identification of public policy options (Chapter 3) and lacking regulatory conditions (Chapter 5), but these questions require additional, systematic research across different supply chains, commodities, and regions.

Fourth, there is a need for additional empirical evidence and theoretical support for particular governance approaches. This especially concerns novel public governance approaches, such as due diligence mechanisms and popular private sector approaches, such as voluntary zero-deforestation commitments. Several disciplines study

deforestation and agro-food commodities from different starting points. Several studies focus on particular aspects related to classifying, measuring, attributing, or otherwise quantifying deforestation, using, for example, remote sensing (see e.g. Murad and Pearse (2018); Sarzynski et al. (2020); or Winkler et al. (2021)), supply chain (see e.g. Green et al. (2019); Reis et al. (2020); or zu Ermgassen et al. (2020a)), or modelling approaches (see e.g. Kastner et al. (2012, 2014); Sandström et al. (2018); or Schaffartzik et al. (2015)). Thus, while the extent and the drivers of deforestation are extremely well understood, the evidence on the impact of, theoretical support for, and causal mechanisms behind various governance approaches is insufficient. An exception is voluntary sustainability standards, which are the best-studied deforestation governance mechanism, though most of the literature on this deals with livelihood and general ecological impacts, rather than deforestation per se. For several governance approaches, most notably the current “fads”, such as ZDCs and due diligence, there is a need for in-situ studies with clear counterfactuals. Many of these approaches would also benefit from studies that explore the theory of change and theoretical propositions underlying these interventions; how are they intended to work, and what conditions can further or hinder this. The study of ZDC implementation (Chapter 5) provides a clear example of how research can further our understanding of various aspects of these relatively less studied governance approaches. In this, here I also show that actors adopt many of these approaches in polycentric governance landscapes, which points to a need for further studying how different approaches affect each other and what this means for their effectiveness, legitimacy, fairness, costs, etc. There is thus scope for numerous fields to tackle various aspects of agro-food supply chain and deforestation governance; from analysing the effect of various interventions in situ to assessing potential issues on equity or fairness of approaches to reducing agro-food commodity-driven deforestation to illuminating and testing the theory of change, many aspects of agro-food supply chain and deforestation governance remain under-researched.

Fifthly, and related to points two and three above, improving governance of agro-food supply chains, particularly as it relates to deforestation, require multidisciplinary

approaches and cross-collaboration. Here, I took a starting point in land system science, but engaged with theories from various social science fields. However, to a large extent, research still takes place in disciplinary silos, where scholars read and collaborate with only a narrow subset of academics, which illustrate the scope for increased multidisciplinary collaboration. Collaborative, multidisciplinary research is essential to understand the complexity of agro-food commodity-driven deforestation. Research is emerging – see for example Bastos Lima et al. (2021) – but there is scope for additional, systematic collaborations across fields and disciplines. Land system science, which is already a diverse research branch encompassing geographers, biologists, anthropologists, political scientists, and various other disciplines, provides a great starting point for such collaboration. Beyond interdisciplinary work, it also includes combining different methods, e.g. using mixed-methods approaches or combining large-n quantitative studies (Chapter 4) with qualitative insights from small-n studies (Chapter 5) or modelling approaches, e.g. linking economic and biophysical models, as well as undertaking integrated assessments. Research on deforestation governance could include and draw upon expertise and approaches from ecology, economy, climatology, political science, business, engineering, geography, anthropology, history, and many more.

Multidisciplinary research would likely also benefit from increased cross-sector collaboration with non-academic actors, particularly companies and NGOs. These actors possess knowledge and data, which could help further our collective understanding of deforestation and how to govern this, and as the EU policy study (Chapter 3) shows, these actors are engaged in the issue and have several opinions about how to address it. Further, as discussed above and demonstrated by both the coffee sustainability study (Chapter 4) and the ZDC implementation study (Chapter 5) engaging with non-state, non-academic actors, such as companies and their representatives, provide a novel source of data and contextual information, which land system scientists – with few exceptions – have largely overlooked.

Geographers and land system scientists generally focus much more on the upstream part of the value chain, particularly the land use outcome and the people farming or

owning the land. Grabs and Carodenuto's (2021) research agenda on traders as sustainability agents is an interesting example of an approach tackling a part of the supply chain which has so far been largely overlooked. It would be interesting to combine insights from the upstream part of the supply chain with research engaging with midstream and downstream actors, such as traders, manufacturers, retailers and consumers, to better understand the connection between downstream actors' decisions and land-use outcomes on the ground. I contributed to this in various ways, for example by connecting the concept of ZDCs to strategic company decisions (Chapter 5) and shedding light on the extent, adoption, and drivers of sustainability practices across companies (Chapter 4). These findings provide some insights into the link between land use and company sustainability governance, but increased engagement with and reliance on companies and NGOs could likely contribute further to this.

The sixth and final perspective pertains to the policy relevance and applicability of deforestation governance studies. Here, I presented three examples of applied and – to some extent – normative research, which beyond furthering our theoretical understandings of various actors' approaches to agro-food supply chain governance also distil clear, policy-relevant findings. As most clearly demonstrated by the EU policy study (Chapter 3), research on agro-food commodity-driven deforestation and other land use and sustainability governance is politically relevant and can be used politically. That science is politically relevant becomes especially clear considering the urgent need to reduce greenhouse gas emissions or reduce deforestation and the targets to do so set by various private companies and public actors (local, state, and national governments) and as enshrined in various global agreements and collective aspirations. This means that we as researchers should acknowledge that our research can contribute to and provide solutions for meeting these targets, which inevitably adds normative elements to much of our research practice (Nielsen et al., 2019). The latter point, that science can be used politically, makes this even clearer. It means that as researchers, we must be aware of how our research is and can be put to use politically. Not providing explicit (normative) recommendations is also a political choice and can have political consequences, just as our research can be used as means

to further ends that we might not agree with ethically or political. The use of and discourse around the research on climate change has made this abundantly clear.

These two aspects imply that studies on agro-food supply chain or deforestation governance should consider whether and how the findings generated by these studies can be included in or contribute to policy processes. Both how the research can be used to inform policy-makers, NGOs, companies, and other stakeholders, but also how these actors will get access to this information. A particular case in point is to make research available and accessible. There are several ways to do this, for example by distributing articles to relevant stakeholders (civil society, industry, policymakers, NGOs, etc.) or by distilling policy-relevant findings in policy briefs, white papers, or news articles, as was the case for the EU policy study (Chapter 3) – see Bager and Persson (2021). Finally, academics can contribute to the policy discussion through more opinionated academic articles, which provide another avenue for engaging with a wider and more policy-oriented audience. An example of the latter is the EU-Mercosur article (Kehoe et al., 2020), which I co-authored and to which this research contribute. No matter the form, disseminating the insights provided by academic work is crucial to further our collective ability to reduce commodity-driven deforestation through governance interventions.

4. POLICY IMPLICATIONS AND RECOMMENDATIONS

Agro-food commodity supply chains' contribution to deforestation, particularly across the tropics, is a difficult problem to address. With its cross-sectoral and telecoupled dimensions and its political, social, economic, and historical undercurrents and drivers, it has many of the characteristics of a 'wicked' problem. As previously argued, conventional single-actor or single-sector unilateral governance approaches led by states or private sector actors are insufficient to address complex problems such as agro-food commodity-driven deforestation and thus unlikely to make a big difference (Lemos and Agrawal, 2006; Underdal, 2010). This research supports this conclusion. Similarly, we cannot expect technological "quick-fixes" to solve the problem. Rather, addressing such a complex and large problem

requires targeting the underlying drivers of the problem. While I do not posit to have the ultimate answer to the problem, I nonetheless point to various interrelated aspects, which can help foster agro-food supply chain governance. These include:

Intervene at multiple levels

There is no ‘silver bullet’ solution for delivering zero deforestation. Interventions are required at multiple levels and by multiple actors (UNDP, 2019).

Support transparency and traceability

Opaque supply chains, unclear connections, and complex structures are clear obstacles to fostering governance and delivering zero deforestation. Actors need to support transparency and traceability initiatives to fully realise the enabling potentials that this information brings.

Support producer countries

Agro-food supply chains extend across numerous jurisdictions in both producer and consumer countries. While consumer countries (for the most part) can afford to take action, producer countries need support to engage actors across diverse production systems.

Create awareness in emerging markets

Awareness of agro-food supply chain sustainability issues is still comparatively low across many emerging markets. With increasing demand from these markets, actors must be made aware of potential sourcing risks along agro-food supply chains. NGOs play a crucial role in supporting this.

Public-private partnerships create win-win situations

While governments and private sector actors can be suspicious of each other (UNDP, 2019), the governance approaches studied here and the turn to “layered” governance suggest collaboration can foster “win-win” situations.

Support multistakeholder action

Pre-competitive collaborations and multi-stakeholder partnerships can mobilise resources and align diverse actors behind a shared vision and agenda. Governments must balance these options against competition laws and risks of collusion, while educating and raising awareness of the potentials and risks of these approaches.

Technology is a means, not an end

Technology can enable governance by reducing complexity and empowering actors. But technology is a means to governance, not an end in itself. Clarifying this can reduce the risks of “techno-optimism” and help identify cases where technology can make a clear and tangible contribution.

Raise the floor by setting minimum requirements

Agro-food supply chains operate in a system where niche sustainability markets are surrounded by a vast range conventional markets. This creates leakage and allows free-riding. To put responsible companies at commercially equal terms requires “raising the floor” (UNDP, 2019) by making laggards adhere to minimum requirements.

Go beyond voluntary approaches

Decades of research document the disappointing outcome of relying only on voluntary governance approaches. There is a need to hold actors accountable for their impacts and demand tangible action.

Require government regulation

In the market-driven, neoliberal phase, regulation was largely absent across many markets. Today, it is increasingly acknowledged that it is necessary. As clearly shown here, governments must regulate to ensure sufficient action. If not enforced, monitored and sanctioned by public governance, it is unlikely that we will see real change on the ground. Without regulation, adoption will remain confined to a few, responsible actors operating in “niche” markets.

Leverage private actors' reach and capacity

Companies, especially MNCs, have enormous reach and influence across agro-food supply chains. Leveraging this can amplify the impact of governance. Companies should be allowed flexibility in adopting and implementing governance, but required to take action within a clearly defined set of targets and objectives.

Establish data collection and reporting frameworks

Establish consistent, sector-wide, mandatory data collection and reporting frameworks for companies to report their sustainability efforts and governance approaches. This can help identify whether targets are met, enables comparison across companies and sectors, and fosters accountability.



The author at work in the field. Photo credit: S. Bager.

REFERENCES

- Abbott, K. W. and Snidal, D.: The governance triangle: Regulatory standards institutions and the shadow of the state, *Polit. Glob. Regul.*, 44–88, 2009.
- Abeyratne, S. A. and Monfared, R. P.: Blockchain ready manufacturing supply chain using distributed ledger, *Int. J. Res. Eng. Technol.*, 05(09), 1–10, doi:10.15623/ijret.2016.0509001, 2016.
- Agrawal, A., Hajjar, R., Liao, C., Rasmussen, L. V. and Watkins, C.: Editorial overview: Forest governance interventions for sustainability through information, incentives, and institutions, *Curr. Opin. Environ. Sustain.*, 32, A1–A7, doi:10.1016/j.cosust.2018.08.002, 2018.
- Alda, M.: Corporate sustainability and institutional shareholders: The pressure of social responsible pension funds on environmental firm practices, *Bus. Strateg. Environ.*, 28(6), 1060–1071, doi:10.1002/bse.2301, 2019.
- Alexander, P., Rounsevell, M. D. A., Dislich, C., Dodson, J. R., Engström, K. and Moran, D.: Drivers for global agricultural land use change: The nexus of diet, population, yield and bioenergy, *Glob. Environ. Chang.*, 35, 138–147, doi:10.1016/j.gloenvcha.2015.08.011, 2015.
- Alix-Garcia, J. and Gibbs, H. K.: Forest conservation effects of Brazil's zero deforestation cattle agreements undermined by leakage, *Glob. Environ. Chang.*, 47(February), 201–217, doi:10.1016/j.gloenvcha.2017.08.009, 2017.
- Amaral, D. F., de Souza Ferreira Filho, J. B., Chagas, A. L. S. and Adami, M.: Expansion of soybean farming into deforested areas in the amazon biome: the role and impact of the soy moratorium, *Sustain. Sci.*, (0123456789), doi:10.1007/s11625-021-00942-x, 2021.
- Amsterdam Declaration Partnership: Amsterdam Declaration: "Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries", (December 2015), 2015.
- Andersson, E.: The role of science in finding solutions to wicked, systemic problems, *Ambio*, doi:10.1007/s13280-021-01525-x, 2021.
- Andreotti, F., Speelman, E. N., Van den Meersche, K. and Allinne, C.: Combining participatory games and backcasting to support collective scenario evaluation: an action research approach for sustainable agroforestry landscape management, *Sustain. Sci.*, (0123456789), doi:10.1007/s11625-020-00829-3, 2020.
- Angelsen, A.: Policies for reduced deforestation and their impact on agricultural production, *Proc. Natl. Acad. Sci.*, 107(46), 19639–19644,

doi:10.1073/pnas.0912014107, 2010.

Angelsen, A.: REDD+ as Result-based Aid: General Lessons and Bilateral Agreements of Norway, *Rev. Dev. Econ.*, 21(2), 237–264, doi:10.1111/rode.12271, 2017.

Angelsen, A. and Kaimowitz, D.: *Agricultural Technologies and Tropical Deforestation*, 2001.

Antonucci, F., Figorilli, S., Costa, C., Pallottino, F., Raso, L. and Menesatti, P.: A review on blockchain applications in the agri-food sector, *J. Sci. Food Agric.*, 99(14), 6129–6138, doi:10.1002/jsfa.9912, 2019.

Arima, E. Y., Richards, P., Walker, R. and Caldas, M. M.: Statistical confirmation of indirect land use change in the Brazilian Amazon, *Environ. Res. Lett.*, 6(2), doi:10.1088/1748-9326/6/2/024010, 2011.

Askew, B. K.: Nestlé targets palm oil deforestation with ‘ game- changing ’ satellite monitoring tech, , (December 2018), 8–9, 2020.

Assunção, J., Gandour, C., Rocha, R. and Rocha, R.: The Effect of Rural Credit on Deforestation: Evidence from the Brazilian Amazon, *Econ. J.*, 130(626), 290–330, doi:10.1093/ej/uez060, 2020.

Astill, J., Dara, R. A., Campbell, M., Farber, J. M., Fraser, E. D. G., Sharif, S. and Yada, R. Y.: Transparency in food supply chains: A review of enabling technology solutions, *Trends Food Sci. Technol.*, 91(December 2018), 240–247, doi:10.1016/j.tifs.2019.07.024, 2019.

Auld, G.: Assessing certification as governance: Effects and broader consequences for coffee, *J. Environ. Dev.*, 19(2), 215–241, doi:10.1177/1070496510368506, 2010.

Auld, G.: Private market-based regulations: What they are, and what they mean for land-use governance, *Rethink. Glob. L. use an urban era*, 217–238, 2013.

Auld, G.: Confronting trade-offs and interactive effects in the choice of policy focus: Specialized versus comprehensive private governance, *Regul. Gov.*, 8(1), 126–148, doi:10.1111/rego.12034, 2014a.

Auld, G.: *Constructing Private Governance: The Rise and Evolution of Forest, Coffee, and Fisheries Certification*, Yale University Press, New Haven, CT., 2014b.

Auld, G., Gulbrandsen, L. H. and McDermott, C. L.: Certification Schemes and the Impacts on Forests and Forestry, *Annu. Rev. Environ. Resour.*, 33(1), 187–211, doi:10.1146/annurev.environ.33.013007.103754, 2008a.

Auld, G., Bernstein, S. and Cashore, B.: The New Corporate Social Responsibility, *Annu. Rev. Environ. Resour.*, 33(1), 413–435, doi:10.1146/annurev.environ.32.053006.141106, 2008b.

Austin, K. G. G., Mosnier, A., Pirker, J., McCallum, I., Fritz, S. and Kasibhatla, P. S. S.: Shifting patterns of oil palm driven deforestation in Indonesia and implications for zero-deforestation commitments, *Land use policy*, 69(1–2), 41–48, doi:10.1016/j.landusepol.2017.08.036, 2017.

Azevedo, A. A., Stabile, M. C. C. and Reis, T. N. P.: Commodity production in Brazil: Combining zero deforestation and zero illegality, *Elem. Sci. Anthr.*, 3, 000076, doi:10.12952/journal.elementa.000076, 2015.

Bager, S. and Persson, M.: The EU and tropical deforestation, *Ecologist* [online] Available from: <https://theecologist.org/2021/apr/01/eu-and-tropical-deforestation> (Accessed 8 May 2021), 2021.

Bager, S. L.: Unintended or unanticipated? The Indirect Greenhouse Gas Effects of Wood Pellet Consumption for Energy Generation, University of Copenhagen., 2016.

Bager, S. L. and Lambin, E. F.: Sustainability strategies by companies in the global coffee sector, *Bus. Strateg. Environ.*, bse.2596, doi:10.1002/bse.2596, 2020.

Bager, S. L., Persson, U. M. and dos Reis, T. N. P.: Eighty-six EU policy options for reducing imported deforestation, *One Earth*, 4(2), 289–306, doi:10.1016/j.oneear.2021.01.011, 2021a.

Bager, S. L., Düdler, B., Henglein, F. and Wu, H.: Event-based Sustainable Commodity Supply Chains on Blockchain, *Front. Blockchain*, (Under rev, 2021b).

Bager, S. L., Singh, C. and Persson, U. M.: Blockchain is not a silver bullet for supply chain sustainability, Unpublished, 2022.

Bair, J.: Global Capitalism and Commodity Chains: Looking Back, Going Forward, *Compet. Chang.*, 9(2), 153–180, doi:10.1179/102452905X45382, 2005.

Bair, J. and Palpacuer, F.: CSR beyond the corporation: Contested governance in global value chains, *Glob. Networks*, 15(s1), S1–S19, doi:10.1111/glob.12085, 2015.

Bakker, K. and Ritts, M.: Smart Earth: A meta-review and implications for environmental governance, *Glob. Environ. Chang.*, 52(November 2017), 201–211, doi:10.1016/j.gloenvcha.2018.07.011, 2018.

Baltensperger, M. and Dadush, U.: The European Union-Mercosur Free Trade Agreement: Prospects and risks, , (September) [online] Available from: https://bruegel.org/2019/09/the-european-union-mercotur-free-trade-agreement-prospects-and-risks/%0Ahttps://bruegel.org/wp-content/uploads/2019/09/PC-11_2019.pdf, 2019.

Balzarova, M. A. and Cohen, D. A.: The blockchain technology conundrum: Quis custodiet ipsos custodes?, *Curr. Opin. Environ. Sustain.*, 45, 42–48, doi:10.1016/j.cosust.2020.08.016, 2020.

Barjolle, D., Quiñones-Ruiz, X. F., Bagal, M. and Comoé, H.: The Role of the State

for Geographical Indications of Coffee: Case Studies from Colombia and Kenya, *World Dev.*, 98, 105–119, doi:10.1016/j.worlddev.2016.12.006, 2017.

Barlow, J., Berenguer, E., Carmenta, R. and França, F.: Clarifying Amazonia's burning crisis, *Glob. Chang. Biol.*, 26(2), 319–321, doi:10.1111/gcb.14872, 2020.

Barry Callebaut: Using artificial intelligence to develop an industry first solution for landscape mapping, Barry Callebaut website [online] Available from: <https://www.barry-callebaut.com/en-DK/group/media/news-stories/artificial-intelligence-against-deforestation> (Accessed 11 May 2021), 2021.

Barry Callebaut, Fairtrade International, Mars Wrigley, Mondeléz International, Rainforest Alliance and VOICE: Joint position paper on the EU's policy and regulatory approach to cocoa., 2019.

Bartley, T.: Transnational Governance as the Layering of Rules: Intersections of Public and Private Standards, *Theor. Inq. Law*, 12(2), 517–542, doi:10.2202/1565-3404.1278, 2011.

Bartley, T.: Transnational governance and the re-centered state: Sustainability or legality?, *Regul. Gov.*, 8(1), 93–109, doi:10.1111/rego.12051, 2014.

Bartley, T.: Transnational standards and empty spaces, in *Rules without rights*, pp. 1–36, Oxford University Press, Oxford, UK., 2018.

Bastos Lima, M. G. and Persson, U. M.: Commodity-Centric Landscape Governance as a Double-Edged Sword: The Case of Soy and the Cerrado Working Group in Brazil, *Front. For. Glob. Chang.*, 3(March), 1–17, doi:10.3389/ffgc.2020.00027, 2020.

Bastos Lima, M. G., Persson, U. M. and Meyfroidt, P.: Leakage and boosting effects in environmental governance: a framework for analysis, *Environ. Res. Lett.*, 14(10), 105006, doi:10.1088/1748-9326/ab4551, 2019.

Bastos Lima, M. G., Harring, N., Jagers, S. C., Löfgren, Å., Persson, U. M., Sjöstedt, M., Brülde, B., Langlet, D., Steffen, W. and Alpízar, F.: Large-scale collective action to avoid an Amazon tipping point - key actors and interventions, *Curr. Res. Environ. Sustain.*, 3(May), 100048, doi:10.1016/j.crsust.2021.100048, 2021.

Bateman, A. and Bonanni, L.: What supply chain transparency really means, *Harv. Bus. Rev.*, 20 August, 2–8 [online] Available from: <https://hbr.org/2019/08/what-supply-chain-transparency-really-means>, 2019.

Bateman, A., Betts, K., Cottrill, K., Pang, J., Deshpande, A. S., Grau, A. and McCool, D.: *State of Supply Chain Sustainability 2021*, MIT Center for Transportation & Logistics and Council of Supply Chain Management Professionals, Cambridge, MA., 2021.

Baumgartner, R. J.: Organizational culture and leadership: Preconditions for the development of sustainable corporation, *Sustain. Dev.*, 17(2), 102–113,

doi:10.1002/sd.405, 2009.

Belmaker, G.: P&G shareholders vote in landslide to address supply-chain deforestation, Mongabay [online] Available from: <https://news.mongabay.com/2020/10/pg-shareholders-vote-in-landslide-to-address-supply-chain-deforestation/> (Accessed 22 May 2021), 2020.

Bemelmans-Videc, M.-L., Rist, R. C. and Vedung, E.: *Carrots, Sticks & Sermons: Policy Instruments & Their Evaluation*, Routledge, London, UK., 1998.

Berenguer, E., Carvalho, N., Anderson, L., Aragão, L. E. O. C., França, F. and Barlow, J.: Improving the spatial-temporal analysis of Amazonian fires, *Glob. Chang. Biol.*, (October), 1–3, doi:10.1111/gcb.15425, 2020.

