



INNOVATION REPORT ON DEFORESTATION FREE SUPPLY CHAINS

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LIST OF ABBREVIATIONS

CBD	Convention on Biological Diversity
COP	Conference of the Parties
COTI	Certification of Origin and Traceability Implementation (Engl. Certification of Origin and Traceability Implementation)
CSR	Corporate Social Responsibility
DFSC	Deforestation-free Supply Chain
DDS	Due Diligence System
EUDR	EU Regulation on Deforestation-free Products
ELAN	Entwaldungsfreie Lieferketten - Aktiv für mehr Nachhaltigkeit (English: Deforestation-free supply chains - active for more sustainability)
FSC	Forest Stewardship Council
FRC	Forest Risk Commodities
MB	Mass Balance
NTFP	Non-Timber Forest Product
PRIMI	Programa de Rastreabilidade Individual e Monitoramento de indiretos (English: Individual Traceability and Indirect Monitoring Programme)
TEI	Team Europe Initiative
UNFCCC	United Nations Framework Convention on Climate Change
ViSeC	Visión Sectorial del Gran Chaco Argentino
VSS	Voluntary Sustainability Standard/Scheme



EXECUTIVE SUMMARY

The European Union's Regulation on Deforestation-free products (EUDR) was adopted by the European Parliament and the Council of the European Union (representing the EU-countries) after consultation with the EU Commission. Aimed to reduce the European Union (EU)'s contribution to global deforestation and forest degradation, it covers seven forest risk commodities (FRC) including beef, cocoa, coffee, rubber, oil palm, soy and wood which are subject to legality/sustainability standards and due diligence requirements. The EUDR was officially adopted in June 2023 and the due date of its entering into force was officially scheduled for 30 December 2024. Meanwhile, given increasing concerns with the lack of clear implementation guidance, expected higher economic burdens and political tensions inside and outside the EU-27 countries, the practical implementation of the EUDR is decided to be delayed by one year. The final decision, including possible legal amendments, will depend on political votes in the European Parliament and the Council of the EU.

Against the background of the need for better information and guidance as regards the EUDR implementation, this report provides a description and comparative analysis of 42 case studies with practical examples for processes and tools that can support the compliance and enforcement of the regulation including the role of corporate social responsibility (CSR) and technical solutions therein. In doing so, the report assesses good practices and lessons to be learned from unsuccessful practices aimed to support deforestation-free supply chains (DFSC) initiatives or to provide response to the EUDR. The cases are assessed using a harmonised analytical framework using evaluation criteria that can be found in the scientific literature and practical experience in policy evaluation studies. They are applied and linked to the three broader EMMA4EU thematic focus areas of **Compliance**, **Technology** and **Corporate Social Responsibility (CSR)**. These assessment criteria include (1) "effectiveness", (2) "efficiency", (3) "transparency", (4) "feasibility", (5) "reflexivity", (6) "limitations" and (7) "innovation". Based on this assessment, case studies are classified as either 'relevant', 'relevant with identified limitations', 'not directly related to the EUDR' or 'with relevant limitations'.

In general, the report concludes that the EUDR promotes the implementation of DFSC initiatives through a risk-based approach, new technical requirements such as geolocation requirements, and comparatively ambitious regulatory scope including legality and sustainability aspects. Overall, it is well aligned with the EU's international commitments and policies, such as the Green Deal, and builds on experiences with implementing and enforcing other EU and non-EU timber-related regulations, such as the EU Timber Regulation (EUTR) and the United States (US) Lacey Act. The EUDR can be seen as an innovative and ambitious governance process encouraging higher standards and DFSC commitments across the forest and agricultural sectors. However, it also presents challenges, such as the potential impact on economic and trade issues and the need for more technical tools and clear guidance from public regulatory and enforcing authorities. Despite these challenges, the report shows that public authorities, economic operators and other stakeholders are adapting to the EUDR's objectives and implementation mechanisms. Taken together, regulatory and behavioral changes bear the potential to support broader environmental (e.g. reduced global deforestation and forest degradation), social (e.g. addressing human rights violations) and economic (e.g. stable supply of deforestation-free and legal commodities) goals.

Regarding **compliance**, this report's policy conclusions emphasize the importance of collaborative, pre-competitive research and development initiatives supported by public bodies and legislators to develop key definitions, clarify concepts, and identify data sets for compliance with the EUDR. The regulation's ambitious nature has led to the creation of numerous tools, technologies, and platforms aimed to support market participants' compliance. Definitions and concepts shared by common understanding can help evaluate these solutions, making them interoperable and complementary. The EUDR can be seen as an innovative policy process, following the 'better regulation' guideline, with examples like its benchmarking system for deforestation risks and inspection obligations for competent authorities. Cooperation between the EU and partner countries under the EUDR is designed



to be flexible to allow for innovative policy and governance solutions.

Recommendations for implementation highlight the need for practitioners to familiarize themselves with tools and practices that support EUDR compliance. Various tools provide data on deforestation risks, mapping, and data processing. Policymakers should incentivize the development of new or improved tools and technologies for compliance such as forensic methods to identify commodity origins. Collaborative platforms and initiatives are crucial for addressing deforestation and forest degradation, providing risk assessments, traceability, and navigation tools for legal requirements. However, practices like excluding non-compliant suppliers from the market and mass balancing systems may need adaptations due to their potential social and environmental impacts.

On **technology**, this report's policy conclusions highlight the significant potential of connected and interrelated data mining and analysis to support the implementation of DFSC and proven due diligence systems (DDS). Public policies, incentives, and programs should facilitate the development and improvement of such tools. Some solutions provide powerful insights into deforestation risks, supply chain mapping, and geolocation of FRCs, aiding in EUDR compliance and monitoring CSR goals. Furthermore, technology-driven approaches can provide labor supply mapping and predictive screening for forced labor in supply chains, supporting compliance with the EUDR's legality requirement.

This report's implementation and innovation conclusions suggest that the EUDR adds value to existing DFSC-related technologies, challenging providers to evolve and improve their solutions. Existing technological tools gain added value from the EUDR, while new tools are emerging. The EUDR also incentivizes the development of new technologies, such as the use of blockchain and artificial intelligence (AI) applications aimed at curbing deforestation. However, economic actors should carefully consider costs, time, transparency, and accountability when adopting these tools to ensure they effectively support compliance. Thorough evaluation and testing of technological solutions are recommended to ensure they meet compliance requirements.

Regarding **corporate social responsibility (CSR)**, this report's policy conclusions emphasize the crucial role of the financial sector in advancing DFSC through sustainable policies and investment strategies. Ambitious and transparent policies, like those of BNP Paribas and the Dutch Pension Fund, support the EU's Stepping-Up Action Plan on Global Forests by redirecting finance towards sustainable land-use practices. Civil society, observers, and solution providers can also play a vital role in monitoring, advocating for, and facilitating DFSC-related CSR initiatives. These entities enhance transparency and accountability, promoting corporate behavioral change and supporting sustainable supply chains. Collaborative platforms and initiatives are essential for driving progress towards sustainable forest management and product sourcing, aligning with regulations like the EUDR.





1. INTRODUCTION

About this report

This EMMA4EU 'D2.3 innovation report' aims to explore practices of deforestation-free supply chain regulations that has been compiled in a joint effort by all EMMA4EU academic and non-academic partners. Specially, the report explores how existing practices of compliance with other legal frameworks and voluntary sustainability initiatives can be aligned with compliance with the European Union's Regulation on Deforestation-Free Products (EUDR); how exiting technologies may be applied and/or upscaled to support such compliance practices; and how current corporate social responsibility practices maybe further aligned with the EUDR to support deforestation free and legal forest and agricultural supply chains. The report is based on a common framework for assessment and empirical case study examples that the analytical framework is applied to (see Chapter 2). This report includes a detailed description of diverse set of 43 individual case studies and summary conclusions based on a cross-case comparative assessment. This report's main aim is to provide state-of-the-art scientific and practical knowledge that can build capacities for implementing the EUDR. The content of this report is hence of equal importance for policymaking, law enforcement, corporate compliance, civil society's advocacy, in, as well as related scientific research and consultancy work.

EU policy development on deforestation-free supply chains

The European Green Deal, approved in 2020, is a framework for several policy initiatives that set out how Europe can become the first climate-neutral continent by 2050, boosting the economy, improving people's health and quality of life, caring for nature and leaving no one behind (European Commission, 2023). The European Green Deal provides a roadmap of actions to promote the efficient use of resources by moving to a clean, circular economy, halt climate change, reverse biodiversity loss and reduce pollution (European Commission, 2021d). It outlines the investments needed and the financing instruments available and explains how to ensure a just and inclusive transition (European Commission, 2019b). Strict new criteria to avoid unsustainable logging and protect areas of high biodiversity value will be applied in line with the increased climate and biodiversity ambition (European Commission, 2021d). The European Union (EU) Biodiversity Strategy 2030, a core part of the Green Deal, was adopted in 2021, recurring among a comprehensive set of approaches on demand-side regulatory measures to minimise the consumption footprint on deforestation and forest degradation (Directorate-General for Environment, European Commission, 2021).

The Green Deal was followed by the Global Gateway (European Commission, 2023a), by which the European Commission and the EU High Representative have set out a new European strategy for economic development with an intended vital sustainability aspect. The strategy seeks 'to work for people and the planet' by tackling the most pressing global challenges, from fighting climate change to improving health systems and boosting the competitiveness and security of global supply chains. For instance, this resulted in bilateral agreements on a high-political level, such as the Memorandum of Understanding with Rwanda, that include sustainability intentions like 'sustainable and responsible production and valorisation of critical and strategic raw materials[, including] increased due diligence and traceability' (European Commission, 2024).

Already in 2003, as a precursor to the recent actions on deforestation and forest degradation, the European Commission published the Forest Law Enforcement Governance and Trade (FLEGT) Action Plan and, among others, drafted the concept of demand-side legislation to assure legal timber trade (European Commission, 2003). The FLEGT Action Plan was the first overall plan and started the journey of the EU policymakers to tackle the problem of forest risk commodity (FRC) import-embedded deforestation. In 2010, the EU Timber Regulation (Regulation (EU) No 995/2010, EUTR) was adopted to further support the legality of transnational timber supply chains.



In 2019, the European Commission published another Action Plan-like strategy on 'stepping up EU Action to Protect and Restore the World's Forests' (European Commission, 2019a) and formulated five priorities of EU actions against deforestation and forest degradation:

- Priority 1: Reduce the EU consumption footprint on land and encourage the consumption of products from deforestation-free supply chains in the EU
- Priority 2: Work in partnership with producing countries to reduce pressures on forests and to 'deforest-proof' EU development cooperation
- Priority 3 Strengthen international cooperation to halt deforestation and forest degradation and encourage forest restoration
- Priority 4: Redirect finance to support more sustainable land-use practices
- Priority 5: Support the availability of, quality of, and access to information on forests and commodity supply chains. Support research and innovation

EU legislation on deforestation-free products

Under Priority 5 of the communication document 'Stepping up EU Action to Protect and Restore the World's Forests', the EU initiated the development and adoption of the EU Regulation on Deforestation-free products (Regulation (EU) 2023/1115, EUDR), which was officially adopted in June 2023. The EUDR was planned to officially enter into force on 30 December 2024, but a phase-in period of additional one year to allow for more time in getting ready was politically negotiated. The EUDR's development was based on the design of the precursor legislation EUTR, an evaluation of its strengths and weaknesses and the materiality of the role of the EU and drivers for deforestation (European Commission, 2021b), as well as on specific elements such as on the role of voluntary third party certification and verification schemes (Directorate General for Environment (European Commission, 2021). In preparation for regulatory demand-side measures, the European Commission undertook an impact assessment of such a law initiative (European Commission, 2021c). Based on these agenda-setting efforts and technical preparations, the main conclusions to support a demand-side regulatory action to minimise the EU's consumption footprint on deforestation and forest degradation are the following (European Commission, 2021c):

- Select main FRCs based on a materiality assessment (e.g. contribution to deforestation and forest degradation, role of EU as consumption market);
- Request geolocalisation about the origin of FRCs to specific plots of land;
- Provide precise enforcement requirements for EU Member States;
- To put the responsibility of market actors for due diligence and supply chain information management in the center, lowering the relevance of certification and verification schemes;
- Keep legality as a core element while adding the requirement of deforestation-free beyond national legislation of producing countries;
- Incorporate new approaches, such as benchmarking of producing countries concerning deforestation and forest degradation risks, requesting a due diligence declaration, introducing a centralized information system, defining the role of substantiated concerns, and including a revision roadmap of the EUDR.

Innovation and legislation: a back-to-back approach by the EU

In 2019, the EU adopted the innovation principle to formulate legislation that promotes intelligent, future-oriented regulation and policies designed to encourage innovation activities that can deliver socially and environmen-



tally beneficial progress (European Commission, 2022b). Furthermore, a 'better regulation' guideline and toolbox was put into effect, supporting the creation of legislation that achieves its objectives while being targeted, practical, easy to comply with and with the least burden possible (European Commission, 2021a). For this, the EU aims to run comprehensive evaluation and fitness checks and impact assessments of its new policies and laws something that was undertaken before the formulation of the EUDR. Furthermore, the EU has also sought input from wider range of stakeholders and included compliance promotion tools that shall help Member States transpose, implement and apply EU law promptly and correctly (European Commission, 2021a). In detail, the innovation principles seek the fulfilment of the following objectives:

- Improve the design of existing and future EU regulations concerning their impact on encouraging beneficial innovation;
- Steer the development of innovative solutions addressing new and complex challenges in a way that embeds EU values and protects Europeans;
- Achieve an optimal balance between predictability of the regulatory environment and adaptability to scientific and technological progress.

This innovation report builds on the idea that the overarching policy objective to decrease the contribution of the EU's consumption to global deforestation are and need robust policy and legislative approaches. These need not only be innovative by their design but also have to trigger effective, efficient and just policy and behavioral responses by all those that are affected by or are affecting deforestation and forest degradation. The destruction of the world's forests is a complex problem that involves among others telecoupling of both demand (EU and non-EU) and supply (tropical and non-tropical) side jurisdictions. To address deforestation and forest degradation requires a thoughtful, multi-sectoral approach of smart and coordinated policymaking and law enforcement, responsible corporate practices, useful technologies, active civil society engagement and scientific support. Among those policy tools, demand-side regulations can provide important contributions that need to be complemented by supply side. By design, the EUDR is a demand side policy tool that is not merely a command-and-control regulation that denies market access to forest risk commodities (beef/cattle, cacao, coffee, oil palm, rubber, soy, and wood) unless basic conditions are met (products must be deforestation/degradation free, legal and subject to due diligence); it also asks for guidance and technical support from the competent authorities to help economic operators comply through exchanging knowledge and good practice examples. There is also a key role to be played by economic operators themselves through the development and application of corporate due diligence systems including information collection, risk assessment and risk mitigation along supply chains. Last, but not least, the EUDR provides a crucial role to environmental non-governmental organizations (NGOs), civil society groups, scientists and consultants to observe implementation and correct non-compliance by so called substantiated concerns. The 43 cases of EUDR-relevant practices collected in this report represent a selection of key examples of how public authorities, economic operators, financial institutions, service providers, scientists and civil society can have a role in and work together towards reduction of deforestation and forest degradation through the implementation of the EUDR. They represent pertinent practices from the total universe of all actions through which public and private have sought to prepare for the original start date of the EUDR by the end of 2024. By assessing these relevant practical cases against an criteria-based analytical framework (see Chapter 2), the innovative value of each case is evaluated, cross-case comparisons are made and overall conclusions drawn.

At the time of writing this report, several relevant actors in Europe such as conservative and liberal members of the European Parliament, several EU countries' governments and EU's based forest and agricultural industries called for a temporary delay of the EUDR presumably mainly due to the lack of clear guidance and knowledge how to comply (Nienaber & Ainger, 2024). Likewise, some big producer (e.g., Brazil, Cameroon, Indonesia) and



other consumer (China, USA) countries advocated for EUDR postponement on the grounds that the lack of clarity and mismatch with national policy and legal frameworks would jeopardize their national or economic interests (e.g. Palencia, 2024; The Sun, 2024). Still, many leading multinational companies, environmental NGOs, and civil society groups, and small and medium sized companies kept with their support for the timely implementation of the EUDR pointing at their readiness for implementation. (e.g. Anonymous, 2024). Latest news show that the EUDR, will be facing a delay in implementation. Originally set to be enforced on December 30, 2024, for large companies, the European Commission has proposed a 12-month delay, moving the compliance date to December 30, 2025, for large companies and to June 30, 2026, for small and micro-enterprises. This delay is officially intended to allow more time for public regulators to provide clear guidance, for businesses to prepare for the law's requirements and for countries to avoid potential transnational trade disruptions along supply chains.

The EUDR's delay may buy in some time to build capacities for implementation and help restore political and economic relationships between the EU and its trade partners. Still, environmental organizations and civil society activists have argued that postponing the law could have severe consequences for further destruction of global primary forests, especially in biodiversity hotspots regions like the Amazon and Southeast Asia. Some estimates suggest that the EUDR's implementation delay could result in the loss of around 2,300 square kilometers of forest, with significant implications for the release of greenhousegas (GHG) emissions amplifying further climate change and biodiversity decline. In parallel, leading multinational companies using rubber or cocoa have also complained about the proposed delays due to legal uncertainty and market disruptions.

Despite the EUDR's delay, the newly elected European Commission maintains that the law's objectives will remain unchanged. Alongside the extension, new guidelines and an updated FAQ have been published to help clarify compliance requirements. The delay will be subject to the approval from the European Parliament and the Council of the EU in consultation with the EU Commission, and publication on the EU Official Journal, before it can be enacted.

The proposed EUDR's implementation delay highlights not only the inherent tension between environmental protection goals and the practical challenges businesses and countries face in adapting to stringent new EU regulations. The controversy also reveals the need to build capacities and provide recommendations through the dissemination of state-of-the art scientific and practical knowledge as well as by learning from experience and adapting already existing policy, corporate and technological tools to the new standards.

Private and public sector policies for deforestation-free supply chains

Shortly before the Conference of the Parties of the Convention on Biological Diversity (CBD COP) in 2008, WWF developed the concept and campaign of Net Zero Deforestation by 2020 (WWF International, n.d.). The Consumer Goods Forum took up the idea in 2010, and by 2017, more than 440 companies pledged for a zero-net deforestation policy (Binsztok, 2017). Within the Consumer Goods Forum, the Forest Positive Coalition was built to facilitate deforestation- and conversion-free supply chains (Consumer Goods Forum, 2020).

In the public policy arena, pledges towards zero deforestation followed. In 2014, many countries supported the New York Declaration on Forests (Forest Declaration Assessment, 2022), which calls for global action to protect and restore forests and offers a standard, multi-stakeholder framework for forest action, consolidating various initiatives and objectives towards forest protection, restoration, and sustainable use. In 2019, this was followed by the Glasgow Declaration (UK Government, 2021), adopted at the Climate COP 26 of the UNFCCC and finally signed by 145 countries. The signatories 'commit to working collectively to halt and reverse forest loss and land degradation by 2030 while delivering sustainable development and promoting an inclusive rural transformation' (UK Government, 2021).



Several countries took their own initiative. For example, the German international development cooperation agency GIZ co-designed the concept of 'deforestation-free supply chains' (in German 'entwaldungsfreie Lieferketten', short ELK), which has been integrated in the policy work of the German Federal Ministry for Economic Collaboration and Development (Bundesministerium für wirtschaftliche Zusammenarbeit und & BMZ, 2019; Weihrauch et al., 2023). Related national legislative supply chain initiatives, putting an emphasis on labour rights and broader environmental protection standards, include the French Duty of Vigilance law, the Dutch Child Labor Act and the German Supply Chain Law (Gustafsson et al., 2023).



2. ANALYTICAL AND METHODOLOGICAL FRAMEWORK

The case studies (see Chapter 4) present examples of FRC regulation practices with relevance to the three EMMA4EU interrelated focus areas: 1) compliance, 2) technology and 3) corporate social responsibility (CSR). In this report, compliance refers to the obligations and responsibilities of public agencies to enforce and the rights of non-state actors to support the implementation of the EUDR. Technology covers what service and knowledge providers (e.g., consultants, scientists, think tanks, certifiers) can offer as tools, systems, processes, and data-based approaches to support the EUDR's implementation and enforcement. CSR refers to corporate strategies and behavioral practices to implement the EUDR in particular, and to address deforestation and avoid unsustainable practices in their supply chain in general.

The selected case studies include examples from both the demand side in the EU (EU-level, EU countries) and supply side in non-EU third countries (e.g. Argentina, Brazil). They cover the production, trade and consumption of different FRCs from the forest and agricultural sectors that are covered and regulated under the EUDR. The case studies include a broad range of FRC regulatory processes including public regulations regulating supply chains, producer country jurisdictional approaches, private sustainability regulation, zero-deforestation industry self-regulation as well as science- and data-based approaches (for classification see for example Sotirov et al. 2020; Sotirov et al., 2022).

Informed by the policy evaluation literature and impact assessment studies, a set of seven assessment criteria for the case studies were identified and formulated as follows:

1) Effectiveness: this reflects the extent to which the action identified in the case study helps achieve the implementation of EUDR and meet its policy goals. As categorized by Sadler (1996), there are three dimensions of effectiveness, namely, procedural, substantive, and transactive. Procedural effectiveness implies that the action conforms to established provisions and standards as laid out in the EUDR and as evidenced by the completion of key components. Substantive effectiveness shows the achievement of policy objectives like zero-deforestation or legality of forest-risk commodities listed in the EUDR as demonstrated by environmental and socio-economic benefits. Transactive effectiveness is achieved when overall results and environmental benefits are obtained at the lowest cost within the shortest possible timeframe.

2) Efficiency: this pertains to the transactive effectiveness (Sadler, 1996), particularly how the action in the case study while enabling the implementation of EUDR contributes to minimizing monetary costs, either through total costs or the cost-benefit ratio reduction (Nagel, 1986). Furthermore, the efficiency of an action is also connected to its ability to be adopted across various contexts and by a diverse range of stakeholders (Capano & Lippi, 2017) related to EUDR. This efficiency hinges on the action's suitability and flexibility (Atisa, 2020), enabling relevant stakeholders to meet the policy goals and standards set by the EUDR.

3) Transparency: refers to a state where information about the action in the case study can be made apparent and readily available to relevant stakeholders and the wider public. Its impact on EUDR implementation depends on what information is made transparent, how, and for what purpose. Merely making information public is insufficient. If the information is not easily interpretable through clear meta-data, sources, methodologies, and visualizations, it may primarily benefit those disclosing it, especially if third parties do not actively scrutinize it. In a more substantive sense, transparency involves key factors necessary to improve sustainability practices within the action identified by the case study, including observation, monitoring, surveillance, mandatory and voluntary disclosure, dissemination, reporting, marketing, complaints and verification (see Gardner, et al., 2019).

4) Feasibility: to ensure the feasibility of the action discussed in the case study, it is crucial that stakeholders with differing interests and values are able to fundamentally agree or reach a consensus on what is best for



everyone (Taebi, 2017). Accordingly, it involves social acceptance of the action and political feasibility. Social acceptance depends on the degree to which the action resonates with the broader community, garnering public endorsement (Wolsink, 2018). Political feasibility requires aligning the action with the current political landscape, ensuring it complies with relevant laws and regulations at both national and international levels. It also involves securing backing from key decision-makers and institutions to facilitate implementation while ensuring the action's stability and effectiveness over time, even in the face of potential changes in political leadership (Schubert et al., 2015).

5) Reflexivity: this refers to the capacity of an action within the case study to evolve and transform based on ongoing assessment and reflective practices. Reflexivity underscores the importance of how well the action can reconfigure or modify itself in response to feedback and evaluative insights (Dryzek, 2016; Yanuardi et al., 2022). In practical terms, reflexivity involves creating systems and arrangements that allow for collaboration among various stakeholders. This means that different types of stakeholders should work together in a dynamic and ongoing process. They must engage in continuous learning and iterative adjustments, to refine processes, practices and institutions (Van Der Jagt et al., 2021), thereby better achieving the EUDR goals.

6) Limitations: this reflects key implementation challenges that the action in the case study is facing. These limitations are not restricted to the need for more financial, human and knowledge resources. They may also include issues such as weak governance, poor enforcement of environmental regulations (DeValue et al., 2022), and companies' difficulties in clearly explaining the methodologies for identifying deforestation and conversion free volumes and ecosystem types included in the analysis (Samberg et al., 2024).

7) Innovation: this hinges on how innovative the action in the case study is and how it contributes to the EUDR compliance compared to the status-quo. It should also avoid the risk of falling into the 'specific outcome, specific solution' trap, where management becomes overly focused on measurable results, potentially overlooking the broader, interconnected aspects of sustainability (Alexander et al., 2024). The action can be sustainability-oriented innovation that aligns with some of the objectives of the EU innovation principle such as achieving 'optimal balance between predictability of the regulatory environment and adaptability to scientific and technological progress'. Examples could include incorporating advanced monitoring technologies, using digital tools like satellite imaging and machine learning, and adapting environmental performance measurement systems to fit the complexities of supply chains, thereby improving transparency and traceability. However, while these advanced analytics and automation offer significant potential, the action needs to incorporate collaborative partnerships between public agencies, businesses (e.g. Sadler, 1996; Samberg et al., 2024; Schubert et al., 2015; Taebi, 2017; Van Der Jagt et al., 2021; Wolsink, 2018; Yanuardi et al., 2022), and communities to ensure that these innovations are implemented ethically (Alexander et al., 2024; Rogers & Dora, 2024).