Bernstein, S. and Cashore, B.: Can non-state global governance be legitimate? An analytical framework, *Regul. Gov.*, 1(4), 347–371, doi:10.1111/j.1748-5991.2007.00021.x, 2007.

Biermann, F. and Pattberg, P.: Global Environmental Governance: Taking Stock, Moving Forward, *Annu. Rev. Environ. Resour.*, 33(1), 277–294, doi:10.1146/annurev.enviro.33.050707.085733, 2008.

Biermann, F., Bai, X., Bondre, N., Broadgate, W., Arthur Chen, C. T., Dube, O. P., Erisman, J. W., Glaser, M., van der Hel, S., Lemos, M. C., Seitzinger, S. and Seto, K. C.: Down to Earth: Contextualizing the Anthropocene, *Glob. Environ. Chang.*, 39, 341–350, doi:10.1016/j.gloenvcha.2015.11.004, 2016.

Bitzer, V., Francken, M. and Glasbergen, P.: Intersectoral partnerships for a sustainable coffee chain: Really addressing sustainability or just picking (coffee) cherries?, *Glob. Environ. Chang.*, 18(2), 271–284, doi:10.1016/j.gloenvcha.2008.01.002, 2008.

Blackman, A. and Rivera, J.: Producer-Level Benefits of Sustainability Certification, *Conserv. Biol.*, 25(6), 1176–1185, doi:10.1111/j.1523-1739.2011.01774.x, 2011.

Blackman, A., Corral, L., Lima, E. S. and Asner, G. P.: Titling indigenous communities protects forests in the Peruvian Amazon, *Proc. Natl. Acad. Sci. U. S. A.*, 114(16), 4123–4128, doi:10.1073/pnas.1603290114, 2017.

BlackRock: BlackRock investment stewardship: engagement priorities for 2021, New York, New York, USA. [online] Available from: <https://www.blackrock.com/dk/individuel/literature/publication/blk-stewardship-priorities-final.pdf>, 2021.

Bloomfield, M. J.: Shame campaigns and environmental justice: corporate shaming as activist strategy, *Env. Polit.*, 23(2), 263–281, doi:10.1080/09644016.2013.821824, 2014.

Böcher, M.: A theoretical framework for explaining the choice of instruments in

environmental policy, *For. Policy Econ.*, 16, 14–22, doi:10.1016/j.forpol.2011.03.012, 2012.

Borck, J. C. and Coglianese, C.: Voluntary Environmental Programs: Assessing Their Effectiveness, *Annu. Rev. Environ. Resour.*, 34(1), 305–324, doi:10.1146/annurev.environ.032908.091450, 2009.

Börner, J., Marinho, E. and Wunder, S.: Mixing carrots and sticks to conserve forests in the Brazilian amazon: A spatial probabilistic modeling approach, *PLoS One*, 10(2), 1–20, doi:10.1371/journal.pone.0116846, 2015.

Börner, J., Baylis, K., Corbera, E., Ezzine-de-Blas, D., Honey-Rosés, J., Persson, U. M. and Wunder, S.: The Effectiveness of Payments for Environmental Services, *World Dev.*, 96, 359–374, doi:10.1016/j.worlddev.2017.03.020, 2017.

Börner, J., Schulz, D., Wunder, S. and Pfaff, A.: The Effectiveness of Forest Conservation Policies and Programs, *Annu. Rev. Resour. Econ.*, 12(1), 1–20, doi:10.1146/annurev-resource-110119-025703, 2020.

Boström, M., Jönsson, A. M., Lockie, S., Mol, A. P. J. and Oosterveer, P.: Sustainable and responsible supply chain governance: Challenges and opportunities, in *Journal of Cleaner Production*, vol. 107, pp. 1–7., 2015.

Boyd, R., Gintis, H. and Bowles, S.: Coordinated punishment of defectors sustains cooperation and can proliferate when rare., *Science* (80-.), 328(5978), 617–20, doi:10.1126/science.1183665, 2010.

Brack, D.: Combating Illegal Logging: Interaction with WTO Rules (Briefing Paper), London, UK., 2013.

Brack, D.: WTO Compatibility with EU Action on Deforestation, Moreton in Marsh, United Kingdom., 2015.

Brack, D. and Bailey, R.: Ending Global Deforestation: Policy options for Consumer Countries., 2013.

Brack, D. and Ozinga, S.: Enforcing due diligence legislation “plus,” Brussels, Belgium. [online] Available from: https://www.fern.org/fileadmin/uploads/fern/Enforcing_due_diligence_legislation_plus_16102020.pdf, 2020.

Brack, D., Glover, A. and Wellesley, L.: Agricultural Commodity Supply Chains: Trade, Consumption and Deforestation, Chatham House, (January), 1–80, 2016.

Bradley, O. J. and Botchway, G. O.: Communicating corporate social responsibility (CSR) in the coffee industry, *Sustain. Accounting, Manag. Policy J.*, 9(2), 139–164, doi:10.1108/SAMPJ-02-2017-0015, 2018.

Brammer, S. and Pavelin, S.: Factors influencing the quality of corporate environmental disclosure, *Bus. Strateg. Environ.*, 17(2), 120–136,

doi:10.1002/bse.506, 2008.

Brandi, C.: The Interaction of Private and Public Governance: The Case of Sustainability Standards for Palm Oil, *Eur. J. Dev. Res.*, (0123456789), doi:10.1057/s41287-020-00306-8, 2020.

Brandt, J. S., Nolte, C. and Agrawal, A.: Land Use Policy Deforestation and timber production in Congo after implementation of sustainable forest management policy, *Land use policy*, 52, 15–22, doi:10.1016/j.landusepol.2015.11.028, 2016.

Bray, J. G. and Neilson, J.: Reviewing the impacts of coffee certification programmes on smallholder livelihoods, *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.*, 13(1), 216–232, doi:10.1080/21513732.2017.1316520, 2017.

Bregman, T., McCoy, K., Servent, R. and MacFarquhar, C.: Turning Collective Commitment into Action: Assessing progress by Consumer Goods Forum members towards achieving deforestation-free supply chains, Oxford, UK., 2016.

Brown, S. and Zarin, D.: What does zero deforestation mean?, *Science* (80-.), 342(6160), 805–807, doi:10.1126/science.1241277, 2013.

Bryman, H.: Cryptocurrency and Blockchain In Coffee , Part 2: At Origin Blockchain Adoption Spreading in the Field, *Dly. Coffee News by Roast Mag.*, 1–9, 2018.

Bullock, G. and van der Ven, H.: The Shadow of the Consumer: Analyzing the Importance of Consumers to the Uptake and Sophistication of Ratings, Certifications, and Eco-Labels, *Organ. Environ.*, 33(1), 75–95, doi:10.1177/1086026618803748, 2020.

Bundesministerium für Ernährung und Landwirtschaft: Leitlinien der Bundesregierung zur Förderung von entwaldungsfreien Lieferketten von Agrarrohstoffen. [online] Available from: <https://www.bmel.de/SharedDocs/Downloads/Wald-Fischerei/Leitlinien-entwaldungsfreie-Lieferketten.html>, 2016.

Burkhardt, D.: MOTION FOR A EUROPEAN PARLIAMENT RESOLUTION with recommendations to the Commission on an EU legal framework to halt and reverse EU-driven global deforestation (2020/2006(INL)), *Eur. Parliam.*, (2020/2006(July 2006), 1–10, 2020.

Busch, J. and Ferretti-Gallon, K.: What drives deforestation and what stops it? A meta-analysis, *Rev. Environ. Econ. Policy*, 11(1), 3–23, doi:10.1093/reep/rew013, 2017.

Bush, S. R., Oosterveer, P., Bailey, M. and Mol, A. P. J.: Sustainability governance of chains and networks: A review and future outlook, *J. Clean. Prod.*, 107, 8–19, doi:10.1016/j.jclepro.2014.10.019, 2015.

Business & Human Rights Resource Centre: 26 companies, business associations, and

initiatives make joint call for EU mandatory human rights & environmental due diligence - Business & Human Rights Resource Centre, [online] Available from: <https://www.business-humanrights.org/en/latest-news/eu-mandatory-due-diligence/> (Accessed 7 September 2020), 2020.

Bux, H., Zhang, Z. and Ahmad, N.: Promoting sustainability through corporate social responsibility implementation in the manufacturing industry: An empirical analysis of barriers using the ISM-MICMAC approach, *Corp. Soc. Responsib. Environ. Manag.*, 27(4), 1729–1748, doi:10.1002/csr.1920, 2020.

Cadman, T., Maraseni, T., Sarker, T. and Hwan, O. M.: Comparative evaluation of zero deforestation governance, *ETFRN News* 58, 58, 161–168, 2017.

Cape, M.: Coding Qualitative Data, in *Qualitative Research Methods in Human Geography*, edited by I. Hay, pp. 333–355, Oxford University Press., 2010.

Carlson, K. M., Heilmayr, R., Gibbs, H. K., Noojipady, P., Burns, D. N., Morton, D. C., Walker, N. F., Paoli, G. D. and Kremen, C.: Effect of oil palm sustainability certification on deforestation and fire in Indonesia, *Proc. Natl. Acad. Sci.*, 115(1), 121–126, doi:10.1073/pnas.1704728114, 2018.

Carodenuto, S. and Cerutti, P. O.: Forest Law Enforcement, Governance and Trade (FLEGT) in Cameroon: Perceived private sector benefits from VPA implementation, *For. Policy Econ.*, 48, 55–62, doi:10.1016/j.forpol.2014.07.010, 2014.

Carvalho, W. D., Mustin, K., Hilário, R. R., Vasconcelos, I. M., Eilers, V. and Fearnside, P. M.: Deforestation control in the Brazilian Amazon: A conservation struggle being lost as agreements and regulations are subverted and bypassed, *Perspect. Ecol. Conserv.*, 17(3), 122–130, doi:10.1016/j.pecon.2019.06.002, 2019.

Cashore, B.: Legitimacy and the Privatization of Environmental Governance: How Non-State Market-Driven (NSMD) Governance Systems Gain Rule-Making Authority, *Governance*, 15(4), 503–529, doi:10.1111/1468-0491.00199, 2002.

Cashore, B., Knudsen, J. S., Moon, J. and van der Ven, H.: Private authority and public policy interactions in global context: Governance spheres for problem solving, *Regul. Gov.*, (March), doi:10.1111/rego.12395, 2021.

Castro-Nunez, A., Charry, A., Castro-Llanos, F., Sylvester, J. and Bax, V.: Reducing deforestation through value chain interventions in countries emerging from conflict: The case of the Colombian cocoa sector, *Appl. Geogr.*, 123(July), 102280, doi:10.1016/j.apgeog.2020.102280, 2020.

Cattau, M. E., Marlier, M. E. and DeFries, R.: Effectiveness of Roundtable on Sustainable Palm Oil (RSPO) for reducing fires on oil palm concessions in Indonesia from 2012 to 2015, *Environ. Res. Lett.*, 11(10), 105007, doi:10.1088/1748-9326/11/10/105007, 2016.

Cazzolla Gatti, R. and Velichevskaya, A.: Certified “sustainable” palm oil took the

place of endangered Bornean and Sumatran large mammals habitat and tropical forests in the last 30 years, *Sci. Total Environ.*, 742, 140712, doi:10.1016/j.scitotenv.2020.140712, 2020.

CDP: The Collective Effort to End Deforestation - A Pathway for Companies to Raise their Ambition, London, UK., 2021.

Challies, E., Newig, J. and Lenschow, A.: Governance for Sustainability in Telecoupled Systems, in *Telecoupling*, edited by C. Friis and J. Ø. Nielsen, pp. 177–197, Springer International Publishing, Cham., 2019.

Challies, E. R. T.: Commodity Chains, Rural Development and the Global Agri-food System, *Geogr. Compass*, 2(2), 375–394, doi:10.1111/j.1749-8198.2008.00095.x, 2008.

Chatterji, A. K. and Toffel, M. W.: Assessing the Impact of CEO Activism, *Organ. Environ.*, 32(2), 159–185, doi:10.1177/1086026619848144, 2019.

Chervier, C., Piketty, M.-G. and Reed, J.: A Tentative Theory of Change to Evaluate Jurisdictional Approaches to Reduced Deforestation, *Front. For. Glob. Chang.*, 3(October), 1–9, doi:10.3389/ffgc.2020.498151, 2020.

Chithambo, L., Tingbani, I., Agyapong, G. A., Gyapong, E. and Damoah, I. S.: Corporate voluntary greenhouse gas reporting: Stakeholder pressure and the mediating role of the chief executive officer, *Bus. Strateg. Environ.*, (July 2019), 1666–1683, doi:10.1002/bse.2460, 2020.

Cho, K., Goldstein, B., Gounaridis, D. and Newell, J. P.: Where does your guacamole come from? Detecting deforestation associated with the exports of avocados from Mexico to the United States, *J. Environ. Manage.*, 278(P1), 111482, doi:10.1016/j.jenvman.2020.111482, 2021.

Cisneros, E., Zhou, S. L. and Börner, J.: Naming and shaming for conservation: Evidence from the Brazilian Amazon, *PLoS One*, 10(9), 1–24, doi:10.1371/journal.pone.0136402, 2015.

Clapp, J.: Distant agricultural landscapes, *Sustain. Sci.*, 10(2), 305–316, doi:10.1007/s11625-014-0278-0, 2015.

Clapp, J.: Mega-Mergers on the Menu: Corporate Concentration and the Politics of Sustainability in the Global Food System, *Glob. Environ. Polit.*, 18(2), 12–33, doi:10.1162/glep_a_00454, 2018.

Clapp, J.: The problem with growing corporate concentration and power in the global food system, *Nat. Food*, 2(6), 404–408, doi:10.1038/s43016-021-00297-7, 2021.

Clapp, J., Newell, P. and Brent, Z. W.: The global political economy of climate change, agriculture and food systems, *J. Peasant Stud.*, 45(1), 80–88, doi:10.1080/03066150.2017.1381602, 2018.

Coe, N. M., Dicken, P. and Hess, M.: Global production networks: Realizing the potential, *J. Econ. Geogr.*, 8(3), 271–295, doi:10.1093/jeg/lbn002, 2008.

COFCO International: Satellite images play major role in building sustainable soy supply chains - Stories - COFCO International, COFCO Int. [online] Available from: <https://www.cofcointernational.com/stories/satellite-images-play-major-role-in-building-sustainable-soy-supply-chain/> (Accessed 14 August 2021), 2021.

Comas Martí, J. M. and Seifert, R. W.: Assessing the comprehensiveness of supply chain environmental strategies, *Bus. Strateg. Environ.*, 22(5), 339–356, doi:10.1002/bse.1749, 2013.

Consumer Goods Forum: Consumer Goods Industry Announces Initiatives on Climate Protection - The Consumer Goods Forum, [online] Available from: https://www.theconsumergoodsforum.com/press_releases/consumer-goods-industry-announces-initiatives-on-climate-protection/ (Accessed 17 May 2021), 2010.

COSA: The COSA Measuring Sustainability Report: Coffee and Cocoa in 12 Countries, Philadelphia, PA, USA. [online] Available from: <http://thecosa.org/wp-content/uploads/2014/01/The-COSA-Measuring-Sustainability-Report.pdf>, 2013.

Cossart, S., Chaplier, J. and Beau De Lomenie, T.: The French Law on Duty of Care: A Historic Step Towards Making Globalization Work for All, *Bus. Hum. Rights J.*, 2(2), 317–323, doi:10.1017/bhj.2017.14, 2017.

Cousins, P. D., Lawson, B. and Squire, B.: Supply chain management: Theory and practice - The emergence of an academic discipline?, *Int. J. Oper. Prod. Manag.*, 26(7), 697–702, doi:10.1108/01443570610672194, 2006.

COWI, Ecofys and Milieu: Feasibility study on options to step up EU action against deforestation, edited by A. S. Olesen, S. L. Bager, D. Brack, M. S. Jespersen, D. S. Hansen, and L. C. Wähler, Brussels, Belgium., 2018.

Creutzig, F., Roy, J., Lamb, W. F., Azevedo, I. M. L., Bruine De Bruin, W., Dalkmann, H., Edelenbosch, O. Y., Geels, F. W., Grubler, A., Hepburn, C., Hertwich, E. G., Khosla, R., Mattauch, L., Minx, J. C., Ramakrishnan, A., Rao, N. D., Steinberger, J. K., Tavoni, M., Ürge-Vorsatz, D. and Weber, E. U.: Towards demand-side solutions for mitigating climate change, *Nat. Clim. Chang.*, 8(4), 268–271, doi:10.1038/s41558-018-0121-1, 2018.

Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N. and Leip, A.: Food systems are responsible for a third of global anthropogenic GHG emissions, *Nat. Food*, 2(3), 198–209, doi:10.1038/s43016-021-00225-9, 2021.

Crosby, B. L.: Policy implementation: The organizational challenge, *World Dev.*, 24(9 SPEC. ISS.), 1403–1415, doi:10.1016/0305-750X(96)00050-2, 1996.

Curtis, P. G., Slay, C. M., Harris, N. L., Tyukavina, A. and Hansen, M. C.: Classifying drivers of global forest loss, *Science* (80-.), 361(6407), 1108–1111,

doi:10.1126/science.aau3445, 2018.

Cuypers, D., Geerken, T., Gorissen, L., Lust, A., Peters, G., Karstensen, J., Prieler, S., Fisher, G., Hizsnyik, E. and Van Velthuisen, H.: The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation, Brussels, Belgium., 2013.

Dallas, M. P., Ponte, S. and Sturgeon, T. J.: Power in global value chains, *Rev. Int. Polit. Econ.*, 26(4), 666–694, doi:10.1080/09692290.2019.1608284, 2019.

Van Dam, Y. K. and De Jonge, J.: The Positive Side of Negative Labelling, *J. Consum. Policy*, 38(1), 19–38, doi:10.1007/s10603-014-9274-0, 2015.

Darnall, N., Henriques, I. and Sadorsky, P.: Adopting proactive environmental strategy: The influence of stakeholders and firm size, *J. Manag. Stud.*, 47(6), 1072–1094, doi:10.1111/j.1467-6486.2009.00873.x, 2010.

Dasgupta, P.: The Economics of Biodiversity: The Dasgupta Review. Abridged Version., 2021a.

Dasgupta, P.: The Economics of Biodiversity: The Dasgupta review. [online] Available from: <https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review>, 2021b.

Dauvergne, P.: Is the Power of Brand-Focused Activism Rising? The Case of Tropical Deforestation, *J. Environ. Dev.*, 26(2), 135–155, doi:10.1177/1070496517701249, 2017.

Dauvergne, P.: Is artificial intelligence greening global supply chains? Exposing the political economy of environmental costs, *Rev. Int. Polit. Econ.*, 0(0), 1–23, doi:10.1080/09692290.2020.1814381, 2020.

Dauvergne, P. and Lister, J.: The prospects and limits of eco-consumerism: Shopping our way to less deforestation?, *Organ. Environ.*, 23(2), 132–154, doi:10.1177/1086026610368370, 2010.

Dauvergne, P. and Lister, J.: Big brand sustainability: Governance prospects and environmental limits, *Glob. Environ. Chang.*, 22(1), 36–45, doi:10.1016/j.gloenvcha.2011.10.007, 2012.

Daviron, B. and Ponte, S.: The Coffee Paradox: Global Markets, Commodity Trade, and the Elusive Promise of Development., Zed Books, London, UK., 2005.

Davis, A. P., Chadburn, H., Moat, J., O'sullivan, R., Hargreaves, S. and Lughadha, N.: High extinction risk for wild coffee species and implications for coffee sector sustainability, *Sci. Adv.*, 5, 3473–3489, doi:10.1126/sciadv.aav3473, 2019.

Davis, G. F., Whitman, M. von N. and Zald, M. N.: Political agency and the responsibility paradox: multinationals and corporate social responsibility, in *Contemporary Political Agency: Theory and practice*, pp. 92–117, Routledge,

London, U.K., 2013.

Davis, K. F., Koo, H. I., Dell'Angelo, J., D'Odorico, P., Estes, L., Kehoe, L. J., Kharratzadeh, M., Kuemmerle, T., Machava, D., Pais, A. de J. R., Ribeiro, N., Rulli, M. C. and Tatlhego, M.: Tropical forest loss enhanced by large-scale land acquisitions, *Nat. Geosci.*, 13(7), 482–488, doi:10.1038/s41561-020-0592-3, 2020.

DeFries, R. and Nagendra, H.: Ecosystem management as a wicked problem., *Science*, 356(6335), 265–270, doi:10.1126/science.aal1950, 2017.

Defries, R. S., Rudel, T., Uriarte, M. and Hansen, M.: Deforestation driven by urban population growth and agricultural trade in the twenty-first century, *Nat. Geosci.*, 3(3), 178–181, doi:10.1038/ngeo756, 2010.

DeFries, R. S., Fanzo, J., Mondal, P., Remans, R. and Wood, S. A.: Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence, *Environ. Res. Lett.*, 12(3), doi:10.1088/1748-9326/aa625e, 2017.

Delmas, M. and Blass, V. D.: Measuring Corporate Environmental Performance: The Trade-Offs of Sustainability Ratings, *Bus. Strateg. Environ.*, 19(4), 245–260, doi:10.1002/bse.676, 2010.

Delmas, M. and Toffel, M. W.: Stakeholders and environmental management practices: An institutional framework, *Bus. Strateg. Environ.*, 13(4), 209–222, doi:10.1002/bse.409, 2004.

Denier, L., Scherr, S., Shames, S., Chatterton, P., Hovani, L. and Stam, N.: *The Little Sustainable Landscapes Book: Achieving sustainable development through integrated landscape management*, Oxford, UK., 2015.

Denvir, A., Arima, E. Y., Gonza, A. and Young, K. R.: Ecological and human dimensions of avocado expansion ' xico : Towards supply-chain sustainability in Me, , doi:10.1007/s13280-021-01538-6, 2021.

Devriendt, N., Lust, A., Lemeire, C., Cuypers, D., Prieler, S., Fisher, G., Hizsnyik, E., De Smet, L., Van Ootegem, L., Happaerts, S., Simons, H., König, C. and de Nie, D.: The impact of EU consumption on deforestation : Identification of critical areas where Community policies and legislation could be reviewed, Brussels, Belgium., 2013a.

Devriendt, N., Lust, A., Lemeire, C., Cuypers, D., Prieler, S., Fisher, G., Hizsnyik, E., De Smet, L., Van Ootegem, L., Happaerts, S., Simons, H., König, C. and de Nie, D.: The impact of EU consumption on deforestation: Proposal of specific Community policy , legislative measures and other initiatives for further consideration by the Commission, Brussels, Belgium., 2013b.

Dicken, P.: *Global Shift: Mapping the Changing Contours of the World Economy*, Seventh Edition., SAGE Publishing. [online] Available from:

<https://uk.sagepub.com/en-gb/eur/book/global-shift-4> (Accessed 2 May 2021), 2014.

Dietz, T. and Grabs, J.: Additionality and Implementation Gaps in Voluntary Sustainability Standards, *New Polit. Econ.*, 0(0), 1–22, doi:10.1080/13563467.2021.1881473, 2021.

Dietz, T., Ostrom, E. and Stern, P. C.: The struggle to govern the commons., *Science*, 302(5652), 1907–12, doi:10.1126/science.1091015, 2003.

Dietz, T., Auffenberg, J., Estrella Chong, A., Grabs, J. and Kilian, B.: The Voluntary Coffee Standard Index (VOCSI). Developing a Composite Index to Assess and Compare the Strength of Mainstream Voluntary Sustainability Standards in the Global Coffee Industry, *Ecol. Econ.*, 150(August 2017), 72–87, doi:10.1016/j.ecolecon.2018.03.026, 2018.

Discua Cruz, A., Centeno Caffarena, L. and Vega Solano, M.: Being different matters! A closer look into product differentiation in specialty coffee family farms in Central America, *Cross Cult. Strateg. Manag.*, 27(2), 165–188, doi:10.1108/CCSM-01-2019-0004, 2020.

Djelic, M.-L. and Sahlin-Andersson, K.: Introduction: A world of governance: The rise of transnational regulation, in *Transnational Governance: Institutional Dynamics of Regulation.*, 2006.

Dou, Y., da Silva, R. F. B., Yang, H. and Liu, J.: Spillover effect offsets the conservation effort in the Amazon, *J. Geogr. Sci.*, 28(11), 1715–1732, doi:10.1007/s11442-018-1539-0, 2018.

Drempetic, S., Klein, C. and Zwergel, B.: The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review, *J. Bus. Ethics*, 167(2), 333–360, doi:10.1007/s10551-019-04164-1, 2020.

Duchelle, A. E., Simonet, G., Sunderlin, W. D. and Wunder, S.: What is REDD+ achieving on the ground?, *Curr. Opin. Environ. Sustain.*, 32, 134–140, doi:10.1016/j.cosust.2018.07.001, 2018.

Eakin, H., DeFries, R., Kerr, S., Lambin, E. F., Liu, J., Marcotullio, P. J., Messerli, P., Reenberg, A., Rueda, X., Swaffield, S. R., Wicke, B. and Zimmerer, K.: Significance of Telecoupling for Exploration of Land-Use Change, *Rethink. Glob. L. Use an Urban Era*, 141–161, doi:10.7551/mitpress/9780262026901.003.0008, 2014.

Eberlein, B.: Who Fills the Global Governance Gap? Rethinking the Roles of Business and Government in Global Governance, *Organ. Stud.*, 40(8), 1125–1145, doi:10.1177/0170840619847720, 2019.

Eduardo, P., Santos, D. O. S., Delaroche, M. and Lui, G.: Lessons from the soy and beef moratoria in Brazil, *ETFRN News* 58, 58(June), 151–159, 2017.

Egels-Zandén, N. and Hansson, N.: Supply Chain Transparency as a Consumer or

Corporate Tool: The Case of Nudie Jeans Co, *J. Consum. Policy*, 39(4), 377–395, doi:10.1007/s10603-015-9283-7, 2016.

Egels-Zandén, N., Hulthén, K. and Wulff, G.: Trade-offs in supply chain transparency: The case of Nudie Jeans Co, *J. Clean. Prod.*, 107, 95–104, doi:10.1016/j.jclepro.2014.04.074, 2015.

Ekstrom, J. A. and Crona, B. I.: Institutional misfit and environmental change: A systems approach to address ocean acidification, *Sci. Total Environ.*, 576, 599–608, doi:10.1016/j.scitotenv.2016.10.114, 2017.

Elder, S. D. and Dauvergne, P.: Farming for Walmart: the politics of corporate control and responsibility in the global South, *J. Peasant Stud.*, 42(5), 1029–1046, doi:10.1080/03066150.2015.1043275, 2015.

Elliot, M. and Heath, A.: The failure of CAP reform: a public choice analysis, *iea Econ. Aff.*, June, 42–48, 2000.

Ellis, E. C.: Anthropogenic transformation of the terrestrial biosphere., *Philos. Trans. A. Math. Phys. Eng. Sci.*, 369(1938), 1010–35, doi:10.1098/rsta.2010.0331, 2011.

Engert, S. and Baumgartner, R. J.: Corporate sustainability strategy - Bridging the gap between formulation and implementation, *J. Clean. Prod.*, 113, 822–834, doi:10.1016/j.jclepro.2015.11.094, 2016.

Engert, S., Rauter, R. and Baumgartner, R. J.: Exploring the integration of corporate sustainability into strategic management: A literature review, *J. Clean. Prod.*, 112, 2833–2850, doi:10.1016/j.jclepro.2015.08.031, 2016.

Ennes, J.: New artificial intelligence tool helps forecast Amazon deforestation, Mongabay [online] Available from: <https://news.mongabay.com/2021/08/new-artificial-intelligence-tool-helps-forecast-amazon-deforestation/> (Accessed 11 August 2021), 2021.

Epstein, M. J. and Roy, M. J.: Sustainability in action: Identifying and measuring the key performance drivers, *Long Range Plann.*, 34(5), 585–604, doi:10.1016/S0024-6301(01)00084-X, 2001.

von Essen, M. and Lambin, E. F.: Jurisdictional approaches to sustainable resource use, *Front. Ecol. Environ.*, 1–9, doi:10.1002/fee.2299, 2021.

Esty, D. C. and Winston, A. S.: Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage, Yale University Press., 2006.

European Commission: COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS: Addressing the challenges of deforestation and forest degradation to tackle climate

change and biodiver, The European Union. [online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52008DC0645>, 2008a.

European Commission: EC Regulation 1005/2008 of 29 September 2008 establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing, amending Regulations (EEC) No 2847/93, (EC) No 1936/2001 and (EC) No 601/2004 and repealing Regulation, European Union. [online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32008R1005>, 2008b.

European Commission: REGULATION (EU) No 995/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010 laying down the obligations of operators who place timber and timber products on the market, European Union. [online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010R0995>, 2010.

European Commission: REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 december 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005. [online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R1305>, 2013a.

European Commission: Regulation (EU) No 1308/2013 of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007., 2013b.

European Commission: European Commission Conference on Illegal Logging and Deforestation 21-23 June 2017, in Conference on Illegal Logging and Deforestation 21-23 June 2017, p. 16, Directorate-Generale for the Environment, Brussels, Belgium. [online] Available from: http://ec.europa.eu/environment/forests/conf_26_05_2014.htm, 2017a.

European Commission: REGULATION (EU) 2017/821 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas, European Union. [online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2017:130:TOC>, 2017b.

European Commission: Roadmap. Ref. Ares(2018)6516782, The European Union. [online] Available from: <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/2027-Stepping-up-EU-Action-against-Deforestation-and-Forest-Degradation>, 2018.

European Commission: Public Consultation on Stepping up EU Action against Deforestation and Forest Degradation, [online] Available from: https://ec.europa.eu/environment/forests/pdf/Public_Consultation_on_Deforestation

and Forest Degradation.pdf, 2019a.

European Commission: Stepping up EU Action to Protect and Restore the World's Forests, The European Union. [online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1565272554103&uri=CELEX:52019DC0352>, 2019b.

European Commission: Illegal fishing, Dir. Marit. Aff. Fish., doi:10.1016/s0140-6736(81)91500-2, 2020.

FAO: Global Forest Resources Assessment 2015., 2016.

FAO: The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction., Rome, Italy., 2019.

FAO: Global Forest Resources Assessment 2020, FAO., 2020.

FAO and FILAC: Forest governance by indigenous and tribal peoples: An opportunity for climate action in Latin America and the Caribbean, Food and Agriculture Organization of the United Nations (FAO), Santiago, Chile., 2021.

Feng, Y., Ziegler, A. D., Elsen, P. R., Liu, Y., He, X., Spracklen, D. V., Holden, J., Jiang, X., Zheng, C. and Zeng, Z.: Upward expansion and acceleration of forest clearance in the mountains of Southeast Asia, Nat. Sustain., doi:10.1038/s41893-021-00738-y, 2021.

FERN: Company promises: How businesses are meeting commitments to end deforestation, Brussels, Belgium. [online] Available from: http://www.fern.org/sites/fern.org/files/Company_promises.pdf, 2017.

Ferretti-Gallon, K. and Busch, J.: What Drives Deforestation and What Stops It? A Meta-Analysis of Spatially Explicit Econometric Studies, Cent. Glob. Dev. Work. Pap. 361, (April 2014), 44, doi:10.2139/ssrn.2458040, 2014.

Fesenfeld, L. P., Wicki, M., Sun, Y. and Bernauer, T.: Policy packaging can make food system transformation feasible, Nat. Food, 1(March), doi:10.1038/s43016-020-0047-4, 2020.

Fischer, E. F.: Quality and inequality: Taste, value, and power in the third wave coffee market. [online] Available from: <https://econpapers.repec.org/paper/zbwmpifgd/174.htm>, 2017.

Flick, U.: An Introduction to Qualitative Research, Fourth Edi., SAGE Publications Ltd., London, U.K., 2009.

Folberth, C., Khabarov, N., Balkovič, J., Skalský, R., Visconti, P., Ciais, P., Janssens, I. A., Peñuelas, J. and Obersteiner, M.: The global cropland-sparing potential of high-yield farming, Nat. Sustain., 3(April), doi:10.1038/s41893-020-0505-x, 2020.

Foley, J. A., Ramankutty, N., Brauman, K. a, Cassidy, E. S., Gerber, J. S., Johnston,

M., Mueller, N. D., O'Connell, C., Ray, D. K., West, P. C., Balzer, C., Bennett, E. M., Carpenter, S. R., Hill, J., Monfreda, C., Polasky, S., Rockström, J., Sheehan, J., Siebert, S., Tilman, D. and Zaks, D. P. M.: Solutions for a cultivated planet, *Nature*, 478(7369), 337–342, doi:10.1038/nature10452, 2011.

Folke, C., Pritchard, L., Berkes, F., Colding, J. and Svedin, U.: The problem of fit between ecosystems and institutions: Ten years later, *Ecol. Soc.*, 12(1), doi:10.5751/ES-02064-120130, 2007.

Folke, C., Österblom, H., Jouffray, J. B., Lambin, E. F., Adger, W. N., Scheffer, M., Crona, B. I., Nyström, M., Levin, S. A., Carpenter, S. R., Anderies, J. M., Chapin, S., Crépin, A. S., Dauriach, A., Galaz, V., Gordon, L. J., Kautsky, N., Walker, B. H., Watson, J. R., Wilen, J. and de Zeeuw, A.: Transnational corporations and the challenge of biosphere stewardship, *Nat. Ecol. Evol.*, 3(10), 1396–1403, doi:10.1038/s41559-019-0978-z, 2019.

Forest Trends: Supply Change: Corporations, Commodities, and Commitments that Count, , 32 [online] Available from: www.supply-change.org, 2015.

Forest Trends: Targeting Zero Deforestation: Company Progress on Commitments That Count, 2019. [online] Available from: <https://www.forest-trends.org/publications/targeting-zero-deforestation/>, 2019.

Forest Trends: Commitments in Action: Corporate Tells for Financing Forest Conservation & Restoration, 2020., 2020.

Forest500: Annual Report - The Countdown to 2020, , 134, doi:10.1017/CBO9781107415324.004, 2019.

Forest500: Company Data (2020 dataset), [online] Available from: <https://forest500.org/data>, 2021a.

Forest500: Time for change: Delivering deforestation-free supply chains., 2021b.

Fouquet, H.: Macron Riles Bolsonaro, Setting Up G-7 Fight Over Amazon Fires - Bloomberg, Bloomberg [online] Available from: <https://www.bloomberg.com/news/articles/2019-08-23/macron-riles-bolsonaro-with-g-7-appeal-over-amazon-forest-fires> (Accessed 24 May 2021), 2019.

Freeman, R. E.: Strategic Management, Cambridge University Press, Cambridge., 2010.

Freeman, R. E. and Elms, H.: The social responsibility of business Is to create value for stakeholders, *MIT Sloan Manag. Rev.*, January, 1–6, 2018.

Freeman, R. E., Wicks, A. C. and Parmar, B.: Stakeholder Theory and “The Corporate Objective Revisited,” *Organ. Sci.*, 15(3), 364–369, doi:10.1287/orsc.1040.0066, 2004.

Freeman, R. E., Phillips, R. and Sisodia, R.: Tensions in Stakeholder Theory, *Bus.*

Soc., 59(2), 213–231, doi:10.1177/0007650318773750, 2020.

Friedman, M.: The Social Responsibility of Business is to Increase its Profits, N. Y. Times Mag., September, 6, doi:10.7150/jgen.24929, 1970.

Friis, C.: Telecoupling: A New Framework for Researching Land-Use Change in a Globalised World, in Telecoupling, edited by C. Friis and J. Ø. Nielsen, pp. 49–67, Springer International Publishing., 2019.

Friis, C. and Nielsen, J. Ø.: Land-use change in a telecoupled world: The relevance and applicability of the telecoupling framework in the case of banana plantation expansion in Laos, Ecol. Soc., 22(4), doi:10.5751/ES-09480-220430, 2017a.

Friis, C. and Nielsen, J. Ø.: On the system. Boundary choices, implications, and solutions in telecoupling land use change research, Sustain., 9(6), 1–20, doi:10.3390/su9060974, 2017b.

Friis, C. and Nielsen, J. Ø., Eds.: Telecoupling: Exploring Land-Use Change in a Globalised World, Springer International Publishing, Cham., 2019.

Friis, C., Nielsen, J. Ø., Otero, I., Haberl, H., Hostert, P., Niewöhner, J. and Hostert, P.: From teleconnection to telecoupling: taking stock of an emerging framework in land system science, J. Land Use Sci., 11(2), 131–153, doi:10.1080/1747423X.2015.1096423, 2016.

Fuchs, D. and Kalfagianni, A.: The causes and consequences of private food governance, Bus. Polit., 12(3), doi:10.2202/1469-3569.1319, 2010.

Fuchs, R., Brown, C. and Rounsevell, M.: Europe's Green Deal offshores environmental damage to other nations, Nature, 586(7831), 671–673, doi:10.1038/d41586-020-02991-1, 2020.

Galaz, V., Crona, B., Dauriach, A., Scholtens, B. and Steffen, W.: Finance and the Earth system – Exploring the links between financial actors and non-linear changes in the climate system, Glob. Environ. Chang., 53, 296–302, doi:10.1016/j.gloenvcha.2018.09.008, 2018a.

Galaz, V., Crona, B., Dauriach, A., Jouffray, J.-B., Österblom, H. and Fichtner, J.: Tax havens and global environmental degradation, Nat. Ecol. Evol., 2(9), 1352–1357, doi:10.1038/s41559-018-0497-3, 2018b.

Galeotti, M., Salini, S. and Verdolini, E.: Measuring environmental policy stringency: Approaches, validity, and impact on environmental innovation and energy efficiency, Energy Policy, 136(October 2019), 111052, doi:10.1016/j.enpol.2019.111052, 2020.

Gallego-Alvarez, I., Ortas, E., Vicente-Villardón, J. L. and Álvarez Etxeberria, I.: Institutional Constraints, Stakeholder Pressure and Corporate Environmental Reporting Policies, Bus. Strateg. Environ., 26(6), 807–825, doi:10.1002/bse.1952, 2017.

Gallo, P. J. and Christensen, L. J.: Firm Size Matters: An Empirical Investigation of Organizational Size and Ownership on Sustainability-Related Behaviors, *Bus. Soc.*, 50(2), 315–349, doi:10.1177/0007650311398784, 2011.

Galpin, T. and Lee Whittington, J.: Sustainability leadership: from strategy to results, *J. Bus. Strategy*, 33(4), 40–48, doi:10.1108/02756661211242690, 2012.

Gammelgaard, B., Sorwad, H., Breum, W. P. and Nielsen, M.: Blockchain Technology for Supply Chains. A Guidebook. [online] Available from: https://www.mckinsey.com/business-functions/operations/our-insights/blockchain-technology-for-supply-chains-a-must-or-a-maybe%0Ahttps://openarchive.cbs.dk/bitstream/handle/10398/9733/Blockchain_Pixi.pdf?sequence=1, 2019.

Garcia, C. A., Savilaakso, S., Verburg, R. W., Gutierrez, V., Wilson, S. J., Krug, C. B., Sassen, M., Robinson, B. E., Moersberger, H., Naimi, B., Rhemtulla, J. M., Dessard, H., Gond, V., Vermeulen, C., Trolliet, F., Oszwald, J., Quétier, F., Pietsch, S. A., Bastin, J.-F., Dray, A., Araújo, M. B., Ghazoul, J. and Waeber, P. O.: The Global Forest Transition as a Human Affair, *One Earth*, 2(5), 417–428, doi:10.1016/j.oneear.2020.05.002, 2020.

Gardner, R., Ostrom, E. and Walker, J. M.: The Nature of Common-Pool Resource Problems, *Ration. Soc.*, 2(3), 335–358, doi:10.1177/1043463190002003005, 1990.

Gardner, T. A., Benzie, M., Börner, J., Dawkins, E., Fick, S., Garrett, R., Godar, J., Grimard, A., Lake, S., Larsen, R. K., Mardas, N., McDermott, C. L., Meyfroidt, P., Osbeck, M., Persson, M., Sembres, T., Suavet, C., Strassburg, B., Trevisan, A., West, C. and Wolvekamp, P.: Transparency and sustainability in global commodity supply chains, *World Dev.*, 121, 163–177, doi:10.1016/j.worlddev.2018.05.025, 2019.

Garrett, R. and Rueda, X.: Telecoupling and Consumption in Agri-Food Systems, in *Telecoupling*, edited by C. Friis and J. Ø. Nielsen, pp. 115–137, Springer International Publishing, 2019.

Garrett, R., Rueda, X., Levy, S., Fernando, J., Blanco, B. and Shah, S.: Measuring Impacts of Supply Chain Initiatives for Conservation: Focus on Forest-Risk Food Commodities Table of Contents, , 1–46, 2018a.

Garrett, R. D., Carlson, K. M., Rueda, X. and Noojipady, P.: Assessing the potential additionality of certification by the Round table on Responsible Soybeans and the Roundtable on Sustainable Palm Oil, *Environ. Res. Lett.*, 11(4), 1–17, doi:10.1088/1748-9326/11/4/045003, 2016.

Garrett, R. D., Koh, I., Lambin, E. F., le Polain de Waroux, Y., Kastens, J. H. and Brown, J. C.: Intensification in agriculture-forest frontiers: Land use responses to development and conservation policies in Brazil, *Glob. Environ. Chang.*, 53(October 2017), 233–243, doi:10.1016/j.gloenvcha.2018.09.011, 2018b.

Garrett, R. D., Levy, S., Carlson, K. M., Gardner, T. A., Godar, J., Clapp, J.,

Dauvergne, P., Heilmayr, R., le Polain de Waroux, Y., Ayre, B., Barr, R., Døvre, B., Gibbs, H. K., Hall, S., Lake, S., Milder, J. C., Rausch, L. L., Rivero, R., Rueda, X., Sarsfield, R., Soares-Filho, B. and Villoria, N.: Criteria for effective zero-deforestation commitments, *Glob. Environ. Chang.*, 54(October 2018), 135–147, doi:10.1016/j.gloenvcha.2018.11.003, 2019.

Garrett, R. D., Levy, S. A., Gollnow, F., Hodel, L. and Rueda, X.: Have food supply chain policies improved forest conservation and rural livelihoods? A systematic review, *Environ. Res. Lett.*, 16(3), 033002, doi:10.1088/1748-9326/abe0ed, 2021.

Gawel, E. and Ludwig, G.: The iLUC dilemma: How to deal with indirect land use changes when governing energy crops?, *Land use policy*, 28(4), 846–856, doi:10.1016/j.landusepol.2011.03.003, 2011.

Geist, H. J. and Lambin, E. F.: Proximate Causes and Underlying Driving Forces of Tropical Deforestation, *Bioscience*, 52(2), 143, doi:10.1641/0006-3568(2002)052[0143:PCAUDF]2.0.CO;2, 2002.

Gerard, A., Lopez, M. C. and Mccright, A. M.: Coffee Roasters' Sustainable Sourcing Decisions and Use of the Direct Trade Label, *Sustainability*, 11(5437), 1–19, 2019.

Gereffi, G.: The Organization of Buyer-Driven Global Commodity Chains: How US Retailers Shape Overseas Production Networks, in *Global Value Chains and Development*, pp. 43–71, Cambridge University Press., 1994.

Gereffi, G.: A commodity chains framework for analyzing global industries, *Work. Pap. IDS*, (September 1999), 1–9, doi:http://www.ids.ac.uk/ids/global/pdfs/gereffi.pdf, 1999.

Gereffi, G. and Lee, J.: Why the World Suddenly Cares About Global Supply Chains, *J. Supply Chain Manag.*, 48(3), 24–32, doi:10.1111/j.1745-493X.2012.03271.x, 2012.

Gereffi, G., Humphrey, J. and Sturgeon, T.: The governance of global value chains, *Rev. Int. Polit. Econ.*, 12(1), 78–104, doi:10.1080/09692290500049805, 2005.

Gibbon, P., Bair, J. and Ponte, S.: Governing global value chains: An introduction, *Econ. Soc.*, 37(3), 315–338, doi:10.1080/03085140802172656, 2008.

Gibbs, H. K., Ruesch, A. S., Achard, F., Clayton, M. K., Holmgren, P., Ramankutty, N. and Foley, J. A.: Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s, *Proc. Natl. Acad. Sci.*, 107(38), 16732–16737, doi:10.1073/pnas.0910275107, 2010.

Gibbs, H. K., Rausch, L., Munger, J., Schelly, I., Morton, D. C., Noojipady, P., Soares-Filho, B., Barreto, P., Micol, L. and Walker, N. F.: Brazil's Soy Moratorium, *Science* (80-.), 347(6220), 377–378, doi:10.1126/science.aaa0181, 2015.

Gibbs, H. K., Munger, J., L'Roe, J., Barreto, P., Pereira, R., Christie, M., Amaral, T.

and Walker, N. F.: Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the Brazilian Amazon?, *Conserv. Lett.*, 9(1), 32–42, doi:10.1111/conl.12175, 2016.

Gibson, L., Lee, T. M., Koh, L. P., Brook, B. W., Gardner, T. A., Barlow, J., Peres, C. A., Bradshaw, C. J. A., Laurance, W. F., Lovejoy, T. E. and Sodhi, N. S.: Primary forests are irreplaceable for sustaining tropical biodiversity, *Nature*, 478(7369), 378–381, doi:10.1038/nature10425, 2011.