Assessment conclusion

The lead authors make an overall evaluation for each case study as to how well it aligns with the requirements and objectives of the EUDR. The evaluation is based on the qualitative and narrative description of the case study authors and was carried out as follows: **'Relevant'** if the case has been determined to positively contribute in a relevant way towards one or several of the assessment criteria above, but no outspoken limitations were mentioned; **'Relevant, with identified limitation'**, when one or several assessment criteria are met, but where limitations or barriers to implement the EUDR are also present. **'EUDR not in focus / has a wider/different scope'**, if the practice due to its scope did not focus or support EUDR implementation or compliance, or if the case had a scope significantly broader than deforestation and forest degradation; and **'Has relevant limitations'**, if a severe limitation or several limitations regarding a case have been identified and mentioned, that critically compromise its support towards implementation of the EUDR or compliance with it.



3. THEMATIC AREAS

Practitioners and managers of deforestation-free supply chains, motivated by the EUDR or beyond by private sector policies, need to develop approaches regarding the following three thematic areas: compliance, technology and CSR. This report provides description and summary information on 42 practices with relevance to one or more of these three thematic areas.

3.1 Compliance

If an approach or practice incorporates elements towards compliance with public or private regulations of FRCs, it is marked as of key interest for compliance (see Table 1). Usually, compliance relates to the requirements, obligations and responsibilities of public authorities, market actors and third parties as stipulated in the EUDR. However, other regulatory instruments (e.g. non-state certification schemes, zero deforestation corporate or mixed initiatives etc.) can also be of the primary interest for compliance questions.

3.2 Technology

Approaches and practices that are based on using existing technologies or developing new technologies will be marked accordingly (see Table 1). For instance, new technologies are needed to comply with new EUDR requirements such as due diligence, geolocalization, supply chain tracking, risk-based country assessments and corporate disclosure. They need to either be adopted for new commodities and sectors or required data types and data volumes need to be handled and managed.

Highlighting such cases and effective solutions for the regulation of DFSC can increase awareness, access to and utilisation capacity in emerging technology solutions for identifying, collecting, monitoring, analysing and reporting on information and data along DFSC, including risks. Technological solutions of relevance for DFSC advance rapidly and are applied unevenly in different sectors. Key examples include blockchain, remote sensing, geographic information systems (GIS) molecular tracing and fingerprinting. Regarding this thematic area, this report gathers descriptions and assessment insights of relevant technology and solutions and provides a robust overview of technological exemplary options at hand.

3.3 Corporate Social Responsibility

Approaches and cases that show elements which either can be integrated into CSR policies or support CSR implementation are marked accordingly (see Table 1). CSR is a management concept whereby companies integrate social and environmental concerns in their business operations and supply chain interactions with their stakeholders. CSR is a form of an industry-self regulation that is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives ('Triple-Bottom-Line- Approach') (UNIDO, 2024). To effectively engage in CSR means that, in the ordinary course of business, a company is operating in ways that enhance society and the environment instead of contributing negatively to them. To do this, corporations need to be aware and trained on the range of quality assurance, standards, certifications and CSR support tools that are available for supply chain actors involved in the production and trade of FRCs, from small to large.



4. CASE STUDY OVERVIEW

The following table provides a summary overview of all 43 case studies as regards their main description, relevance for thematic area, and supply chain scope as well as a summary assessment in line with the evaluation criteria.

Table 1: Overview of all 43 case studies identified, selected, described and assessed by the EMMA4EU project. (Source: own elaboration)

Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#1 - Trase Trase maps supply chains from consumer markets to regions of production using data on commodity production and trade. Trase shows how consumer markets are affected by deforestation and other environmental issues when they buy from regions where commodities are produced.	Compliance Technology	Agriculture	Data-based	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Transparency Feasibility Innovation identified	Relevant	Trase website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#2 - BNP Paribas agricultural sector policy BNP Paribas has new rules to stop deforestation in the Amazon and Cerrado. It now asks customers who buy or produce beef or soy from these areas to have a plan to stop deforestation by 2025.	CSR	Agriculture Forestry	Industry self-regulation	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency	Relevant	BNP Paribas agricultural sector policy
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#3 - Forest 500 by Global Canopy The Forest 500 project tracks the policies and performance of the 350 most influential companies and 150 financial institutions linked to deforestation.	CSR	Agriculture Forestry	Other approach: Private sector assessment	Demand-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Soy, Cattle, Palm oil, Wood, Pulp and paper	Efficiency Transparency Limitations Innovation identified	Relevant, with identified limitations	Forest 500 website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#4 - MapBiomas MapBiomas is a network of NGOs, universities, and tech startups that produces annual maps of land cover and land use. Since 2019, it has also provided reports on deforestation in Brazil through the MapBiomas Alert platform. This compiles and validates data from various remote sensing systems and cross-references it with public databases. The reports include satellite images of deforested areas and detailed insights from data analysis. MapBiomas offers precise data on land use and land use change through its free, easy-to-use platform.	Technology	Agriculture Forestry	Data-based Science-based	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Limitations Innovation identified	Relevant, with identified limitations	MapBiomas website



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#5 - EU Observatory on deforestation and forest degradation (EUFO) EUFO was created by the Joint Research Centre (JRC) to provide information on land use change worldwide. It aims to monitor changes in forest cover and related drivers. Additionally, a warning system will assist relevant stakeholders through early notification of possible deforestation or forest degradation activities.	Compliance Technology	Agriculture Forestry	Science-based	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Soy, Cattle, Palm oil, Coffee, Cocoa, Rubber, Wood, Maize	Effectiveness Efficiency Transparency Limitations Innovation identified	Relevant, with identified limitations	EUFO website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#6 - The Accountability Framework Initiative The AFi is a global group that protects forests, ecosystems and human rights in the supply chains of businesses involved in agriculture and forestry. The Accountability Framework helps businesses make ethical and sustainable choices. The AFi is a platform where information about the EUDR can be found and shared. It is useful for companies that do not have strong no-deforestation policies.	Compliance CSR	Agriculture Forestry	Data-based Science-based Private regulation Other: Guidance by a multi-stakeholder platform	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations	AFi website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#7 - Satelligence Satelligence has a lot of experience in assessing supply chains at different scales. It uses a network of trusted partners to provide businesses with data on land use change and services for those involved in EUDR due diligence.	Compliance Technology	Agriculture Forestry	Data-based	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations	Satelligence website



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#8 - Verité Verité is a civil society organization that helps people understand labor and human rights issues in global supply chains. It works with different sectors and industries to develop tools and research to assess labor conditions in different production systems and value chains.	Compliance Technology	Agriculture	Private regulation	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Agricultural FRC (beyond EUDR), Cattle, Palm oil, Coffee, Cocoa, Rubber, See: https://verite.org/commodity-atlas/	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	EUDR not in focus / has a wider/different scope	Verité website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#9 - Produce, Conserve and Include (PCI) State Strategy PCI Strategy was launched in 2015 to help the Brazilian state of Mato Grosso develop in a sustainable way. It aims to show that it is possible to increase productivity and reduce deforestation.	Compliance	Agriculture Forestry	Public policy / regulation Other: Multi-stakeholder jurisdictional approach	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR), Soy, Cattle, Wood, Corn, cotton, biofuels	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations	PCI website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#10 - Blockchain Blockchain can help companies comply with EU rules on recording, sharing and verifying information about products covered by the EUTR. It can also help Competent Authorities and delegated bodies monitor activities.	Technology CSR	Agriculture Forestry		Supply-side (Specific countries) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR), Wood	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations	
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#11 - Forensic timber tracing Timber tracing is a way to check where wood comes from. It uses chemical or genetic tests. This has become a popular method in the last 20 years. It is used to check where wood is from and what type of wood it is.	Compliance Technology	Agriculture Forestry	Science-based	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Wood	Efficiency Feasibility Limitations Innovation identified	Relevant, with identified limitations	Timtrace: Project to test forensic timber tracing methods



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#12 - Oil palm agroforestry Agroforestry is an alternative to standard monoculture. It allows farmers to produce oil palm without deforesting land. This practice has social and ecological advantages and disadvantages.	CSR	Agriculture	Other: Agricultural non-deforestation practice	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Palm oil	Reflexivity	EUDR not in focus / has a wider/different scope	
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#13 - Remote sensing-based forest disturbance driver mapping Monitoring forest disturbance in near real-time using satellite images. New satellite imaging technology can detect tropical forest disturbances in high detail and in near real-time, offering a new view of deforestation and forest degradation in the tropics.	Technology	Agriculture Forestry	Data-based Science-based	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All EUDR-FRC	Effectiveness Transparency Innovation identified	Relevant	Different websites: Earth Engine App of WUR
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#14 - Brazil's CAR (Cadastro Ambiental Rural / Environmental Rural Registry) The CAR is an instrument established by the Brazilian Forest Code. It was adopted to monitor rural properties concerning their compliance with environmental laws. The CAR is an electronic record containing information on the landowner, property boundaries, and environmental information.	Compliance Technology	Agriculture Forestry	Data-based Public policy / regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Transparency Feasibility	Relevant	Website of CAR
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#15 - Sustainability policy of the Dutch Pension Fund In March 2024, the fund introduced a new policy that focuses more on deforestation and biodiversity. This follows a trend of companies accounting for biodiversity risk via the concept of "double materiality".	Technology CSR	Agriculture Forestry Finance	Industry self-regulation	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Transparency	Relevant	Strategy document
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#16 - Sourcing Hub The Sourcing Hub database contains risk data on timber and agricultural commodities. It covers legal production and trade risks and offers guidance on how to mitigate them. The data is the result of detailed risk assessments developed by Preferred by Nature.	Compliance Technology CSR	Agriculture Forestry	Private regulation	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Soy, Cattle, Palm oil, Wood	Effectiveness Efficiency Transparency Limitations	Relevant, with identified limitations	Sourcing Hub website



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#17 - Universal Mill List The Universal Mill List (UML) is a global database of verified palm oil mills. It is designed to enhance transparency and sustainability in the palm oil industry.	CSR	Agriculture	Private regulation	Supply chain orientation: Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
		Efficiency Transparency	Relevant	Explanation side and link to data source at Rainforest Alliance's website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#18 - Global Forest Watch It is an online platform that monitors forests worldwide. It was set up in 2014 by the World Resources Institute (WRI) and other organizations. GFW uses satellite technology, open data, and crowdsourcing to provide real-time information about the state of the world's forests.	Compliance CSR	Forestry	Data-based	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Transparency	Relevant	Global Forest Watch website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#19 - ViSeC (Visión Sectorial del Gran Chaco Argentino) It is an industry-led platform that started in 2021 to reduce the environmental impact of the soybean industry in Argentina. It does this by identifying land used for soy production and promoting sustainable practices. The system is voluntary and financed by private donors. The aim is to cover the entire soy value chain.	Compliance CSR	Agriculture	Private regulation Multi-stakeholder platform	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Soy, Cattle	Effectiveness Efficiency Innovation identified	Relevant	ViSeC website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#20 - World Forest ID It is a US charity that collects plant samples from forests and farms around the world to build a database of species.	Compliance Technology	Agriculture	Science-based	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Limitations Innovation identified	Relevant, with identified limitations	World Forest ID website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#21 - Risk Information Alliance A group (in 2024: Forest Stewardship Council - FSC, Preferred by Nature, the Roundtable on Sustainable Biomaterials - RSB, the Sustainable Biomass Program - SBP, and Global Platform for Sustainable Rubber - GPSNR) of organizations have joined forces to develop risk assessments.	Compliance	Agriculture Forestry	Private regulation	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All EUDR-FRC	Effectiveness Efficiency Feasibility Innovation identified	Relevant	Risk Information Alliance website



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#22 - The EUDR's Benchmarking system The EUDR's benchmarking system looks at deforestation and forest degradation risks in countries. It also looks at what countries are doing to fight these problems.	Compliance	Agriculture Forestry	Public policy / regulation	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All EUDR-FRC	Effectiveness Efficiency Innovation identified	Relevant	Link to EUDR law text
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#23 - The EUDR's inspection obligations for competent authorities The EUDR makes sure that inspections are done properly by setting yearly minimum inspection requirements for authorities. This helps countries and market participants to comply.	Compliance	Agriculture Forestry	Public policy / regulation	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All EUDR-FRC	Effectiveness Efficiency Feasibility Limitations Innovation identified	Relevant, with identified limitations	Link to EUDR law text
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#24 - The role of private certification under the EUDR The EUDR relies on strong state-based regulation. It does not allow private regulation as a way of proving compliance. Third-party verified schemes can only be used as an extra tool to support the EUDR's risk assessment if they meet the EUDR's information requirements.	Compliance	Agriculture Forestry	Public policy / regulation Private regulation	Demand-side (Global) Supply-side (EU)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All EUDR-FRC	Efficiency	Relevant	Link to EUDR law text
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#25 - The role of EU-partner country cooperation under the EUDR The EUDR says the EU must work with producer countries to tackle deforestation and forest degradation. These partnerships aim to make supply chains more sustainable and stop human rights violations.	Compliance	Forestry	Public policy / regulation	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Feasibility	Relevant	Link to EUDR law text
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#26 - Substantiated concerns under the EUDR The EUDR aims to make regulations more effective and efficient by allowing inspections to be carried out by competent authorities. It also encourages the use of watchdog competencies by NGOs and others.	Compliance	Agriculture Forestry	Public policy / regulation	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
		Effectiveness Efficiency Feasibility Limitations Innovation identified	Relevant, with identified limitations	Link to EUDR law text



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#27 - Direct cocoa supply chains and own plantations: The Ritter Sport case The company makes sure our supply chains don't cause deforestation. It sources only cocoa from certified sustainable sources. It traces it all the way back to the producer organizations, so it can monitor and verify the cocoa supply chain. It works directly with the cocoa producer organizations to make sure they comply.	CSR	Agriculture	Industry self-regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Coffee	Effectiveness Transparency Feasibility Reflexivity Innovation identified	Relevant	Link to company website on sustainability
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#28 - Forest Stewardship Council (FSC) It is an important tool for ensuring that wood and rubber are sourced sustainably. FSC certification involves checking that forest management and supply chain procedures meet strict standards related to biodiversity, indigenous rights, community engagement and environmental protection.	Compliance Technology CSR	Forestry	Private regulation	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Rubber, Wood, Non-wood forest products	Effectiveness Efficiency Transparency Reflexivity Limitations Innovation identified	Relevant, with identified limitations	Link to the website of FSC on deforestation and degradation
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#29 - Remote sensing-based products and services for EUDR This case study looks at how publicly accessible data platforms and commercial remote sensing services help the EU to monitor deforestation and forest degradation in tropical countries.	Compliance	Agriculture Forestry	Data-based Science-based	Demand-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Efficiency Transparency Innovation identified	Relevant	Many tools are available, no specific source
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#30 - explorer.land (Map-based data & story-telling for more transparency) This digital tool makes it easier to see where nature-based projects are taking place. It shows spatial data, mainly in the form of maps of areas where work is being done. It also includes data on land use and deforestation, so users can see how land has been used in the past.	Technology CSR	Agriculture Forestry	Data-based	Demand-side (Global) Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Transparency Feasibility Innovation identified	Relevant	explorer.land website



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#31 - ELAN platform by Global Nature Fund and OroVerde The platform helps companies move towards deforestation-free supply chains. GNF and OroVerde work together to tackle environmental issues and encourage businesses to be more responsible.	Compliance, CSR	Agriculture Forestry	Other approach: Guidance	Supply-side (EU)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations	Relevant, with identified limitations	Elan! platform website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#32 - Ensuring inclusion of compliant smallholders Adherence to the EU Deforestation Regulation (EUDR) by supporting smallholders from the coffee supply chain towards deforestation-free and legal production.	Compliance	Agriculture	Industry self-regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Coffee, Cocoa	Effectiveness Efficiency Feasibility Limitations	Relevant	No specific source
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#33 - Mass balance The Roundtable on Sustainable Palm Oil (RSPO) uses a mass balancing model to label sustainable palm oil. In a mass balance approach known and unknown origins are mixed, with quantities controlled and monitored to ensure that certified products sold align with those introduced into the supply chain.	Technology	Agriculture Forestry	Private regulation	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Efficiency Limitations	Has relevant limitations	Subsite of the website on supply chain models
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#34 - Conservation liability in the palm oil industry This approach links conservation funding with business value chains, focusing on the environmental risk of deforestation. The main strategy is to link sourcing areas to downstream firms' conservation responsibilities. This approach helps businesses assess sourcing risks and potentially assign conservation responsibilities based on their sourcing footprint.	CSR	Agriculture Forestry	Industry self-regulation	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Palm oil	Effectiveness, Efficiency, Transparency, Feasibility, Reflexivity, Limitations	Relevant, with identified limitations	No specific source
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#35 - Artificial intelligence applications aimed at curbing deforestation Artificial intelligence could help us process the huge amounts of data from drone surveys and satellite imagery. But it is slow, labor-intensive and expensive.	Technology	Agriculture Forestry	Data-based Science-based Technology	
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency	Relevant, with identified limitations	No specific source



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#36 - Payment for Ecosystem Services These are programmes that provide promising incentives for combating deforestation. PES programmes offer financial compensation to individuals, communities, or landholders who engage in activities that conserve and protect ecosystems. It is essential to have a detailed understanding of their potential and limitations.	CSR	Agriculture Forestry	Private regulation	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	All FRC (beyond EUDR)	Effectiveness Efficiency Limitations	EUDR not in focus / has a wider/different scope	No specific source
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#37 - Selo Verde The initiative was first implemented in the Brazilian state of Pará and subsequently in Minas Gerais. It prioritises environmental compliance and the traceability of commodities produced in these regions, making it a supply-side initiative that is applied and developed in a producer country.	Compliance Technology	Agriculture	Public policy / regulation Private regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Cattle, Coffee	Effectiveness Transparency Limitations	Relevant, with identified limitations	Selo Verde Pará (Version 2.3)
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#38 - Beef on Track The programme was established in 2020 as a monitor, report and verify (MRV) system to ensure the harmonized implementation of the Term of Adjustment of Conduct (TAC) and the Public Livestock Commitment (CPP in Portuguese), two Brazilian deforestation-free agreements applicable to the cattle sector. The aim is to prevent beef producers from sourcing from illegally deforested areas.	Compliance Technology	Agriculture	Public policy / regulation Private regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Cattle	Effectiveness Transparency Limitations	Has relevant limitations	Beef on Track website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#39 - PRIMI+COTI initiatives PRIMI is a private, sector-led monitoring protocol that enables beef and leather producers to provide evidence against the following sustainability criteria: originating from deforestation-free areas, no overlap with indigenous lands and protected areas, no environmental embargoes, no slave-like labor. This protocol encompasses cattle supply chains from the initial stages of production (initial birth and breeding farms) to the slaughterhouse. Complementary COTI is the protocol for the downstream supply chain, comprising actors such as tanneries, leather exporters, retailers, and other downstream companies that utilize the products in question.	Compliance Technology	Agriculture	Private regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Cattle	Efficiency Transparency Limitations	Relevant, with identified limitations	Website of the PRIMI protocol



Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#40 - Amazon Soy Moratorium The voluntary zero-deforestation agreement covers soy production in the Amazon and aims to halt soy-driven deforestation in the Brazilian Amazon biome. It involves the private sector and civil society, having been endorsed by the Brazilian government, namely through the Ministry of Environment. The ASM is a market-based mechanism.	Compliance Technology	Agriculture	Private regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Soy	Effectiveness Efficiency Feasibility Limitations	Relevant, with identified limitations	Website of the Amazon Soy Moratorium
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#41 - Soft Commodity Forum The initiative was established in 2019 by some of the largest grain traders worldwide – ADM, Bunge, Cargill, and LDC – as a collaborative business engagement and multi stakeholder initiative. It was later joined by COFCO International and Viterro. The SCF, led by the World Council for Sustainable Business Development (WBCSD), brought together leading global commodity traders under a common, pre-competitive project to address the sustainability challenges they all share for the first time.	CSR	Agriculture	Private regulation	Demand-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Soy	Effectiveness Transparency Feasibility Limitations	Has relevant limitations	SCF sub-site at WBCSD website
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#42 - Rainforest Alliance The Rainforest Alliance is an international non-profit organization working at the intersection of business, agriculture, and forests to make responsible business the new normal. Rainforest Alliance certified products are aligned with EUDR and based on a data sharing policy. This allows EU buyers to obtain the necessary data for their EUDR due diligence system.	Compliance Technology	Agriculture	Private regulation	Supply-side (Global)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Agricultural FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility	Relevant	Website of Rainforest Alliance
Title and short description	Thematic Area/ Areas	Sector	Type of approach	Supply chain orientation
#43 - Kyagalanyi Coffee exporter Kyagalanyi Coffee Limited is Uganda's largest coffee exporter, founded in 1992. The company sources robusta and arabica coffee from the major producing regions in the country. It runs sustainability initiatives that provide technical training to improve productivity and coffee quality, and address climate change impacts on farming communities. The company runs the Volcafe Responsible Sourcing (RS) programme.	Compliance Technology CSR	Agriculture	Industry self-regulation	Supply-side (Specific countries)
	FRC scope	Assessment criteria	Assessment conclusion	Key external source
	Cocoa	Efficiency Feasibility	Relevant, with identified limitations	Website of the private initiative



5. CASE STUDIES DESCRIPTION

The following section provides a summary description of each of the 43 case studies based on information available during the first months of 2024. Where available, a link to an explanation video is provided for several case studies to facilitate the exchange of knowledge and experience and foster policy-oriented learning and mutual understanding between regulators, regulatory targets and third parties.

The description generally follows the following structure: First, a summary is provided explaining the practice, instrument or case study. It mentions which thematic area the case is relevant to and shows the supply chain orientation, geographical focus, and commodities covered. Second, the practice, instrument or case study is assessed against the analytical key criteria of effectiveness (achieving the EUDR regulatory goals and standards), efficiency (lower costs and easiness to use), transparency (participation and public accessibility), feasibility (social acceptance, political support), reflexivity (capacity of learning from experience and adapt), limitations (implementation challenges such as lack of resources, limitations in knowledge, etc.) as well as innovations (e.g. alignment with EU innovation principles). Third, a case study description concludes with an explanatory statement whether the practice is 'recommended', 'has relevant limitations', or whether the 'EUDR is not in focus / has a wider/different scope'.

5.1 Trase

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Data-based	Supply-side (Specific countries)	All FRC (beyond EUDR)	Effectiveness Transparency Feasibility Innovation identified	Relevant
 Link to key reference Trase website				 Link to training video www.emma4eu.eu/learn/case-studies		
 Authors (Institution) Elena Massarenti (Etifor)				 Last update April 2024		

For quick navigation: [Click here to go back to Case study overview table](#)

Trase is a data-driven initiative that helps understand the complex interplay between global commodity trade, financing, and deforestation. By linking consumer markets and trading companies to sourcing regions and their associated deforestation, Trase enables companies, investors, and governments to assess deforestation risks and identify opportunities for sustainable production. It supports the EU Regulation on Deforestation-free products (Regulation (EU) 2023/1115, EUDR), compliance and broader sustainability goals through advanced supply chain mapping technology, known as the Spatially Explicit Information on Production Consumption Systems (SEI-PCS). The system starts by combining self-reported company data with customs, shipping, tax, logistics, and other data to track goods movement within countries and trace them back to their production locations at a subnational level, which is crucial for local decision-making. By further integrating geospatial land-use data with trade and sourcing patterns, Trase pinpoints regions with high deforestation risks tied to specific commodities. This strengthens the EU's sub-national risk benchmarking system, enabling authorities to target enforcement in high-risk areas. Its open dataset also supports due diligence efforts by helping to profile suppliers and export ports based on deforestation trends, thus aiding in the identification and mitigation of deforestation-related risks in production countries. Trase also tracks other environmental impacts such as carbon emissions, helping



companies meet broader sustainability goals (CSR). In terms of scope, Trase covers nearly 70% of global forest-risk commodity trade. It focuses primarily on South America, especially Brazil, mapping supply chains for soy, corn, cattle, chicken, pork, cotton, cocoa, and coffee. In Paraguay, it focuses on soy, corn, and cattle; in Argentina and Bolivia, on soy; in Colombia, on cocoa; and in Ecuador, on shrimp. In South Asia, the focus is on palm oil, wood for pulp, and shrimp, while in Africa, it includes cocoa from Côte d'Ivoire. On the supply side, Trase maps data for selected producing countries with higher deforestation rates for these commodities, while on the demand side, it covers all export markets, ensuring any destination country for a given commodity is included.

This case study excels in three key areas: effectiveness, transparency, and feasibility. Trase is highly effective in supporting EUDR compliance by mapping supply chains and identifying high-risk areas for intervention. For example, Trase data shows that 80 percent of deforestation associated with EU imports of soybeans and beef from Brazil occurs in less than 5 percent of the producing municipalities (EuREDD Facility, 2017). This allows for precise identification of deforestation hotspots and more efficient, targeted interventions in the most critical areas. Transparency is upheld through openly accessible data, methods, and sources that can be integrated into third-party tools. Furthermore, Trase benefits from the support and partnership of and dialogue with governments, industry and civil society for its development and implementation, which enhances its feasibility. In turn, governments use Trase data to shape policies that aim to decouple deforestation from trade in key agricultural commodities, while civil society leverages this data to hold both governments and companies accountable by identifying high-risk areas and monitoring policy impacts. To summarise, Trase provides reliable data from official sources, linking supply chain actors to specific production regions, and tracking sourcing patterns and deforestation exposure over time. However, some limitations exist. A first limitation is that Trase data depends on the availability of detailed supply chain information, which can vary by country and commodity, requiring dedicated scoping and engagement with experts (e.g., if there is no public data on individual contracts between farmers and traders, deforestation risk can only be measured at the municipal, rather than the farm level) (zu Ermgassen et al, 2020). A second limitation is that Trase can't always provide farm-to-fork coverage although linking commodity flow to individual farms may be possible in some contexts. Trase focus is therefore only on the middle section of a supply chain and at the subnational level (Global Canopy, 2024c). A third limitation is linked to the complexity of tracking highly processed products, making it impossible to comprehensively trace all companies involved. For instance, the ownership of embedded soy in poultry exports is lost when soy from various origins is mixed into feed in unknown proportions. However, Trase can map poultry exports from Brazil and can estimate soybean equivalents in those exports based on average feed ratios for different poultry production systems.

Trase's innovation lies in its data-driven, interdisciplinary approach, enabling comprehensive mapping of global supply chains from production to consumption. Unlike traditional traceability systems, Trase uses a territorial perspective to map the entire flow of commodities, such as Brazilian soy, from local municipalities through exporters to consumers worldwide. This broader and more holistic view helps assess the net effect of the EUDR and identify potential 'leakage' effects. Trase supports the balance between regulation and technological progress by integrating advanced data science and geospatial tools into frameworks like the EUDR. It provides transparent supply chain data, helping regulators set clear, predictable guidelines while adapting to new technologies, such as satellite-based deforestation monitoring. As these technologies advance, Trase quickly incorporates them, refining data and risk assessments in real-time. This adaptability ensures that regulations stay aligned with the latest innovations, allowing policymakers to respond swiftly to emerging risks while maintaining consistent enforcement and encouraging ongoing innovation (Trase, n.d.).

In conclusion, and despite some limitations that can be overcome with Trase's ability to adapt and expand through expert engagement and estimation techniques, Trase is a really valuable tool for enhancing supply chain transparency and compliance efforts through 1) accessible and reliable data sourced from official channels, 2)



comprehensive coverage linking supply chain actors to specific production regions, 3) more targeted interventions and checks, 4) increased awareness of companies, financial institutions, governments and others of their risks and opportunities for more sustainable production and trade. Trase's next step is to integrate traceability platforms, tools, and datasets for deeper insights. This involves merging satellite-based forest loss maps with precise data on commodity production and expansion. Additionally, incorporating verified company supply chain information will help users better understand the links between actors and deforestation, creating a comprehensive package for more refined decision-making (Fripp, 2023).

5.2 BNP Paribas agricultural sector policy

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture, Forestry	Industry self-regulation	Demand-side (Global) Supply-side (Global)	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency	Relevant
Link to key reference BNP Paribas agricultural sector policy				Link to training video -		
Authors (Institution) Nicola Andrighetto (Etifor)				Last update April 2024		

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The role of financial institutions in contrasting deforestation, as well as in contributing to climate goals and in promoting new and upcoming legislation, appears crucial. Indeed, according to many reports by Forests and Finance (2023), financial institutions provide most of the capital utilised for deforesting land through debt or equity. Despite growing awareness to stop financing deforestation and a growing number of commitments, like the Finance Sector Deforestation Action (FSDA) launched at COP26, to eliminate deforestation from their portfolios by 2025, many financial institutions remain exposed to land-use change risks (World Business Council, 2022). In 2022, according to the Forest500 report (Global Canopy, 2023), PNB Paribas ranked first among 150 financial institutions in terms of the strength of their commitment to combating deforestation and protecting human rights. In detail, BNP Paribas has established three specific policies for governing its financing and investments in the sectors of palm oil, wood pulp and agriculture. These three policies apply to: (i) all business lines, branches, subsidiaries and joint ventures of which BNP Paribas has the operational control, (ii) to all activities of BNP Paribas (lending, debt and equity capital markets, guarantees and advisory work, etc.), (iii) to all BNP Paribas entities managing proprietary assets.

The BNP's policies governing its financing and investments extend beyond mere compliance with existing laws on land use change, encompassing issues like biodiversity protection, working conditions, and human rights (CSR). Geographically, these policies apply worldwide, addressing both the supply side (exporters) and demand side (importers). They particularly target commodities such as palm oil, wood pulp, and agricultural products, with a special emphasis on soybean and beef originating from Brazil.

The most innovative and interesting aspect of this case study is the process that led BNP Paribas, in 2022, to be a leader, among global financial institutions, in the ranking drawn up by Global Canopy in its Forest 500 report. In fact, the process that pushed BNP Paribas to undertake a strong policy of fighting deforestation starts from the strong criticism and pressure received from civil society in previous years. This demonstrates, in addition to the regulatory aspects, how the role of civil society in defining strategies to reduce deforestation can be fundamental.



The adoption of PNB policy can be very effective in reducing deforestation, as BNP clients include large importers and exporters of forest-risk products (Forests and Finance, 2023). Beyond that, policies established by financial institutions, such as BNP, can be very useful in preparing their clients in complying with forthcoming regulation, such as EUDR (Race to Zero, 2023). In terms of efficiency, the policies established by PNB Paribas are based on a well-defined purpose. Probably, the part devoted to the implementation mechanism appears too general, with vague references, even if certifications, such as FSC and the Program for the Endorsement of Forest Certification (PEFC) for pulp and RSPO for palm oil, are considered among the mandatory criteria. This makes the creation of new specific standards unnecessary and may make it easier for companies to comply with these policies. However, to date, it is important to point out that the policies established by PNB Paribas do not have a robust and structured system to monitor the actual compliance of companies involved in the implementation of the EUDR regulatory standards.

Lack of transparency, which means poor monitoring of policy's enforcement, is one of the main limitations of financial institutions' policies to improve the sustainability of their financing and investments (Wörsdörfer, 2015). However, once a bank discloses its socio-environmental policies, it becomes susceptible to possible active pressure from stakeholders to increase its commitment to socio-environmental policies (Moraes et al., 2023). Despite this, BNP Paribas's policy also lacks a robust monitoring and enforcement system, with no regular public reporting on the impacts of these policies. This issue continues to be a weak element of BNP Paribas strategy, and indeed this is still emphasised by some NGOs¹.

5.3 Forest 500 by Global Canopy

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture, Forestry	Other approach: Private sector assessment	Demand-side (Global)	Soy, Cattle, Palm oil, Wood, Pulp and paper	Efficiency Transparency Limitations Innovation identified	Relevant, with identified limitations
Link to key reference Forest 500 website				Link to training video -		
Authors (Institution) Elena Massarenti (Etifor)				Last update April 2024		

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The Forest 500 initiative by Global Canopy serves as an essential platform for evaluating and holding accountable 350 companies and 150 financial institutions with significant exposure to tropical deforestation risks. Using indicators aligned with the Accountability Framework, Forest 500 looks at the commitments companies have made on deforestation and related human rights issues, and also on how those commitments are being implemented (Global Canopy, 2023b). The Accountability Framework Initiative's Common Methodology covers four categories: 1) overall approach, 2) commitment strength, 3) associated human rights abuses (previously social considerations), and 3) implementation and reporting. Scores, calculated out of 100 points, are determined based on how answers are categorised by assessors (Global Canopy, 2023a). This practice falls under the thematic area of CSR by holding companies accountable through objective ranking on a yearly basis. The Forest 500's geographical focus spans both the supply and demand sides, covering companies involved in the global supply chain of the six highest forest-risk commodities: soy, beef, leather, palm oil, timber, and pulp and paper. The 2024 expansion broadens the Forest 500's scope by introducing new commodities such as cocoa, coffee, and rubber, aligning with the upcoming EUDR requirements. Additionally, it now includes non-tropical forest types, like boreal and temperate forests, to ensure more comprehensive global coverage of deforestation risks across



diverse ecosystems (Global Canopy, 2024b). The initiative is regarded as good practice based on transparency and efficiency. The platform provides accessible, publicly available information crucial for demonstrating companies' commitments to sourcing deforestation-free commodities. This transparency aids consumers in making informed choices and enables investors to assess and mitigate risks. The online research and ranking platform is freely accessible, user-friendly, and meets criteria for both efficiency and transparency. In terms of positive aspects, it incorporates multiple social indicators addressing human rights violations, gender issues, and the Free, Prior, and Informed Consent of local and indigenous communities. Furthermore, it assesses financial institutions, a component not covered by the European Union's Due Diligence Regulation. The initiative seeks evidence to verify companies' pledges and reporting. However, there are limitations. Companies are assessed solely based on publicly available information from their websites or reporting portals, such as certification schemes, potentially limiting the depth of assessment.

The EUDR mandates due diligence for companies operating in the EU market, making Forest 500's transparent and accessible data invaluable for businesses seeking compliance. This regulatory push has amplified the relevance of Forest 500, leading to greater user engagement, the expansion of use cases, and a focus on integrating human rights considerations into deforestation policies (Global Canopy, 2024a). As companies and financial institutions strive to meet EUDR standards, Forest 500 has gained additional value as a critical compliance tool in the evolving regulatory landscape. By continuously developing its ranking system and assessment methodologies, the initiative supports companies and financial institutions in navigating new regulatory requirements, thereby improving the design of future EU regulations.

In summary, as regulatory frameworks such as the EUDR gain momentum, the Forest 500 initiative plays a pivotal role in holding companies and financial institutions accountable for their impact on global deforestation. By expanding its scope and enhancing its methodologies, Forest 500 remains a critical tool in the fight against deforestation, providing transparent, actionable data to support regulatory compliance and corporate responsibility. While there are limitations due to reliance on publicly available information, the initiative continues to set benchmarks for deforestation-free commitments and reporting, contributing to more sustainable business practices and a fairer, more transparent global supply chain.

5.4 MapBiomass

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology	Agriculture Forestry	Data-based Science-based	Supply-side (Specific countries)	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Limitations Innovation identified	Relevant, with identified limitations
Link to key reference MapBiomass website				Link to training video -		
Authors (Institution) Helena Leonel Ferreira (Etifor)				Last update April 2024		

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The Brazilian Annual Land Use and Land Cover Mapping Project (MapBiomass) is a collaborative network formed by NGOs, universities, and technology startups, which has produced annual land cover and land use mapping, apart from monitoring surface water and fire scars monthly with data from 1985. Reports are also produced for each



deforestation event detected in Brazil since January 2019 through the MapBiomas Alert (MapBiomas, 2024a).

This initiative holds an innovative technological aspect that, although not being its primary objective, can support EUDR implementation. It holds a supply-side geographical focus, covering several South American countries, including Brazil, Peru, Bolivia, Colombia, Venezuela, Uruguay, Ecuador, and Paraguay, as well as Indonesia. The maps provide information on land cover and use, including data on pastureland, soy, coffee, oil palm, silviculture, sugarcane, rice, cotton, and citrus plantations. Additionally, the maps depict urban areas, mining activities, aquaculture, fire occurrences and other features, such as forest physiognomy, non-forest ecosystems, water bodies, and infrastructure (MapBiomas, 2024a).

The MapBiomas Alert platform compiles alerts from various detection systems across all Brazilian biomes using remote sensing (e.g., DETER/INPE, SAD/IMAZON, GLAD/UMD, SAD Cerrado/IPAM). Trained analysts, organised by biome, validate this data through visual inspection of high-resolution images. The platform then cross-references the findings with relevant public territorial data, such as conservation units, indigenous territories, embargoed areas, vegetation suppression permits, forest management plans, and archaeological sites. Detailed reports for each confirmed deforestation event are made openly available and updated weekly on the platform. Users can access full reports by searching for the CAR (national Rural Environmental Registry) code and view high-resolution before-and-after images of the deforestation (Vélez et al., 2023).

MapBiomas stands out by leveraging national land use monitoring systems coupled with satellite data, enabling the provision of precise country-specific information, including details about its native vegetation, which makes it an effective tool in supporting actors to comply with EUDR requirements. This approach reduces some of the inaccuracies inherent to generic satellite image databases, as discussed also in the EUFO case study. For instance, leveraging a well consolidated national database allows to discern nuanced discrepancies between various types of vegetation, such as dense forests and high-density coffee plantations — which is often challenging for generic systems. Moreover, the utilisation of high-resolution satellite imagery and the ability to generate deforestation alerts constitute substantial benefits of this system. Furthermore, the platform offers the distinct advantage of being accessible to all via the internet, with no cost involved, and constitutes a user-friendly interface, making it an efficient and transparent tool.

In early 2023, the Brazilian National Bank for Economic and Social Development (BNDES) partnered with MapBiomas, using its resources to verify whether loans granted to rural landowners were being destined for areas with illegal deforestation, which may result in cease of financing by the bank (Agência BNDES de Notícias, 2023). This example demonstrates how this tool provides significant added value in addressing the new challenges posed by the EUDR. Actors subject to this regulation can take advantage of its features as a support for complying with the new obligations, highlighting the tool's innovative approach to navigating complex and evolving requirements.

This demonstrates the effectiveness and efficiency features that this platform can have in supporting EUDR implementation.

Although recognized as a good practice, this initiative has acknowledged limitations, which are outlined on the platform itself. One key limitation is the relatively long processing time, ranging from 30 to 90 days between deforestation detection by the source system and alert publication on the platform. This delay occurs because most alerts are imported monthly from national detection systems, and part of the processing is done manually by trained analysts, rather than being fully automated (MapBiomas, 2024b).

Second, the national detection systems from which MapBiomas sources its information have minimum area thresholds for detecting deforestation alerts. This can lead to the omission of smaller deforestation areas, impacting the accuracy of the alerts MapBiomas assesses. Moreover, despite significant progress in monitoring biomes other than the Amazon, including Cerrado and Caatinga, current detection systems still underestimate the suppression of non-forest native vegetation (MapBiomas, 2024b).



5.5 The EU Observatory on deforestation and forest degradation (EUFO)

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture Forestry	Science-based		FRC scope: Soy, Cattle, Palm oil, Coffee, Cocoa, Rubber, Wood, Maize	Effectiveness Efficiency Transparency Limitations Innovation identified	Relevant, with identified limitations
Link to key reference EUFO website				Link to training video -		
Authors (Institution) Helena Leonel Ferreira (Etifor)				Last update April 2024		

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The recently launched EU Observatory on deforestation and forest degradation (EUFO) was developed by the Joint Research Center (JRC) in response to the need for harmonised information on land use change worldwide after the approval of the EUDR. This initiative highlights the EUDR's alignment with the EU Innovation Principle, demonstrating its impact on encouraging beneficial innovation that advances the EU's environmental, social, and economic objectives.

Its aim is to provide continuous monitoring of changes in the world's forest cover and related drivers. The land cover maps feature time series, starting from the EUDR's cut-off date, as well as a range of classes allowing landscape composition to be examined. Additionally, a warning system will assist competent authorities, operators, traders and other relevant stakeholders through early notification of possible deforestation or forest degradation activities. Building on already existing monitoring tools, including Copernicus products and other publicly or privately available sources, the EUFO will be taken up by the Forest Information System for Europe (FISE), which will become the cornerstone for harmonised forest data in Europe. This platform represents an advance for EUDR implementation both in terms of compliance and technology, holding a demand-side focus, as it is intended to facilitate access to information on supply chains for public entities, consumers and business, and linking deforestation and forest degradation to EU demand for commodities and products (Joint Research Centre, 2024).

Although the information provided by this platform does not assure compliance or imply non-compliance with EUDR (or any other legal frameworks and commitments), it will play a supporting role for companies' due diligence obligations, e.g. in its assessment of deforestation risk, supporting its effectiveness. Additionally, it is expected to support competent authorities' sample selection of due diligence declarations to be checked with more detailed and robust data. Moreover, while relying solely on several national monitoring sources for checks would be considerably challenging and time-consuming, this platform supports competent authorities by providing standardised and official information to refer to. Consequently, the EUFO serves as an integrated forest monitoring system within the EU, making it an effective and efficient tool. Its efficiency, along with transparency traits, are supported by the fact that it is a free and open-access platform, offering easy-to-use data. The transparency of this tool can also be grasped from the fact that its supporting data and methodology are well described and documented in the platform and JRC reports. Additionally, a list of identified issues is reported by the JRC in their reports and website and is continuously updated. Consisting of an official and centralised tool within the EU, the platform counts on political support for its development and implementation, which enhances its feasibility (Joint Research Centre, 2024). Its reflexivity feature is supported by the periodical updates and



refinements to which this tool will be submitted, as well as accuracy assessments, which are expected to alleviate some of its known issues.

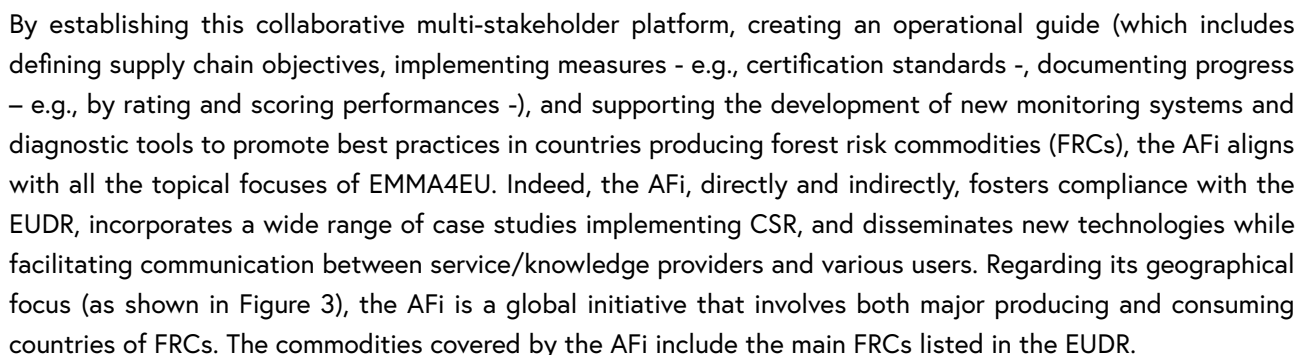
In summary, this tool is likely to assist competent authorities, operators, and traders in addressing challenges related to implementing the EUDR, being, therefore, assessed as a good practice. Nevertheless, while the standardised and global coverage of the platform presents the benefits previously mentioned, it also leads to limitations regarding its lack of specificity. The use of this tool is particularly challenging for high-slope areas, dry forest lands, complex landscapes with patches of degraded forest and agricultural plantations, among other cases. Comparisons with national and regional monitoring systems indicate notable discrepancies since these offer more specific data. It has been reported that perennial crops such as oil palm, rubber, cocoa, and coffee are frequently mistaken by forests in open forest data. Consequently, pruning or clearing of plantations may trigger false alerts for deforestation (Alkema et al., 2024). The JRC has reported that 61% of cocoa plantations in Ghana, 67% of coffee areas in Brazil, and 71% of rubber areas in Thailand were incorrectly labelled as forest in the Global Forest Cover map (GFC) 2020. On the other hand, industrial oil palm plantations, soy fields, and pastureland have shown much more satisfactory results (Joint Research Centre, 2024). Since the Observatory holds no authoritative status, the information provided by this tool requires verification and it is recommended to be complemented with other spatial datasets on forest cover at national or regional level. Additionally, this platform is expected to be of great value in better informing policy developments and contributing to research activities.

5.6 The Accountability Framework Initiative

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance CSR	Agriculture Forestry	Data-based Science-based Private regulation Other: Guidance by a multi-stakeholder platform	Demand-side (Global) Supply-side (Global)	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations
Link to key reference AFi website				Link to training video -		
Authors (Institution) Mauro Masiero, Aynur Mammadova, Giovanni Bausano, Todora Rogelja (UNIPD)				Last update September 2024		

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The Accountability Framework Initiative (AFi) is a coalition aimed at ensuring that agricultural and forestry supply chains prioritise the preservation of forests, natural ecosystems, and human rights. The AFi provides the Accountability Framework as a practical guide to assist businesses and other stakeholders involved in the production, trading, and financing of agricultural and forestry commodities, helping them establish ethical and sustainable supply chains. In addition, the AFi coalition, consisting of over 25 environmental and human rights NGOs worldwide, advocates for the adoption of the Framework to promote positive outcomes on a global scale. The AFi fosters the adoption of best practices among various stakeholders (e.g., civil society, governmental bodies, industry associations, and investors) to develop an integrated platform for implementing effective measures aimed at reducing deforestation and human rights violations embodied in commodity supply chains.



Efficiency: the AFi offers free operational guidance to all operators engaged in deforestation-free commodity supply chains. As such, it serves as a practical, efficient, and cost-effective platform to access information, network, and stay updated about the latest operational and technological advancements needed to meet EUDR requirements. The standardisation of monitoring and reporting procedures through the continuous interaction among individual suppliers or associations of suppliers and purchasers is a condition of efficiency. In this context, the framework contributes to harmonising the needs of different actors with specific roles in different markets (Varsei et al., 2014).

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T.A., et al., 2019) is strengthened through the active organisation of public seminars and workshops covering a wide range of topics relevant to the EUDR. Furthermore, AFI's structure not only provides companies with a well-defined roadmap for setting goals, implementing actions, and regularly reporting progress and outcomes to the public, but it also helps to develop and monitor the transparency of companies aimed at improving their environmental, social, and governance performance. This process allows operators to be recognized for their efforts toward sustainability by buyers, investors, civil society, and other stakeholders. In this context, companies are strongly encouraged to share and communicate their results achieved through the application of the Framework. To this end, the AFI provides companies with several communication channels (e.g., dedicated webinars or podcasts). To improve transparency in sharing data, the AFI has developed a self-assessment tool for companies aimed at communicating their alignment with the Framework on specific policies and practices. Moreover, the AFI has recently collaborated with the Global Reporting Initiative (GRI) to develop an updated Biodiversity standard. This tool provides companies with an additional option for disclosing their biodiversity impacts through more detailed, spatially explicit reporting.

Feasibility: the AFI represents the consensus of a broad coalition (Gardner, et al., 2019) of environmental and human rights NGOs, leading private companies, financial institutions, and international standards. Hence, the methodology is a collaborative effort involving prominent international organisations (e.g., WWF), which represent influential entities in the global political arena. For instance, the AFI's coalition actively took part in the 27th Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) in 2022. Its primary focus was to promote its efforts in supporting companies with accounting and disclosing greenhouse gas emissions connected to land-use change. In addition, the strong partnership between AFI and GRI (as well as other leading and widely accepted global standards for sustainable reporting) is particularly relevant to increasing the Framework's social and political acceptance and support. Indeed, the broad acceptance of the Framework across various sectors, from businesses to private and public institutions, represents a clear indicator of its feasibility.

Reflexivity: the AFI is the result of continuous knowledge exchange and ongoing multi-layered participation (Beske-Janssen et al., 2015; Gardner et al., 2019). As a result, it has a significant capacity for learning from diverse experiences and adapting to future events (e.g., legislations, and trade agreements).

Limitations: the main potential limitation lies in its extensive application and vast quantity of resources (Alexander, 2023), which could paradoxically restrict access for smallholders (Cesar de Oliveira et al., 2024) and medium-sized businesses with limited capacity, in terms of human and economic resources, to handle vast technical documentation. Moreover, the Framework relies on self-application and self-monitoring of guidelines, with no external audit, certification, or verification activities. As a consequence, the AFI serves exclusively as a global benchmark for companies aimed at aligning with legally binding policy measures and certification standards through the implementation of actions for achieving general and specific objectives. Overall, this aspect may limit its role as a supervisory authority for forest-risk supply chains.

Innovation: the AFI's most significant innovation lies in the creation of the first fully transparent and comprehensive global platform designed to support responsible commodities supply chains. Transparency and feasibility are the key elements that make the AFI as a critical example for EUDR compliance. Developed through a collaborative, consensus-based process involving diverse stakeholders, this Framework has established one of the first clear, unified guidelines for setting goals, implementing actions, and monitoring sustainable and ethical supply chains. By moving beyond individual efforts and opinions, the Framework facilitates alignment and accountability across various actors and contexts, enabling scalable and effective actions to protect forests and local communities. In doing so, this global coalition can rapidly promote and share innovative solutions for addressing new and complex challenges associated with the most critical EUDR potential issues, such as socioeconomic and environmental leakages.



In addition, the AFi has developed a free e-learning course, offering professionals a structured program to understand and implement the steps necessary for aligning with the Framework and subsequently with the EUDR.

In summary, the AFi is a global coalition dedicated to prioritising forest preservation, ecosystems, and human rights within agricultural and forestry supply chains. Through the Accountability Framework, businesses and stakeholders can establish ethical and sustainable supply chains. With over 25 global environmental and human rights NGOs, the AFi represents a broad platform where key information about the implementation of the EUDR's requirements can be found and disseminated locally. By fostering multi-stakeholder collaboration, developing operational guides, and creating monitoring tools, the AFi aligns with EUDR compliance and promotes CSR implementation. It is particularly useful in assisting companies with poorly developed no-deforestation internal policies, management systems, and supplier engagement. Due to these attributes, it is among the most developed good practices in place to address future EUDR implementation.