Gilbert, P. and Lawford-Smith, H.: Political feasibility: A conceptual exploration, *Polit. Stud.*, 60(4), 809–825, doi:10.1111/j.1467-9248.2011.00936.x, 2012.

Giovannucci, D. and Ponte, S.: Standards as a new form of social contract? Sustainability initiatives in the coffee industry, *Food Policy*, 30(3), 284–301, doi:10.1016/j.foodpol.2005.05.007, 2005.

Glasbergen, P. and Schouten, G.: Transformative Capacities of Global Private Sustainability Standards: A Reflection on Scenarios in the Field of Agricultural Commodities, *J. Corp. Citizsh.*, 2015(58), 85–101, doi:10.9774/GLEAF.4700.2015.ju.00010, 2015.

Global Canopy Programme: Sleeping giants of deforestation: the companies, countries and financial institutions with the power to save forests. The 2016 Forest 500 results and analysis, Oxford, UK., 2016.

Godar, J. and Gardner, T.: Trade and Land-Use Telecouplings, in *Telecoupling*, edited by C. Friis and J. Ø. Nielsen, pp. 149–175, Springer International Publishing., 2019.

Godar, J., Persson, U. M., Tizado, E. J. and Meyfroidt, P.: Towards more accurate and policy relevant footprint analyses: Tracing fine-scale socio-environmental impacts of production to consumption, *Ecol. Econ.*, 112, doi:10.1016/j.ecolecon.2015.02.003, 2015.

Godar, J., Suavet, C., Gardner, T. A., Dawkins, E. and Meyfroidt, P.: Balancing detail and scale in assessing transparency to improve the governance of agricultural commodity supply chains, *Environ. Res. Lett.*, 11(3), 035015, doi:10.1088/1748-9326/11/3/035015, 2016.

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Pretty, J., Robinson, S., Thomas, S. M. and Toulmin, C.: Food security: the challenge of feeding 9 billion people., *Science*, 327(5967), 812–8, doi:10.1126/science.1185383, 2010a.

Godfray, H. C. J., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Nisbett, N., Pretty, J., Robinson, S., Toulmin, C. and Whiteley, R.: The future of the global food system., *Philos. Trans. R. Soc. Lond. B. Biol. Sci.*, 365(1554), 2769–77, doi:10.1098/rstb.2010.0180, 2010b.

Goldstein, B. and Newell, J. P.: Why academics should study the supply chains of

individual corporations, *J. Ind. Ecol.*, 23(6), 1316–1327, doi:10.1111/jiec.12932, 2019.

Gollnow, F., Hissa, L. de B. V., Rufin, P. and Lakes, T.: Property-level direct and indirect deforestation for soybean production in the Amazon region of Mato Grosso, Brazil, *Land use policy*, 78(June 2017), 377–385, doi:10.1016/j.landusepol.2018.07.010, 2018.

Gomez-Trujillo, A. M., Velez-Ocampo, J. and Gonzalez-Perez, M. A.: A literature review on the causality between sustainability and corporate reputation: What goes first?, *Manag. Environ. Qual. An Int. J.*, 31(2), 406–430, doi:10.1108/MEQ-09-2019-0207, 2020.

Gong, Y. and Janssen, M.: From policy implementation to business process management: Principles for creating flexibility and agility, *Gov. Inf. Q.*, 29(SUPPL. 1), S61–S71, doi:10.1016/j.giq.2011.08.004, 2012.

González, N. C. and Kröger, M.: The potential of Amazon indigenous agroforestry practices and ontologies for rethinking global forest governance, *For. Policy Econ.*, 118(June), 102257, doi:10.1016/j.forpol.2020.102257, 2020.

Goodman, J., Korsunova, A. and Halme, M.: Our Collaborative Future: Activities and Roles of Stakeholders in Sustainability-Oriented Innovation, *Bus. Strateg. Environ.*, 26(6), 731–753, doi:10.1002/bse.1941, 2017.

Grabs, J.: The rise of buyer-driven sustainability governance: Emerging trends in the global coffee sector, *J. Bus. Ethics*, 173(1), 43 [online] Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3015166, 2017.

Grabs, J.: Assessing the institutionalization of private sustainability governance in a changing coffee sector, *Regul. Gov.*, (July), doi:10.1111/rego.12212, 2018.

Grabs, J. and Carodenuto, S. L.: Traders as sustainability governance actors in global food supply chains: A research agenda, *Bus. Strateg. Environ.*, 30(2), 1314–1332, doi:10.1002/bse.2686, 2021.

Grabs, J. and Ponte, S.: The evolution of power in the global coffee value chain and production network, *J. Econ. Geogr.*, 19(4), 803–828, doi:10.1093/jeg/lbz008, 2019.

Graham, S.: The Influence of External and Internal Stakeholder Pressures on the Implementation of Upstream Environmental Supply Chain Practices, *Bus. Soc.*, 59(2), 351–383, doi:10.1177/0007650317745636, 2020.

Graz, J.: Grounding the Politics of Transnational Private Governance: Introduction to the Special Section, *New Polit. Econ.*, 0(0), 1–11, doi:10.1080/13563467.2021.1881472, 2021.

Green, J. M. H., Croft, S. A., Durán, A. P., Balmford, A. P., Burgess, N. D., Fick, S., Gardner, T. A., Godar, J., Suavet, C., Virah-Sawmy, M., Young, L. E. and West, C.

D.: Correction for Green et al., Linking global drivers of agricultural trade to on-the-ground impacts on biodiversity, *Proc. Natl. Acad. Sci.*, 116(51), 26085–26086, doi:10.1073/pnas.1920142116, 2019.

Greenpeace: Eating up the Amazon, Washington, DC. [online] Available from: <https://www.greenpeace.org/usa/wp-content/uploads/legacy/Global/usa/report/2010/2/eating-up-the-amazon.pdf>, 2006.

Greenpeace: Amazon Cattle Footprint, , 16 [online] Available from: <http://www.greenpeace.org/international/Global/international/planet-2/report/2009/1/amazon-cattle-footprint-mato.pdf>, 2009a.

Greenpeace: Slaughtering the Amazon, Washington, DC., 2009b.

Greenpeace: Countdown to Extinction: What will it take to get companies to act?, 2019.

Greenpeace: Moment of truth- Time for brands to come clean about their links to forest destruction for palm oil, , 64, doi:10.1016/j.reprotox.2010.10.004, 2020.

Greenpeace: Destruction: Certified., 2021.

Gupta, A.: Transparency under scrutiny: Information disclosure in global environmental governance, *Glob. Environ. Polit.*, 8(2), 1–7, doi:10.1162/glep.2008.8.2.1, 2008.

Gupta, A., Boas, I. and Oosterveer, P.: Transparency in global sustainability governance: to what effect?, *J. Environ. Policy Plan.*, 22(1), 84–97, doi:10.1080/1523908X.2020.1709281, 2020.

Gupta, J., Shin, H. Y., Matthews, R., Meyfroidt, P. and Kuik, O.: The forest transition, the drivers of deforestation and governance approaches, in *Climate Change, Forests and REDD*, edited by J. Gupta, N. van der Grijp, and O. Kuik, pp. 25–51, Routledge, 2013.

Hall, J. and Vredenburg, H.: Managing stakeholder ambiguity, *MIT Sloan Manag. Rev.*, 47(1), 2005.

Halpern, C.: Governing despite its instruments? Instrumentation in EU environmental policy, *West Eur. Polit.*, 33(1), 39–57, doi:10.1080/01402380903354064, 2010.

Hammer, M.: *Beyond Reengineering. How the Process-Centered Organization Is Changing Our Work and Our Lives*, HarperCollins., 1996.

Hannah, L., Roehrdanz, P. R., Krishna Bahadur, K. C., Fraser, E. D. G., Donatti, C. I., Saenz, L., Wright, T. M., Hijmans, R. J., Mulligan, M., Berg, A. and van Soesbergen, A.: The environmental consequences of climate-driven agricultural frontiers, *PLoS One*, 15(2), 1–19, doi:10.1371/journal.pone.0228305, 2020.

Hansen, J., Kharecha, P., Sato, M., Masson-Delmotte, V., Ackerman, F., Beerling, D.

J., Hearty, P. J., Hoegh-Guldberg, O., Hsu, S.-L., Parmesan, C., Rockstrom, J., Rohling, E. J., Sachs, J., Smith, P., Steffen, K., Van Susteren, L., von Schuckmann, K. and Zachos, J. C.: Assessing “dangerous climate change”: required reduction of carbon emissions to protect young people, future generations and nature., *PLoS One*, 8(12), e81648, doi:10.1371/journal.pone.0081648, 2013a.

Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., Thau, D., Stehman, S. V., Goetz, S. J., Loveland, T. R., Kommareddy, A., Egorov, A., Chini, L., Justice, C. O. and Townshend, J. R. G.: High-Resolution Global Maps of 21st-Century Forest Cover Change, *Science* (80-.), 342(6160), 850–853, doi:10.1126/science.1244693, 2013b.

Hatanaka, M. and Busch, L.: Third-party certification in the global agrifood system: An objective or socially mediated governance mechanism?, *Sociol. Ruralis*, 48(1), 73–91, doi:10.1111/j.1467-9523.2008.00453.x, 2008.

Haupt, F., Streck, C., Bakhtary, H., Behm, K., Kroeger, A. and Schulte, I.: Zero-deforestation Commodity Supply Chains by 2020: Are We on Track ?, 2017.

Haupt, F., Bakhtary, H., Schulte, I., Galt, H. and Streck, C.: Progress on Corporate Commitments and their Implementation, TFA 2020, Clim. Focus. CDP, Glob. Canopy, Rainfor. Alliance, (June) [online] Available from: <https://www.tfa2020.org/wp-content/uploads/2018/06/Progress-on-Corporate-Commitments-and-their-Implementation.pdf>, 2018a.

Haupt, F., Streck, C., Bakhtary, H., Behm, K., Kroeger, A. and Schulte, I.: Zero-deforestation commodity supply chains by 2020: Are we on track?, 2018b.

Hayward, J., Krecik, S., Smith, W., Paoli, G., Bexell, A. and Meekers, P.: Musim Mas and CORE – from collaboration to implementation, *ETFRN News*, 58, 50–57, 2017.

Heflich, A.: An EU legal framework to halt and reverse EU-driven global deforestation. European added value assessment, Brussels, Belgium., 2020.

Heilmayr, R., Rausch, L. L., Munger, J. and Gibbs, H. K.: Brazil’s Amazon Soy Moratorium reduced deforestation, *Nat. Food*, 1(12), 801–810, doi:10.1038/s43016-020-00194-5, 2020a.

Heilmayr, R., Carlson, K. M. and Benedict, J. J.: Deforestation spillovers from oil palm sustainability certification, *Environ. Res. Lett.*, 15(7), 075002, doi:10.1088/1748-9326/ab7f0c, 2020b.

Van Helden, F.: Introduction to FLEGT, VPAs and the EU Timber Regulation, *ETFRN News* 53 Mov. Forward with For. Gov., 99–100, 2012.

Helmig, B., Spraul, K. and Ingenhoff, D.: Under Positive Pressure: How Stakeholder Pressure Affects Corporate Social Responsibility Implementation, *Bus. Soc.*, 55(2), 151–187, doi:10.1177/0007650313477841, 2016.

Henders, S., Persson, U. M. and Kastner, T.: Trading forests: Land-use change and carbon emissions embodied in production and exports of forest-risk commodities, *Environ. Res. Lett.*, 10(12), 125012, doi:10.1088/1748-9326/10/12/125012, 2015.

Henderson, J., Dicken, P., Hess, M., Coe, N. and Wai-Chung Yeung, H.: Global production networks and the analysis of economic development, *Rev. Int. Polit. Econ.*, 9(3), 436–464, doi:10.1080/09692290210150842, 2002.

Henson, S. and Humphrey, J.: Understanding the complexities of private standards in global agri-food chains as they impact developing countries, *J. Dev. Stud.*, 46(9), 1628–1646, doi:10.1080/00220381003706494, 2010.

Héritier, A. and Eckert, S.: New Modes of Governance in the Shadow of Hierarchy: Self-regulation by Industry in Europe, *J. Public Policy*, 28(1), 113–138, doi:10.1017/S0143814X08000809, 2008.

Hernandez-Aguilera, J. N., Gómez, M. I., Rodewald, A. D., Rueda, X., Anunu, C., Bennett, R. and van Es, H. M.: Quality as a Driver of Sustainable Agricultural Value Chains: The Case of the Relationship Coffee Model, *Bus. Strateg. Environ.*, 27(2), 179–198, doi:10.1002/bse.2009, 2018.

Heron, T., Prado, P. and West, C.: Global Value Chains and the Governance of ‘Embedded’ Food Commodities: The Case of Soy, *Glob. Policy*, 9(October), 29–37, doi:10.1111/1758-5899.12611, 2018.

Herrero, M., Thornton, P. K., Mason-D’Croz, D., Palmer, J., Benton, T. G., Bodirsky, B. L., Bogard, J. R., Hall, A., Lee, B., Nyborg, K., Pradhan, P., Bonnett, G. D., Bryan, B. A., Campbell, B. M., Christensen, S., Clark, M., Cook, M. T., de Boer, I. J. M., Downs, C., Dizyee, K., Folberth, C., Godde, C. M., Gerber, J. S., Grundy, M., Havlik, P., Jarvis, A., King, R., Loboguerrero, A. M., Lopes, M. A., McIntyre, C. L., Naylor, R., Navarro, J., Obersteiner, M., Parodi, A., Peoples, M. B., Pikaar, I., Popp, A., Rockström, J., Robertson, M. J., Smith, P., Stehfest, E., Swain, S. M., Valin, H., van Wijk, M., van Zanten, H. H. E., Vermeulen, S., Vervoort, J. and West, P. C.: Innovation can accelerate the transition towards a sustainable food system, *Nat. Food*, 1(5), 266–272, doi:10.1038/s43016-020-0074-1, 2020.

Higonnet, E., Bellantonio, M. and Hurowitz, G.: Chocolate’s Dark Secret, , 1–24 [online] Available from: http://www.mightyearth.org/wp-content/uploads/2017/09/chocolates_dark_secret_english_web.pdf, 2018.

Hill, M. and Hupe, P.: *Implementing Public Policy: Governance in Theory and Practice*, Sage, London, UK., 2002.

van Hilten, M., Ongena, G. and Ravesteijn, P.: Blockchain for Organic Food Traceability: Case Studies on Drivers and Challenges, *Front. Blockchain*, 3(September), 1–13, doi:10.3389/fbloc.2020.567175, 2020.

Hogwood, B. W. and Gunn, L.: *Policy Analysis for the Real World*, Oxford University Press, Oxford, UK., 1984.

den Hond, F., de Bakker, F. G. A. and Doh, J.: What Prompts Companies to Collaboration With NGOs? Recent Evidence From the Netherlands., 2015.

Hong, C., Burney, J. A., Pongratz, J., Nabel, J. E. M. S., Mueller, N. D., Jackson, R. B. and Davis, S. J.: Global and regional drivers of land-use emissions in 1961–2017, *Nature*, 589(7843), 554–561, doi:10.1038/s41586-020-03138-y, 2021.

Hopkins, T. K. and Wallerstein, I.: Patterns of Development of the Modern World-System, *Rev. (Fernand Braudel Center)*, 1(2), 111–145, doi:10.2307/40240765, 1977.

Horne, R. E.: Limits to labels: The role of eco-labels in the assessment of product sustainability and routes to sustainable consumption, *Int. J. Consum. Stud.*, 33(2), 175–182, doi:10.1111/j.1470-6431.2009.00752.x, 2009.

Horner, R.: Beyond facilitator? State roles in global value chains and global production networks, *Geogr. Compass*, 11(2), 1–13, doi:10.1111/gec3.12307, 2017.

Hosonuma, N., Herold, M., De Sy, V., De Fries, R. S., Brockhaus, M., Verchot, L., Angelsen, A. and Romijn, E.: An assessment of deforestation and forest degradation drivers in developing countries, *Environ. Res. Lett.*, 7(4), doi:10.1088/1748-9326/7/4/044009, 2012.

Hospes, O.: Marking the success or end of global multi-stakeholder governance? The rise of national sustainability standards in Indonesia and Brazil for palm oil and soy, *Agric. Human Values*, 31(3), 425–437, doi:10.1007/s10460-014-9511-9, 2014.

Howard, P. and Jaffee, D.: Tensions Between Firm Size and Sustainability Goals: Fair Trade Coffee in the United States, *Sustainability*, 5(1), 72–89, doi:10.3390/su5010072, 2013.

Howlett, M.: Beyond Good and Evil in Policy Implementation: Instrument Mixes, Implementation Styles, and Second Generation Theories of Policy Instrument Choice, *Policy Soc.*, 23(2), 1–17, doi:10.1016/s1449-4035(04)70030-2, 2004.

Howlett, M.: Moving policy implementation theory forward: A multiple streams/critical juncture approach, *Public Policy Adm.*, 1–26, doi:10.1177/0952076718775791, 2018.

Hutniczak, B. and Delpuech, C.: Combatting illegal, unreported and unregulated fishing: Where countries stand and where efforts should concentrate in the future. [online] Available from: [https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/FI\(2017\)16/FINAL&docLanguage=En](https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/FI(2017)16/FINAL&docLanguage=En), 2018.

IDH: The urgency of action to tackle tropical deforestation., Utrecht, the Netherlands. [online] Available from: <https://www.idhsustainabletrade.com/tacklingdeforestation/>, 2020.

IDH - the Sustainable Trade Initiative: Letter on UK Due Diligence Consultation, , 3

[online] Available from: <https://www.idhsustainabletrade.com/news/idh-uk-endorses-industry-deforestation-due-diligence-response/>, 2020.

Idle, T.: Innovation Forum - The devil in the detail of deforestation data, Innov. Forum [online] Available from: <https://www.innovationforum.co.uk/articles/the-devil-in-the-detail-of-deforestation-data> (Accessed 22 August 2021), 2021.

Imbach, P., Fung, E., Hannah, L., Navarro-Racines, C. E., Roubik, D. W., Ricketts, T. H., Harvey, C. A., Donatti, C. I., Läderach, P., Locatelli, B. and Roehrdanz, P. R.: Coupling of pollination services and coffee suitability under climate change, *Proc. Natl. Acad. Sci.*, 114(39), 10438–10442, doi:10.1073/pnas.1617940114, 2017.

Ingram, V., Behagel, J., Mammadova, A. and Verschuur, X.: The outcomes of deforestation-free commodity value chain approaches - Background report. [online] Available from: <https://www.wur.nl/nl/project/Outcomes-of-deforestation-free-commodity-value-chain-approaches.htm>, 2020.

IPBES: The global assessment report on summury on policymakers of the IPBES global asessment report on biodiversity and ecosystem services, edited by S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. R. Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas, IPBES secretariat, Bonn, Germany., 2019.

IPCC: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems., 2019.

Itten, R., Jattke, M., Stucki, M., Lütolf, P. and Gassmann, R.: Blockchain in agro-food business: boosting transparency and trust in the coffee value chain with distributed ledgers, 2nd Life Cycle Innov. Conf. (LCIC), Online, 26-28 August 2020 [online] Available from: <https://digitalcollection.zhaw.ch/handle/11475/20717> (Accessed 3 November 2020), 2020.

Iyengar, S. S. and Lepper, M. R.: When choice is demotivating: can one desire too much of a good thing?, *J. Pers. Soc. Psychol.*, 79(6), 995–1006 [online] Available from: <http://www.ncbi.nlm.nih.gov/pubmed/11138768>, 2000.

Jaffe, R. and Bacon, C. M.: From differentiated coffee markets toward alternative trade and knowledge networks, *Confronting Coffee Cris. Fair Trade, Sustain. Livelihoods Ecosyst. Mex. Cent. Am.*, 311–336, doi:10.7551/mitpress/9780262026338.003.0013, 2008.

Jaffee, D.: Weak Coffee: Certification and Co-Optation in the Fair Trade Movement, *Soc. Probl.*, 59(1), 94–116, doi:10.1525/sp.2012.59.1.94, 2012.

Jann, W. and Wegrich, K.: Theories of the Policy Cycle, in *Handbook of Public Policy*

Analysis: Theory, Politics, and Methods, edited by F. Fischer, G. J. Miller, and M. S. Sidney, pp. 43–62, CRC Press., 2007.

Jarman, H. and Luna-Reyes, L. F.: Private Data and Public Value: Governance, Green Consumption, and Sustainable Supply Chains., 2016.

Jewell, J. and Cherp, A.: On the political feasibility of climate change mitigation pathways: Is it too late to keep warming below 1.5°C?, *Wiley Interdiscip. Rev. Clim. Chang.*, 11(1), 1–12, doi:10.1002/wcc.621, 2020.

Jong, H. N.: Indonesia forest-clearing ban is made permanent, but labeled ‘propaganda,’ *Mongabay* [online] Available from: <https://news.mongabay.com/2019/08/indonesia-forest-clearing-ban-is-made-permanent-but-labeled-propaganda/> (Accessed 15 May 2021), 2019.

Jonsson, R., Giurca, A., Masiero, M., Pepke, E., Pettenella, D., Prestemon, J. and Winkel, G.: Assessment of the EU Timber Regulation and FLEGT Action Plan., 2015.

Jopke, P. and Schoneveld, G.: Corporate commitments to zero deforestation., 2018.

Judge-Lord, D., McDermott, C. L. and Cashore, B.: Do Private Regulations Ratchet Up? How to Distinguish Types of Regulatory Stringency and Patterns of Change, *Organ. Environ.*, 33(1), 96–125, doi:10.1177/1086026619858874, 2020.

Juerges, N. and Hansjürgens, B.: Soil governance in the transition towards a sustainable bioeconomy – A review, *J. Clean. Prod.*, 170, 1628–1639, doi:10.1016/j.jclepro.2016.10.143, 2018.

Kareiva, P. M., McNally, B. W., McCormick, S., Miller, T. and Ruckelshaus, M.: Improving global environmental management with standard corporate reporting, *Proc. Natl. Acad. Sci.*, 112(24), 7375–7382, doi:10.1073/pnas.1408120111, 2015.

Kastner, T., Kastner, M. and Nonhebel, S.: Tracing distant environmental impacts of agricultural products from a consumer perspective, *Ecol. Econ.*, 70(6), 1032–1040, doi:10.1016/j.ecolecon.2011.01.012, 2011.

Kastner, T., Rivas, M. J. I., Koch, W. and Nonhebel, S.: Global changes in diets and the consequences for land requirements for food, *Proc. Natl. Acad. Sci.*, 109(18), 6868–6872, doi:10.1073/pnas.1117054109, 2012.