5.7 Satelligence

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture Forestry	Data-based	Supply chain orientation: Demand-side (Global) Supply-side (Global)	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations
Link to key reference Satelligence website				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Mauro Masiero, Aynur Mammadova, Giovanni Bausano, Todora Rogelja (UNIPD)				Last update April 2024		

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By using radar and optical satellite resources alongside remote sensing and modelling techniques, Satelligence provides businesses, NGOs, and governmental bodies with geo-referenced qualitative and quantitative information to achieve zero deforestation commitments. Satelligence directly monitors crop-producing areas and associated agricultural-driven land-use changes, as well as the extent and conditions of natural ecosystems, while also indirectly assessing supply chain risks. It offers a traceability platform designed to assist companies verify compliance with legislation and certification schemes. In addition, it helps companies involved in FRCs supply chains in analysing and visualising data and related insights. It aims to bridge the gap between operators and their supply chains through real-time and reliable data (Heldt & Beske-Janssen, 2023). By offering a data-intensive platform for traceability and analytics and providing businesses access to on-the-ground insights associated with the production of primary products at a fine spatial resolution (Heldt & Beske-Janssen, 2023), Satelligence falls under the technological EMMA4EU topical foci. Overall, it integrates fieldwork, satellite data, AI, and machine learning software to monitor around 6 billion hectares of global terrestrial areas involved in FRC's primary production. Specifically, its 'Global Database of Geolocated Assets and Supplier-Buyer Relations' covers 66 million hectares (M/ha) of soy, 25 M/ha of oil palm, 6 M/ha of coffee plantations, 13 M/ha of rubber, 9 M/ha of coconut, 31.000 timber concessions and pulp plantations.



Effectiveness: Satelligence offers to businesses and operators directly involved with the EUDR a 'fast-track compliance' service consisting of five main steps: 1. analysis of gaps and opportunities regarding operators dealing with the EUDR compliance system, 2. geo-referenced data collection of primary production plots, 3. risk assessment (deforestation and legality), 4. support on compiling the due diligence statements, and 5. risk mitigation, and assistance with grievance procedures.

Efficiency: considering the complexity (and claimed readiness-to-use) of Satelligence's services, as well as the advanced technological system required to achieve fast-track compliance with the EUDR, one might expect the service's costs to be high (especially for small and medium-sized operators). Overall, Satelligence is very efficient in addressing specific monitoring tasks at the subnational level by offering a real-time deforestation risk analysis through updated geo-datasets and a more detailed land-use change assessment with finer spatial resolution compared to publicly available products. The flexibility to meet customised requests (i.e., addressing specific monitoring tasks at plot level) (Alexander, 2023) represents a further value-added provided by Satelligence in the domain of deforestation and forest degradation observation.

Transparency: Satelligence data are not freely and publicly available. However, they are sponsored as easily accessible and potentially integrable into external software systems and workflows. In addition, the involvement of different stakeholders (e.g., smallholders, suppliers, NGOs, and private companies) appears to be a clear asset (Gardner et al., 2019) of the Satelligence network. Moreover, Satelligence data quality is Ernst & Young ISAE 3000 certified.

Feasibility: Satelligence has many partners ranging from the scientific, consultancy, third, and public sectors. Thus, it has already shown a wide range of social and institutional acceptance. Moreover, by placing a strong focus on the EUDR, Satelligence has tailored its workflow to meet the Regulation requirements. Indeed, it offers a comprehensive package designed for EUDR compliance. Consequently, it appears to be very likely that shortly after the official launch of the EUDR online due diligence platform, Satelligence will cover a broad list of stakeholders, providing potential case studies involving agricultural and forestry mapping in tropical-producing countries, operators' risk analysis, and risk mitigation activities. The ongoing and upcoming activities carried out by Satelligence could represent key materials for the overall evaluation of the EUDR technical implementation process. Examples of prominent Satelligence's clients are Fairtrade International which relies on it to meet EUDR requirements for its globally certified cocoa and coffee producer organisations, and Cargill, employing its services to monitor its soy, oil palm, and cocoa supply chains.

Reflexivity: Satelligence operates on a continuous workflow aimed at maintaining and updating a broad set of supply chain data (both field and satellite data). Therefore, it is characterised by strong adaptability and an overall capacity to learn from experience.

Limitations: The primary limitation of this service/knowledge provider may involve cost barriers (Chen, 2022) for small-medium-sized operators. As debated by policy experts (Leenoi, 2024) and researchers (e.g., Cesar de Oliveira et al., 2024; Zhunusova et al., 2022), a critical aspect linked to the EUDR compliance system is its indirect discrimination between different stakeholders affected by the Regulation. For instance, large versus micro/medium-sized commercial operators or agribusiness giants versus smallholders. The latter groups will most likely be facing higher costs (Alexander, 2023) and knowledge barriers to meet the EUDR standards. In this context, Satelligence falls within those categories of technology and service providers accessible only, or at least more easily and directly, by big operators and commercial organisations. Furthermore, a possible constraint could involve the future public dissemination and accessibility of information and materials linked to Satelligence's service of fast-track compliance with the EUDR.

Innovation: Satelligence is grounded in technology upgrades and innovation, aimed at reducing the knowledge gap among operators and traders concerning their land use impacts. Satelligence represents an example of



the importance of balancing the predictability of complex regulations, such as the EUDR, with the need to adapt to scientific and technological advancements. A key innovation of Satelligence is its ability to perform customized real-time deforestation risk analysis at unprecedented fine resolution. This efficiency and flexibility are fundamental elements for reaching timely EUDR compliance.

Satelligence can represent a good practice in the domain of service/knowledge providers offering tools and technologies to support the EUDR implementation for several reasons (Heldt & Beske-Janssen, 2023). Firstly, it has extensive experience in supply chain assessment across scales, by feeding a well-established partner network. The latter could facilitate its applicability and promote cross-sectoral cooperation on specific technical aspects related to the EUDR implementation. Moreover, Satelligence has recently emerged as leading platform empowering businesses with real-time monitoring data on land-use change, as well as with services tailored specifically for operators involved in the EUDR due diligence procedures (i.e., data collection, risk analysis, and risk mitigation). Nevertheless, Satelligence presents two potential limitations: 1) cost barriers for small to medium-sized operators (Alexander, 2023), and 2) concerns about the future public access and dissemination of technical and qualitative information related to Satelligence's services.

5.8 Verità

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Private regulation		Agricultural FRC (beyond EUDR), Cattle, Palm oil, Coffee, Cocoa, Rubber, See: https://verite.org/commodity-atlas/	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	EUDR not in focus / has a wider/different scope
Link to key reference Verità website				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Mauro Masiero, Aynur Mammadova, Giovanni Bausano, Todora Rogelja (UNIPD)				Last update April 2024		

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Verità is a civil society organisation that, through various services, provides knowledge and new competencies regarding labour and human rights violations associated with global supply chains. Verità collaborates with different sectors and industries by developing tools, and programs, and conducting research activities to assess labour conditions in different production systems and value chains. The research activities aim to gather information about labour issues and advocate for solutions. The Verità platform encompasses different expertise and resources to facilitate business operations (e.g. transparency and due diligence) as well as to train operators on specific human rights issues. Moreover, Verità acts as a consultancy agency for companies involved in human rights legislation compliance activities and serves as an audit body to detect potential abuses in global supply chains.

Overall, these activities cover a broad range of abuses (e.g., forced and child labour, human trafficking) and workplace discrimination based on race, ethnicity, age, gender, sexual orientation, religion, ability, or other categories explicitly protected by national or local legislation. Hence, by performing different activities ranging



from research to training, as well as the application and delivery of tools and programs, Verité, with a global impact (grounded on a network of experts located in Africa, Asia, Europe, South America, North America, and Australia), falls both under compliance and technology-focused topics. In terms of sector and product coverage, Verité, among others, includes agriculture and forestry, with specific case studies on palm oil, cocoa, and the broader connection between deforestation, forest degradation, and poor labour conditions.

Effectiveness: although not directly linked with the EUDR implementation, Verité might represent an inspiring platform to add within the EUDR-related compliance procedures (due diligence process) and discourses a robust framework on human, indigenous, local communities, and smallholders' rights.

Efficiency: numerous resources and toolkits are freely available and ready to use. Therefore, Verité can serve as an already well-established source of information and guidelines to efficiently support human rights due diligence procedures within a company's EUDR compliance workflow. Among the various tools, the Cumulus Forced Labor Screen Platform, defined as a 'remote, technology-driven approach to labour supply mapping and predictive forced labour screening in supply chains' (Catá Backer & McQuilla, 2023) has the key advantage of flexibility, which depends on the use of peculiar data on labour conditions and agreements which can be modelled against specific policy targets. In other words, operators can feed the platform with their data to screen labour and human rights risks embodied in their suppliers' recruitment policies and employees' working conditions. This process ends in a sort of supply chain benchmarking against a rating system associated with labour conditions.

Transparency: between research and consultancy, Verité represents a hybrid case study in terms of public accessibility. On the one hand, it is dedicated to delivering resources freely and expanding public knowledge through research on labour issues in supply chains, on the other hand, it offers services as a consultancy agency to large companies.

Feasibility: Verité collaborates with a wide range of private and public entities (e.g., multinational brands, suppliers, international institutions, investors, civil society organisations, and trade unions.), including local and national public authorities. This demonstrates broad sociopolitical acceptance.

Reflexivity: Given the verité methodology is based on research activities involving policy benchmarking, supply chains analysis, qualitative assessments (e.g., on-site interviews), and consultancy and training activities conducted at different levels (workers, businesses, and decision-makers), Verité's adaptability and reflexivity capacity should be very high.

Limitations: the primary limitation might concern the scope of this best practice, since is not directly linked to deforestation and forest degradation – i.e., showing a poor interconnection among different compliance perspectives (Beske-Janssen et al., 2015) -, but rather focuses specifically on a collateral objective (i.e., '[...] to effectively combat deforestation and forest degradation, and to promote deforestation-free supply chains, while taking into account the protection of human rights and the rights of indigenous peoples and local communities') of the EUDR. Indeed, operators might consider it as too complex or time-resource consuming (Alexander, 2023) when compared to the concrete compliance results that can be achieved. In addition, data and rating systems for forced labor mainly rely on voluntary recording systems shared by companies through a self-regulatory approach (Catá Backer & McQuilla, 2023; Varsei et al., 2014). Hence, the practical implementation of this information could be very limited in some cases.

Innovation: since 1995, Verité has been dedicated to eliminating labor rights violations in global supply chains. Over nearly three decades, public institutions, businesses, workers and professionals have increasingly benefited from a growing number of publicly shared resources and tools aimed at empowering people and improving working conditions and quality of life.

Through its wide range of services (analysis, consultancy, research, and training), Verité has collected information,



identified solutions, and overcome barriers in over seventy countries, covering most of the forest risk commodities targeted by the EUDR.

For these reasons, Verité's capacity building programs, online resources, and global network of experts represent a significant added value for the EUDR compliance system when addressing the rights and working conditions of local communities and indigenous people.

In turn, the future application of the EUDR, by attracting more users, fostering further developments, and generating new case studies, has the potential to drive additional innovation based on verité's expertise and research on emerging and complex challenges.

Human rights and labour conditions are explicitly included in the Regulation, but they could risk being treated as ancillary aspects compared to environmental issues, while they should instead be addressed as complementary pivotal issues. Therefore, Verité can help fill this gap by providing useful resources and an already well-established network of actors involved in various activities addressing the social and labour dimensions embodied in commodities supply chains. Nevertheless, the general complexity of tools and platforms required to address these issues, together with the challenge of gathering effective and valid information across different sectors and products, may present significant limitations.

Overall, Verité's exceptional efficiency in promoting and supporting human rights due diligence procedures is the key element that makes it a valuable instrument for future EUDR compliance.

5.9 Produce, Conserve and Include (PCI) State Strategy

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Public policy / regulation Other: Multi-stakeholder jurisdictional approach	Supply-side (Specific countries)	All FRC (beyond EUDR), Soy, Cattle, Wood, Corn, cotton, biofuels	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations
Link to key reference PCI website				Link to training video -		
Authors (Institution) Mauro Masiero, Aynur Mammadova, Giovanni Bausano, Todora Rogelja (UNIPD)				Last update April 2024		

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Approach: jurisdictional approaches to address deforestation and forest degradation can be understood as a compliance mechanism that involves the participation of and governance by diverse stakeholders within a given territory. In this sense, the jurisdictional approach is a subset of landscape approaches. *'Landscape approach (LA) is a place-based management approach that involves the collaboration of stakeholders in a landscape to advance shared sustainability goals and build resilience. It aims to reconcile and optimise multiple social, economic, and environmental objectives across multiple economic sectors and land uses'* (Ewerton & Prescott, 2022). The processes of LA include integrated landscape management, land-use plans, policies, investments, and other interventions that are agreed upon through stakeholder participation and contribution. *'Jurisdictional approaches (JA) are a type of landscape approach to advance shared sustainability goals where the landscape is*



defined by administrative boundaries of subnational or national governments and the approach is implemented with a high level of government involvement' (Ewerton & Prescott, 2022). The main mechanism of JA is using government structures to institutionalise the desired changes in laws, incentives, rules, etc. which is claimed to bring in better results (Chervier et al., 2020).

Introduction to PCI strategy: The Produce, Conserve, and Include Strategy (PCI Strategy) was launched in 2015 during COP 21 in Paris, as a jurisdictional initiative for the sustainable development of the state of Mato Grosso, the fifth-largest beef exporting state in Brazil. The PCI Strategy aims to prove the concept that enhanced productivity and deforestation reduction are compatible. The strategic vision of PCI Strategy includes: a) The future growth of commodity production to be accommodated within the existing productive area (through intensification); b) Forest areas to be restored according to legal requirements while protecting the remaining forests; c) Family farming, indigenous peoples and traditional communities to be able to participate in the development process, improving their living standards. It aims to avoid approximately 6 gigatons of GHG by 2030 and create a scalable model that can be replicated across Brazil and beyond. The PCI Strategy has detailed targets to achieve by 2030 in each one of the sub-sectors, Produce, Conserve, and Include. Figure 1 presents the details of these targets. As this initiative takes a landscape approach, it focuses on the sustainability of the production of all commodities that the state specializes in, including cattle, soybeans, corn, cotton, and biofuels. In 2019, the PCI Institute was established by the state of Mato Grosso (Produce, Conserve, Include, 2024b).

PRODUCE	CONSERVE	INCLUDE
Expansion and increase in the efficiency of agricultural and forestry production Cattle Breeding - Recover 2.5M ha of low productivity pasture areas by 2030. - Increase productivity from 50 to 116 kg/ha/year by 2030. Agriculture (soybeans, corn and cotton) - Expand the area of grains in degraded pasture areas from 14.69 to 12.5 million hectares by 2030. - Increase grain production from 50 to 125 M ton by 2030. Native forest - Expand the area under sustainable forest management from 2.8 to 6M ha by 2030. Planted Forest - Expand the area of planted forests in areas already open from 317 thousand to 800 thousand ha by 2030. - Increase the production of planted wood from 4.9 M m³ to 11.75 M m³ by 2030. Biofuels - Increase biofuel production to 13 million m³ by 2030.	Conservation of native vegetation and restoration of liabilities Logging - Maintain 60% of the state of Mato Grosso native vegetation cover. - Reduce deforestation by 90% forest by 2030 and 84% by 2024 having as reference the baseline: 2001-2010 (PRODES) of 5,714 km², reaching 571 km² / year until 2030. - Reduce deforestation in the Cerrado by 95% by 2030 and 83% by 2024 having as reference the baseline of 3,016 km² (SEMA), reaching 150 km²/year. - Reduce 30% of hot spots compared to the 2010–2019 reference period (28,300 hot spots) by 2030. - Eliminate illegal logging by 2030. - Eliminate illegal deforestation by 2030. - Compensate 1 Mha of liable to legal deforestation Environmental Regularization (Forest Code) - Register 90% of rural properties (CAR) by 2024. - Validate 90% of CAR by 2024. - Regularize 1M ha (100%) of degraded APP by 2030. - Regularize 5.8 Mha (100%) of Legal reserve, 1.9M ha of which by means restoration until 2030.	Socioeconomic inclusion of family farming and traditional population Production and Market Inclusion 100% adhesion of municipalities in the SEIAF system by 2030. - Increase the Gross Production Value (VBP) of family farming from 12 billion to R\$ 20 billion by 2030. - Expand participation of family farming products in institutional markets (Programa Nacional de Alimentação Escolar - PNEAE) to 30% by 2030. - Increase access to Pronaf credit from R\$ 882 million to R\$ 1.3 billion/year until 2030. Land regularization - Accomplish land regularization of 70% of family farming plots by 2030.

Figure 2: Detailed targets of the PCI strategy. Source: (Produce, Conserve, Include, 2024b)



Efficiency, effectiveness and transparency represent the main features of the PCI Strategy for its use within the EUDR framework. Feasibility and reflexivity are also relevant, though to a lesser extent.

Effectiveness: the jurisdictional approach can effectively address the challenge of deforestation and forest degradation, as it allows dealing with complex and interlinked deforestation drivers. Oftentimes, the local conditions of production and the complexities of deforestation frontiers do not allow for creating 'islands' of sustainable and deforestation-free individual supply chains, as there is always a risk of laundering and leakage. Jurisdictional approach can achieve better results compared to individual supply chain initiatives or chain of custody commodity certifications in these specific territories (Nepstad et al., 2013).

A one-to-one match of EUDR requirements and the targets of the PCI Strategy can be a challenge. For example, EUDR adopts December 31, 2020 as a cut-off date, i.e. and products and commodities linked to deforestation or forest degradation after that date are not permitted in EU markets. However, the national legislation of Brazil still allows a certain percentage of the farmlands of Mato Grosso (up to 20%) to be deforested for productive activities. This is called legal deforestation in Brazil and is regulated through the Forest Code of the country. Thus, the products exported from Mato Grosso that are perfectly aligned with PCI Strategy and the national legislation would not automatically be EUDR-compliant.

Efficiency: there have been multiple efforts to create private sustainability standards and certification mechanisms to claim production made in Brazilian territories as sustainable and deforestation-free (Alves-Pinto et al., 2013). However, these initiatives have faced challenges in achieving scale due to the high costs of auditing individual farms and the low level of participation among main commodity buyers. A landscape approach is considered a low-cost alternative 'territorial certification'. This is possible through monitoring of municipal indicators that identify low socio-environmental risk jurisdictions for commodities procurement from international markets (Earth Innovation Institute, 2017). Besides, in the case of PCI, most of the funding for the design and implementation was received from international donors and investors such as KfW and IDH and is also being promoted as jurisdictional REDD+ allowing extra funds to flow. Thus, the burden and costs of sustainability are not felt at the individual supply chain, buyer, or producer level which is also a very relevant point for the EUDR implementation (Earth Innovation Institute, 2017).

Transparency: the design of the PCI Strategy was based on building and formalising good governance based on a strong coalition among diverse stakeholders and developing a shared vision. Indigenous Peoples started participating through the recently formed Federation of Indigenous Peoples and Organizations of Mato Grosso (FEPOIMT), which led the state-wide indigenous consultation process on the state REDD+ system in 2018 (Produce, Conserve, Include, 2019). PCI implementation and progress against the targets are being monitored by The PCI Monitoring Committee which was established in 2017 and consists of representatives of diverse stakeholder organisations. The monitoring Platform offers a complete control panel to the public to track the progress of PCI objectives. Periodic reports on target monitoring are made publicly available (Produce, Conserve, Include, 2024a).

Feasibility: the PCI Strategy builds upon multi-stakeholder processes in the design, implementation, and monitoring phases, which has allowed extensive application and large uptake by the public and by the involved stakeholders. The local government of Mato Grosso state is an important player and contributor to the Strategy. The establishment of the PCI Institute, the long-term vision, and secured funding strengthened the role of government policies but at the same time made the initiative not dependent on political cycles and elections. The PCI Strategy is often brought up as a successful example within the national context (Produce, Conserve, Include, 2019).

Reflexivity: the PCI Strategy started in 2015 and it has targets to reach by 2030. This 15-year time frame allows continuous reflection and adjustment of the targets and learning continuously from the mistakes. Continuous



reporting to the public and investors provides a good stimulus for reflection and monitoring of the results. The lessons learned from the Green Municipalities program in Para State were carefully considered in the design stage of the PCI strategy (Milhorance & Bursztyn, 2018).

Limitations: limitations of the PCI Strategy are mentioned in the studies evaluating its design and progress. First, it is mainly considered as an initiative where neo-liberal discourse and market interests prevail. Despite its initial intent and the active participation of the environmental NGOs in the design phase, private interests of market actors and agribusiness gained priority, also by threatening to leave the initiative as a bloc (Milhorance & Bursztyn, 2018). The focus on markets becomes evident when considering PCI goals and targets carefully. The targets in the Produce sector focus on increasing the production output by the state even further, despite Mato Grosso being already an important producer at the national and international level. Besides, despite the push by the NGOs, the targets did not also include the reduction or elimination of the use of fertilisers and pesticides. Thus, the debates around the establishment of the PCI did not necessarily circle strong sustainability but the one that is acceptable by the diversity of the actors. In this sense, PCI does not necessarily represent a paradigm shift in production models and land use in the territory (Milhorance & Bursztyn, 2018). Second, despite the initial intent the design processes of the PCI fell short in directly involving indigenous groups in the elaboration and associated planning process (Cheyns et al., 2017; Macdonald et al., 2023). Their interests and rights were ensured thanks to the involvement of and guarantees required by international investors such as KfW (Milhorance & Bursztyn, 2018). The representation by traditional communities was also ensured at later stages. Third, its progress is measured against targets such as the reduction of deforestation within a state. In a study conducted by (Umunay et al., 2018), the progress in reducing deforestation within Mato Grosso is compared to that of the state of Pará which faces similar challenges. It is mentioned that compared to 2015 in 2017 the state managed to reduce its deforestation by 2.5%, while deforestation in Para jumped up 13%. This raises an important question of leakage which is a very common concern also for jurisdictional approaches. That is to say, the gain in the reduction of deforestation in Mato Grosso could be compensated somewhere else, for example in Pará.

The PCI Strategy offers an effective and efficient tool to make sure that there is a local buy-in by the diversity of the stakeholders and that all of them are represented in the decision-making mechanisms. The establishment of the PCI Institute can also be considered as an institutional innovation. It has a Monitoring committee and regularly reports its progress. The integrated landscape approach permits a birds-eye view of the successes and challenges within a territory and allows everyone to take ownership of improving the conditions. The PCI approach also offers a cost-effective solution compared to individual supply chain initiatives. However, it is not without challenges and limitations. The market discourse prevails in the target setting and implementation of the Strategy, compared to the environmental one. The direct involvement of the indigenous groups was a challenge in the beginning despite the official statements. The issue of leakage of deforestation to other states of Brazil or even outside of Brazil is unresolved. One-to-one match with the requirements of the EUDR can also be challenging. Thus, given all these benefits and shortcomings, PCI can still be considered a positive step towards deforestation-free production and economy in the country, but its shortcomings need to be acknowledged, discussed, and resolved.



5.10 Blockchain

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology CSR	Agriculture Forestry		Supply-side (Specific countries) Supply-side (Global)	All FRC (beyond EUDR), Wood	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations Innovation identified	Relevant, with identified limitations
 Link to key reference -				 Link to training video -		
 Authors (Institution) Mauro Masiero, Aynur Mammadova, Giovanni Bausano, Todora Rogelja (UNIPD)				 Last update April 2024		

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Blockchain technology is an advanced database mechanism - normally referred to as a decentralised and distributed ledger technology - allowing information sharing within a network. Each information (i.e., a transaction and associated data) is stored in a single digital block that is linked to the previous block and links to the next one(s), creating a chain of transactions. This chain is immutable and tamper-proof, ensuring the integrity of the data as well as secure (encrypted), accessible, and reliable records. When a transaction is initiated, a block is attached to the chain and then propagated to the rest of the network: other nodes verify its validity (Figure 3a). A hash function is used to determine a value that connects the block chronologically with another block and cryptographically encrypts it. Once a block is added to the chain, it becomes extremely difficult to alter or tamper with the data because each block contains a unique cryptographic hash, which is generated based on the data in the block. If any data in the block is changed, the hash will also change, alerting the network to the tampering attempt (Trackgood, 2024). Blockchain solutions are broadly categorised on two properties: data access and consensus participation. Data access can either be public, where anyone can transact and view transaction history, or private, where access is restricted to a select number of participants who may transact and view transaction history. Consensus participation is either permissioned, where only a predefined group of nodes participate in validating and appending blocks, or permissionless, where anyone can participate in the consensus process (Spencer-Hicken et al., 2023).

Originally developed for the cryptocurrency sector, it has expanded and shown potential also for different sectors, industries, and applications, including supply chain traceability (or chain of custody). Examples include many cases of applications to the agriculture sector and related products (Kamilaris, 2019; Xiong, 2020), as well as in forestry (He & Turner, 2022; Stepfer et al., 2024), including possible applications to forest certification schemes (FSC, 2024a). Blockchain solutions combined with artificial intelligence have also been developed to secure full tracking of socially and environmentally critical commodities, like diamonds, across an entire value chain (Tracr, 2024).

Blockchain solutions have been used both to provide information to consumers (e.g., on food safety and quality) as well as to regulatory agencies in charge of performing monitoring activities and controls (e.g., about the origin of a certain product or commodity) (Figure 3b).