Kastner, T., Schaffartzik, A., Eisenmenger, N., Erb, K. H., Haberl, H. and Krausmann, F.: Cropland area embodied in international trade: Contradictory results from different approaches, *Ecol. Econ.*, 104, 140–144, doi:10.1016/j.ecolecon.2013.12.003, 2014.

Kehoe, L., dos Reis, T. N. P., Meyfroidt, P., Bager, S., Seppelt, R., Kuemmerle, T., Berenguer, E., Clark, M., Davis, K. F., zu Ermgassen, E. K. H. J., Farrell, K. N., Friis, C., Haberl, H., Kastner, T., Murtough, K. L., Persson, U. M., Romero-Muñoz, A., O’Connell, C., Schäfer, V. V., Virah-Sawmy, M., le Polain de Waroux, Y. and Kiesecker, J.: Inclusion, Transparency, and Enforcement: How the EU-Mercosur

Trade Agreement Fails the Sustainability Test, *One Earth*, doi:10.1016/j.oneear.2020.08.013, 2020.

Kim, Y. H. and Davis, G. F.: Challenges for global supply chain sustainability: Evidence from conflict minerals reports, *Acad. Manag. J.*, 59(6), 1896–1916, doi:10.5465/amj.2015.0770, 2016.

King, B. G. and McDonnell, M.-H.: Good firms, good targets: the relationship among corporate social responsibility, reputation, and activist targeting, in *Corporate Social Responsibility in a Globalizing World*, edited by K. Tsutsui and A. Lim, pp. 430–454, Cambridge University Press, Cambridge., 2015.

Kingdon, J. W.: *Agendas, alternatives and public policies*, Little, Brown, Boston, MA, USA., 1984.

Kissinger, G., Herold, M. and de Sy, V.: *Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers*, Vancouver, Canada., 2012.

Klettner, A., Clarke, T. and Boersma, M.: The Governance of Corporate Sustainability: Empirical Insights into the Development, Leadership and Implementation of Responsible Business Strategy, *J. Bus. Ethics*, 122(1), 145–165, doi:10.1007/s10551-013-1750-y, 2014.

Koberg, E. and Longoni, A.: A systematic review of sustainable supply chain management in global supply chains, *J. Clean. Prod.*, 207, 1084–1098, doi:10.1016/j.jclepro.2018.10.033, 2019.

Köhler, S. and Pizzol, M.: Technology assessment of blockchain-based technologies in the food supply chain, *J. Clean. Prod.*, 269, doi:10.1016/j.jclepro.2020.122193, 2020.

Köhler, S., Bager, S. and Pizzol, M.: Sustainability standards and blockchain in agro-food supply chains: Synergies and conflicts, *Technol. Forecast. Soc. Chang.*, Under revi, 2021.

Kolk, A.: Sustainability, accountability and corporate governance: exploring multinationals' reporting practices, *Bus. Strateg. Environ.*, 17(1), 1–15, doi:10.1002/bse.511, 2008.

Kolk, A.: Mainstreaming sustainable coffee, *Sustain. Dev.*, 21(5), 324–337, doi:10.1002/sd.507, 2013.

Kos, D. and Kloppenburg, S.: Digital technologies, hyper-transparency and smallholder farmer inclusion in global value chains, *Curr. Opin. Environ. Sustain.*, 41, 56–63, doi:10.1016/j.cosust.2019.10.011, 2019.

Kouhizadeh, M. and Sarkis, J.: Blockchain practices, potentials, and perspectives in greening supply chains, *Sustain.*, 10(10), doi:10.3390/su10103652, 2018.

Krausmann, F., Erb, K.-H., Gingrich, S., Haberl, H., Bondeau, A., Gaube, V., Lauk, C., Plutzer, C. and Searchinger, T. D.: Global human appropriation of net primary production doubled in the 20th century., *Proc. Natl. Acad. Sci. U. S. A.*, 110(25), 10324–9, doi:10.1073/pnas.1211349110, 2013.

Lacy, P., Arnott, J. and Lowitt, E.: The challenge of integrating sustainability into talent and organization strategies: investing in the knowledge, skills and attitudes to achieve high performance, edited by G. Lenssen, *Corp. Gov. Int. J. Bus. Soc.*, 9(4), 484–494, doi:10.1108/14720700910985025, 2009.

Lake, S.: Weak by design: company commitments fall short on deforestation, *Glob. Canopy*, 1 February, 1–5, 2018.

Lam, D. P. M., Martín-López, B., Wiek, A., Bennett, E. M., Frantzeskaki, N., Horcea-Milcu, A. I. and Lang, D. J.: Scaling the impact of sustainability initiatives: a typology of amplification processes, *Urban Transform.*, 2(1), doi:10.1186/s42854-020-00007-9, 2020a.

Lam, L. S. F., Crocker, T., Amadi, E. and Newman, A.: Zeroing-in on Deforestation: Which agricultural commodities companies are addressing deforestation issues?, London, UK., 2020b.

Lambin, E. F. and Meyfroidt, P.: Global land use change, economic globalization, and the looming land scarcity, *Proc. Natl. Acad. Sci. U. S. A.*, 108(9), 3465–3472, doi:10.1073/pnas.1100480108, 2011.

Lambin, E. F. and Thorlakson, T.: Sustainability Standards: Interactions Between Private Actors, Civil Society, and Governments, *Annu. Rev. Environ. Resour.*, 43(1), 369–393, doi:10.1146/annurev-environ-102017-025931, 2018.

Lambin, E. F., Meyfroidt, P., Rueda, X., Blackman, A., Börner, J., Cerutti, P. O., Dietsch, T., Jungmann, L., Lamarque, P., Lister, J., Walker, N. F. and Wunder, S.: Effectiveness and synergies of policy instruments for land use governance in tropical regions, *Glob. Environ. Chang.*, 28(1), 129–140, doi:10.1016/j.gloenvcha.2014.06.007, 2014.

Lambin, E. F., Gibbs, H. K., Heilmayr, R., Carlson, K. M., Fleck, L. C., Garrett, R. D., Le Polain De Waroux, Y., McDermott, C. L., McLaughlin, D., Newton, P., Nolte, C., Pacheco, P., Rausch, L. L., Streck, C., Thorlakson, T. and Walker, N. F.: The role of supply-chain initiatives in reducing deforestation, *Nat. Clim. Chang.*, 8(2), 109–116, doi:10.1038/s41558-017-0061-1, 2018.

Lambin, E. F., Kim, H., Leape, J. and Lee, K.: Scaling up solutions for a sustainability transition, *One Earth*, 3(1), 89–96, doi:10.1017/CBO9781107415324.004, 2020.

Larsen, R. K., Osbeck, M., Dawkins, E., Tuhkanen, H., Nguyen, H., Nugroho, A., Gardner, T. A., Zulfahm and Wolvekamp, P.: Hybrid governance in agricultural commodity chains: Insights from implementation of ‘No Deforestation, No Peat, No Exploitation’ (NDPE) policies in the oil palm industry, *J. Clean. Prod.*, 183, 544–554,

doi:10.1016/j.jclepro.2018.02.125, 2018.

Lascoumes, P. and Le Gales, P.: Introduction: Understanding Public Policy through Its Instruments—From the Nature of Instruments to the Sociology of Public Policy Instrumentation, *Gov. An Int. J. Policy, Adm. Institutions*, 20(1), 1–21, 2007.

Latta, P. and Barbara, S.: Direct Trade: The New Fair Trade, *Glob. Soc. J.*, 2(2), 2014.

Laurance, W. F., Sayer, J. and Cassman, K. G.: Agricultural expansion and its impacts on tropical nature., *Trends Ecol. Evol.*, 29(2), 107–116, doi:10.1016/j.tree.2013.12.001, 2014.

Lee, J.: Can blockchain transform sustainability within supply chain management ?, University of York., 2018.

Lee, J., Gereffi, G. and Beauvais, J.: Global value chains and agrifood standards: Challenges and possibilities for smallholders in developing countries, *Proc. Natl. Acad. Sci.*, 109(31), 12326–12331, doi:10.1073/pnas.0913714108, 2012.

Leijten, F., Sim, S., King, H. and Verburg, P. H.: Which forests could be protected by corporate zero deforestation commitments? A spatial assessment, *Environ. Res. Lett.*, 15(6), doi:10.1088/1748-9326/ab8158, 2020.

Lemos, M. C. and Agrawal, A.: Environmental governance, *Annu. Rev. Environ. Resour.*, 31(1), 297–325, doi:10.1146/annurev.energy.31.042605.135621, 2006.

Lenschow, A., Newig, J. and Challies, E.: Globalization's limits to the environmental state? Integrating telecoupling into global environmental governance, *Env. Polit.*, 25(1), 136–159, doi:10.1080/09644016.2015.1074384, 2016.

Lenzen, M., Moran, D., Kanemoto, K., Foran, B., Lobefaro, L. and Geschke, A.: International trade drives biodiversity threats in developing nations, *Nature*, 486(7401), 109–112, doi:10.1038/nature11145, 2012.

Lernoud, J., Potts, J., Sampson, G., Voora, V., Willer, H. and Wozniak, J.: The State of Sustainable Markets 2017 - Statistics and Emerging Trends, International Trade Centre (ITC), International Institute for Sustainable Development (IISD), Research Institute of Organic Agriculture (FiBL), Geneva., 2017.

Lesniewska, F. and McDermott, C. L.: FLEGT VPAs: Laying a pathway to sustainability via legality lessons from Ghana and Indonesia, *For. Policy Econ.*, 48, 16–23, doi:10.1016/j.forpol.2014.01.005, 2014.

Lewis, S. A., Fezzi, C., Dacks, R., Ferrini, S., James, P. A. S., Marino, L., Golbuu, Y. and Oleson, K. L. L.: Conservation policies informed by food system feedbacks can avoid unintended consequences, *Nat. Food*, 1(12), 783–786, doi:10.1038/s43016-020-00192-7, 2020.

Liesen, A., Hoepner, A. G., Patten, D. M. and Figge, F.: Does stakeholder pressure influence corporate GHG emissions reporting? Empirical evidence from Europe,

Accounting, Audit. Account. J., 28(7), 1047–1074, doi:10.1108/AAAJ-12-2013-1547, 2015.

Lin, K., Chavalarias, D., Panahi, M., Yeh, T., Takimoto, K. and Mizoguchi, M.: Mobile-based traceability system for sustainable food supply networks, *Nat. Food*, 1(11), 673–679, doi:10.1038/s43016-020-00163-y, 2020.

Linton, A.: A niche for sustainability? Fair labor and environmentally sound practices in the specialty coffee industry, *Globalizations*, 5(2), 231–245, doi:10.1080/14747730802057621, 2008.

Liscow, Z. D.: Do property rights promote investment but cause deforestation? Quasi-experimental evidence from Nicaragua, *J. Environ. Econ. Manage.*, 65(2), 241–261, doi:10.1016/j.jeem.2012.07.001, 2013.

Liu, J.: Integration across a metacoupled world, *Ecol. Soc.*, 22(4), doi:10.5751/ES-09830-220429, 2017.

Liu, J., Hull, V., Batistella, M., DeFries, R., Dietz, T., Fu, F., Hertel, T. W., Izaurrealde, R. C., Lambin, E. F., Li, S., Martinelli, L. A., McConnell, W. J., Moran, E. F., Naylor, R., Ouyang, Z., Polenske, K. R., Reenberg, A., de Miranda Rocha, G., Simmons, C. S., Verburg, P. H., Vitousek, P. M., Zhang, F., Zhu, C., Liu, J., Hull, V., Batistella, M., DeFries, R., Dietz, T., Fu, F., Hertel, T. W., Izaurrealde, R. C., Lambin, E. F., Li, S., Martinelli, L. A., McConnell, W. J., Moran, E. F., Naylor, R., Ouyang, Z., Polenske, K. R., Reenberg, A., De, G., Simmons, C. S., Verburg, P. H., Vitousek, P. M., Zhang, F. and Zhu, C.: Framing Sustainability in a Telecoupled World, *Ecol. Soc.*, 18(2), 26, doi:10.5751/ES-05873-180226, 2013.

Liu, J., Hull, V., Moran, E., Nagendra, H., Swaffield, S. R. and Turner II, B. L.: Applications of the Telecoupling Framework to Land-Change Science, *Rethink. Glob. L. Use an Urban Era*, 14, 119–140, doi:10.7551/mitpress/9780262026901.003.0007, 2014.

Liu, J., Dou, Y., Batistella, M., Challies, E., Connor, T., Friis, C., Millington, J. DA, Parish, E., Romulo, C. L., Silva, R. F. B., Triezenberg, H., Yang, H., Zhao, Z., Zimmerer, K. S., Huettmann, F., Treglia, M. L., Basher, Z., Chung, M. G., Herzberger, A., Lenschow, A., Mechiche-Alami, A., Newig, J., Roche, J. and Sun, J.: Spillover systems in a telecoupled Anthropocene: typology, methods, and governance for global sustainability, *Curr. Opin. Environ. Sustain.*, 33, 58–69, doi:10.1016/j.cosust.2018.04.009, 2018.

Liu, J., Dietz, T., Carpenter, S. R., Taylor, W. W., Alberti, M., Deadman, P., Redman, C., Pell, A., Folke, C., Ouyang, Z. and Lubchenco, J.: Coupled human and natural systems: The evolution and applications of an integrated framework, *Ambio*, doi:10.1007/s13280-020-01488-5, 2021.

Locke, K., Feldman, M. and Golden-Biddle, K.: Coding Practices and Iterativity: Beyond Templates for Analyzing Qualitative Data, *Organ. Res. Methods*, 1–23,

doi:10.1177/1094428120948600, 2020.

Loconto, A. and Dankers, C.: Impact of international voluntary standards on smallholder market participation in developing countries: a review of the literature., 2014.

Di Lucia, L.: External governance and Europeanization beyond borders: EU biofuel policies in Mozambique, in *A Guide to EU Renewable Energy Policy*, pp. 265–286, Edward Elgar Publishing., 2017.

Lund-Thomsen, P.: Corporate Social Responsibility in Global Value Chains, in *Handbook on Global Value Chains*, edited by S. Ponte, G. Gereffi, and G. Raj-Reichert, pp. 285–295, Edward Elgar. [online] Available from: <https://www.e-elgar.com/shop/gbp/handbook-on-global-value-chains-9781788113762.html>, 2019.

Lyons-White, J. and Knight, A. T.: Palm oil supply chain complexity impedes implementation of corporate no-deforestation commitments, *Glob. Environ. Chang.*, 50(August 2017), 303–313, doi:10.1016/j.gloenvcha.2018.04.012, 2018.

Lyons-White, J., Pollard, E. H. B., Catalano, A. S. and Knight, A. T.: Rethinking zero deforestation beyond 2020 to more equitably and effectively conserve tropical forests, *One Earth*, 3(6), 714–726, doi:10.1016/j.oneear.2020.11.007, 2020.

MacGregor, F., Ramasar, V. and Nicholas, K. A.: Problems with Firm-Led Voluntary Sustainability Schemes: The Case of Direct Trade Coffee, *Sustainability*, 9(4), 651, doi:10.3390/su9040651, 2017.

Majone, G.: On the Notion of Political Feasibility*, *Eur. J. Polit. Res.*, 3(3), 259–274, doi:10.1111/j.1475-6765.1975.tb00780.x, 1975.

Mallet, P., Maireles, M., Kennedy, E. and Devisscher, M.: How sustainability standards can contribute to landscape approaches and zero deforestation commitments, , (April), 2016.

Manning, S., Boons, F., von Hagen, O. and Reinecke, J.: National contexts matter: The co-evolution of sustainability standards in global value chains, *Ecol. Econ.*, 83, 197–209, doi:10.1016/j.ecolecon.2011.08.029, 2012.

Martius, C., Angelsen, A., Larson, A. M., Thuy, P. T., Sonwa, D. J. and Belcher, B.: Pathway to impact. Is REDD+ a viable theory of change?, *Transform. REDD+ Lessons new Dir.*, 17–28, 2018.

Matricardi, E. A. T., Skole, D. L., Costa, O. B., Pedlowski, M. A., Samek, J. H. and Miguel, E. P.: Long-term forest degradation surpasses deforestation in the Brazilian Amazon, *Science* (80-.), 369(6509), 1378–1382, doi:10.1126/science.abb3021, 2020.

Matthews, A.: The European Union’s common agricultural policy and developing countries: the struggle for coherence, *J. Eur. Integr.*, 30(3), 381–399,

doi:10.1080/07036330802141998, 2008.

Matthews, A.: The CAP in the 2021–2027 MFF Negotiations, *Intereconomics*, 53(6), 306–311, doi:10.1007/s10272-018-0773-0, 2018.

Maus, V. and Giljum, S.: Using satellite earth observations to map global resource extraction and related environmental impacts: examples from agriculture and mining, *FINEPRINT* Br. No. 10 [online] Available from: <https://www.fineprint.global/publications/briefs/satellite-earth-observations/> (Accessed 13 August 2021), 2020.

Mayer, F. and Gereffi, G.: Regulation and economic globalization: Prospects and limits of private governance, *Bus. Polit.*, 12(3), doi:10.2202/1469-3569.1325, 2010.

Mayer, F. W., Phillips, N. and Posthuma, A. C.: The political economy of governance in a ‘global value chain world,’ *New Polit. Econ.*, 22(2), 129–133, doi:10.1080/13563467.2016.1273343, 2017.

McCoy, K. and Servent, R.: Public- and private-sector roles in achieving zero deforestation, in *ETFRN News* 58, pp. 171–177., 2017.

Meadowcroft, J.: Politics and scale: some implications for environmental governance, *Landsc. Urban Plan.*, 61, 169–179, 2002.

Meadows, D.: *Leverage Points: Places to Intervene in a System*, Hartland, VT. [online] Available from: http://www.donellameadows.org/wp-content/userfiles/Leverage_Points.pdf, 1999.

Meemken, E.-M., Sellare, J., Kouame, C. N. and Qaim, M.: Effects of Fairtrade on the livelihoods of poor rural workers, *Nat. Sustain.*, 2(7), 635–642, doi:10.1038/s41893-019-0311-5, 2019.

Meemken, E.-M. M.: Do smallholder farmers benefit from sustainability standards? A systematic review and meta-analysis, *Glob. Food Sec.*, 26(April), 100373, doi:10.1016/j.gfs.2020.100373, 2020.

Mehrabi, Z., McDowell, M. J., Ricciardi, V., Levers, C., Martinez, J. D., Mehrabi, N., Wittman, H., Ramankutty, N. and Jarvis, A.: The global divide in data-driven farming, *Nat. Sustain.*, 4(2), 154–160, doi:10.1038/s41893-020-00631-0, 2021.

De Mendonca, T. and Zhou, Y.: When companies improve the sustainability of the natural environment: A study of large U.S. companies, *Bus. Strateg. Environ.*, 29(3), 801–811, doi:10.1002/bse.2398, 2020.

van Meter, D. S. and van Horn, C. E.: The Policy Implementation Process: A Conceptual Framework, *Adm. Soc.*, 6(4), 445–488, 1975.

Meyfroidt, P.: Approaches and terminology for causal analysis in land systems science, *J. Land Use Sci.*, 11(5), 501–522, doi:10.1080/1747423X.2015.1117530, 2016.

Meyfroidt, P.: Explanations in Telecoupling Research, in *Telecoupling*, edited by C. Friis and J. Ø. Nielsen, pp. 69–86, Springer International Publishing, Cham., 2019.

Meyfroidt, P., Rudel, T. K. and Lambin, E. F.: Forest transitions, trade, and the global displacement of land use, *Proc. Natl. Acad. Sci.*, 107(49), 20917–20922, doi:10.1073/pnas.1014773107, 2010.

Meyfroidt, P., Vu, T. P. and Hoang, V. A.: Trajectories of deforestation, coffee expansion and displacement of shifting cultivation in the Central Highlands of Vietnam, *Glob. Environ. Chang.*, 23(5), 1187–1198, doi:10.1016/j.gloenvcha.2013.04.005, 2013.

Meyfroidt, P., Carlson, K. M., Fagan, M. E., Gutiérrez-Vélez, V. H., Macedo, M. N., Curran, L. M., DeFries, R. S., Dyer, G. A., Gibbs, H. K., Lambin, E. F., Morton, D. C. and Robiglio, V.: Multiple pathways of commodity crop expansion in tropical forest landscapes, *Environ. Res. Lett.*, 9(7), 074012, doi:10.1088/1748-9326/9/7/074012, 2014.

Meyfroidt, P., Roy Chowdhury, R., de Bremond, A., Ellis, E. C., Erb, K.-H., Filatova, T., Garrett, R. D., Grove, J. M., Heinimann, A., Kuemmerle, T., Kull, C. A., Lambin, E. F., Landon, Y., le Polain de Waroux, Y., Messerli, P., Müller, D., Nielsen, J. Ø., Peterson, G. D., Rodríguez García, V., Schlüter, M., Turner, B. L. and Verburg, P. H.: Middle-range theories of land system change, *Glob. Environ. Chang.*, 53(March), 52–67, doi:10.1016/j.gloenvcha.2018.08.006, 2018.

Middendorp, R. S., Boever, O., Rueda, X. and Lambin, E. F.: Improving smallholder livelihoods and ecosystems through direct trade relations: High-quality cocoa producers in Ecuador, *Bus. Strateg. Dev.*, 3(2), 165–184, doi:10.1002/bsd2.86, 2020.

Millard, E.: Still brewing: Fostering sustainable coffee production, *World Dev. Perspect.*, 7–8(November), 32–42, doi:10.1016/j.wdp.2017.11.004, 2017.

Minang, P. A., Duguma, L. A., Bernard, F., Mertz, O. and van Noordwijk, M.: Prospects for agroforestry in REDD+ landscapes in Africa, *Curr. Opin. Environ. Sustain.*, 6(1), 78–82, doi:10.1016/j.cosust.2013.10.015, 2014.

Ministère de la Transition Écologique et Solidaire: Stratégie nationale de lutte contre la déforestation importée: 2018-2030 (National strategy to combat imported deforestation: 2018-2030). [online] Available from: https://www.ecologique-solidaire.gouv.fr/sites/default/files/2018.11.14_dp_sndi_mtes.pdf, 2018.

Minten, B., Dereje, M., Engida, E. and Tamru, S.: Tracking the Quality Premium of Certified Coffee: Evidence from Ethiopia, *World Dev.*, 101, 119–132, doi:10.1016/j.worlddev.2017.08.010, 2018.

Mintzberg, H. and Waters, J. A. : Of Strategies, Deliberate and Emergent, *Strateg. Manag. J.*, 6(3), 257–272, 1985.

Mitchell, R. K., Agle, B. R. and Wood, D. J.: Toward a Theory of Stakeholder

Identification and Salience: Defining the Principle of Who and What Really Counts, *Acad. Manag. Rev.*, 22(4), 853–886, 1997.

Mitiku, F., de Mey, Y., Nyssen, J. and Maertens, M.: Do Private Sustainability Standards Contribute to Income Growth and Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia, *Sustainability*, 9(2), 246, doi:10.3390/su9020246, 2017.

Moffette, F. and Gibbs, H.: Agricultural Displacement and Deforestation Leakage in the Brazilian Legal Amazon, *Land Econ.*, 97(1), 2–47 [online] Available from: <https://economics.ca/2018/papers/MF0041-1.pdf>, 2021.

Moffette, F., Alix-Garcia, J., Shea, K. and Pickens, A. H.: The impact of near-real-time deforestation alerts across the tropics, *Nat. Clim. Chang.*, 11(2), 172–178, doi:10.1038/s41558-020-00956-w, 2021.

Mol, A. P. J.: Transparency and value chain sustainability, *J. Clean. Prod.*, 107, 154–161, doi:10.1016/j.jclepro.2013.11.012, 2015.

Moran, D., Giljum, S., Kanemoto, K. and Godar, J.: From Satellite to Supply Chain: New Approaches Connect Earth Observation to Economic Decisions, *One Earth*, 3(1), 5–8, doi:10.1016/j.oneear.2020.06.007, 2020.

Morgans, C. L., Meijaard, E., Santika, T., Law, E., Budiharta, S., Ancrenaz, M. and Wilson, K. A.: Evaluating the effectiveness of palm oil certification in delivering multiple sustainability objectives, *Environ. Res. Lett.*, 13(6), 064032, doi:10.1088/1748-9326/aac6f4, 2018.

Morrison, T. H., Adger, W. N., Brown, K., Lemos, M. C., Huitema, D., Phelps, J., Evans, L., Cohen, P., Song, A. M., Turner, R., Quinn, T. and Hughes, T. P.: The black box of power in polycentric environmental governance, *Glob. Environ. Chang.*, 57(March), 101934, doi:10.1016/j.gloenvcha.2019.101934, 2019.

Moss, T.: Solving Problems of ‘Fit’ at the Expense of Problems of ‘Interplay’? The Spatial Reorganisation of Water Management Following the EU Water Framework Directive, *How Institutions Chang.*, 85–121, doi:10.1007/978-3-322-80936-0_7, 2003.

Muir, G., Murray, J., Sartoretto, E., Hewitt, D., Simpson, R. and Fox, J.: Coordinating climate action: experiences from REDD+ and FLEGT, *Unasylva*, 67(246), 37–44, 2016.

Munroe, D. K., Batistella, M., Friis, C., Gasparri, N. I., Lambin, E. F., Liu, J., Meyfroidt, P., Moran, E. and Nielsen, J. Ø.: Governing flows in telecoupled land systems, *Curr. Opin. Environ. Sustain.*, 38(June), 53–59, doi:10.1016/j.cosust.2019.05.004, 2019.

Murad, C. A. and Pearse, J.: Landsat study of deforestation in the Amazon region of Colombia: Departments of Caquetá and Putumayo, *Remote Sens. Appl. Soc.*

Environ., 11(July), 161–171, doi:10.1016/j.rsase.2018.07.003, 2018.

Nagendra, H. and Ostrom, E.: Polycentric governance of multifunctional forested landscapes, , 6(2), 104–133, 2012.

Nathan, M. L.: “Lighting tomorrow with today”: towards a (strategic) sustainability revolution, *Int. J. Sustain. Strateg. Manag.*, 2(1), 29, doi:10.1504/ijssm.2010.032162, 2010.

Neeff, T. and Linhares-Juvenal, T.: Zero-deforestation commitments - A new avenue towards enhanced forest governance? [online] Available from: <http://www.fao.org/3/i9927en/I9927EN.pdf>, 2018.

Neo, P.: ‘We need to be prepared’: Asian markets will be increasingly concerned with palm oil sustainability - MPOC Exclusive Part 2, Food Navig. Asia [online] Available from: <https://www.foodnavigator-asia.com/Article/2021/08/18/We-need-to-be-prepared-Asian-markets-will-be-increasingly-concerned-with-palm-oil-sustainability-MPOC-Exclusive-Part-2> (Accessed 22 August 2021), 2021.

Nepstad, D., McGrath, D., Stickler, C., Alencar, A., Azevedo, A., Swette, B., Bezerra, T., DiGiano, M., Shimada, J., Seroa da Motta, R., Armijo, E., Castello, L., Brando, P., Hansen, M. C., McGrath-Horn, M., Carvalho, O., Hess, L., Seroa, R., Armijo, E., Castello, L., Brando, P., Hansen, M. C., McGrath-Horn, M., Carvalho, O., Hess, L., Seroa da Motta, R., Armijo, E., Castello, L., Brando, P., Hansen, M. C., McGrath-Horn, M., Carvalho, O. and Hess, L.: Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains., *Science* (80-.), 344(6188), 1118–23, doi:10.1126/science.1248525, 2014.

Nestlé: Nestlé accelerates No Deforestation commitment by implementing 100% satellite monitoring coverage of its global palm oil supply chains, [online] Available from: <https://www.nestle.com/media/pressreleases/allpressreleases/no-deforestation-satellite-monitoring-coverage-palm-oil-supply-chains> (Accessed 24 May 2021), 2018.

Newell, P., Taylor, O. and Touni, C.: Governing Food and Agriculture in a Warming World, *Glob. Environ. Polit.*, 18(2), 53–71, doi:10.1162/glep_a_00456, 2018.

Newig, J., Challies, E., Cotta, B., Lenschow, A. and Schilling-Vacaflor, A.: Governing global telecoupling toward environmental sustainability, *Ecol. Soc.*, 25(4), art21, doi:10.5751/ES-11844-250421, 2020.

Nicholson-Crotty, S. and Carley, S.: Effectiveness, Implementation, and Policy Diffusion, *State Polit. Policy Q.*, 16(1), 78–97, doi:10.1177/1532440015588764, 2015.

Nielsen, J. Ø., de Bremond, A., Roy Chowdhury, R., Friis, C., Metternicht, G., Meyfroidt, P., Munroe, D., Pascual, U. and Thomson, A.: Toward a normative land systems science, *Curr. Opin. Environ. Sustain.*, 38, 1–6, doi:10.1016/j.cosust.2019.02.003, 2019.

Nolte, C., le Polain de Waroux, Y., Munger, J., Reis, T. N. P. and Lambin, E. F.: Conditions influencing the adoption of effective anti-deforestation policies in South America's commodity frontiers, *Glob. Environ. Chang.*, 43, 1–14, doi:10.1016/j.gloenvcha.2017.01.001, 2017.

Noojipady, P., Morton, D. C., Schroeder, W., Carlson, K. M., Huang, C., Gibbs, H. K., Burns, D., Walker, N. F. and Prince, S. D.: Managing fire risk during drought: The influence of certification and El Niño on fire-driven forest conversion for oil palm in Southeast Asia, *Earth Syst. Dyn.*, 8(3), 749–771, doi:10.5194/esd-8-749-2017, 2017.

NYDF: New York Declaration on Forests, Forest Declaration. [online] Available from: https://forestdeclaration.org/images/uploads/resource/NYDF_Declaration.pdf (Accessed 13 July 2021), 2014.

NYDF Assessment Partners: Protecting and Restoring Forests: A Story of Large Commitments yet Limited Progress, Accessible at forestdeclaration.org, 2019.

NYDF Assessment Partners: Balancing forests and development: Addressing infrastructure and extractive industries, promoting sustainable livelihoods., 2020.

Oberlack, C., Boillat, S., Brönnimann, S., Gerber, J. D., Heinimann, A., Speranza, C. I., Messerli, P., Rist, S. and Wiesmann, U.: Polycentric governance in telecoupled resource systems, *Ecol. Soc.*, 23(1), doi:10.5751/ES-09902-230116, 2018.

OECD: OECD Due Diligence Guidance for Responsible Business Conduct, Paris, France., 2018.

Oharenko, Y.: Guest Article: An EU Carbon Border Adjustment Mechanism: Can it Make Global Trade Greener While Respecting WTO Rules? | SDG Knowledge Hub | IISD, IISD SDG Knowl. Hub [online] Available from: http://sdg.iisd.org/commentary/guest-articles/an-eu-carbon-border-adjustment-mechanism-can-it-make-global-trade-greener-while-respecting-wto-rules/?utm_medium=email&utm_campaign=SDG_Update-18_May2021&utm_content=SDG_Update-18_May2021+CID_4c567e3acee1f060a9b5a50069b8cffc&utm_source=cm (Accessed 23 May 2021), 2021.

Olesen, A., Böttcher, H., Siemons, A., Herrmann, L., Martius, C., Roman-Cuesta, R. M., Atmadja, S., Hansen, D. S., Andersen, S. P., Georgiev, I., Bager, S. L., Schwöppe, C. and Wunder, S.: Study on EU Financing of REDD+ Related Activities, and Results-Based Payments Pre and Post 2020: Sources, Cost-Effectiveness and Fair Allocation of Incentives., 2018.

Opal, C.: Innovations to keep forests standing, *ETFRN News* 58, 58, 59–65, 2017.

Ordway, E. M., Asner, G. P. and Lambin, E. F.: Deforestation risk due to commodity crop expansion in sub-Saharan Africa, *Environ. Res. Lett.*, 12(4), doi:10.1088/1748-9326/aa6509, 2017.

Ortiz, A. M. D., Outhwaite, C. L., Dalin, C. and Newbold, T.: A review of the interactions between biodiversity, agriculture, climate change, and international trade: research and policy priorities, *One Earth*, 4(1), 88–101, doi:10.1016/j.oneear.2020.12.008, 2021.

Ostrom, E.: Revisiting the Commons: Local Lessons, Global Challenges, *Science* (80-.), 284(5412), 278–282, doi:10.1126/science.284.5412.278, 1999.

Ostrom, E.: A General Framework for Analyzing Sustainability of Social-Ecological Systems, *Science* (80-.), 325(5939), 419–422, 2007.

Ostrom, E.: Beyond Markets and States: Polycentric Governance of Complex Economic Systems, *Am. Econ. Rev.*, 100(3), 641–672, doi:10.1257/aer.100.3.641, 2010a.

Ostrom, E.: Polycentric systems for coping with collective action and global environmental change, *Glob. Environ. Chang.*, 20(4), 550–557, doi:10.1016/j.gloenvcha.2010.07.004, 2010b.

Ostrom, E., Janssen, M. A. and Anderies, J. M.: Going beyond panaceas, *Proc. Natl. Acad. Sci.*, 104(39), 15176–15178, doi:10.1073/pnas.0701886104, 2007.

Ovalle-Rivera, O., Läderach, P., Bunn, C., Obersteiner, M. and Schroth, G.: Projected Shifts in *Coffea arabica* Suitability among Major Global Producing Regions Due to Climate Change, edited by R. D. Loyola, *PLoS One*, 10(4), e0124155, doi:10.1371/journal.pone.0124155, 2015.

Overdevest, C. and Zeitlin, J.: Assembling an experimentalist regime: Transnational governance interactions in the forest sector, *Regul. Gov.*, 8(1), 22–48, doi:10.1111/j.1748-5991.2012.01133.x, 2014.

Overdevest, C. and Zeitlin, J.: Experimentalism in transnational forest governance: Implementing European Union Forest Law Enforcement, Governance and Trade (FLEGT) Voluntary Partnership Agreements in Indonesia and Ghana, *Regul. Gov.*, 12(1), 64–87, doi:10.1111/rego.12180, 2018.

Pahle, M., Burtraw, D., Flachsland, C., Kelsey, N., Biber, E., Meckling, J., Edenhofer, O. and Zysman, J.: Sequencing to ratchet up climate policy stringency, *Nat. Clim. Chang.*, 8(10), 861–867, doi:10.1038/s41558-018-0287-6, 2018.

Palmer, J.: Risk governance in an age of wicked problems: lessons from the European approach to indirect land-use change, *J. Risk Res.*, 15(5), 495–513, doi:10.1080/13669877.2011.643477, 2012.

Panhuysen, S. and Pierrot, J.: Coffee Barometer 2014., 2014.

Panhuysen, S. and Pierrot, J.: Coffee Barometer 2018., 2018.

Panhuysen, S. and Pierrot, J.: Coffee Barometer 2020., 2020.

Partzsch, L.: European Union's proxy accountability for tropical deforestation, *Env. Polit.*, 00(00), 1–22, doi:10.1080/09644016.2020.1793618, 2020a.

Partzsch, L.: The Return of the State, in *Alternatives to Multilateralism: New Forms of Social and Environmental Governance*, pp. 89–131, The MIT Press., 2020b.

Pasiecznik, N., Savenije, H., Orshoven, C. V. A. N. and Bock, J. A. N.: Key issues: making zero deforestation commitments work better, *Zero Deforestation A Commit. to Chang.*, (58), 8–20, 2017.

Pavlić Skender, H. and Zaninović, P. A.: Perspectives of Blockchain Technology for Sustainable Supply Chains, in *Integration of Information Flow for Greening Supply Chain Management*, edited by Adam Kolinski, Davor Dujak, and Paulina Golinska-Dawson, pp. 77–92, Springer., 2020.

Pearce, F.: Protecting Forests, Respecting Rights: Options for EU Action on deforestation and forest degradation. [online] Available from: <http://www.fern.org/protectingforests>, 2015.

Pedersen, A. F., Nielsen, J. Ø., Mempel, F., Bager, S. L., Jønsson, J. B. and Corbera, E.: The ambiguity of transparency in the artisanal and small-scale mining sector of Tanzania, *Extr. Ind. Soc.*, 2021.

Pendrill, F., Persson, M., Godar, J., Kastner, T., Moran, D., Schmidt, S. and Wood, R.: Agricultural and forestry trade drives large share of tropical deforestation emissions, *Glob. Environ. Chang.*, 56(February), 1–10, doi:10.1016/j.gloenvcha.2019.03.002, 2019a.

Pendrill, F., Persson, U. M., Godar, J., Kastner, T., Persson, M., Godar, J. and Kastner, T.: Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition, *Environ. Res. Lett.*, 14(5), 1–17, doi:10.1088/1748-9326/ab0d41, 2019b.

Pendrill, F., Persson, U. M. and Kastner, T.: Deforestation risk embodied in production and consumption of agricultural and forestry commodities 2005-2017 (Version 1.0) [Data set], Zenodo., 2020.

Perrault, E. and Clark, C.: Environmental Shareholder Activism, *Organ. Environ.*, 29(2), 194–211, doi:10.1177/1086026615571939, 2016.

Perrini, F. and Tencati, A.: Sustainability and stakeholder management: the need for new corporate performance evaluation and reporting systems, *Bus. Strateg. Environ.*, 15(5), 296–308, doi:10.1002/bse.538, 2006.

Persson, M., Henders, S. and Kastner, T.: Trading Forests: Quantifying the Contribution of Global Commodity Markets to Emissions from Tropical Deforestation, *SSRN Electron. J.*, (October 2014), doi:10.2139/ssrn.2622757, 2014.

Pham, Y., Reardon-Smith, K., Mushtaq, S. and Cockfield, G.: The impact of climate

change and variability on coffee production: a systematic review, *Clim. Change*, 156(4), 609–630, doi:10.1007/s10584-019-02538-y, 2019.

Picken, T. O. M., Warmerdam, W., Gregory, M. and Mark, M. V. A. N. D. E. R.: Decoupling international finance from deforestation, and the need for regulation, *ETFRN News*, 58, 119–125, 2017.

Pirlot, P., Delreux, T. and Farcy, C.: Forests: A Multi-sectoral and Multi-level Approach to Sustainable Forest Management, in *European Union External Environmental Policy*, pp. 167–187, Springer International Publishing., 2018.

le Polain de Waroux, Y., Garrett, R. D., Heilmayr, R. and Lambin, E. F.: Land-use policies and corporate investments in agriculture in the Gran Chaco and Chiquitano, *Proc. Natl. Acad. Sci.*, 113(15), 4021–4026, doi:10.1073/pnas.1602646113, 2016.

Pollitt, M. and Shaorshadze, I.: The Role of Behavioural Economics in Energy and Climate Policy. [online] Available from: <https://www.repository.cam.ac.uk/handle/1810/242021>, 2011.

Ponte, S.: The “Latte Revolution”? Regulation, markets and consumption in the global coffee chain, *World Dev.*, 30(7), 1099–1122, doi:10.1016/S0305-750X(02)00032-3, 2002.

Ponte, S.: Standards and Sustainability in the Coffee Sector: A Global Value Chain Approach., 2004.

Ponte, S.: “Roundtabling” sustainability: Lessons from the biofuel industry, *Geoforum*, 54, 261–271, doi:10.1016/j.geoforum.2013.07.008, 2014.

Ponte, S.: *Business, Power & Sustainability*, Zed Books, London, UK., 2019.

Ponte, S. and Gibbon, P.: Quality standards, conventions and the governance of global value chains, *Econ. Soc.*, 34(1), 1–31, doi:10.1080/0308514042000329315, 2005.

Ponte, S., Gereffi, G. and Raj-Reichert, G.: *Handbook on Global Value Chains*, Edward Elgar, Northampton., 2019a.

Ponte, S., Gereffi, G., Raj-Reichert, G., Ponte, S., Gereffi, G. and Raj-Reichert, G.: Introduction to the Handbook on Global Value Chains, *Handb. Glob. Value Chain.*, 1–27, doi:10.4337/9781788113779.00005, 2019b.

Poore, J. and Nemecek, T.: Reducing food’s environmental impacts through producers and consumers, *Science* (80-.), 360(6392), 987–992, doi:10.1126/science.aag0216, 2018.

Porter, M. E.: *Competitive advantage: Creating and Sustaining Superior Performance*, First Free., The Free Press, New York, New York, USA., 1985.

Potoski, M. and Prakash, A.: Green clubs: Collective action and voluntary environmental programs, *Annu. Rev. Polit. Sci.*, 16, 399–419, doi:10.1146/annurev-

polisci-032211-211224, 2013.

Potts, J., Lynch, M., Wilkings, A., Huppé, G., Cunningham, M. and Voora, V.: The State of Sustainability Initiatives Review 2014. Standards and the Green Economy, Winnipeg, Manitoba, Canada., 2014.

Prakash, A. and Potoski, M.: Collective action through voluntary environmental programs: A club theory perspective, *Policy Stud. J.*, 35(4), 773–792, doi:10.1111/j.1541-0072.2007.00247.x, 2007.

Pressman, J. L. and Wildavsky, A.: *Implementation: How Great Expectations in Washington are Dashed in Oakland; Or, Why It's Amazing that Federal Programs Work at All, This Being a Saga of the Economic Development Administration as Told by Two Sympathetic Observers Who Seek to Build Morals*, University of California Press, Berkeley, CA., 1973.

Probst, B., BenYishay, A., Kontoleon, A. and Reis, T. N. P. dos: Impacts of a large-scale titling initiative on deforestation in the Brazilian Amazon, *Nat. Sustain.*, 373–395, doi:10.1038/s41893-020-0537-2, 2020.

Pu, X. and Zhang, H.: Voluntary certification of agricultural products in competitive markets: The consideration of boundedly rational consumers, *Sustain.*, 8(9), doi:10.3390/su8090953, 2016.

Rainforest Action Network: Indonesian Forestry Titan Royal Golden Eagle Remains a Major Roadblock to Progress in Saving Leuser Ecosystem, RAN Leuser Watch [online] Available from: <https://www.ran.org/leuser-watch/indonesian-forestry-titan-royal-golden-eagle-remains-a-major-roadblock-to-progress-in-saving-leuser-ecosystem/> (Accessed 16 August 2021), 2021.

Rajão, R., Soares-Filho, B., Nunes, F., Börner, J., Machado, L., Assis, D., Oliveira, A., Pinto, L., Ribeiro, V., Rausch, L., Gibbs, H. and Figueira, D.: The rotten apples of Brazil's agribusiness, *Science* (80-.), 369(6501), 246–248, doi:10.1126/science.aba6646, 2020.

Ramankutty, N., Evan, A. T., Monfreda, C. and Foley, J. A.: Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000, *Global Biogeochem. Cycles*, 22(1), 1–19, doi:10.1029/2007GB002952, 2008.

Ramankutty, N., Mehrabi, Z., Waha, K., Jarvis, L., Kremen, C., Herrero, M. and Rieseberg, L. H.: Trends in Global Agricultural Land Use: Implications for Environmental Health and Food Security, *Annu. Rev. Plant Biol.*, 69(1), annurev-arplant-042817-040256, doi:10.1146/annurev-arplant-042817-040256, 2018.

Rautner, M., Leggett, M. and Davis, F.: *The Little Book of Big Deforestation Drivers*. [online] Available from: http://globalcanopy.org/sites/default/files/documents/resources/LittleBookofBigDeforestationDrivers_EN_0.pdf, 2013.

Raynolds, L. T.: Mainstreaming Fair Trade Coffee: From Partnership to Traceability, *World Dev.*, 37(6), 1083–1093, doi:10.1016/j.worlddev.2008.10.001, 2009.

Raynolds, L. T., Murray, D. and Heller, A.: Regulating sustainability in the coffee sector: A comparative analysis of third-party environmental and social certification initiatives, *Agric. Human Values*, 24(2), 147–163, doi:10.1007/s10460-006-9047-8, 2007.

Reed, J., Ickowitz, A., Chervier, C., Djoudi, H., Moombe, K., Ros-Tonen, M., Yanou, M., Yuliani, L. and Sunderland, T.: Integrated landscape approaches in the tropics: A brief stock-take, *Land use policy*, 99(April), 104822, doi:10.1016/j.landusepol.2020.104822, 2020.

Reinecke, J. and Ansari, S.: Taming Wicked Problems: The Role of Framing in the Construction of Corporate Social Responsibility, *J. Manag. Stud.*, 53(3), 299–329, doi:10.1111/joms.12137, 2016.

Reinecke, J., Manning, S. and von Hagen, O.: The Emergence of a Standards Market: Multiplicity of Sustainability Standards in the Global Coffee Industry, *Organ. Stud.*, 33(5–6), 791–814, doi:10.1177/0170840612443629, 2012.

Reis, T. N. P. dos, Meyfroidt, P., zu Ermgassen, E. K. H. J., West, C., Gardner, T., Bager, S., Croft, S., Lathuillière, M. J. and Godar, J.: Understanding the Stickiness of Commodity Supply Chains Is Key to Improving Their Sustainability, *One Earth*, 3(1), 100–115, doi:10.1016/j.oneear.2020.06.012, 2020.

Reisch, L., Eberle, U. and Lorek, S.: Sustainable food consumption: An overview of contemporary issues and policies, *Sustain. Sci. Pract. Policy*, 9(2), 7–25, doi:10.1080/15487733.2013.11908111, 2013.

Renckens, S.: Private Governance and Public Authority., 2020.