Blockchain represents a technological tool that can be adopted to comply with EUDR requirements and to ensure information recording, sharing, and verification about transactions of commodities and products falling within



the EUDR scope. In such a perspective it can also represent a useful tool for checking and monitoring activities by Competent Authorities and delegated bodies. In doing so, blockchain technology can mainly support the demand side, ensuring access to data and information required by the Regulation and thus being assisted towards compliance. In principle, it applies to all commodities and products within the scope of the EUDR.

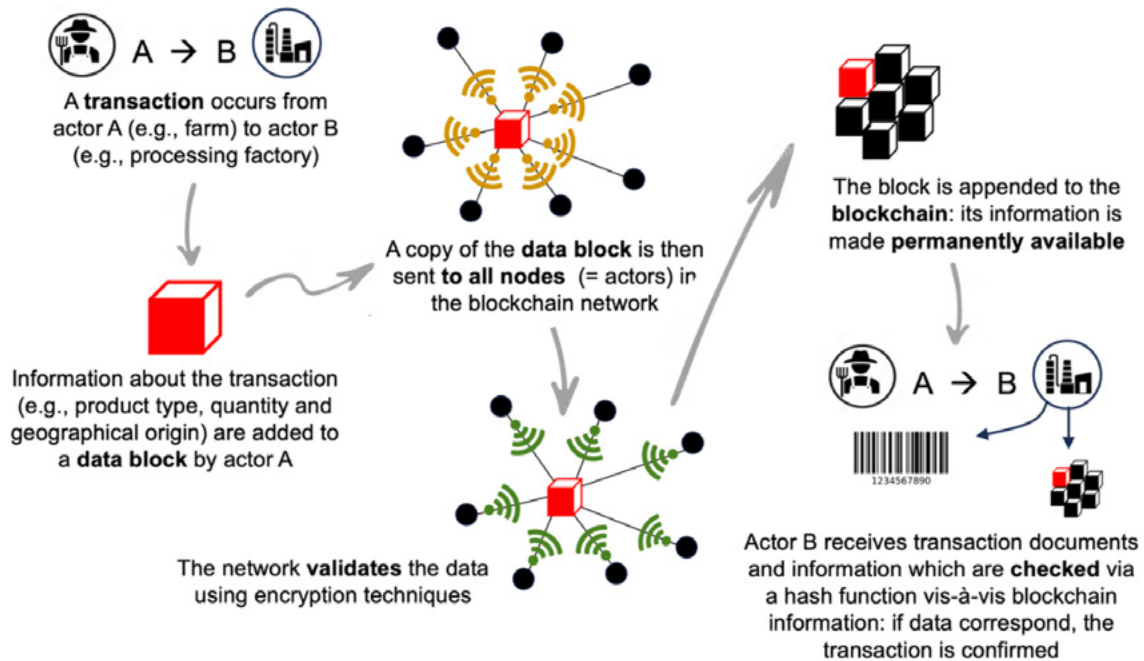


Figure 3. a): General functioning of a blockchain system (adapted from Kamilaris, 2019).

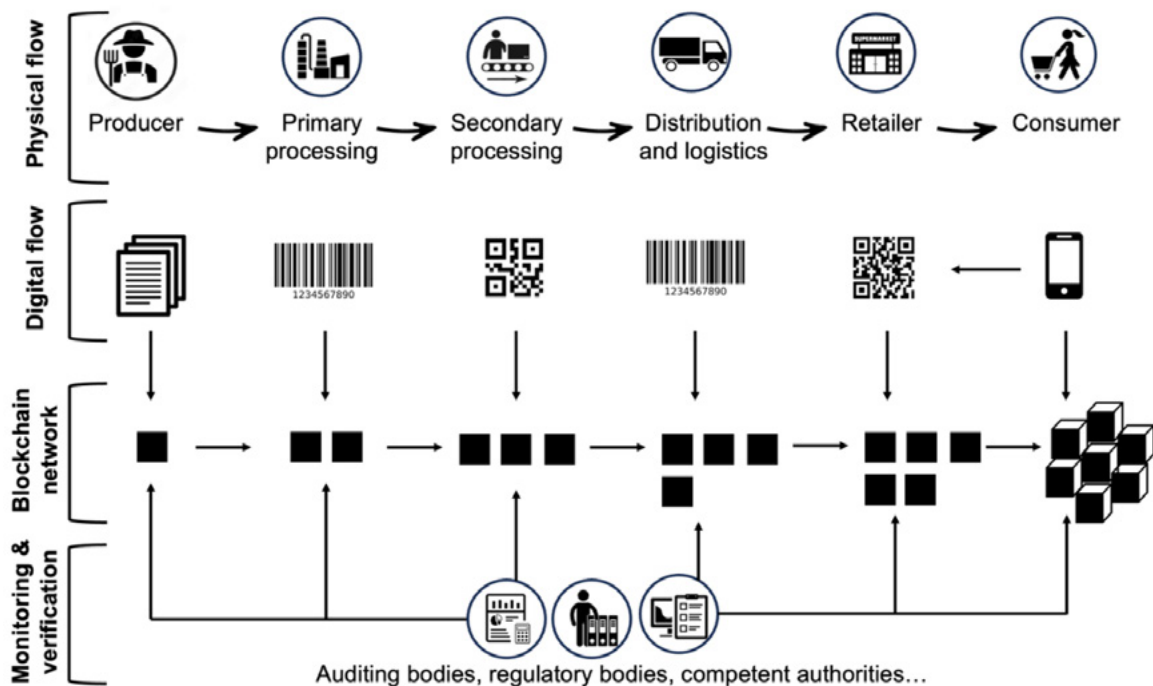


Figure 3. b): An example applied to a simple supply chain (adapted from Kamilaris, 2019).



Effectiveness, efficiency and transparency represent the three main features of blockchain technology for its use within EUDR compliance. Feasibility and reflexivity are also relevant, though to a lesser extent.

Effectiveness: blockchain has emerged as a potential technology that can significantly improve traceability across complex supply networks due to its core capabilities of providing an immutable, traceable, and secure medium for information sharing among dispersed parties (Saber et al., 2019). It can store and make available data along the entire supply chain and support transactions through consensus-based validation mechanisms. In doing so it may provide support in particular in accessing information for the aims of due diligence procedures and, by making this information secure, in supporting risk assessment lowering the risk level. At the same time, blockchain may integrate existing tools, e.g. chain of custody standards, facilitating compliance with EUDR requirements efficiently. Finally, it can support monitoring and checking by Competent Authorities.

Efficiency: blockchain technology can significantly reduce transaction costs as well as contribute to improving efficiency by reducing indirect costs associated with e.g. paperwork and errors. If embodied within existing tools, e.g. chain of custody standards, it may facilitate compliance with EUDR requirements efficiently. Web and mobile apps can enable using blockchain technology for real-time tracking along the supply chain, further reducing costs.

Transparency: blockchain enables 'transparency among untrusted stakeholders' (Scully & Hobig, 2019). Depending on the settings, data access can either be public, i.e. open to anyone, or private, where access is limited to selected participants and the blockchain is typically controlled by one party (e.g., the blockchain service provider). Similarly, consensus participation is either permissioned, i.e. only a predefined group of nodes (or miners) participate in validating and appending blocks, or permissionless, where anyone can participate in the consensus process (Spencer-Hicken et al., 2023). The consortium blockchain is a hybrid form between the public and private ones, where the control, responsibility, and maintenance of the network of a consortium blockchain is distributed among several trusted entities (Stepfer et al., 2024).

Feasibility: blockchain technology is increasingly used, nevertheless, there are still groups and individuals who do not support it because of the possible drawbacks it possesses like energy consumption, computation derived, sensitive data accessibility, potential proneness to misuses for nefarious purposes, possible reduction in job positions (e.g. accountants, people operating in monitoring), etc. The European Union encourages the development and implementation of blockchain technologies and solutions through a dedicated strategy aiming to make the EU leading and innovating in this sector (EU, 2024). A European Blockchain Services Infrastructure (EBSI) was born in 2018 when 29 countries (i.e., all EU member states, plus Norway and Liechtenstein) and the EU Commission joined forces to create the European Blockchain Partnership (EBP) to leverage blockchain to create cross-border services for public administrations, businesses, citizens and their ecosystems to verify information and make services trustworthy.

Reflexivity: blockchain technology builds on principles of data accessibility, transparency and consensus sharing as it relies on (potential) mutual checking by nodes involved within the chain.

Limitations: Implementing blockchain on a large scale requires significant investments in infrastructure and collaboration among stakeholders. The latter implies all actors involved within a certain network (e.g. a supply chain) engage in using this technology: if one participant does not do so, the system will not provide users with the proposed functionality. Moreover, the system requires a verification system to be adopted to check whether the raw data is correct otherwise this might affect data quality along the chain (garbage in-garbage out effect). Although the technology behind blockchain is considered robust, privacy concerns arise due to the transparent nature of blockchain (Trackgood, 2024). From a technical perspective, tamper resistance and immutability of data once they are validated in the blockchain ensures reliability, however limits the ability to correct data errors (Bischoff & Seuring, 2021). Moreover, the use of blockchain technology relies on access to



a web connection which cannot be given for granted in remote areas. The use of the blockchain relies on high computer computational performances and, therefore, is also very energy intensive. Finally, since this technology is relatively young, there is still a lack of standardised procedures and regulations behind its adoption. Blockchain technology can contribute both to EUDR compliance and CSR policies and strategies. For example, it can be adopted to integrate and reinforce existing CSR tools (e.g. third-party certification) making them more robust while, at the same time, moving them forward toward compliance with regulatory requirements. On the one hand, this may reinforce the adoption of CSR practices going beyond EUDR aims, thus potentially having broader positive impacts, and on the other, it may turn into an efficient solution for those actors that are already implying CSR tools and are also requested to comply with EUDR requirements.

Blockchain offers interesting opportunities for implementation in support of EUDR enforcement and compliance. Despite being a relatively new technology, it has gained relevance and is increasingly being explored as a solution for supply chain management and traceability in different sectors and for various commodities and products. It can contribute ensuring balance between regulation and scientific/technological progress as, notwithstanding high initial investment efforts and some caveats, it can provide valuable support to operators, assisting them in dealing with information gathering and verification securely and efficiently. Certification standards are increasingly engaging in adopting blockchain as a tool for making transaction monitoring secure thus reinforcing chain of custody controls.

5.11 Forensic timber tracing

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture Forestry	Science-based	Supply-side (Global)	Wood	Efficiency Feasibility Limitations Innovation identified	Relevant, with identified limitations
Link to key reference Timtrace: Project to test forensic timber tracing methods				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Pieter Zuidema (Wageningen University)				Last update February 2024		

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A substantial share of tropical deforestation is associated with timber exploitation. The EUDR aims to reduce this exploitation-associated deforestation, by requiring traders to verify the geographic origin of timber and provide documentation to support this. Yet, this compliance system is sensitive to fraud. Competent authorities responsible to verify compliance with EUDR therefore need to be able to perform independent checks on the traded timber (van Solinge et al., 2016). Timber tracing – the independent verification of origin based on chemical or genetic characteristics of traded wood – is a potentially important tool to verify timber origin. Development and diversification of timber tracing methods has been rapid during the past two decades (Low et al., 2022). These methods are used to verify the taxonomic identity or geographic origin of the traded timber. The latter is relevant to verify compliance with the EUDR.

The WUR-based Timtrace project aims to develop and test timber tracing methods. We do so using both chemical (stable isotopes, multi-element analyses (Boeschoten et al., 2022, 2023; Vlam et al., 2018) and genetic methods (SSR and SNP markers, Vlam et al., 2018). We also compare and combine the success rate and spatial accuracy of methods. Recently, we successfully added a new method to the timber tracing toolbox: multi-elemental analyses



(Boeschoten et al., 2022, 2023). Measuring a large number of chemical elements at once in pieces of wood using a mass spectrometer, we obtained a chemical fingerprint. Using machine learning methods, we then related wood chemical composition to soil and climate characteristics. Results of this study (Boeschoten et al., 2023) are promising: multi-element analyses on wood samples from Red Meranti (Asia), Azobe and Tali (Central Africa) could be traced back to their sub-national origin with 86%-98% accuracy (see figure 4 below). Independently collected blind samples from Central Africa were correctly assigned for 70-72% at a sub-national level.

Genetic and chemical timber tracing is a promising technology to support compliance practices and an effective tool for the implementation of the EUDR regarding timber products. Timber tracing methods can independently verify the claimed species and geographical origin of timber and can thus ensure that traded timber was produced without causing deforestation. Therefore, it can help prevent timber that is sourced from high deforestation risk areas from entering the European market. Timber tracing techniques have broad political support and will likely be employed by competent authorities to verify compliance with the EUDR, as authorities have already done so to verify claims on timber legality under the EUTR and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

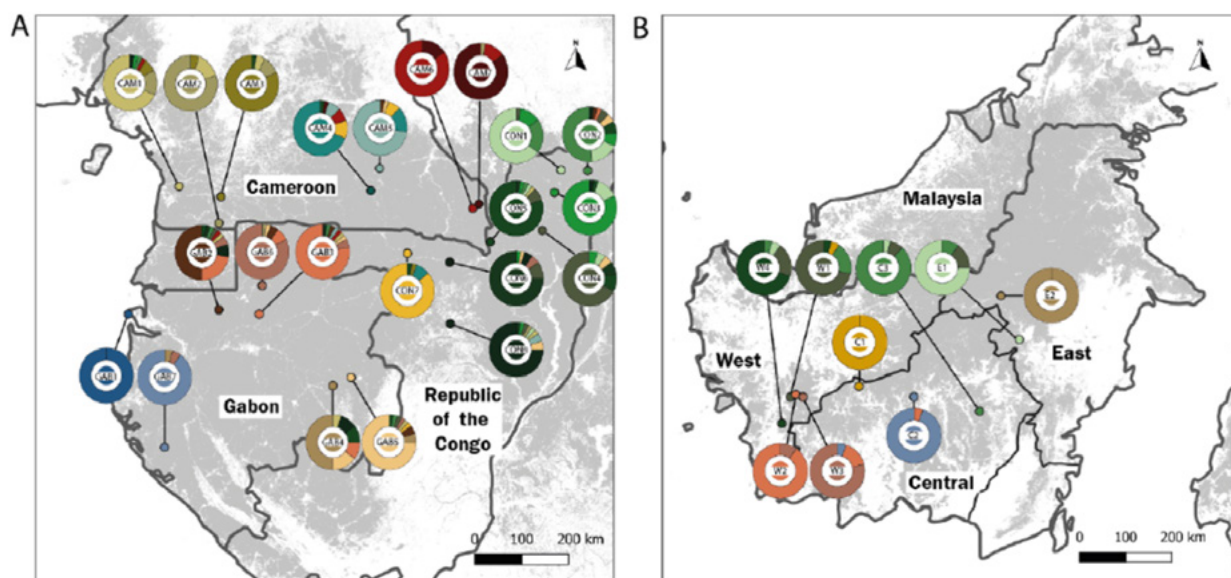


Figure 4: Results of assignments tests for wood samples from Central Africa (A) and Borneo (B). Colour of inner circle identified the site where wood samples were collected. Donut graph show colours of sites to which samples from the focal site were assigned in statistical tests. (Boeschoten & et al., 2023)

Costs of timber tracing are currently relatively high because reference databases need to be established, and methods are still in development. Operationalization of timber tracing methods hinges on the availability of large numbers of reference samples, the development of statistical methods for sample assignment, and the accuracy of spatial resolution of tracing. However, with growing reference databases (and combining these) and increasing availability of reference databases, costs will be substantially reduced. The field of timber tracing is developing rapidly in terms of sample collections, sample sharing, establishing centralised reference databases, developing methods and testing methods. We foresee that government authorities and NGOs will be able to utilise timber tracing to verify provenance of timber. Timber traders themselves may also use these techniques to verify compliance internally and to support building a database of reference samples.

Currently, there are two major barriers to large scale implementation of timber tracing. First, there is a shortage of funding to collect a representative number of samples from across the main production areas of the major



traded timber species. Second, there spatial resolution at which timber tracing tools can reliably identify the geographic origin of timber is currently still relatively low.

Genetic and chemical traceability techniques are a good practice to check for EUDR compliance for timber products entering European markets. Timber tracing techniques can verify whether timber products originate from high-risk deforestation areas or from areas with unsustainable forest management practices. Timber tracing can thus contribute to the transparency of value chains and deliver important if not necessary information for EUDR compliance of timber products.

5.12 Oil palm agroforestry

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture	Other: Agricultural non-deforestation practice	Supply-side (Global)	Palm oil	Reflexivity	EUDR not in focus / has a wider/different scope
Link to key reference -				Link to training video -		
Authors (Institution) Andrew Miccolis (CIFOR-ICRAF, Wageningen University)				Last update February 2024		

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Oil palm (*Eleais guienensis*) is one of the forest-risk commodities covered by the EUDR. Oil palm has accelerated forest clearing to establish large-scale monocrop plantations (Sheil et al., 2009) particularly in Southeast Asia (Isenhour, 2014). However, it is also lauded for its high potential for job and income generation (Voora et al., 2019), International and academic debates on oil palm have focused largely on reducing the environmental impacts of land clearing for new plantations, including deforestation leading to habitat loss and carbon emissions (Sheil et al., 2009), and adopting social measures that improve labour conditions and other social benefits (Voora et al., 2019). However, very little attention has been given to alternatives to the standard monocrop production systems that may reduce pressures on standing forests while also bolstering farmer livelihoods. Agroforestry presents an alternative for smallholders to produce oil palm without deforesting land, because (though this depends on how EUDR defines deforestation and forests) forest cover can be maintained. In addition, agroforestry bears a high potential for diversifying oil palm plantations (Khasanah et al., 2020; Miccolis et al., 2022), increasing resilience to extreme climate events, enhancing environmental functions, and reducing risks to farmers (Batistella et al., 2013; Bhagwat & Willis, 2008).

Field trials among smallholder farmers in the Brazilian Amazon have piloted multi-strata oil palm agroforestry based on agroecological management practices (Miccolis et al., 2022). Conducted initially on 10 demonstration sites co-designed with - and led by - family farmers in Tomé Açu, Pará State (Figure 5), these oil palm agroforestry systems consist of double, triple or quadruple rows of oil palm intercropped with various combinations of fruit (e.g. açai palm, cocoa) and hardwood trees (e.g. ipe, mahogany), in addition to fertiliser species (e.g. pidgeon peas, Inga spp, Gliricidia spp, and Tithonia spp). Some of these sites also include valuable cash crops such as black pepper and passionfruit, which are widely planted regionally, though largely in monocrop systems. Additionally, in the first few years, annual crops such as maize, beans, cassava and bananas provide farmers with food and income on a short-term basis as oil palm has not yet begun to produce (Figure 6).

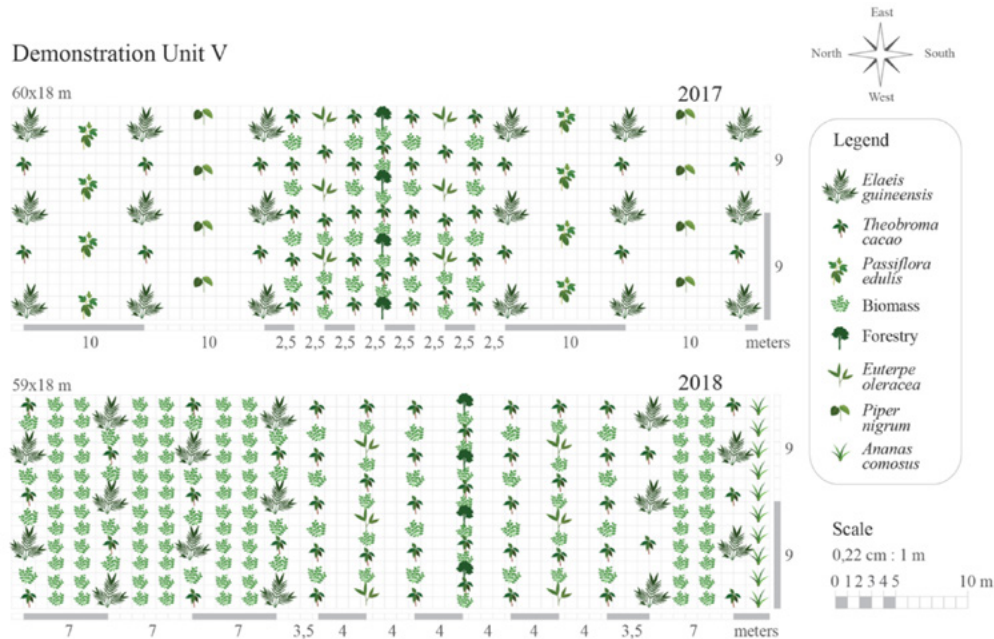


Figure 5: Example of the design of a Demonstration Unit (num. 5, farmer Zé Paixão), consisting of two fields, established in 2017 and 2018, Tomé Açu, Pará, Brazil. The system is comprised of double rows of oil palm intercropped with food/cash crops (e.g. *Manihot esculenta*, banana), fertilizer species (*Tithonia diversifolia*; *Gliricidia sepium*, and *Inga edulis*), tree crops (*Theobroma cacao*, *Euterpe oleracea*), and forest species (*Carapa guianensis*, *Spondias mombin*, *Khaya ivorensis*, *Swietenia macrophylla*, *Handroanthus albus*; and *Handroanthus heptaphyllus*).



Figure 6: Succession of oil palm agroforestry Demonstration Unit (num. 5), from 2017 to 2021, in Tomé Açu, Pará, Brazil. Source: (Miccolis et al., 2022)

Early results from these trials show a high potential for economic feasibility, social suitability and adaptability to different farmer contexts (Miccolis et al., 2022), in addition to improvement of key environmental functions, most notably tree species diversity and soil cover. It may therefore improve local and political support for the EUDR. At the same time, mixing in oil palm in existing forests challenges some of the definitions and standards as laid out by the EUDR as what entail deforestation and forest degradation. In general, agroforestry and other mixed land use types require further learning under the EUDR and are expected to be a major topic in the upcoming review of 2025.

This innovative land use technology has implications for implementation of the EUDR since it enables oil palm production without reducing forest cover, although this depends on the exact definitions managed by the EUDR, and whether agroforestry systems are recognized as forested land. In addition, it has potential for agricultural intensification (producing more on less land) and thereby may reduce pressure on surrounding forest cover.



5.13 Remote sensing-based forest disturbance driver mapping

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology	Agriculture Forestry	Data-based Science-based	Supply-side (Global)	All EUDR-FRC	Effectiveness Transparency Innovation identified	Relevant
Link to key reference Different websites: Earth Engine App of WUR				Link to training video -		
Authors (Institution) Bart Slagter (Wageningen University)				Last update January 2024		

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The EUDR prohibits the import of products produced on land that was deforested after 2020. Remote sensing-based assessments of deforestation and forest degradation at large scale offer a crucial and efficient tool to enforce this regulation. Currently, an important role is foreseen for operational forest disturbance alerting systems, such as RAdar for Detecting Deforestation (RADD) (Reiche et al., 2021) and Global Land Analysis and Discovery (GLAD) (Hansen et al., 2016). Recent advancement in satellite imaging technologies have enabled such systems to detect tropical forest disturbances spatially explicit, in high spatial detail and in near real-time, offering an unprecedented view on deforestation and forest degradation in the tropics.

Still, there is an urgent need for enhancing such monitoring methods to automatically attribute direct drivers to detected disturbances. This could provide important spatially explicit information to make forest disturbance alerts more actionable and useful for uptake by different stakeholders. Enforcing the EUDR can benefit from such information, enabling the separation of different types of deforestation and forest degradation. For example, a forest clearing caused by flooding or a windthrow may have a different implication than a clearing caused by industrial agriculture. Having such information rapidly and spatially explicitly can increase transparency in what is happening at a specific location and help assess risks.

A study by Slagter et al. (2023) employed high spatiotemporal resolution satellite data and explored their potential for automated and spatially explicit monitoring of direct drivers of small-scale forest disturbance. It focused on selected tropical study areas in the Republic of Congo, Democratic Republic of Congo and Suriname, which mainly experience small-scale disturbances, and it applied a deep learning method on selected satellite images at forest disturbance locations to attribute a direct driver to each detected disturbance patch, namely: smallholder agriculture, road development, selective logging, mining, or other (Figure 7).

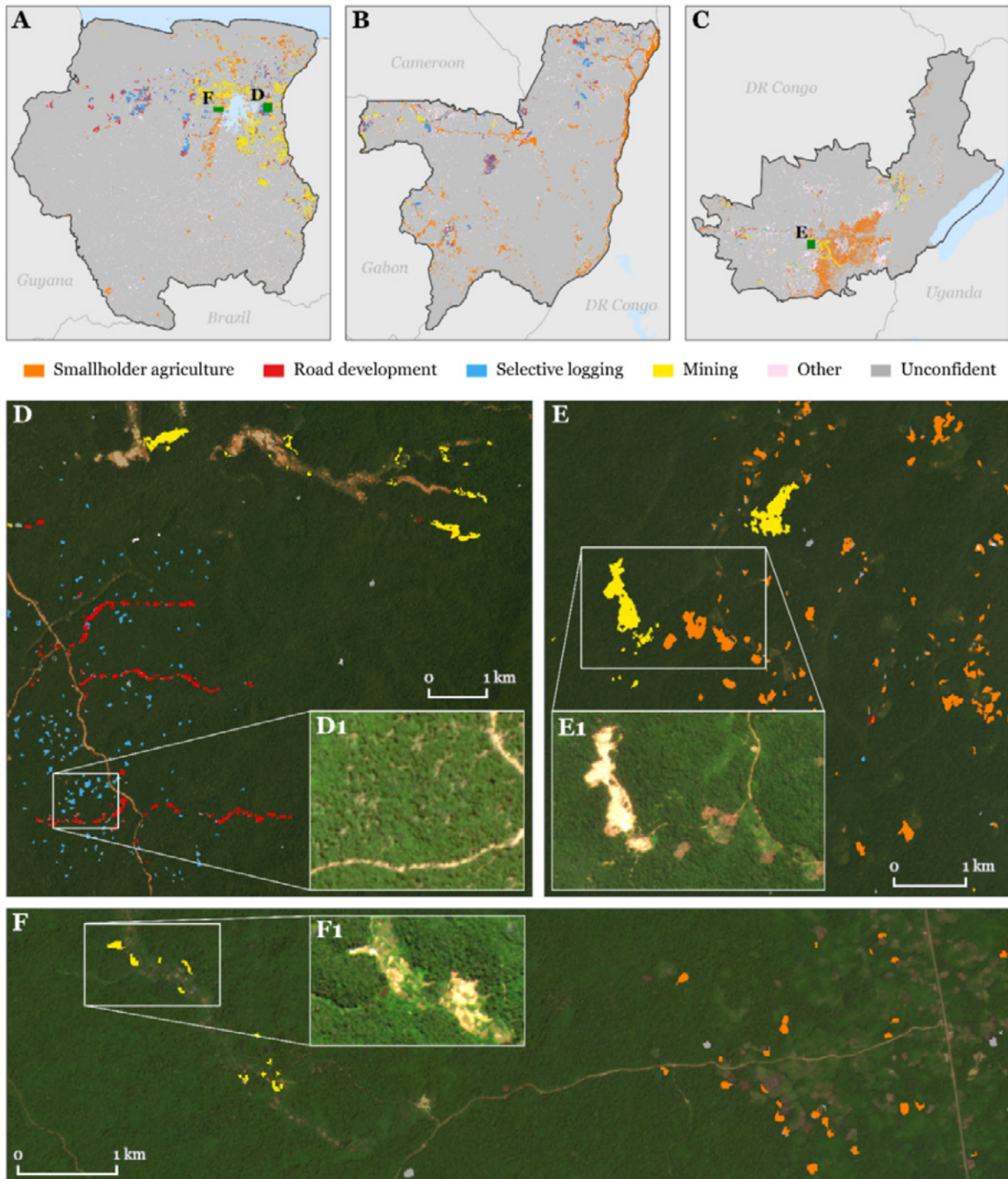


Figure 7: Output maps of the forest disturbance driver classifications for 2020 and the first half of 2021 (A, B & C). Detailed examples are shown in D, E & F. A complete overview of the maps can be accessed via: <https://bartslagter94.users.earthengine.app/view/forest-disturbance-drivers>

Remote-sensing-based forest disturbance driver mapping can be an effective tool for EUDR implementation. Linking direct drivers to satellite data via operational forest disturbance alerting systems can contribute to EUDR implementation with better alert prioritisation and provide more actionable and enhanced information on deforestation risk. In addition, forest disturbance driver maps can enable mitigation of deforestation risk such as rapid law enforcement against illegal activities, aid in ecological impact assessments and provide more detail for forest disturbance-related carbon emission reporting.



A system using openly available satellite imagery to detect and attribute forest disturbances in near real-time is highly efficient and transparent. In the past, assessments of deforestation and their drivers have relied on visual interpretation of satellite imagery, which is far more labour intensive compared to automated mapping. Still, for enforcement of the EUDR, a 'ground-truth' verification of what drove a forest change (based on visual interpretation of imagery) may be necessary. Satellite-based forest monitoring systems and the data they produce (i.e. maps) are generally well-adopted and usable for the public. Platforms like Global Forest Watch are ensuring that frequently updated digital forest maps are accessible via a web viewer, download, or subscription.

The use of openly available satellite imagery can be seen as a fair and unbiased means to assess deforestation and their drivers. The underlying imagery can be viewed by anyone, which is an important base for political and societal support. On the other hand, the application of Machine/Deep Learning models to automate mapping is never 100% accurate and these algorithms also lack transparency. Awareness of model errors (e.g. false detections or false driver attributions) is warranted. Automated mapping based on Machine/Deep Learning models is always prone to errors and users should be aware of this. To use this tool in practice to enforce the EUDR, some knowledge about the algorithms, their underlying data, and model errors (and where the errors stem from) is needed.

It is important – also for the legitimacy of the EUDR outside the EU – that local producers are not wrongfully made accountable for naturally occurring forest loss. At the same time, deforestation alerts that showcase specific human drivers allow for more rapid action to combat such deforestation and can be an effective way to mitigate deforestation risk. In order to inform whether producers and traders are in compliance with the EUDR or not, forest disturbance alerting systems need to be 'ground-truthed' nonetheless. Exploring how for example law enforcement agencies can make use of these systems therefore remains a challenge for the future.

5.14 Brazil's Rural Environmental Registry / Cadastro Ambiental Rural (CAR)

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture Forestry	Data-based Public policy / regulation	Supply-side (Specific countries)	All FRC (beyond EUDR)	Transparency Feasibility	Relevant
Link to key reference Website of CAR				Link to training video -		
Authors (Institution) Jorge Sellare (Wageningen University)				Last update April 2024		

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Brazil's Rural Environmental Registry (Cadastro Ambiental Rural, CAR) is an instrument established by the new Brazilian Forest Code, enacted in 2012 by the Law n° 12.651/2012. It was adopted as a measure to regularise and monitor rural properties in relation to their compliance with environmental laws. The CAR consists of an electronic record that contains information on the landowner, polygon data on the boundaries of the property, and detailed geotagged information on the environmental situation of properties, such as permanent preservation areas, legal reserves, areas of native vegetation, among others. As such, the CAR works as an environmental management tool and is completed by the landowners themselves with technical support from government agencies and partner organisations. The implementation of the CAR involves various actors, including the Ministry of the Environment, state environmental agencies, farmers, NGOs and companies in the agricultural sector.



In terms of Corporate Social Responsibility, the CAR can contribute to increased transparency and sustainability in the agricultural supply chain. Coupling the CAR with other publicly available land use databases, such as those from MapBiomas (see case study), makes it possible to identify which properties do not comply with environmental legislation and link deforestation to the expansion of cropland and pasture (see case study on Trase). Such information has been used to map the supply chains of specific commodities (e.g. beef, cocoa, coffee, palm oil, soy) in Brazil, making it possible to estimate the deforestation footprint of companies and importing countries (see case study on Trase). Companies that import agricultural commodities from Brazil can thus use CAR information to verify the environmental compliance of their suppliers and ensure that their products are in accordance with the EUDR.

The CAR can contribute significantly to compliance with the new European Deforestation Regulation by providing detailed information on the environmental situation of rural properties. For example, European companies can check whether suppliers are complying with Brazil's environmental protection laws and whether they are preserving areas of native vegetation. The CAR has been used for the monitoring of other sustainability initiatives, such as the G4 Cattle Agreement (Gibbs, 2016) and the Soy Moratorium (Gibbs, 2015), and also used as a requirement for farmers to access rural credit (Souza et al., 2020).

The costs associated with implementing the CAR vary according to the size of the property and the technical support available. For example, georeferencing the property can represent a significant cost for small farmers – although some support programs and initiatives by third-party agencies have tried to offset these registration costs (Jung et al., 2017). CAR information is public and can be accessed through the National Rural Environmental Registry System (SICAR), allowing anyone to consult the environmental situation of rural properties².

Political support for the CAR has been expressed through public policies to encourage environmental regularisation and through partnerships with civil society organisations and the private sector (Gibbs, 2015, 2016; Jung et al., 2017). However, it has been reported that some groups in the parliament have been lobbying for a restructuring in the governance structure of the CAR, which could jeopardise its integrity as a tool for environmental monitoring (Lopes & Chiavari, 2023).

Farmers' adherence to the CAR has been gradual but significant. In the past couple of years, the number of registered properties has increased across the whole country, including the registration of smallholder farms and indigenous peoples and local communities (IPLC). However, because the CAR is self-reported, it is essential that the data be validated by public agents to ensure accuracy and avoid overlapping of rural properties with indigenous lands and conservation units. This final step is still the biggest bottleneck for its full implementation and it has been estimated that only 2% of all registries have been validated. Challenges such as a lack of financial and technical resources and difficulties in contacting the landowners have hindered wider and more effective adherence (Lopes, Machado, et al., 2023).

The CAR can be evaluated as a positive practice, as it contributes to transparency, the sustainable management of natural resources, and compliance with environmental legislation. It offers a solid database for monitoring and regularising rural properties, as well as providing valuable information for companies seeking to ensure sustainability in their supply chains. However, it is important to recognize the limitations and challenges faced in its implementation and seek solutions to overcome them, thus ensuring the continued effectiveness of the CAR as an environmental management tool.

² <https://www.car.gov.br>



5.15 Sustainability policy of the Dutch Pension Fund

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology CSR	Agriculture Forestry Finance	Industry self-regulation		All FRC (beyond EUDR)	Effectiveness Transparency	Relevant
Link to key reference Strategy document				Link to training video www.emma4eu.eu/learn/case-studies		
Authors (Institution) Jelle Behagel (Wageningen University)				Last update April 2024		

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As part of their broader sustainability policy, the Dutch pension fund ABP introduced a new policy in March 2024, which includes a more explicit focus on deforestation and biodiversity in their investment decisions (ABP, 2024). The decision (partly) follows upon pressure from academics and media reports (Mongabay, 2021; Volkskrant, 2021) on the large investments that Dutch and Japanese pension funds have in Brazilian meat packers that are directly involved in deforestation in the Amazon, as well as deforestation in other biomes in Latin America such as Cerrado. The decision to include biodiversity in investment decisions also follows a trend where companies increasingly are responding to and accounting for biodiversity risk (Carvalho et al., 2023) via the concept of 'double materiality', i.e. by accounting how negative impacts of company operations affect biodiversity loss as well as to what extent these negative impacts pose a risk to future company operations themselves (Baumüller & Sopp, 2021).

ABP accounts for deforestation in their investment policy via three general mechanisms. First, it excludes investments in companies that operate in high deforestation risk areas and that do not have a zero-deforestation policy in place by 2025. Such investment will be removed from the portfolio at the latest in 2030. This seems to anticipate the EUDR, although it appears to be less stringent than the EUDR, which raises questions on the liability of financial funds for high deforestation risk commodity production. Second, it accounts for risks associated with deforestation and biodiversity loss (measured as land use conversion) via investment decisions and uses risk data such as those offered by Trase and other platforms to do so. This means it includes risk of deforestation and land use change in a decision-tree on whether to buy publicly traded funds and it also uses this information to put deforestation and biodiversity loss on the agenda of shareholder meetings and to engage with companies' sustainability policies. Third, it spends at least 1 billion euros between now and 2030 (out of 10 billion on impact investments on climate and biodiversity combined) (Thompson, 2023) that both yield financial returns and have a clear positive impact on biodiversity.

Investment policies by financial institutions may be effective ways to support a market that is deforestation-free and thus supports the implementation of the EUDR. This type of due diligence by financial institutions may moreover support the development of forest risk databases on a broad scale, that can also be used by operators and traders.

The list of companies traded by the ABP pension fund are (in annual retrospect) public. In that sense, it is transparent which companies are publicly owned by ABP. How investment decisions are concretely made and what engagement practices with companies are carried out is less transparent, as ABP and their investment bank APG argue this involves sensitive financial data. Compliance with the EUDR is moreover not complete. While companies need to be compliant, financial institutions so far do not have the same obligations and ABP seems to have a less stringent approach investing in companies that are responsible for deforestation than what is mandated by companies themselves.



While the current sustainability policy of ABP is more ambitious and more specific than previous iterations and finds public support by being responsive to calls from the public and its own pension holders for more sustainability, it remains to be seen how effective the policy actually is in curbing forest and biodiversity loss. Even for impact investing, proving that such investments are additional to standard practice, i.e. that the investment itself leads to higher levels of forest cover or biodiversity, has been found to be difficult (Thompson, 2023). This complexity of connecting financial flows to positive and negative environmental impacts is an important issue to study further.

The role of private finance, and especially of financial institutions such as pension funds, in achieving zero deforestation globally is very important. The biodiversity finance gap report shows that between 30 and 90 billion USD of green financial products for biodiversity are needed per year by 2030 to prevent a sixth mass extinction event (Paulson Institute, the Nature Conservancy and Cornell Atkinson Centre for Sustainability, 2020). The relative contribution of ABP seems to be far below that number. Moreover, the EUDR itself is stricter than the targets ABP policy sets for itself (i.e. zero deforestation by only by 2030 rather than 2025). While the ABP sustainability policy is a step in the right direction, the EUDR may need to expand its scope to financial institutions if the 2025 review of the EUDR finds that financial flows continue to support deforestation abroad.

5.16 Sourcing Hub

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology CSR	Agriculture Forestry	Private regulation	Demand-side (Global) Supply-side (Global)	Soy, Cattle, Palm oil, Wood	Effectiveness Efficiency Transparency Limitations	Relevant, with identified limitations
Link to key reference Sourcing Hub website				Link to training video www.emma4eu.eu/learn/case-studies		
Authors (Institution) David Hadley Garcia, Chloé Viala and Tim Bender (Preferred by Nature)				Last update November 2024		

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Summary of the case study: the Preferred by Nature Sourcing Hub is a public-facing interface displaying risk data relating to timber and agricultural commodities. Country-level risk data is especially important for stakeholders implementing or controlling due diligence regulations (such as the EUDR), as this data is the entry point to a risk assessment process about the production of key commodities under scrutiny. The database currently covers mostly a range of risks related to legal production and trade, which is key to ensure compliance with the EUDR requirement on the legal production of commodities³. It also offers specific guidance on how to mitigate identified risks. The risk data on the Sourcing Hub is the result of detailed risk assessments developed by Preferred by Nature. Since 2017, the Sourcing Hub has continuously evolved, updated and published new risk assessments on countries worldwide.

The Sourcing Hub falls under all EMMA4EU topical foci: Compliance, technology, and corporate social responsibility. While its geographical focus may be considered principally as a demand side tool relevant to the EU and similar jurisdictions, it is in fact equally applicable to supply-side applications and has been successful to this effect.

³ The Sourcing Hub is being expanded to also cover risks related to sustainability criteria, covering social, environmental (including deforestation) and climate-change related risks.



Most of the risk information currently available via the platform relates to forestry (wood), although some limited analysis is available for soy, palm oil and cattle also⁴.

Analysis of Key Assessment Criteria: in relation to its effectiveness, over time the Sourcing Hub has come to be known – and extensively used – as a highly credible public resource, providing open access to detailed risk assessment information, as well as fostering consensus on a common baseline for understanding risks in production systems for specific commodities and producer countries. Frequent users of the Sourcing Hub include a wide range of stakeholders, from enforcement authorities of EU member states responsible for enforcing relevant timber legality-related laws (in particular EUTR), private sector organisations subject to regulations in consumer regions such as the EUDR, primary processors (often in producer regions), civil-society organisations, researchers, and others.

The Sourcing Hub facilitates efficient access to country-level sustainability information and risk data. All results of Preferred by Nature's analyses are published and made available without charge on the Sourcing Hub, in line with the organisation's open-source approach (Preferred by Nature, 2013) to sustainability knowledge, tools and systems. This has served to reduce the burden on individual stakeholders to develop such country-level assessments in isolation. The 'working-document' nature of our risk assessments and extensive outreach and consultation on draft risk assessments, has had a positive effect on ensuring the credibility of risk assessment results.

Integral to the risk assessment process is transparency in the risk assessment methodology and sources which have input into risk assessment decisions. Preferred by Nature publishes the methodology used for risk assessments, and assessments rigorously lists all relevant sources used in the analyses. Draft risk assessments are made available for consultation.

There have been some key limitations in relation to the Sourcing Hub platform, as country-level assessments demand significant resources – and take a significant length of time - to develop. They require to be updated regularly, and usually a complete overhaul is needed every 3 to 5 years. Poorly done, they can undermine the credibility of the stakeholders and systems they are supposed to be helping. The Sourcing Hub has been limited by a lack of financing, as a result of the high costs associated with the development of risk analyses and some systemic challenges associated with traditional project funding.

The Sourcing Hub has equal relevance for entities seeking compliance with regulatory requirements such as those upheld by the EUDR (or alignment in the case of entities supplying into the jurisdiction) as those seeking to meet broader market requirements for sustainable products, via their own CSR activities.

Summary of assessment as good or bad practice: the Sourcing Hub can be considered good practice, and this is evidenced. In 2022, Preferred by Nature analysed traffic on the Sourcing Hub, as well as conducted interviews with key stakeholders including a number of governmental Competent Authorities, responsible for EUTR implementation. It was demonstrated through these surveys (Preferred by Nature, 2023), that the Sourcing Hub has been a key resource for compliance by Operators, Traders, Monitoring Organisations and Competent Authorities, under the EUTR. At this time, both companies and Competent Authorities signalled a strong commitment to continue using the Sourcing Hub as a resource in their work.

⁴ The Sourcing Hub is being expanded to also cover risks related to sustainability criteria, covering social, environmental (including deforestation) and climate-change related risks.



In short, the platform helps to make publicly and freely available critical country-level sustainability information and a range of support tools, to enable effective decision-making in commodity supply chains, from production, through processing, transport and trade. It provides detailed analyses for a large number of countries.

The benefits of the current Sourcing Hub in providing access to well-researched risk evaluations, includes the following: i) fostering understanding of risks around legality and sustainability topics for multiple stakeholders; ii) assisting the streamlining of risk-based approaches to managing supply chains, both in consumer and producer markets; iii) offering guidance on solutions to identified legality and sustainability risks in the form of descriptions of officially-issued documents, proposed risk mitigation actions and lists of legislation.

5.17 Universal Mill List

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture	Private regulation	Supply-side (Global)		Efficiency Transparency	Relevant
 Link to key reference Explanation side and link to data source at Rainforest Alliance's website				 Link to training video -		
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The Universal Mill List (UML) is a publicly accessible global database designed to enhance transparency and sustainability in the palm oil industry. It compiles a verified list of palm oil mill locations worldwide, drawing data from processors, traders, consumer goods manufacturers, the Roundtable on Sustainable Palm Oil (RSPO), and FoodReg.

The UML provides information including mill names, parent companies, RSPO certification statuses, and precise geolocation data, serving as a valuable tool for supply chain mapping and traceability. Although it does not encompass all mills, the UML covers a substantial, verified collection, making it an invaluable resource for businesses aiming to understand their supply chains better and ensure compliance with environmental and social standards.

UML's database can support businesses preparing for the EUDR by offering a starting point for those needing to trace their palm oil sources. By facilitating access to mills and enhancing traceability, the UML can play a pivotal role in connecting demand from the EU with supply-side operations in tropical producer countries. The database is free and publicly available. It is the first effort to create a transparent list of mills within a specific commodity sector, but it also builds on the willingness of the private sector to contribute data for public sharing.

The UML serves as an example of good practice for fostering deforestation-free supply chains, particularly within the palm oil industry. By providing a publicly accessible, global database of verified palm oil mill locations, the UML significantly enhances transparency efforts. It aggregates critical information from diverse sources, including certification statuses and geolocation data, aiding in effective supply chain mapping and traceability. Although not exhaustive, the UML's extensive coverage offers businesses a vital tool for better understanding their supply chains and ensuring adherence to environmental and social standards. This initiative exemplifies the collaborative spirit between the private sector and sustainability bodies.



5.18 Global Forest Watch

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance CSR	Forestry	Data-based	Demand-side (Global) Supply-side (Global)	All FRC (beyond EUDR)	Efficiency Transparency	Relevant
Link to key reference Global Forest Watch website				Link to training video -		
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Global Forest Watch (GFW) is an online platform that provides data and tools for monitoring forests worldwide. It was established in 2014 by the World Resources Institute (WRI) and a large group of partner organisations. GFW uses satellite technology, open data, and crowdsourcing to provide real-time information about the state of the world's forests. Its primary goal is to empower governments, businesses, communities, and individuals with the information they need to manage and conserve forest landscapes effectively.

GFW's capabilities align with the EMMA4EU's focus on technology and CSR by enabling businesses and other stakeholders to track deforestation, supporting deforestation free supply chains. Its global scope, with a particular emphasis on land use changes driven by agriculture and forestry commodities, addresses both the supply-side in tropical producer countries and the demand side in the EU. GFW facilitates compliance with EUDR by offering open access to data and tools for setting forest baselines, tracking deforestation, and mapping commodities, serving a wide range of users including government agencies, civil society, and companies.

GFW can contribute to the effectiveness of implementing the EUDR by providing GIS data for forest monitoring, integrated deforestation alerts to capture loss of forest cover, and specific map layers on global forest cover. Key layers available on GFW include GLAD/Hansen Tree Cover Loss, Tropical Tree Cover, Spatial Database of Planted Trees, and SBTN Natural Lands Map. This data enables the remote observation of vast commodity-producing areas, crucial for compliance with EUDR's requirements. While being a valuable tool, GFW's forest layers have acknowledged limitations, particularly in tropical areas and mosaic landscapes, that can affect their direct applicability for EUDR compliance. However, these forest layers are open-source, peer-reviewed sources of information, making them invaluable as initial steps in the due diligence process. When coupled with other data sources, GFW's insights can significantly enhance the understanding of forest cover changes and help stakeholders identify areas of concern.

GFW is free and easy to use but comes with the option to upgrade to Pro which includes advanced functionalities. The platform enhances transparency by making forest data openly accessible, supporting public participation and scrutiny in supply chain monitoring. GFW enjoys a wide level of support from numerous partners and is recognised by a wide range of stakeholders. GFW shows reflexivity in its methodology by continuously updating its datasets and tools to improve monitoring accuracy and relevance.

GFW can be an important tool for deforestation-free supply chains, offering real-time deforestation alerts and historical data through a user-friendly platform. Its satellite technology enhances transparency, enabling stakeholders to quickly identify and act against deforestation. GFW supports alignment with requirements of the EUDR, making it an essential resource for sustainable land use and combating global deforestation. Despite their limitations, the availability and credibility of GFW's data make it a crucial starting point for comprehensive



environmental monitoring and compliance efforts, underlining the importance of integrating multiple sources for a more accurate assessment within the EUDR requirements.

5.19 ViSeC (Visión Sectorial del Gran Chaco Argentino)

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance CSR	Agriculture	Private regulation Multi-stakeholder platform	Supply-side (Specific countries)	Soy, Cattle	Effectiveness Efficiency Innovation identified	Relevant
 Link to key reference ViSeC website				 Link to training video -		
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ViSeC (*Visión Sectorial del Gran Chaco Argentino*) is an innovative industry-led platform that started in 2021. The platform is designed to mitigate the environmental impacts associated with the soybean value chain in Argentina, focusing specifically on reducing deforestation and promoting sustainable land use practices. It achieves this by identifying plots of land used for soy production through the Argentina national database of farm owners (RENSPA). The system is voluntary and is financed by private donors, which means there is no cost to users. The aim is to cover the entire Argentinian soy value chain (Tropical Forest Alliance & Preferred by Nature, 2024; VISEC, n.d.).

It is a multisectoral and industry-wide initiative driven by the acknowledgement within the private sector that efforts need to be sector-specific. This is particularly crucial for addressing challenges related to indirect sourcing, such as difficulties in tracing complex supply chains involving one or several intermediaries between producers and organisations implementing sustainability programmes. It aligns with the EMMA4EU topical focus of CSR, as it represents a comprehensive approach by businesses and other stakeholders in the soybean industry to comply with environmental standards and regulations, including the EUDR. On their platform, ViSeC has gathered almost all soy associations in Argentina. In addition to this, there are many requests from producers, warehouses and trade chambers. Membership is publicly available on their website, emphasising the transparency aspect of the initiative.

ViSeC's operations, while having a direct geographical focus on the supply side, specifically in Argentina's Gran Chaco region, indirectly cater to the demand side in the EU by ensuring that soy products meet the increasing sustainability criteria required by European markets. The initiative's use of technology to monitor, verify, and report on the sustainability of the soy supply chain demonstrates a concrete example of how technological solutions can facilitate compliance and promote CSR practices across global commodities markets.

ViSeC showcases promising effectiveness in implementing EUDR requirements by establishing a traceable and sustainable soy supply chain, directly addressing environmental concerns such as deforestation and unsustainable land use. It builds efficiency by integrating existing databases and tools into a single platform.

ViSeC enjoys broad multi-sector support, including backing from the government, private sector, and civil society. Since 2024 it is in a phase of gradual implementation and has not yet fully scaled up. The first ViSeC



EUDR compliant shipment successfully took place in November 2023. Furthermore, the first version of the ViSeC system is slated to become operational in the first quarter of 2024. There are plans to expand the system to the beef value chain and to Paraguay.

The ViSeC platform is a good example of creating deforestation-free supply chains, particularly within Argentina's soy sector, by aligning with CSR principles and addressing EUDR standards. Its innovative use of technology for traceability and sustainability verification positions ViSeC as a solid tool in mitigating environmental impacts and enhancing compliance with international environmental regulations. Focused on Argentina's Gran Chaco region yet impacting EU market demands, ViSeC exemplifies how strategic, multi-sector collaboration can drive significant advancements in sustainable agriculture. Despite facing challenges like resource requirements and the need for stakeholder alignment, its broad support and adaptive framework suggest a promising approach to sustainable commodity production, making ViSeC a commendable model in the global effort to eliminate deforestation from supply chains.