Renda, A., Schrefler, L., Luchetta, G. and Zavatta, R.: ASSESSING THE COSTS AND BENEFITS OF REGULATION., 2013.

Richards, D. R. and Friess, D. A.: Rates and drivers of mangrove deforestation in Southeast Asia, 2000–2012, *Proc. Natl. Acad. Sci.*, 113(2), 344–349, doi:10.1073/pnas.1510272113, 2016.

Richey, L. A. and Ponte, S.: Brand Aid and coffee value chain development interventions: Is Starbucks working aid out of business?, *World Dev.*, (June), 105193, doi:10.1016/j.worlddev.2020.105193, 2020.

Rijk, G., Wiggs, C. and Piotrowski, M.: FMCGs' Lagging Efforts in NDPE Execution Lead to Deforestation, USD 16-82B Reputation Risk, Washington, DC. [online] Available from: <https://chainreactionresearch.com/wp-content/uploads/2020/07/FMCGs-Lagging-Efforts-in-NDPE-Execution-1.pdf>, 2020.

van Rijsbergen, B., Elbers, W., Ruben, R. and Njuguna, S. N.: The Ambivalent Impact

of Coffee Certification on Farmers' Welfare: A Matched Panel Approach for Cooperatives in Central Kenya, *World Dev.*, 77, 277–292, doi:10.1016/j.worlddev.2015.08.021, 2016.

Rimmington, M., Smith, J. C. and Hawkins, R.: Corporate social responsibility and sustainable food procurement, *Br. Food J.*, 108(10), 824–837, doi:10.1108/00070700610702082, 2006.

Risius, M. and Spohrer, K.: A Blockchain Research Framework: What We (don't) Know, Where We Go from Here, and How We Will Get There, *Bus. Inf. Syst. Eng.*, 59(6), 385–409, doi:10.1007/s12599-017-0506-0, 2017.

Rittel, H. W. J. and Webber, M. M.: Dilemmas in a General Theory of Planning Published by : Springer, *Policy Sci.*, 4(2), 155–169, 1973.

Roberts, R. W.: Determinants of corporate social responsibility disclosure: An application of stakeholder theory, *Accounting, Organ. Soc.*, 17(6), 595–612, doi:10.1016/0361-3682(92)90015-K, 1992.

Robinson, B. E., Holland, M. B. and Naughton-Treves, L.: Does secure land tenure save forests? A meta-analysis of the relationship between land tenure and tropical deforestation, *Glob. Environ. Chang.*, 29, 281–293, doi:10.1016/j.gloenvcha.2013.05.012, 2014.

Robinson, B. E., Holland, M. B. and Naughton-Treves, L.: Community land titles alone will not protect forests, *Proc. Natl. Acad. Sci. U. S. A.*, 114(29), E5764, doi:10.1073/pnas.1707787114, 2017.

Robinson, B. E., Masuda, Y. J., Kelly, A., Holland, M. B., Bedford, C., Childress, M., Fletschner, D., Game, E. T., Ginsburg, C., Hilhorst, T., Lawry, S., Miteva, D. A., Musengezi, J., Naughton-Treves, L., Nolte, C., Sunderlin, W. D. and Veit, P.: Incorporating Land Tenure Security into Conservation, *Conserv. Lett.*, 11(2), e12383, doi:10.1111/conl.12383, 2018.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. a., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R. W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J.: Planetary boundaries: Exploring the safe operating space for humanity, *Ecol. Soc.*, 14(2), 472–475, doi:10.1038/461472a, 2009.

Rogers, A., Castree, N. and Kitchin, R.: Agro-food system, in *A Dictionary of Human Geography*, Oxford University Press, Oxford, UK. [online] Available from: <https://www.oxfordreference.com/view/10.1093/acref/9780199599868.001.0001/acref-9780199599868-e-41> (Accessed 2 July 2021), 2013.

Rogers, E. M.: *Diffusion of innovations*, 1st Editio., Free Press, New York, New York, USA., 1962.

Roopsind, A., Sohngen, B. and Brandt, J.: Evidence that a national REDD+ program reduces tree cover loss and carbon emissions in a high forest cover, low deforestation country, *Proc. Natl. Acad. Sci.*, 116(49), 24492–24499, doi:10.1073/pnas.1904027116, 2019.

Rosenberg, L., Swilling, M. and Vermeulen, W. J. V.: Practices of Third Wave Coffee: A Burundian Producer's Perspective, *Bus. Strateg. Environ.*, 27(2), 199–214, doi:10.1002/bse.2010, 2018.

Rosenzweig, C., Mbow, C., Barioni, L. G., Benton, T. G., Herrero, M., Krishnapillai, M., Liwenga, E. T., Pradhan, P., Rivera-Ferre, M. G., Sapkota, T., Tubiello, F. N., Xu, Y., Mencos Contreras, E. and Portugal-Pereira, J.: Climate change responses benefit from a global food system approach, *Nat. Food*, 1(2), 94–97, doi:10.1038/s43016-020-0031-z, 2020.

Rounsevell, M. D. A., Pedrolí, B., Erb, K.-H., Gramberger, M., Busck, A. G., Haberl, H., Kristensen, S., Kuemmerle, T., Lavorel, S., Lindner, M., Lotze-Campen, H., Metzger, M. J., Murray-Rust, D., Popp, A., Pérez-Soba, M., Reenberg, A., Vadineanu, A., Verburg, P. H. and Wolfslehner, B.: Challenges for land system science, *Land use policy*, 29(4), 899–910, doi:10.1016/j.landusepol.2012.01.007, 2012.

Rueda, X. and Lambin, E. F.: Linking Globalization to Local Land Uses: How Eco-Consumers and Gourmands are Changing the Colombian Coffee Landscapes, *World Dev.*, 41(1), 286–301, doi:10.1016/j.worlddev.2012.05.018, 2013.

Rueda, X., Thomas, N. E. and Lambin, E. F.: Eco-certification and coffee cultivation enhance tree cover and forest connectivity in the Colombian coffee landscapes, *Reg. Environ. Chang.*, 15(1), 25–33, doi:10.1007/s10113-014-0607-y, 2015.

Rueda, X., Garrett, R. D. and Lambin, E. F.: Corporate investments in supply chain sustainability: Selecting instruments in the agri-food industry, *J. Clean. Prod.*, 142, 2480–2492, doi:10.1016/j.jclepro.2016.11.026, 2017.

Rueda, X., Paz, A., Gibbs-Plessl, T., Leon, R., Moyano, B. and Lambin, E. F.: Smallholders at a Crossroad: Intensify or Fall behind? Exploring Alternative Livelihood Strategies in a Globalized World, *Bus. Strateg. Environ.*, 27(2), 215–229, doi:10.1002/bse.2011, 2018.

Ruysschaert, D. and Salles, D.: Towards global voluntary standards: Questioning the effectiveness in attaining conservation goals, *Ecol. Econ.*, 107, 438–446, doi:10.1016/j.ecolecon.2014.09.016, 2014.

Sabatier, P.: From Policy Implementation to Policy Change: A Personal Odyssey, in *Reform and change in higher education*, pp. 17–34, Springer, Dordrecht., 2005.

Sabatier, P. and Mazmanian, D.: The Conditions of Effective Implementation: A Guide to Accomplishing Policy Objectives, *Policy Anal.*, 5(4), 481–504 [online] Available from: <http://www.jstor.org/stable/42783358>, 1979.

Sako, M. and Zylberberg, E.: Supplier strategy in global value chains: Shaping governance and profiting from upgrading, *Socio-Economic Rev.*, 17(3), 687–707, doi:10.1093/ser/mwx049, 2019.

Säll, S. and Gren, I.: Effects of an environmental tax on meat and dairy consumption in Sweden, *Food Policy*, 55, 41–53, doi:10.1016/j.foodpol.2015.05.008, 2015.

Samper, L. and Quiñones-Ruiz, X.: Towards a Balanced Sustainability Vision for the Coffee Industry, *Resources*, 6(17), 1–28, doi:10.3390/resources6020017, 2017.

Samper, L., Giovannucci, D. and Vieira, L. M.: The powerful role of intangibles in the coffee value chain, *Econ. Res. Work. Pap. No. 39*, (27), 2015.

Sandström, V., Valin, H., Krisztin, T., Havlík, P., Herrero, M. and Kastner, T.: The role of trade in the greenhouse gas footprints of EU diets, *Glob. Food Sec.*, 19(August), 48–55, doi:10.1016/j.gfs.2018.08.007, 2018.

Sarzynski, T., Giam, X., Carrasco, L. and Lee, J. S. H.: Combining Radar and Optical Imagery to Map Oil Palm Plantations in Sumatra, Indonesia, Using the Google Earth Engine, *Remote Sens.*, 12(7), 1220, doi:10.3390/rs12071220, 2020.

Schaffartzik, A., Haberl, H., Kastner, T., Wiedenhofer, D., Eisenmenger, N. and Erb, K. H.: Trading land: A review of approaches to accounting for upstream land requirements of traded products, *J. Ind. Ecol.*, 19(5), 703–714, doi:10.1111/jiec.12258, 2015.

Schaltegger, S., Hörisch, J. and Freeman, R. E.: Business cases for sustainability: A stakeholder theory perspective, *Organ. Environ.*, 32(3), 191–212, doi:10.1177/1086026617722882, 2019.

Scherer, A. G. and Palazzo, G.: The New Political Role of Business in a Globalized World: A Review of a New Perspective on CSR and its Implications for the Firm, Governance, and Democracy, *J. Manag. Stud.*, 48(4), 899–931, doi:10.1111/j.1467-6486.2010.00950.x, 2011.

Schilling-Vacaflor, A. and Lenschow, A.: Bringing the State back in : Exploring new public environmental policy approaches for governing the Brazil-Europe soy chain . Almut Schilling-Vacaflor & Andrea Lenschow (Osnabrück University) Paper presented at the International Public Policy Associatio, , 2019, 1–21, 2019.

Schilling-Vacaflor, A. and Lenschow, A.: Hardening foreign corporate accountability through mandatory due diligence in the European Union? New trends and persisting challenges, *Regul. Gov.*, (April), rego.12402, doi:10.1111/reg.12402, 2021.

Schleifer, P., Fiorini, M. and Auld, G.: Transparency in transnational governance: The determinants of information disclosure of voluntary sustainability programs, *Regul. Gov.*, 13(4), 488–506, doi:10.1111/reg.12241, 2019.

Schmidt, C. G. and Wagner, S. M.: Blockchain and supply chain relations: A

transaction cost theory perspective, *J. Purch. Supply Manag.*, 25(4), 100552, doi:10.1016/j.pursup.2019.100552, 2019.

Scholer, M.: *Coffee and wine: two worlds compared*, First Edit., Troubador, Leicester, UK., 2018.

Schreck, P. and Raithel, S.: Corporate Social Performance, Firm Size, and Organizational Visibility: Distinct and Joint Effects on Voluntary Sustainability Reporting, *Bus. Soc.*, 57(4), 742–778, doi:10.1177/0007650315613120, 2018.

Scott, J.: Reducing the European Union's Environmental Footprint Through 'Territorial Extension,' *Sustain. Law*, 65–85, doi:10.1007/978-3-030-42630-9_5, 2020.

Sethi, S. P.: *Multinational Corporations and the Impact of Public Advocacy on Corporate Strategy*, Springer Netherlands, Dordrecht., 1994.

Sexsmith, K. and Potts, J.: Voluntary Sustainability Standards and Value Chain Governance: How sustainability standards affect the distribution of decision-making power in global value chains, Winnipeg, Manitoba, Canada., 2009.

Sexton, R. J. and Xia, T.: Increasing Concentration in the Agricultural Supply Chain: Implications for Market Power and Sector Performance, *Annu. Rev. Resour. Econ.*, 10, 229–251, doi:10.1146/annurev-resource-100517-023312, 2018.

Seymour, F. and Busch, J.: *Why Forests? Why Now?: The Science, Economics, and Politics of Tropical Forests and Climate Change*, Center for Global Development., 2016.

Seymour, F. and Harris, N. L.: Reducing tropical deforestation, *Science* (80-.), 365(6455), 756–757, doi:10.1126/science.aax8546, 2019.

Shahab, Y., Ntim, C. G., Chen, Y., Ullah, F., Li, H. X. and Ye, Z.: Chief executive officer attributes, sustainable performance, environmental performance, and environmental reporting: New insights from upper echelons perspective, *Bus. Strateg. Environ.*, 29(1), 1–16, doi:10.1002/bse.2345, 2020.

Shnayder, L. and Van Rijnsoever, F. J.: How expected outcomes, stakeholders, and institutions influence corporate social responsibility at different levels of large basic needs firms, *Bus. Strateg. Environ.*, 27(8), 1689–1707, doi:10.1002/bse.2235, 2018.

Shubham, Charan, P. and Murty, L. S.: Secondary stakeholder pressures and organizational adoption of sustainable operations practices: The mediating role of primary stakeholders, *Bus. Strateg. Environ.*, 27(7), 910–923, doi:10.1002/bse.2041, 2018.

Siegel, K. M. and Bastos Lima, M. G.: When international sustainability frameworks encounter domestic politics: The sustainable development goals and agri-food governance in South America, *World Dev.*, 135, 105053,

doi:10.1016/j.worlddev.2020.105053, 2020.

Silva, C. A. and Lima, M.: Soy Moratorium in Mato Grosso: Deforestation undermines the agreement, *Land use policy*, 71(September 2017), 540–542, doi:10.1016/j.landusepol.2017.11.011, 2018.

Skjott Linneberg, M. and Korsgaard, S.: Coding qualitative data: a synthesis guiding the novice, *Qual. Res. J.*, 19(3), 259–270, doi:10.1108/QRJ-12-2018-0012, 2019.

Skodvin, T.: Exploring the notion of political feasibility in environmental policy, , (December), 2007.

Slough, T., Kopas, J. and Urpelainen, J.: Satellite-based deforestation alerts with training and incentives for patrolling facilitate community monitoring in the Peruvian Amazon., *Proc. Natl. Acad. Sci. U. S. A.*, 118(29), doi:10.1073/pnas.2015171118, 2021.

Smit, L., Bright, C., McCorquodale, R., Bauer, M., Deringer, H., Baeza-Breinbauer, D., Torres-Cortés, F., Alleweldt, F., Kara, S., Salinier, C. and Tejero Tobed, H.: Study on due diligence requirements through the supply chain, Publications Office of the European Union, Luxembourg, Luxembourg., 2020.

Smith, H. J.: The Shareholder vs. Stakeholders Debate, *MIT Sloan Manag. Rev.*, 44(4), 2003.

Smith, W. K., Nelson, E., Johnson, J. A., Polasky, S., Milder, J. C., Gerber, J. S., West, P. C., Siebert, S., Brauman, K. A., Carlson, K. M., Arbuthnot, M., Rozza, J. P. and Pennington, D. N.: Voluntary sustainability standards could significantly reduce detrimental impacts of global agriculture, *Proc. Natl. Acad. Sci.*, 116(6), 2130–2137, doi:10.1073/pnas.1707812116, 2019.

Song, X. P., Hansen, M. C., Stehman, S. V., Potapov, P. V., Tyukavina, A., Vermote, E. F. and Townshend, J. R.: Global land change from 1982 to 2016, *Nature*, 560(7720), 639–643, doi:10.1038/s41586-018-0411-9, 2018.

Soterroni, A. C., Ramos, F. M., Mosnier, A., Fargione, J., Andrade, P. R., Baumgarten, L., Pirker, J., Obersteiner, M., Kraxner, F., Câmara, G., Carvalho, A. X. Y. and Polasky, S.: Expanding the soy moratorium to Brazil's Cerrado, *Sci. Adv.*, 5(7), doi:10.1126/sciadv.aav7336, 2019.

Sotirov, M., Stelter, M. and Winkel, G.: The emergence of the European Union Timber Regulation: How Baptists, Bootleggers, devil shifting and moral legitimacy drive change in the environmental governance of global timber trade, *For. Policy Econ.*, 81(March), 69–81, doi:10.1016/j.forpol.2017.05.001, 2017.

Southey, F.: Enforcing sustainability in palm oil: what would mandatory due diligence look like?, *Food Navig.*, 6–9 [online] Available from: <https://www.foodnavigator.com/Article/2020/06/08/Enforcing-sustainability-in-palm-oil-What-would-mandatory-due-diligence-look-like> (Accessed 21 August

2020), 2020.

Springmann, M., Mason-D'Croz, D., Robinson, S., Wiebe, K., Godfray, H. C. J., Rayner, M. and Scarborough, P.: Mitigation potential and global health impacts from emissions pricing of food commodities, *Nat. Clim. Chang.*, 7(1), 69–74, doi:10.1038/nclimate3155, 2017.

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B. L., Lassaletta, L., De Vries, W., Vermeulen, S. J., Herrero, M., Carlson, K. M., Jonell, M., Troell, M., DeClerck, F., Gordon, L. J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., Godfray, H. C. J., Tilman, D., Rockström, J. and Willett, W.: Options for keeping the food system within environmental limits, *Nature*, 562(7728), 519–525, doi:10.1038/s41586-018-0594-0, 2018.

Stadtler, H. and Kilger, C.: *Supply Chain Management and Advanced Planning*, Second Edi., Springer Berlin Heidelberg, Berlin, Heidelberg., 2002.

Stanbury, P. and Webb, T.: The role of a sustainable commodities marketplace for procurement, *Inf. Forum* [online] Available from: <https://www.innovationforum.co.uk/articles/the-role-of-a-sustainable-commodities-marketplace-for-procurement> (Accessed 20 August 2021), 2021.

Steurer, R.: Soft Instruments, Few Networks: How “New Governance” Materializes in Public Policies on Corporate Social Responsibility Across Europe, *Environ. Policy Gov.*, 21(4), 270–290, doi:10.1002/eet.575, 2011.

Stratoudakis, Y., McConney, P., Duncan, J., Ghofar, A., Gitonga, N., Mohamed, K. S., Samoilys, M., Symington, K. and Bourillon, L.: Fisheries certification in the developing world: Locks and keys or square pegs in round holes?, *Fish. Res.*, 182, 39–49, doi:10.1016/j.fishres.2015.08.021, 2015.

Streck, C., Haupt, F., Roe, S., Behm, K., Kroeger, A., Schulte, I., Andrillon, X., Donofrio, S., Hayward, J., Lake, S., McCarthy, B., McCoy, K., Servent, R., Ward, F., McNeill, C., Keegan Daniel Zarin, D., Currey, K., Fleck Marco Albani, L., Kopacz, A., Ohnmacht, P., Reber, F., Gladstone, J., Meintrup, L., Fordington Chris Meyer, A., McCarthy Niki Mardas, B., Bregman, T., Andrillon Andrew Kluth Ana Maria Arabia Zuniga, X., Herrera Villarraga Lucian Peppelenbos Ulrika Hvistendahl Sarah Price, S., Hayward, J., Morage Toby Gardner, M., Godar Christy Slay, J., Cooke, C., Curtis, P., Kester III Nancy Harris, J., Winchester, C., Murphy Rachael Sherman McDonald, M., Barry, M., Wheatley Marks, F., Wilson, E. and Tonassi, S.: Progress on the New York Declaration on Forests: Eliminating Deforestation from the Production of Agricultural Commodities – Goal 2 Assessment Report, *Clim. Focus* [online] Available from: www.forestdeclaration.org, 2016.

Sullivan, H. and Stewart, M.: Who Owns the Theory of Change?, *Evaluation*, 12(2), 179–199, doi:10.1177/1356389006066971, 2006.

Sunstein, C. R. and Reisch, L. A.: Automatically Green: Behavioral Economics and

Environmental Protection, Forthcoming, *Harvard Environ. Law Rev.*, 1–27, doi:10.2139/ssrn.2245657, 2013.

De Sy, V., Herold, M., Achard, F., Beuchle, R., Clevers, J. G. P. W. P. W., Lindquist, E., Verchot, L., Sy, V. De, Herold, M., Achard, F., Beuchle, R., Clevers, J. G. P. W. P. W., Lindquist, E. and Verchot, L.: Land use patterns and related carbon losses following deforestation in South America, *Environ. Res. Lett.*, 10(12), doi:10.1088/1748-9326/10/12/124004, 2015.

Sylvester, G.: *E-Agriculture in Action: Blockchain for Agriculture - Opportunities and Challenges*, edited by G. Sylvester, Food and Agriculture Organization of the United Nations and the International Telecommunication Union, Bangkok, Thailand., 2019.

Takahashi, R. and Todo, Y.: The impact of a shade coffee certification program on forest conservation: A case study from a wild coffee forest in Ethiopia, *J. Environ. Manage.*, 130, 48–54, doi:10.1016/j.jenvman.2013.08.025, 2013.

Tayleur, C., Balmford, A., Buchanan, G. M., Butchart, S. H. M., Ducharme, H., Green, R. E., Milder, J. C., Sanderson, F. J., Thomas, D. H. L., Vickery, J. and Phalan, B.: Global Coverage of Agricultural Sustainability Standards, and Their Role in Conserving Biodiversity, *Conserv. Lett.*, 10(5), 610–618, doi:10.1111/conl.12314, 2017.

Taylor, R. and Streck, C.: The Elusive Impact of the Deforestation-Free Supply Chain Movement, *World Resour. Institute Work. Pap.*, (June), 1–14, 2018.

TEREA: Evaluation of the EU FLEGT Action Plan 2004-2014., 2016.

Termeer, C. J. A. M., Dewulf, A., Breeman, G. and Stiller, S. J.: *Governance Capabilities for Dealing Wisely With Wicked Problems.*, 2015.

Tetrault Sirsly, C. A. and Lvina, E.: From Doing Good to Looking Even Better: The Dynamics of CSR and Reputation, *Bus. Soc.*, 58(6), 1234–1266, doi:10.1177/0007650315627996, 2019.

The Economist: The parable of St Paul - Schumpeter, , 1–4 [online] Available from: <https://www.economist.com/news/business/21727908-unilever-worlds-biggest-experiment-corporate-do-gooding-parable-st-paul>, 2017.

The National Board of Trade Sweden: *Border Carbon Adjustments: An analysis of trade related aspects and the way forward*, The National Board of Trade Sweden, Stockholm, Sweden., 2020.

Thiruchelvam, V., Mughisha, A. S., Shahpasand, M. and Bamiah, M.: Blockchain-based technology in the coffee supply chain trade: Case of Burundi coffee, *J. Telecommun. Electron. Comput. Eng.*, 10(3–2), 121–125, 2018.

Thorlakson, T.: A move beyond sustainability certification: The evolution of the

chocolate industry's sustainable sourcing practices, *Bus. Strateg. Environ.*, 27(8), 1653–1665, doi:10.1002/bse.2230, 2018.

Thorlakson, T., de Zegher, J. F. and Lambin, E. F.: Companies' contribution to sustainability through global supply chains, *Proc. Natl. Acad. Sci.*, 115(9), 2072–2077, doi:10.1073/pnas.1716695115, 2018a.