5.20 World Forest ID

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Science-based	Supply-side (Global)	All FRC (beyond EUDR)	Limitations Innovation identified	Relevant, with identified limitations
Link to key reference World Forest ID website				Link to training video www.emma4eu.eu/learn/case-studies/		
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World Forest ID (WFID) is a U.S. non-profit organisation that collects species samples, specifically from timber, soy, cocoa, coffee and palm oil, from forests and agricultural lands worldwide to build a geo-referenced plant species database (World Forest ID, n.d.).

Such a database can facilitate scientific species and origin testing, allowing for the verification of origin claims by companies and organisations. Scientific testing can provide independent verification of claims regarding species of materials and their geographic origin.

With sophisticated laboratory techniques, testing has become easier and has been adapted for use on wood and paper products. While scientific testing methods are generally reliable, there is always a risk of false positives or negatives in identifying wood species or origins. The effectiveness of these platforms depends on the availability of physical samples for comparison.

As part of the EUDR regulation, market actors are required to provide exact geolocation and species information on relevant commodities. This, and other similar regulations, have contributed to the increased need for industry, government agencies, and other stakeholders to be able to identify the species and origin of timber used in wood-based products. While scientific testing is not a requirement for the EUDR it supports public agencies and non-state actors in uncovering fraudulent claims and promotes adherence to regulatory requirements.

WFID serves as a tool and knowledge provider, offering databases to support the implementation of the EUDR. Their efforts in data collection, reference database development, and collaboration with various organisations enhance the accuracy and reliability of species and origin validation processes. With their actions they support



educating Operators on the benefits of testing and technology on their products for species and origin validation.

General limitations of scientific testing are the lack of available reference data, access to testing labs and facilities. WFID with their approach to provide open-source extensive reference data of species origin enable scientific testing to become more effective. This can provide competent authorities the opportunity to effectively validate origin claims by operators made within the intention to align with the EUDR or other regulations.

Scientific testing can be seen as a good practice to improve traceability by validating claims of species origin. WFID's approach to build an open-source extensive database of reference data, which is currently one of the limitations of scientific testing, and collaborating with organisations and competent authorities is an example of good practice to ensure claims of deforestation free supply chains are true.

5.21 Risk Information Alliance

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Private regulation	Demand-side (Global) Supply-side (Global)	All EUDR-FRC	Effectiveness Efficiency Feasibility Innovation identified	Relevant
Link to key reference Risk Information Alliance website				Link to training video -		
Authors (Institution) David Hadley Garcia, Chloé Viala and Tim Bender (Preferred by Nature)				Last update November 2024		

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Summary of the case study: a group of organisations, starting with the Forest Stewardship Council (FSC), Preferred by Nature, the Roundtable on Sustainable Biomaterials (RSB), and the Sustainable Biomass Program (SBP), have joined forces as the Risk Information Alliance (Preferred by Nature, 2024). The Alliance is a collaborative initiative between organisations with a common interest and need to develop country-level sustainability risk assessments.

The aim of the initiative is to unlock a fundamental sustainability challenge, which is the lack of meaningful sustainability risk data available globally relevant to forestry and agricultural landscapes. The Risk Information Alliance falls under the following EMMA4EU topical foci: Compliance. Its geographical focus is global, and the Alliance will benefit demand side and supply-side systems.

Sustainability risk Information generated by the Alliance will reflect the interest of all partner organisations. However, currently the focus is all EUDR-relevant commodities (soy, cattle, oil palm, wood, cocoa, coffee and rubber).

Analysis of Key Assessment Criteria: in relation to effectiveness and efficiency, the Alliance seeks to address some overwhelming challenges that prohibit the development and maintenance of sustainability-related risk assessment data. Risk assessments demand significant resources – and take a significant length of time - to develop. They require to be updated regularly, and usually a complete overhaul is needed every 3 to 5 years. Poorly done, they can undermine the credibility of the stakeholders and systems they are supposed to be helping. Additionally, in terms of finding the necessary (financial) resources, experience dictates that while it is possible to obtain institutional funding for developing new country risk assessments, it remains a serious



challenge to obtain funding to upkeep and maintain risk assessments over time.

In light of these challenges, a conceptual underpinning of the Risk Information Alliance, is that it is only possible to address these challenges by engaging and collaborating amongst organisations, which will work together towards ensuring cost-efficiency and aligned results for credibility. This means in practice, working to align two key elements of Alliance-partner organisations' risk assessment infrastructure: the assessment methodology and the set of risk-indicators which are being assessed. This will allow for the sharing of risk information across Alliance-partners – and the use/incorporation of the risk information by each partner in a way which was not previously possible – to allow for very significant cost savings.

In relation to resource-limitations and feasibility considerations, the combining of Alliance-partners' collective stakeholder networks, will be beneficial in a number of ways: allow for wider access to technical experts amongst partner organisations, improving returns from consultations of draft risk assessments due to the ability to Alliance-partners to leverage their collective networks, as well as lowering the overall individual costs of development and outreach for consultations.

It is expected that, over time, the Alliance will seek to experience new methodological approaches which reduce costs but maintain the credibility of results and adapt to changes in the sustainability and regulatory landscape.

The country-level risk data generated by the Risk Information Alliance will be utilised by each alliance partner in different ways, according to the nature of the certification or assurance system the risk data supports. Given the coverage of risk indicators, it will have equal relevance for entities seeking compliance with key regulatory requirements (or alignment in the case of entities supplying into the jurisdiction) such as the EUDR, as those seeking to meet broader market requirements for sustainable products, via their own CSR activities.

While relatively new, and still to be fully tested, the concept of the Risk Information Alliance can be considered good practice. Through an innovative and collaborative approach, the Alliance will encourage risk data sharing in a pre-competitive sphere and cut through the complex and costly landscape facing companies and sustainability systems. Rather than countering bad practice, what can be evidenced is the lack of any significant achievement, to date, by organisations to collaborate to make available – on a consistent basis – credible sustainability risk data available globally, relevant to forestry and agricultural landscapes.

5.22 The EUDR's benchmarking system

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Public policy / regulation		All EUDR-FRC	Effectiveness Efficiency Innovation identified	Relevant with limitations
Link to key reference Link to EUDR law text				Link to training video www.emma4eu.eu/learn/case-studies/		
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To facilitate compliance with the new EUDR's new requirements, the EUDR foresees the categorisation of producer countries or parts thereof as low-risk, standard-risk, or high-risk concerning deforestation and forest degradation (Art. 29). These risk categories are assigned to EU as well as non-EU-countries and must be based on an objective and transparent assessment by the European Commission ('Commission'). Since 29 June 2023, all countries have been classified as standard-risk. The Commission must publish lists of countries or parts thereof as low- or high-risk through implementing acts until 30 December 2024. The list must be reviewed and updated based on necessity and new evidence. The three main assessment criteria are the (1) rate of deforestation and forest degradation, the (2) rate of expansion of agricultural land for forest-risk commodities (FRCs), and (3) FRC production trends. The Commission may also include, inter alia, greenhouse gas emission removal-related information provided by other actors (e.g. affected countries and regional authorities, operators, NGOs), agreements addressing deforestation and forest degradation, national laws to tackle deforestation and forest degradation, transparency of data provided by the country and sanctions of the UN and EU. The Commission must engage in dialogues with all high-risk countries and all countries at risk of being classified as high-risk to reduce the level of risk. The Commission must also notify countries and competent authorities about intended and implemented risk rating changes (Art. 29).

The benchmarking system is an integral part of the EUDR and builds on EU Member States' individual practice of pursuing a risk-based approach in implementing the EUTR (Köthke, 2020). Building on this individual risk-rating practice, it seeks to institutionalise a uniform risk rating to improve regulatory effectiveness and efficiency by facilitating targeted and risk-based inspections by competent authorities and supporting enterprises in identifying risks along their supply chains. First, it foresees lower inspection obligations in the case of a low-risk rating and enhanced scrutiny in the case of a high-risk rating. Competent authorities must check at least 3% of market participants that place relevant products on the market, make them available on the intra-EU market or export them and that come from countries or regions with a standard-risk rating. A low-risk rating reduces the inspection obligations to 1%, while a high-risk rating increases the inspection obligations to 9% of all operators. Furthermore, in case of a high-risk, competent authorities must check 9% of the quantity of each of the relevant products. The EUDR does not request quantity-related minimum inspection obligations for standard and low-risk imports, trades and exports (Art. 16). Second, the EUDR foresees simplified due diligence requirements for operators and traders sourcing relevant products from areas with a low-risk rating (i.e. no risk assessment and risk mitigation obligations) (Art. 13). The design of the benchmarking system has several key limitations. The EUDR prohibits the import, export and intra-EU trade of FRCs and derived products unless they (1) are deforestation-free and forest degradation-free, (2) have been produced in accordance with the relevant legislation of the country of production, and (3) are covered by a due diligence statement. The benchmarking system's first key limitation to support EUDR compliance is that it is not set up to rate legality risks due to its focus on deforestation and forest degradation and the exclusion of legality criteria from its three core assessment criteria. Second, the benchmarking system risks deteriorating relations with producer countries despite the Commission's obligation to cooperate with producer countries and risk rating transparency obligations (see above); best illustrated by a statement from 17 like-minded countries from the Americas, Southeast Asia, and Africa following the EUDR's adoption: '[The EUDR] establishes an inherently discriminatory and punitive unilateral benchmarking system that is potentially inconsistent with the World Trade Organization (WTO) obligations (Indonesian Embassy in Brussels, 2023). Third, the burden of intensified inspection obligations on the share of operators, but also product volume in case of high-risk ratings, might overstretch the available resources for enforcing the EUDR. Fourth, while it is mentioned, it remains unclear how the EU intends to ensure that the assessment is objective and transparent. This might lay the ground for disputes between producing countries, especially from outside the EU, and the EU.

The benchmarking undertaken by the EU regarding a phenomenon (deforestation and forest degradation) that is merely in the national sovereign sphere of interest of producing countries can be considered as a new and



innovative approach in addressing environmental degradation globally. It seeks to support a standardised identification of the relevant level of inspection intensity by EU Member States' competent authorities. Furthermore, it can serve as a starting point for the due diligence risk assessment by operators. As a prerequisite, the EU needs to commission and put into practice an objective and data-driven benchmarking process. The EUDR can thereby pave the way for new approaches to assess deforestation and forest degradation risks. On the one hand, the benchmarking system is expected to be based on an adjective, data- and science-driven process that can balance the predictability of the regulatory environment and adaptability to scientific and technological progress, in accordance with the 'Better Regulation' guideline (European Commission, 2021a). On the other hand, due to its limitations, it can result in diplomatic tensions and might not be seen as an innovative but one-sided measure to evaluate other countries' land use practices.

To summarise, the benchmarking system can support the EUDR's implementation and enforcement by providing deforestation and forest degradation risk assessments to Member States, competent authorities and enterprises. In case other than low-risk ratings, disputes between the EU and its trading partners are likely. Thus, risk-rating transparency, good diplomacy and cooperation with partner countries – in particular high-risk countries – are needed to avoid deteriorating relationships with partner countries and potential unintended consequences (e.g. trade leakage to less regulated markets)..

5.23 The EUDR's inspection obligations for competent authorities

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Public policy / regulation		All EUDR-FRC	Effectiveness Efficiency Feasibility Limitations Innovation identified	Relevant, with identified limitations
Link to key reference Link to EUDR law text				Link to training video www.emma4eu.eu/learn/case-studies/		
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EU institutions institutionalised new annual minimum inspection obligations for Member States' competent authorities in the EUDR to enhance compliance by Member States and regulated corporate actors. This reflects learnings from EUTR-related enforcement shortcomings in terms of the uneven stringency in enforcing the EUTR across Member States (e.g. design of inspections, use of scientific testing, number of checks, level of penalties), as identified in the state-of-the-art research (e.g. Berning & Sotirov, 2023; Köthke, 2020; McDermott & Sotirov, 2018; Saunders, 2020) and Commission's 2021 EUTR-FLEGT fitness check (European Commission, 2021b). Based on the assessment of countries and the resulting risk category, the EUDR obliges competent authorities to conduct differentiated minimum inspection intensities, ranging annually from 1%, 3% or 9% of all operators, respectively, to low, standard or high-risk assignments. To identify the checks to be carried out, the competent authorities must use a risk-based approach that is based on supply chain and commodity specific criteria (Art. 16). Additionally, competent authorities must identify non-compliance high-risk situations that require immediate action before relevant products are imported, exported or traded on the EU market (e.g. suspensions) (Art. 17). The EUDR also



establishes stricter obligations for competent authorities, operators and traders in case substantiated concerns (see below) have been brought forward. Customs authorities support enforcement through controls of relevant products under the procedure 'release for free circulation' and 'export' based on the apriori availability of the reference number of the due diligence declaration and collaboration with competent authorities (Art. 26).

The new minimum inspection obligations seek to enhance regulatory effectiveness by requesting the EUDR's uniform enforcement across EU Member States. The Commission's 2021 EUTR-FLEGT Fitness check found that competent authorities' human and financial resources varied substantially across Member States, suggesting that 'some countries devote very limited resources to the implementation and enforcement of the EUTR considering the number of operators and volume of import (European Commission, 2021, p. 13). To address these resource constraints and improve implementation efficiency and feasibility, the EUDR institutionalised an enforcement cost reclaim mechanism, enabling EU Member States to authorise their competent authorities to reclaim costs (e.g. testing, storage and corrective action-related costs) from non-compliant operators or traders (Art. 20). Furthermore, the EUDR obliges EU Member States to ensure that their national regulatory framework provides their competent authorities with adequate powers, functional independence and required resources to fulfil their obligations (Art. 14). Additionally, the EUDR requests the mandatory submission of due diligence statements electronically through a new centralised information system, visible to competent authorities and customs. This system is expected to be essential in supporting the (1) identification of operators and trades, (2) detection of higher-risk economic activities, and (3) planning of inspections (interviews). Regarding transparency, the new information system containing the due diligence statements must also be accessible to operators, traders and their authorised representatives. Furthermore, the public must have access to the complete anonymised datasets. Key limitations for Member States' competent authorities include continued resource constraints (e.g., financial resources, staff) and knowledge gaps about the number of operators and traders (Personal communication with key informants).

The EUDR's prescriptive inspection obligations follow the Better Regulation approach of the EU (European Commission, 2021a) by helping Member States to coherently transpose, implement and apply EU law in a timely and correct manner. As a result, it contributes to the predictability of the regulatory environment.

To summarise, uniform minimum inspection obligations across EU Member States are essential to ensure the EUDR's coherent implementation and enforcement across Member States, effectively deter the import, export, and trade of illegally and unsustainably produced goods, and provide a level playing field for sustainable and legal FRCs and products. Sufficient resources (e.g., financial resources, staff) for competent authorities are essential to ensure their capacity to conduct inspection obligations and achieve the desired deterrence effect.

5.24 The role of private certification under the EUDR

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Public policy / regulation Private regulation	Supply chain orientation: Demand-side (Global) Supply-side (EU)	All EUDR-FRC	Efficiency	Relevant, with limitations
Link to key reference Link to EUDR law text				Link to training video -		
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Compared to the EUTR, the EUDR relies on a stronger state-based regulatory approach by restricting the use of private regulation (e.g. certification) as a compliance-proving tool. The EUTR recognised private regulation (i.e., third-party verified schemes such as certification) as a tool that may support compliance with the EUTR's risk assessment and mitigation obligations (Dieguez and Sotirov 2021). Under the EUDR, third-party verified schemes (e.g., forest and agricultural certification) are now only complementary to other obligatory elements, thus only permitted as an auxiliary tool to support the EUDR's risk assessment obligations if they fulfil the EUDR's information requirements (Berning & Sotirov, 2023; Köthke et al., 2023).

In line with the state-of-the-art research on the limited success of private sustainability governance (e.g. Dietz et al., 2022; Schleifer, 2023), key effectiveness-related concerns raised on private certification in terms of serving as a compliance proving tool under the EUDR included issues around transparency, differing rules, procedures and quality assurance systems, chain of custody frauds and the lack of independent audits (European Commission, 2021b, 2021c). While many enterprises advocated for a recognition of certification schemes as an efficient and feasible due diligence tool, the EUDR explicitly states that third-party verified schemes may only complement the risk assessment step in a company's due diligence system to ensure enterprises accountability and liability for legal and sustainable supply chains (Berning & Sotirov, 2023, 2024). Notably, the EUDR does not directly reference certification in the risk mitigation step within the due diligence requirements. However, the audit, documentation and transaction control activities of certification schemes could be interpreted as falling under one of the mentioned measures under the EUDR's Article 11 on risk mitigation, namely 'carrying out independent surveys or audits'. Despite these limitations, private initiatives can be essential in prototyping and supporting implementation tools and procedures, used in support of all three due diligence steps. Furthermore, private regulation is more flexible in adjusting its standards compared to public regulation and can ratchet up sustainability and legality standards beyond regulatory requirements.

While there is not much innovation in itself about how the EUDR defines the role for third-party verified schemes, the full set of requirements for EUDR operators' DDS pose an innovation impulse, as well as challenge, upon those schemes. Key examples include the new traceability and geolocalisation, as well as data management and due diligence declaration requirements. The EUDR thereby steers the development of innovative solutions addressing complex challenges on supply chain management to halt deforestation and assure legal origin.

To summarise, private regulation can be a good practice to support a company's due diligence system in acquiring information, assessing and mitigating risk, while signalling accountability and sustainability efforts to consumers. By specifying new minimum information requirements for third-party verified schemes, the EUDR ratchets up minimum standards for private regulation (e.g., new geolocation requirement). The change in the regulatory context pressures in a significant way existing certification schemes to offer new services and incentivises the development of new compliance-proving tools (e.g., geolocation traceability tools) and initiatives (e.g. national initiatives in producer countries at jurisdictional or landscape level). Still, third party certification schemes can be subject to severe limitations and hence cannot replace due diligence obligations of economic operators under the EUDR.



5.25 The role of EU-partner country cooperation under the EUDR

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Forestry	Public policy / regulation	Supply-side (Global)	All FRC (beyond EUDR)	Effectiveness Efficiency Feasibility	Relevant
Link to key reference Link to EUDR law text				Link to training video -		
Authors (Institution) Laila Berning, Ulrich Malessa, Metodi Sotirov (University of Freiburg)				Last update May 2024		

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In 2003, the EU adopted the FLEGT Action Plan, which led to the development of two EU laws regulating timber legality. The FLEGT Regulation (Council Regulation No 2173/2005) allows for controlling timber imports to the EU from partner countries that entered into bilateral FLEGT Voluntary Partnership Agreements (VPAs). Partner countries must set up national timber legality licensing and assurance systems (TLAS) to reap EU market benefits under EU-partner country FLEGT VPAs. The EUTR (EU Regulation No 995/2010) is a demand-side legally binding market-correcting trade regulation with the objective of fighting against illegal logging and related trade (Recital 31). The EUTR was adopted in 2010, entered into application in 2013, and will be repealed by the EUDR with effect from 30 December 2024. Compared to the FLEGT Action Plan, the EUDR restricts the recognition of FLEGT licences as a compliance-proving tool. Unlike under the EUTR, FLEGT licences only partially fulfil the EUDR's final market placement conditions and due diligence requirements and are not granted a green-lane to the EU market. FLEGT licences are accepted as proof of the EUDR's legality but not the new deforestation-free standard (Berning & Sotirov, 2023, 2024).

The European Commission's key FLEGT VPA-related concerns included the VPA's limit to legality, which was perceived as incompatible with the non-negotiable approach based on a new deforestation-free definition. The European Commission also raised concerns about implementation shortcomings and major producer countries' unwillingness to negotiate (European Commission, 2021b, 2021c). The recognition of FLEGT-licensed wood as fulfilling the EUDR's legality requirement seeks to respect bilateral commitments with timber-producing countries and to preserve the progress achieved with partner countries that achieved the FLEGT-licensing stage (i.e. Indonesia). Overall, these developments signal a policy shift away from EU-partner country FLEGT VPAs (Berning & Sotirov, 2023, 2024; cf. Zeitlin & Overdevest, 2021). Besides Timber Legality Assurance Systems, the EUDR institutionalised a new partnership and cooperation mechanism without new trade elements. The EUDR made cooperation with partner countries mandatory by stipulating that the Commission, on behalf of the EU, and interested Member States must engage with affected partner countries – particularly high-risk countries – 'to jointly address the root causes of deforestation and forest degradation' (Art. 30). This is implemented through initiatives such as Forest Partnerships and Team Europe Initiatives (European Commission, 2022a, 2023a).

At the 2022 COP 27 UN Climate Change Conference, the Commission President signed Forest Partnership Memoranda of Understanding with five countries (i.e., Guyana, Mongolia, the Republic of Congo, Uganda, and Zambia). The stated policy goal is to establish a holistic cooperation framework to jointly reverse deforestation in supported countries, thereby enhancing climate and biodiversity protection. While every Forest Partnership is tailored to the specific situation and signatory country, the EU seeks mutual political commitments to (1) ensure sustainable forest management by improving forest governance and enhancing the business environment, (2) generate an economic transformation by stimulating the forest bio-economy, (3) reduce deforestation and



forest degradation, and (4) identify ways to facilitate the production of and trade in legal and sustainable forest products (European Commission, 2022a). In 2023, during the COP 28 UN Climate Change Conference, the EU together with Germany, France and the Netherlands, announced the global Team Europe Initiative (TEI) on Deforestation-free Value Chains, offering a platform to enhance coordination amongst all stakeholders in their efforts to combat deforestation, as well as technical assistance and capacity building towards partner governments as well as producers on key issues such as traceability, geo-localisation and land-use mapping (European Commission, 2023a).

Overall, the European Commission seeks to enhance policy effectiveness in tackling deforestation and forest degradation by requesting higher compliance standards (i.e. deforestation-free requirement in addition to legality obligations). The European Commission also seeks to enhance EU-partner country cooperation efficiency and feasibility by transitioning away from the development cooperation-based FLEGT VPA model with trade elements (i.e., green-lane for FLEGT licensed wood) towards a stronger development cooperation-based approach without new trade elements based on experience and learnings with resource-intensive EU-partner country VPA negotiations. The EUDR's new mandatory partnership approach, coupled with high-risk rating-related cooperation (dis-)incentives for partner countries, seeks to incentivise more effective and efficient supply-side initiatives in addressing deforestation, forest degradation and associated human rights violations. Key limitations include risks of deteriorating partnerships based on potential high-risk-rating related dissatisfactions by partner countries (Personal communication with key informants). Additionally, the new partnership agreements might lack relevance and commitment due to lower linkage to trade policies.

While in the precursor regulation, the EUTR, the cooperation was foreseen as a voluntary, but once implemented a legally-binding partnership agreement (FLEGT VPAs), the EUDR foresees a wider, less defined cooperation model. VPAs could still be agreed upon and implemented, but the new approach could be more feasible. This could allow for the development of innovative solutions addressing new and complex challenges, while not representing a direct support for such solutions.

To summarise, supply-side-focused policy and governance initiatives are essential flanking policies and crucial in achieving the overarching, worldwide policy goal of reducing global deforestation, forest degradation and human rights violations. It is still too early to assess the positive and negative implications of policy changes from trade-focused to project-based development cooperation initiatives. The risks of deteriorating cooperation with producer countries need to be addressed to avoid undermining the overarching socio-environmental policy goals.

5.26 Substantiated concerns under the EUDR

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Public policy / regulation			Effectiveness Efficiency Feasibility Limitations Innovation identified	Relevant, with identified limitations
Link to key reference Link to EUDR law text				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Laila Berning, Ulrich Malessa, Metodi Sotirov (University of Freiburg)				Last update May 2024		

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Based on the 'Aarhus Convention' and aligned with the 'whole-of-society' approach of the 'Kunming-Montreal' protocol, the EU strengthened civil society participation and transparency compared to the EUTR to contribute to the EUDR's enforcement by defining substantiated concerns and detailing their respective considerations. The EUDR establishes stricter obligations for competent authorities, operators and traders related to substantiated concerns, defined as 'a duly reasoned claim based on objective and verifiable information regarding non-compliance with this regulation and which could require the intervention of competent authorities' (Art. 2). It can be assumed that this mechanism will be used most frequently by non-state actors such as NGOs or corporate sector professionals. However, it is not restricted, and the public, including natural or legal persons, can submit substantiated concern (Art. 31). Substantiated concerns may support the prescribed risk-based approach to identify the checks to be carried out (Art. 16). Unlike under the EUTR, EU Member States' competent authorities must now assess substantiated concerns and conduct follow-up activities such as checks and hearings of operators and traders (Art. 31). Additionally, competent authorities can take immediate interim measures (e.g. seizures and suspensions) after examining substantiated concerns (Art. 23). Furthermore, operators must now consider substantiated concerns in their risk assessment procedure (Art. 10). Notably, operators and traders must also inform competent authorities and traders to whom they supplied the relevant product about receiving substantiated concerns (Art. 4 and 5).