Thorlakson, T., Hainmueller, J. and Lambin, E. F.: Improving environmental practices in agricultural supply chains: The role of company-led standards, *Glob. Environ. Chang.*, 48(February 2017), 32–42, doi:10.1016/j.gloenvcha.2017.10.006, 2018b.

Toledo, V. M. and Moguel, P.: Coffee and Sustainability: The Multiple Values of Traditional Shaded Coffee, *J. Sustain. Agric.*, 36(3), 353–377, doi:10.1080/10440046.2011.583719, 2012.

Toonen, H. M. and Bush, S. R.: The digital frontiers of fisheries governance: fish attraction devices, drones and satellites, *J. Environ. Policy Plan.*, 22(1), 125–137, doi:10.1080/1523908X.2018.1461084, 2020.

Trase: Trase Yearbook 2018, Sustainability in forest-risk supply chains: Spotlight on Brazilian soy., 2018.

Trase and Forest500: Eliminating deforestation from supply chains by 2020 : a review of the Amsterdam Declaration countries., 2019.

Trienekens, J. H., Wognum, P. M., Beulens, A. J. M. and van der Vorst, J. G. A. J.: Transparency in complex dynamic food supply chains, *Adv. Eng. Informatics*, 26(1), 55–65, doi:10.1016/j.aei.2011.07.007, 2012.

Tripoli, M. and Schmidhuber, J.: Emerging Opportunities for the Application of Blockchain in the Agri-food Industry Agriculture, Food Agric. Organ. United Nations, (August) [online] Available from: https://www.researchgate.net/profile/Josef_Schmidhuber/publication/327287235_Emerging_Opportunities_for_the_Application_of_Blockchain_in_the_Agri-food_Industry/links/5b86ced4299bf1d5a7310c38/Emerging-Opportunities-for-the-Application-of-Blockchain-in-the-, 2018.

Tröster, B.: Blockchain Technologies for Commodity Value Chains : The solution for more sustainability ?, Austrian Foundation for Development Research – ÖFSE, Vienna, Austria., 2020.

Tubiello, F. N., Salvatore, M., Ferrara, A. F., House, J., Federici, S., Rossi, S., Biancalani, R., Condor Golec, R. D., Jacobs, H., Flammini, A., Prospero, P., Cardenas-Galindo, P., Schmidhuber, J., Sanz Sanchez, M. J., Srivastava, N. and Smith, P.: The Contribution of Agriculture, Forestry and other Land Use activities to Global Warming, 1990-2012, *Glob. Chang. Biol.*, 21(7), 2655–2660, doi:10.1111/gcb.12865, 2015.

Tukker, A., Bulavskaya, T., Giljum, S., de Koning, A., Lutter, S., Simas, M., Stadler,

K. and Wood, R.: Environmental and resource footprints in a global context: Europe's structural deficit in resource endowments, *Glob. Environ. Chang.*, 40, 171–181, doi:10.1016/j.gloenvcha.2016.07.002, 2016.

Turner, B. L., Lambin, E. F. and Reenberg, A.: The emergence of land change science for global environmental change and sustainability, edited by Intergovernmental Panel on Climate Change, *Proc. Natl. Acad. Sci.*, 104(52), 20666–20671, doi:10.1073/pnas.0704119104, 2007.

Turner, B. L., Lambin, E. F. and Verburg, P. H.: From land-use/land-cover to land system science, *Ambio*, doi:10.1007/s13280-021-01510-4, 2021.

UK Department for Food Environment and Rural Affairs: Due diligence on forest risk commodities - Defra - Citizen Space, [online] Available from: <https://consult.defra.gov.uk/eu/due-diligence-on-forest-risk-commodities/> (Accessed 25 November 2020), 2020.

UNCTAD: FRAMEWORK FOR THE VOLUNTARY STANDARDS ASSESSMENT TOOLKIT., 2020.

Underdal, A.: Complexity and challenges of long-term environmental governance, *Glob. Environ. Chang.*, 20(3), 386–393, doi:10.1016/j.gloenvcha.2010.02.005, 2010.

UNDP: Value Beyond Value Chains. Guidance note for the private sector, New York, New York, USA., 2019.

UNFCCC: PARIS AGREEMENT, United Nations Framework Convention on Climate Change. [online] Available from: https://unfccc.int/sites/default/files/english_paris_agreement.pdf (Accessed 13 July 2021), 2015.

UNFSS: Meeting Sustainability Goals. Voluntary Sustainability Standards and the Role of the Government, , 60 [online] Available from: <http://www.bsigroup.com/en-GB/Sustainability-Standards-Navigator/Themes/Resource-Management/Waste-Management/>, 2016.

United Nations Forum on Sustainability Standards: Voluntary sustainability standards Part I: Issues, , 1–56, 2015.

Vanclay, J. K., Shortiss, J., Aulsebrook, S., Gillespie, A. M., Howell, B. C., Johanni, R., Maher, M. J., Mitchell, K. M., Stewart, M. D. and Yates, J.: Customer Response to Carbon Labelling of Groceries, *J. Consum. Policy*, 34(1), 153–160, doi:10.1007/s10603-010-9140-7, 2011.

Vanderhaegen, K., Akoyi, K. T., Dekoninck, W., Jocqué, R., Muys, B., Verbist, B. and Maertens, M.: Do private coffee standards ‘walk the talk’ in improving socio-economic and environmental sustainability?, *Glob. Environ. Chang.*, 51(April), 1–9, doi:10.1016/j.gloenvcha.2018.04.014, 2018.

Velásquez, D., Sánchez, A., Sarmiento, S., Toro, M., Maiza, M. and Sierra, B.: A Method for Detecting Coffee Leaf Rust through Wireless Sensor Networks, Remote Sensing, and Deep Learning: Case Study of the Caturra Variety in Colombia, *Appl. Sci.*, 10(2), 697, doi:10.3390/app10020697, 2020.

van der Ven, H.: Gatekeeper power: understanding the influence of lead firms over transnational sustainability standards, *Rev. Int. Polit. Econ.*, 25(5), 624–646, doi:10.1080/09692290.2018.1490329, 2018.

van der Ven, H., Rothacker, C. and Cashore, B.: Do eco-labels prevent deforestation? Lessons from non-state market driven governance in the soy, palm oil, and cocoa sectors, *Glob. Environ. Chang.*, 52(June), 141–151, doi:10.1016/j.gloenvcha.2018.07.002, 2018.

Verburg, P. H., Erb, K. H., Mertz, O. and Espindola, G.: Land System Science: Between global challenges and local realities, *Curr. Opin. Environ. Sustain.*, 5(5), 433–437, doi:10.1016/j.cosust.2013.08.001, 2013.

Vermeulen, S. J., Campbell, B. M. and Ingram, J. S. I.: Climate Change and Food Systems, *Annu. Rev. Environ. Resour.*, 37(1), 195–222, doi:10.1146/annurev-environ-020411-130608, 2012.

Vicol, M., Neilson, J., Hartatri, D. F. S. and Cooper, P.: Upgrading for whom? Relationship coffee, value chain interventions and rural development in Indonesia, *World Dev.*, 110, 26–37, doi:10.1016/j.worlddev.2018.05.020, 2018.

Villiers, C.: Global supply chains and sustainability: the role of disclosure and due diligence laws, in *The Cambridge Handbook of Corporate Law, Corporate Governance and Sustainability*, vol. 12, pp. 551–565, Cambridge University Press., 2019.

Vogel, D.: Private Global Business Regulation, *Annu. Rev. Polit. Sci.*, 11(1), 261–282, doi:10.1146/annurev.polisci.11.053106.141706, 2008.

Vogel, D.: The Private Regulation of Global Corporate Conduct, *Bus. Soc.*, 49(1), 68–87, doi:10.1177/0007650309343407, 2010.

Voora, V., Bermúdez, S. and Larrea, C.: MARKETPLACE SERIES 2019 Global Market Report : Coffee, 2019.

Vorst, I. J. G. A. J. Van Der: Supply Chain Management : theory and practices, *Emerg. Sci. Chain. Networks Bridg. Theory Pract.*, (June), 1–19, 2004.

Wade, C. M., Austin, K. G., Cajka, J., Lapidus, D., Everett, K. H., Galperin, D., Maynard, R. and Sobel, A.: What is Threatening Forests in Protected Areas? A Global Assessment of Deforestation in Protected Areas, 2001–2018, *Forests*, 11(5), 539, doi:10.3390/f11050539, 2020.

Waldman, K. B. and Kerr, J.: Limitations of Certification and Supply Chain Standards

for Environmental Protection in Commodity Crop Production, *Annu. Rev. Environ. Resour.*, 6, 429–449, doi:10.1146/annurev-resource-100913-012432, 2014.

Wardell, D. A., Piketty, M.-G., Lescuyer, G. and Pacheco, P.: Reviewing initiatives to promote sustainable supply chains: The case of forest-risk commodities, Center for International Forestry Research (CIFOR), 2021.

Webber, D. J.: ANALYZING POLITICAL FEASIBILITY: POLITICAL SCIENTISTS' UNIQUE CONTRIBUTION TO POLICY ANALYSIS, , 545–554, 1986.

Weber, A. K.: Corporate Role Conceptions in Global Forest Governance, *Glob. Policy*, doi:10.1111/1758-5899.12874, 2020.

West, T. A. P. and Fearnside, P. M.: Brazil's conservation reform and the reduction of deforestation in Amazonia, *Land use policy*, 100(May 2019), 105072, doi:10.1016/j.landusepol.2020.105072, 2021.

West, T. A. P., Börner, J., Sills, E. O. and Kontoleon, A.: Overstated carbon emission reductions from voluntary REDD+ projects in the Brazilian Amazon, *Proc. Natl. Acad. Sci.*, 117(39), 24188–24194, doi:10.1073/pnas.2004334117, 2020.

Wheeler, D., Colbert, B. and Freeman, R. E.: Focusing on Value: Reconciling Corporate Social Responsibility, Sustainability and a Stakeholder Approach in a Network World, *J. Gen. Manag.*, 28(3), 1–28, doi:10.1177/030630700302800301, 2003.

Wiedmann, T. and Lenzen, M.: Environmental and social footprints of international trade, *Nat. Geosci.*, 11(5), 314–321, doi:10.1038/s41561-018-0113-9, 2018.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S. E., Srinath Reddy, K., Narain, S., Nishtar, S. and Murray, C. J. L.: Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, *Lancet*, 393(10170), 447–492, doi:10.1016/S0140-6736(18)31788-4, 2019.

Wilson, G. A. and Buller, H.: The use of socio-economic and environmental indicators in assessing the effectiveness of EU agri-environmental policy, *Eur. Environ.*, 11(6), 297–313, doi:10.1002/eet.273, 2001.

Winkler, K., Fuchs, R., Rounsevell, M. and Herold, M.: Global land use changes are four times greater than previously estimated, *Nat. Commun.*, 12(1), 2501, doi:10.1038/s41467-021-22702-2, 2021.

Wolf, J.: The Relationship Between Sustainable Supply Chain Management, Stakeholder Pressure and Corporate Sustainability Performance, *J. Bus. Ethics*,

119(3), 317–328, doi:10.1007/s10551-012-1603-0, 2014.

Wood, R., Stadler, K., Simas, M., Bulavskaya, T., Giljum, S., Lutter, S. and Tukker, A.: Growth in Environmental Footprints and Environmental Impacts Embodied in Trade: Resource Efficiency Indicators from EXIOBASE3, *J. Ind. Ecol.*, 22(3), 553–564, doi:10.1111/jiec.12735, 2018.

World Resources Institute: Global Forest Watch, [online] Available from: www.globalforestwatch.org (Accessed 13 June 2020), 2014.

Wunder, S., Duchelle, A. E., Sassi, C. De, Sills, E. O., Simonet, G. and Sunderlin, W. D.: REDD+ in Theory and Practice: How Lessons From Local Projects Can Inform Jurisdictional Approaches, *Front. For. Glob. Chang.*, 3(February), 1–17, doi:10.3389/ffgc.2020.00011, 2020.

WWF: Slow Road to Sustainability: The sourcing of soft commodities by Consumer Goods Forum members - Report on progress, Gland, Switzerland., 2016.

WWF UK: Soya and the cerrado: Brazil's forgotten jewel, Surrey, UK., 2011.

WWF UK: Deforestation and Social Risks in the UK's Commodity Supply Chains, Surrey, UK. [online] Available from: [https://www.wwf.org.uk/sites/default/files/2017-10/Risky Business - October 2017.pdf](https://www.wwf.org.uk/sites/default/files/2017-10/Risky%20Business%20-%20October%202017.pdf), 2017.

Yifan, J.: Stalemate: sustainable palm oil struggles to take off in China, *China Dialogue* [online] Available from: <https://chinadialogue.net/en/food/stalemate-sustainable-palm-oil-struggles-to-take-off-in-china/> (Accessed 29 April 2021), 2021.

Yu, Y., Feng, K. and Hubacek, K.: Tele-connecting local consumption to global land use, *Glob. Environ. Chang.*, 23(5), 1178–1186, doi:10.1016/j.gloenvcha.2013.04.006, 2013.

Zhang, F. and Zhu, L.: Enhancing corporate sustainable development: Stakeholder pressures, organizational learning, and green innovation, *Bus. Strateg. Environ.*, 28(6), 1012–1026, doi:10.1002/bse.2298, 2019.

zu Ermgassen, E. K. H. J., Godar, J., Lathuillière, M. J., Löfgren, P., Gardner, T., Vasconcelos, A. and Meyfroidt, P.: The origin, supply chain, and deforestation risk of Brazil's beef exports, *Proc. Natl. Acad. Sci.*, 117(50), 31770–31779, doi:10.1073/pnas.2003270117, 2020a.

zu Ermgassen, E. K. H. J., Ayre, B., Godar, J., Bastos Lima, M. G., Bauch, S., Garrett, R., Green, J., Lathuillière, M. J., Löfgren, P., MacFarquhar, C., Meyfroidt, P., Suavet, C., West, C. and Gardner, T.: Using supply chain data to monitor zero deforestation commitments: an assessment of progress in the Brazilian soy sector, *Environ. Res. Lett.*, 15(3), 035003, doi:10.1088/1748-9326/ab6497, 2020b.

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APPENDICES

1. SUPPLEMENTARY MATERIAL FOR CHAPTER 3

Supplementary Table 1. Overview of selected policy classification typologies

Classification	Policy and Governance Area	Source
• Sticks (regulation) • Carrots (incentives) • Sermons (information)	Public Policy	Bemelmans-Videc et al. (1998)
• Regulatory • Economic, financial and market incentives • Suasive, informational and research • Management	Forest Policy	Gupta et al. (2013)
• Information • Incentives • Institutions	Forest Policy	Agrawal et al. (2018)
• Regulatory instruments • Planning instruments • Economic instruments • Informational instruments • Co-operative instruments	Soil Policy	Juerges & Hansjürgens (2018)
• Legislative and Regulatory • Economic and Fiscal • Agreement-based and Incentive-based • Information-based and Communication based • De-facto and de-jure standards best practices	Public Policy	Lascoumes & Le Gales (2007)
• Legislative and Regulatory Instruments	Environmental Policy	Halpern (2010)

• Economic and fiscal instruments • Agreement-based and incentive-based instruments • Information- and communication-based instruments • De facto and de jure/best practice		
• Legal • Financial • Informational • Partnering • Hybrid	Public Policy	Steurer (2011)
• Informational • Cooperative • Economic • Regulatory	Public Policy	(Böcher, 2012)

Supplementary Table 2. Classification of policy instruments

Policy instrument	Means through which the policy instrument is applied
<i>Information-based</i>	Campaigns, symbols, labels, data, research.
<i>Cooperative</i>	Roundtables, certification, agreements, transfers, mediation.
<i>Market-based</i>	Taxes, subsidies, tradable permits, tariffs, user charges, rebates, compensation, offsets.
<i>Regulatory</i>	Standards, bans, prohibitions, limits, permits, licenses, mandates.

Supplementary Table 3. Determinants (or dimensions) of political feasibility, as well as data sources for assessing these

	Guiding question	Assessment criteria	Data source(s)
<i>Advocacy</i>	To which extent are different actors promoting a given policy proposal?	The support for each proposal is normalized by the average support for proposals for that actor group, to account for the fact that there are substantial differences in the number of proposals between different types of actors. Proposals are classified as having low (more than 50% below the average), medium, or high (more than 50% above the average) support from each actor group. Policy proposals that have high support by four or more out of the five actor types are classified as having high advocacy; support by at least two actor types is classified as medium advocacy, while proposals with support from one actor type or less are classified as having low advocacy.	Public consultation, literature review, and EU stakeholder workshops
<i>Institutional settings</i>	Who decides, and how, on the implementation of a given policy proposal, and which capacities are required to	We define policies that require the involvement of non-EU institutions (e.g., foreign governments) or involvement of all EU MS as having low institutional feasibility. Policies that require the involvement of the different EU institutions (e.g., Commission, Parliament, Council), are judged as having medium institutional feasibility. Policies where EU MS or the EC are required to	EU legislation and statutes

	implement the policy?	can act unilaterally are judged as having high institutional feasibility.	
<i>Monetary costs</i>	What are the economic costs of the policy (administrative, transactional, private and societal), and how are these distributed?	Policies only incurring direct costs and affecting cost streams of less than a billion euros annually is estimated as having high cost feasibility. Conversely, policies affecting monetary streams of more than ten billion euros, and hence more likely to incur indirect costs or redistributive effects, are assumed to exhibit low cost feasibility. Policies with cost streams in-between the two cut-offs, or having smaller (annual costs lower than billion euros) but potential indirect costs, are judged as having medium cost feasibility.	Academic and grey literature; EU budget documents.

1.1. SUPPORTING DATA

The data material on which this article build is available at Zenodo [doi:10.5281/zenodo.4443032]. This material consists of an Excel-file “Supporting information - data & analysis,” which contains all policy proposals extracted from grey literature, workshop, and public consultation, including the categorization (actor and policy instrument) for all 1,141 policy proposals. It also includes the data and analysis for the political feasibility assessment.

The data is available at: doi:10.5281/zenodo.4443032

(<https://zenodo.org/record/4443032#.YRY9m8ozaUk>).

2. SUPPLEMENTARY MATERIAL FOR CHAPTER 5

Supplementary Table 4. Implementation theories and frameworks derived from strategic management and corporate social responsibility (top) and public policy and policy process theory (bottom)

Implementation framework	Source
<i>Implementation within strategic management and corporate social responsibility</i>	
Framework for integration of corporate sustainability into strategic management • Organizational influence (internal and external) • Internal and external drivers • Supporting and hindering factors	Engert et al. (2016)
Implementation framework for drivers of corporate social performance • Setting priorities • Identifying the causal relationships • Developing appropriate measures • Collecting and analysing data • Reviewing the framework	Epstein and Roy (2001)
Success factors for corporate sustainability strategy implementation • Organizational structure • Organizational culture • Leadership • Management control • Employee motivations and qualifications • Communication (internal and external)	Engert and Baumgartner (2016)
Framework for weaving sustainability thinking into the strategic management process • Leadership procedures • Structures • Culture • Best practice	Nathan (2010)

• Reward systems • Control systems • Governance and ethics • Policies	
Factors crucial to successful organisational CSR implementation • ‘commitment’ • ‘structures and procedures’ • ‘interaction’ (stakeholder engagement)	Klettner et al. (2014)
Strategy implementation framework • Legitimation • Constituency building • Resource accumulation • Organization design • Resource mobilization • Monitoring impact	Crosby (1996)
<i>Implementation within public policy and policy process theory</i>	
Conditions for effective policy implementation • Clear and consistent objectives • Sound causal theory • Adequate administrative authority • Committed and skilful implementing officials • Support from key interest groups • Facilitative socio-economic conditions	Sabatier (2005) building on Sabatier and Mazmanian (1979)
A Conceptual Framework for the Policy Implementation Process • Defining relevant policy standards and objectives • Allocating policy resources • Inter-organizational communication and enforcement activities • The characteristics of the implementing agencies • The economic, social, and political environment affecting the implementing jurisdiction or organization • The disposition of implementors for the carrying out of policy decisions.	van Meter and van Horn (1975)

Principles for flexible and agile policy implementation and their benefit • Formulating the business processes using business services • Event-driven integration and orchestration • Separation of process, knowledge and resource • Reuse by collaborative policy implementation	Gong and Janssen (2012)

Supplementary Table 5.

Code	Type	Employee position	Activity	Employee location	Company HQ location
A1	Corporate	Procurement	Trader	Europe	Europe
A2	Corporate	Sustainability	FMCG	Europe	Europe
A3	Corporate	Sustainability	Manufacturer	Europe	Europe
A4	Corporate	Sustainability	Manufacturer	Europe	Europe
A5	Corporate	Sustainability	Retailer	Europe	Europe
A6	Corporate	Procurement	Retailer	Europe	Europe
A7	Corporate	Sustainability	FMCG	Asia	Europe
A8	Corporate	Sustainability	Trader	North America	North America
A9	Corporate	Sustainability	Trader	North America	North America
A10	Corporate	Procurement	FMCG	Europe	Europe
A11	Corporate	Sustainability	Producer	Asia	Asia
A12	Corporate	Procurement	Manufacturer	Asia	Europe
A13	Corporate	Director/C-level	Producer	Asia	Asia
A14	Corporate	Sustainability	FMCG	Europe	North America
A15	Corporate	Sustainability	Producer	Asia	Asia
A16	Corporate	Corporate Affairs	Producer	Asia	Asia
A17	Corporate	Corporate Affairs	Producer	Asia	Asia

A18	Corporate	Procurement	Producer	Europe	Asia
A19	Corporate	Procurement	Trader	Europe	North America
A20	Corporate	Sustainability	FMCG	Europe	Europe
A21	Corporate	Sustainability	FMCG	Asia	Europe
A22	Corporate	Sustainability	FMCG	Asia	North America
A23	Corporate	Procurement	FMCG	Europe	Europe
A24	Corporate	Sustainability	Producer	Asia	Asia
A25	Corporate	Sustainability		Asia	Asia
B1	Non-corporate	Director/C-level	Consultancy	Europe	Europe
B2	Non-corporate	Specialist	Consultancy	Europe	Europe
B3	Non-corporate	Specialist	Consultancy	Europe	Europe
B4	Non-corporate	Director/C-level	Consultancy	Europe	Europe
B5	Non-corporate	Specialist	Consultancy	Europe	Europe
B6	Non-corporate	Specialist	Consultancy	Africa	Europe
B7	Non-corporate	Local expert	Consultancy	Africa	Europe
B8	Non-corporate	Local expert	Consultancy	Africa	Europe
B9	Non-corporate	Local expert	Consultancy	Europe	Europe
B10	Non-corporate	Specialist	Consultancy	Europe	Europe