The strengthened role of non-state actors under the EUDR seeks to enhance regulatory effectiveness and efficiency by facilitating targeted and risk-based inspections through competent authorities, particularly drawing on watchdog competencies by NGOs and others such as trade federations and insiders (informed professionals). The mechanism is expected to enhance the feasibility of identifying and sanctioning non-compliant enterprises more efficiently by institutionalising specified rules about follow-up processes (e.g. inspections and reporting obligations). Furthermore, the access to justice provision grants natural or legal persons the right to challenge the decisions, acts or failures to act of competent authorities (e.g., about checking or not checking an operator) (Art. 32). Additionally, the newly introduced obligations for operators and traders to inform their clients and competent authorities about substantiated concerns seek to enhance transparency about corporate (mis-) conduct along the supply chain (Art. 4 and 5, Berning & Sotirov, 2023, 2024). Key limitations include a potential drastic increase in inspection obligations for competent authorities limiting the execution and quality of inspections and enforcement procedures due to competent authorities' constraints in processing substantiated concerns (Personal communication with key informant).

The EU innovated the design of substantiated concerns as an enforcement-supporting mechanism under the EUDR based on learnings from implementing and enforcing the EUTR, as outlined above. The 2021 EUTR-FLEGT fitness check, for instance, stated that the majority of identified operators and traders were checked and subjected to enforcement actions (European Commission, 2021b). The EU thereby improved the design of future regulations (EUDR) by drawing on experience with implementing and enforcing the EUTR as its precursor legislation.

To summarise, the empowerment and institutionalisation of third parties' rights to scrutinize and held accountable the obligations of competent authorities, operators and traders through substantiated concerns is a crucial mechanism under the EUDR. It may effectively deter public authorities' inaction and corporate non-compliance based on reputational concerns and a higher likelihood of being inspected and fined.



5.27 Direct cocoa supply chains and own plantations: The RitterSport case

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture	Industry self-regulation	Supply-side (Specific countries)	Coffee	Effectiveness Transparency Feasibility Reflexivity Innovation identified	Relevant
Link to key reference Link to company website on sustainability				Link to training video -		
Authors (Institution) Isabell Rzepecki, Stefan Andreas Haas (Open Forest)				Last update August 2024		

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This case study revolves around Ritter Sport, a prominent player in the confectionery industry, focusing on its implementation of deforestation-free supply chains in the cocoa sector. This practice encompasses both the supply side, involving tropical producer countries, and the demand side, within the EU. Ritter Sport's approach to implementing deforestation-free supply chains in the cocoa sector represents a significant innovation in CSR. The company's innovative practices include:

1. Achieving traceability down to the producer organization level, enabling effective monitoring of the cocoa supply chain.
2. Establishing direct partnerships with cocoa producer organizations to implement tailored measures addressing deforestation and climate change impacts.
3. Integrating cultivation with conservation efforts at their El Cacao farm, dedicating nearly half the area to forest and wetlands. These innovations align with the EU Innovation Principle objectives by improving the design of existing regulations (through proactive compliance), addressing complex challenges (like deforestation and climate change), and balancing regulation with progress (by going beyond mere compliance to foster sustainable practices).

Ritter Sport's initiative specifically targets cocoa commodities, highlighting its commitment to ethical sourcing and sustainability throughout its supply chain.

Ritter Sport ensures that its supply chains are free from deforestation through several key measures. Firstly, the company exclusively sources its cocoa from certified sustainable sources, ensuring that its raw materials come from responsibly managed farms (Ritter Sport, 2022, 2024a). Moreover, Ritter Sport has achieved traceability down to the producer organization level, enabling it to monitor and verify the sustainability of its cocoa supply chain effectively. In addition to certification, Ritter Sport goes beyond mere compliance by establishing direct partnerships with cocoa producer organizations in various countries. Through these partnerships, the company implements specific measures tailored to address the impacts of deforestation and climate change on local communities (Hoffmann, 2023).

For example, in collaboration with the Cocoa Abrabopa Association in Ghana, Ritter Sport has implemented programs aimed at diversifying income sources and mitigating the effects of deforestation (Ritter Sport, 2024b; Yumda, 2022). Furthermore, Ritter Sport's commitment to deforestation-free supply chains spans decades, demonstrating its long-standing dedication to sustainability and social responsibility. The company actively supports initiatives such as the Pro Planteur project and is an early member of the Sustainable Cocoa Forum,



further solidifying its role as a responsible corporate citizen. Ritter Sport also aims to achieve complete traceability of its cocoa supply chain by 2025, particularly focusing on partnerships and initiatives in countries like Ivory Coast. By fostering long-standing partnerships with various programs and producer organizations since 2014, the company ensures transparency and sustainability in its cocoa sourcing practices. Moreover, Ritter Sport integrates cultivation with conservation efforts at El Cacao, its cocoa farm, dedicating nearly half of the area to forest and wetlands to safeguard vital ecosystems. As a result, El Cacao not only serves as a productive cocoa farm but also contributes to biodiversity conservation (Ritter Sport, 2024b).

Effectiveness is clearly demonstrated in the establishment of deforestation-free supply chains, showcasing adherence to regulatory standards. Efficiency is highlighted by the company's ability to achieve cost reductions and streamline traceability processes. Transparency is underscored by their direct collaborations with producer organizations, providing accessibility to their sustainable initiatives. Feasibility is illustrated by the social acceptance and political backing garnered by Ritter Sport's endeavours. Reflexivity is evident in the company's aptitude to assimilate lessons from experience and adapt their approaches accordingly. Limitations may arise from resource constraints and knowledge deficiencies in implementing deforestation-free supply chains. Synergies between Ritter Sport's CSR initiatives and technological advancements enable enhanced traceability and partnership facilitation, thereby promoting compliance with regulatory standards.

Ritter Sport's practice can be assessed as a good practice due to its comprehensive approach to implementing deforestation-free supply chains in the cocoa industry. By sourcing cocoa exclusively from certified sustainable sources and fostering direct partnerships with producer organizations, the company ensures positive impacts on social, economic, and environmental conditions in cocoa farming. Their commitment to transparency, as demonstrated through partnerships and traceability initiatives, underscores their dedication to ethical sourcing. Additionally, Ritter Sport's support for supply chain laws and European regulations further solidifies their position as a responsible corporate citizen. Their efforts in integrating cultivation with conservation, as seen in El Cacao, exemplify their commitment to sustainability. Overall, Ritter Sport sets a commendable standard for the food industry, showcasing the possibility of combining economic success with social and environmental responsibility.

5.28 Forest Stewardship Council (FSC)

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance, Technology, CSR	Forestry	Private regulation	Demand-side (Global) Supply-side (Global)	Rubber, Wood, Non-wood forest products	Effectiveness Efficiency Transparency Reflexivity Limitations Innovation identified	Relevant, with identified limitations
Link to key reference Link to the website of FSC on deforestation and degradation				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Isabell Rzepecki, Stefan Andreas Haas (Open Forest)				Last update August 2024		

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The Forest Stewardship Council (FSC) certification serves as a pivotal instrument in ensuring deforestation-free supply chains, falling under the EMMA4EU topical focus of Technology. The certification represents a significant innovation in ensuring deforestation-free supply chains for wood and rubber. Key innovative aspects include:

1. A comprehensive certification system that spans both forest management and chain of custody processes,



ensuring responsible practices from forest to consumer.

2. Rigorous standards that address multiple aspects of sustainability, including biodiversity conservation, indigenous rights, and environmental protection.

3. A global traceability system that enhances transparency throughout the supply chain, allowing consumers and businesses to make informed decisions. These innovations align with the EU Innovation Principle by improving regulation design (through standardized certification), addressing complex challenges (like deforestation and sustainable resource management), and balancing regulation with progress (by adapting to evolving challenges in the forestry sector).

Geographically, FSC certification predominantly operates on the demand side, primarily in consumer countries like those in the EU, while also encompassing supply-side efforts in tropical producer countries. The certification process applies to rubber and wood, which are both commodities addressed in the EUDR. FSC certification entails rigorous assessments of forest management practices and chain of custody procedures, ensuring compliance with strict standards related to biodiversity conservation, indigenous rights, community engagement, and environmental protection. By tracing the flow of certified materials from forest to consumer, FSC certification promotes transparency and responsible sourcing practices throughout the supply chain, ultimately contributing to deforestation prevention and sustainable forest management.

FSC stands as a beacon of excellence in promoting responsible forest management and supply chain transparency. Established in 1993, FSC is an international non-profit organization dedicated to the conservation of forests and the promotion of sustainable forestry practices worldwide. At the heart of FSC's mission lies its certification system, which sets rigorous standards for forest management and chain of custody processes. Forests certified by FSC undergo comprehensive assessments to ensure they meet strict criteria regarding biodiversity conservation, indigenous rights, community engagement, and environmental protection. These standards not only safeguard against deforestation, but also mitigate forest degradation and promote the sustainable use of forest resources. FSC's chain of custody certification extends this commitment to transparency throughout the supply chain. Companies that obtain FSC certification demonstrate their adherence to responsible sourcing practices by tracking the flow of FSC-certified materials from forest to consumer. This ensures that products bearing the FSC label originate from well-managed forests and have been handled responsibly at every stage of production.

The FSC certification serves as a powerful tool for consumers, businesses, and governments alike in their efforts to combat deforestation and promote sustainability. By choosing FSC-certified products, consumers can make informed decisions that support responsible forest management and environmental conservation. Businesses that prioritize FSC certification signal their commitment to corporate social responsibility and environmental stewardship, enhancing their reputation and market competitiveness (FSC, 2024b).

FSC's certification system, which sets rigorous standards for forest management and chain of custody processes, demonstrates its commitment to regulatory compliance. Moreover, FSC's emphasis on transparency ensures participation and public accessibility throughout the supply chain, enhancing accountability and trust. The organization's efficiency is notable, as it strives to lower costs and improve ease of use for stakeholders involved in sustainable forestry practices. FSC's initiatives also focus on feasibility, seeking social acceptance and political support to promote sustainable forestry practices globally. Additionally, FSC exhibits reflexivity, continuously learning from experience and adapting its practices to evolving challenges and opportunities. However, FSC faces limitations, including implementation constraints such as resource and knowledge gaps. Despite these challenges, synergies exist between FSC's practices across compliance, CSR and technology, highlighting opportunities for improvement and innovation in promoting sustainable forest management and deforestation-free supply chains (FSC, 2022, 2024b).

Moreover, FSC certification empowers governments to implement policies and regulations that incentivize sustainable forestry practices and combat illegal logging. By promoting transparency and accountability in



the global timber trade, FSC contributes to the preservation of forests, biodiversity, and the livelihoods of forest-dependent communities. FSC can be viewed as both a good and a bad example in ensuring deforestation-free supply chains. On one hand, FSC has developed a robust certification system that sets rigorous standards for forest management and chain of custody processes (FSC, 2024b). This system aims to promote responsible forestry practices and enhance transparency throughout the supply chain. Companies obtaining FSC certification demonstrate their commitment to sustainable sourcing practices, contributing to forest conservation and community engagement.

Research has demonstrated numerous positive outcomes of FSC certification across various aspects of forest management and conservation. A cross-country analysis found that FSC certification reduces deforestation by 0.25% per unit per year compared to uncertified concessions, equivalent to saving about 125 hectares annually for an average-sized FSC concession (Wolff et al., 2023). This effect becomes more pronounced after the seventh year of certification, indicating long-term benefits (Wolff et al., 2023). FSC certification has led to improvements in human capital, including better working conditions and safety practices for forest workers (Lima de Freitas, 2003). The certification process has also enhanced forest management practices and increased awareness of environmental conservation among smallholders (Lima de Freitas, 2022). In Brazil, FSC certification has helped large companies meet market demands for sustainably sourced timber products and provided a framework for improving supply chain transparency (Lima de Freitas, 2022).

The FSC system provides a common framework for responsible forest stewardship and has been recognized for its comprehensive Principles and Criteria (Ingram et al., 2020). However, recent research (Zwerts et al., 2024) highlights significant challenges in applying FSC certification to Intact Forest Landscapes (IFLs). Their study found that only 0.6% of global IFLs are currently FSC-certified, limiting the direct impact of certification on these critical areas. The concept of 'conservation burden' introduced in their work quantifies the potential impact of IFL protection on forest management operations, revealing complex trade-offs between conservation goals and economic viability.

However, recent scandals have tarnished FSC's reputation and raised doubts about the integrity of its certification process. Instances of fraud and malpractice within FSC's systems have revealed significant shortcomings, including complicity of major corporations in illegal logging and human rights abuses (Earthrights, 2021). The scandals surrounding the FSC certification process are significant and wide-ranging. They include instances of corruption and illegal logging in Europe, where major timber producers like HS Timber Group and Romania's state forest administration agency, Romsilva, have been implicated (Environmental Investigation Agency 2015). Additionally, Ikea, the world's largest furniture retailer, has been linked to illegal logging in Siberia (Earthrights, 2024). Fraudulent practices in the Chinese plywood industry, involving companies like Jiangsu High Hope Arser, have also been uncovered (Environmental Investigation Agency, 2015). Furthermore, major pulp and paper companies such as Asia Pulp and Paper (APP) and APRIL have faced accusations of destroying rainforests in Indonesia (Earthrights, 2021). In Ukraine, state-owned logging companies, along with wood panel and paper giants, have been accused of widespread illegality and corruption, with evidence of timber sourced from FSC-certified logging enterprises being linked to corrupt schemes (Earthrights, 2018). Lastly, in the Congo Basin, logging firms like Siforco and Sodefor, as well as agribusiness Olam, have been implicated in human rights abuses and deforestation, despite holding FSC certification. These scandals underscore significant weaknesses in FSC's certification process, including issues with oversight, transparency, and conflicts of interest (Earthrights, 2021). These scandals have exposed systemic weaknesses within FSC's certification process, such as the failure to detect and address misconduct effectively. As a result, FSC's credibility is increasingly questioned, highlighting the need for reforms to restore trust and ensure the integrity of sustainable forestry certification.

In conclusion, while FSC's certification system aims to promote responsible forestry practices, its track record of scandals raises serious concerns about its credibility and effectiveness in safeguarding forests and communities. Addressing these systemic issues is essential to restoring trust in FSC and ensuring the integrity of sustainable forestry certification.



5.29 Remote sensing based products and services for EUDR

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture Forestry	Data-based Science-based	Demand-side (Global)	All FRC (beyond EUDR)	Efficiency Transparency Innovation identified	Relevant
Link to key reference Many tools are available, no specific source				Link to training video -		
Authors (Institution) Isabell Rzepecki, Stefan Andreas Haas (Open Forest)				Last update February 2024		

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This case study examines the roles of publicly accessible data platforms and commercial remote sensing services in aligning with the EUDR. It assesses their contributions towards compliance, due diligence, and the technological advancements in monitoring deforestation and forest degradation across the EU and tropical producing countries. This covers all commodities covered by the EUDR such as cattle, cacao, coffee, oil palm, rubber, soy, and timber, as well as any other FRC.

The Ideal Data Product for EUDR Compliance: a comprehensive remote sensing data solution meeting EUDR standards would encompass a classification of various forest types (primary, naturally regenerating, plantation, and other wooded lands) as of 2020, with at least annual updates thereafter. Currently, such a globally scoped product remains unavailable in the public domain.

Examples of public Data Platforms and Services:

Global Forest Watch (GFW): An open-source web application that provides data and tools for monitoring forests. It allows users to access near-real-time information about where and how forests are changing around the world. The public platform lacks data to identify natural and non-natural forest types on a global scope yet (Global Forest Watch, 2024).

EU Forest Observatory (EUFO): A platform designed to support the EU's efforts in monitoring forests and forestry activities. It aims to provide comprehensive data on forest cover, health, and management practices across Europe. The tools that are publicly available at the moment require GIS expert users (European Commission, 2019a; Joint Research Centre, 2024).

Natural Lands Map: A map product driven by the SBTN (Science Based Targets Network) that offers detailed information on natural and non-natural landscapes, including forest types and land use changes. It's aimed at supporting conservation efforts and providing insights into natural habitat distributions (Mazur et al., 2023; SBTi, 2023).

Examples of commercial Remote Sensing Services:

KANOP: A commercial service that offers high-resolution satellite imagery and analytics for forest monitoring. It specializes in detecting changes in forest cover and biomass and providing data for compliance and conservation purposes (Kanop, 2024).

NADAR: A new commercial remote sensing service providing custom geospatial data analysis on a site basis, tailored to EUDR due diligence and compliance (Busse, 2024).

Chloris Geospatial: A service that offers advanced remote sensing and geospatial analysis for various sectors,



including forestry. It provides insights into vegetation health, land use changes, and deforestation activities. (Chloris Geospatial, 2022)

In navigating the landscape of options for EUDR compliance, commercial entities stand out for their effectiveness in providing bespoke, high-resolution insights tailored to fulfill customers' reporting needs. However, open data services, while offering wide-ranging monitoring capabilities, lack the EUDR-specific differentiation required for full due diligence. This gap is partially addressed by the SBTN Natural Lands Map, bridging the divide between generic monitoring and EUDR compliance (Busse, 2024; Global Forest Watch, 2023, 2024).

Efficiency is a critical consideration, with commercial platforms offering in-depth intelligence but demanding significant resources. In contrast, open data services are more budget-friendly but may require additional processing and a deeper understanding of the data for EUDR compliance (Joint Research Centre, 2024; Vogt & Caudullo, 2022). Transparency is paramount for supply chain visibility. While open data platforms openly document their methodology and accuracy, commercial services may sacrifice full methodological transparency to safeguard proprietary interests while delivering detailed compliance data. Feasibility presents a trade-off between cost and comprehensiveness. Commercial solutions offer comprehensive compliance support but at a higher cost, whereas platforms like the EU Forest Observatory provide free but less tailored data, with accessibility challenges for non-GIS experts. Reflexivity or adaptability to new technologies and regulations, favors commercial services, which can swiftly adjust to evolving requirements. In contrast, open data platforms, such as the EU Forest Observatory, may lag behind in providing EUDR-specific updates, despite aiming for global coverage.

The competitive landscape sees commercial services offering precision and enhanced usability, albeit with higher costs, contrasting with open platforms that, despite promising global, transparent, and free solutions like the EU Forest Observatory, fall short of current user needs for EUDR compliance. The enduring relevance of commercial offerings hinges on their ability to lower costs while providing a superior user experience that negates the need for expert interpretation, thereby mitigating compliance risks. This balance of cost-effectiveness and user-centric design is pivotal in navigating the complexities of EUDR compliance.

5.30 Explorer.land (Map-based data & story-telling for more transparency)

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology CSR	Agriculture Forestry	Data-based	Demand-side (Global) Supply-side (Global)	All FRC (beyond EUDR)	Effectiveness Transparency Feasibility Innovation identified	Relevant
Link to key reference explorer.land website				Link to training video -		
Authors (Institution) Isabell Rzepecki, Stefan Andreas Haas (Open Forest)				Last update February 2024		

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Explorer.land is specifically designed as a digital tool to enhance transparency in nature-based projects by showcasing spatial data, primarily through the mapping of polygons that represent production or intervention sites (OpenForests, 2024a, 2024b). This platform integrates global data layers on land use and deforestation, enabling users to analyse the historical context of land use and deforestation within project areas. Such a feature is invaluable for brands looking to conduct internal analyses or to publicly demonstrate their commitment to



sustainability and deforestation-free initiatives to stakeholders, including end consumers. This approach directly contributes to the broader objectives of Corporate Social Responsibility (CSR) by leveraging technology to support transparency in environmental and sustainability efforts. While explorer.land is not limited to a specific geographical focus, its utility is global, with significant implications for both supply-side (tropical producer countries) and demand-side stakeholders (e.g., EU markets) concerned with deforestation and environmental sustainability.

Explorer.land effectively supports the implementation of environmental and sustainability standards by providing a platform for transparently sharing project impacts and locations. Its effectiveness, particularly in enhancing transparency, is heightened when brands and projects use it to communicate their deforestation and land use practices to a broader audience. Offering a streamlined approach to accessing and presenting complex spatial data, the platform reduces the need for extensive manual data gathering and analysis, thus improving efficiency. Facilitating increased transparency and stakeholder engagement in environmental projects, explorer.land makes project data publicly accessible, demonstrating its commitment to transparency. Demonstrating its social acceptance and the growing political and market support for transparency and sustainability, the adoption of explorer.land by nature-based projects and brands is evident, highlighting its feasibility. Reflecting its adaptability and responsiveness to user needs and environmental changes, the platform's capacity to integrate and present evolving data on land use and deforestation is noteworthy, showcasing its reflexivity. However, potential challenges such as ensuring the comprehensiveness and accuracy of the provided data layers, as well as the technical capacity of users to interpret and utilise the information effectively, should be acknowledged.

Given its design and applications, explorer.land can be considered a good practice in the context of promoting transparency and trust in nature-based projects. The platform directly addresses the need for accessible and reliable data on land use and deforestation, critical factors for stakeholders in assessing the sustainability and environmental impact of projects. By facilitating the visual presentation of this data, explorer.land enhances the ability of brands and projects to communicate their commitment to deforestation-free and sustainable practices. However, the platform's overall impact is contingent upon its widespread adoption, the continuous updating and accuracy of its data layers, and the engagement of its users in leveraging this tool for meaningful transparency and accountability. In summary, while explorer.land presents a valuable tool for enhancing CSR and sustainability reporting, its effectiveness is ultimately dependent on how it is integrated into broader environmental governance and stakeholder engagement strategies.

5.31 ELAN platform by Global Nature Fund and OroVerde

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance CSR	Agriculture Forestry	Other approach: Guidance	Supply-side (EU)	All FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations	Relevant, with identified limitations
Link to key reference Elan! platform website				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Isabell Rzepecki, Stefan Andreas Haas (Open Forest)				Last update February 2024		

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The Global Nature Fund (GNF) is an international non-profit founded in 1998, dedicated to promoting sustainable development and biodiversity conservation globally. Operating from its headquarters in Germany, with offices in Bonn and Berlin, GNF focuses on project implementation, advocacy, capacity building, and awareness initiatives to address environmental challenges (Global Nature Fund, 2024).

OroVerde - The Tropical Rainforest Foundation, established in 1989 in Bonn, Germany, is committed to tropical forest conservation and biodiversity preservation through projects in sustainable land management, reforestation, and environmental education, collaborating with local partners for a sustainable future (OroVerde, 2024).

GNF and OroVerde - The Tropical Rainforest Foundation, both dedicated to environmental conservation, jointly developed the ELAN tool. This collaborative effort aims to assist companies in transitioning to deforestation-free supply chains, reflecting their shared commitment to sustainability and biodiversity preservation. Operating globally, GNF and OroVerde leverage their expertise and resources to address environmental challenges and promote responsible business practices for a more sustainable future (OroVerde & Global Nature Fund, 2024).

The ELAN tool falls under the category of Compliance and CSR within the EMMA4EU framework. It serves as a comprehensive online platform designed to support businesses in achieving compliance with the European Union Due Diligence Regulation (EUDR) by facilitating the transition to deforestation-free supply chains. With a geographical focus on the supply side, particularly tropical producer countries, the tool addresses the complexities of ensuring sustainability in the production of all the commodities which are part of the EUDR (cocoa, rubber, coffee, wood, soy, palm oil and beef). By offering guidance on strategy development, risk analysis, monitoring, and resource access, the ELAN tool empowers companies to adopt responsible business practices and contribute to biodiversity preservation and environmental conservation.

It serves as a comprehensive online platform to aid companies in transitioning towards deforestation-free supply chains. It is meticulously designed to tackle the complexities and challenges inherent in ensuring sustainability and combating deforestation in global supply chains. The tool offers several key functionalities. Firstly, it assists companies in formulating strategies to combat deforestation, providing crucial information on regulatory requirements, definitions of deforestation, responsibilities, objectives, and climate protection measures. A core feature of ELAN is its ability to help companies identify and mitigate specific deforestation risks within their supply chains. It offers insights into supply chain traceability, risk commodities and regions, available tools, certifications, and multi-stakeholder initiatives (OroVerde & Global Nature Fund, 2023).

It focuses on effectiveness by aiding companies in implementing the regulatory standards outlined in the European Union's Deforestation Regulation (EUDR), ensuring compliance and accountability throughout the supply chain. Secondly, the tool enhances efficiency by streamlining processes, resulting in lower costs and facilitating ease of use for businesses navigating complex supply chain requirements. Additionally, ELAN promotes transparency by encouraging participation and providing public accessibility to information regarding deforestation-free practices, fostering trust and accountability among stakeholders. Furthermore, the tool evaluates feasibility by considering factors such as social acceptance and political support, ensuring that strategies align with societal expectations and regulatory frameworks. Lastly, ELAN enhances reflexivity by enabling companies to learn from experience, adapt their practices, and continuously improve their approach to achieving deforestation-free supply chains, thus contributing to long-term sustainability goals. However, the tool faces limitations such as resource constraints, knowledge gaps, the complexity of supply chains, and challenges in achieving social and political consensus.

While the ELAN portal offers valuable resources for companies seeking to transition to deforestation-free and sustainable supply chains, its practical application falls short, particularly in addressing the diverse needs of users. Despite providing essential information and promoting transparency, ELAN's navigation challenges, generic recommendations, and limited functionality detract from its effectiveness as a step-by-step navigational tool. Even though the platform still has its shortcomings, ELAN serves as a recommended first starting point for companies



committed to improving their supply chain sustainability. Further improvements are necessary to make it a practical tool that gains wider reach.

5.32 Ensuring inclusion of compliant smallholders

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance	Agriculture	Industry self-regulation	Supply-side (Specific countries)	Coffee, Cocoa	Effectiveness Efficiency Feasibility Limitations	Relevant
Link to key reference -				Link to training video -		
Authors (Institution) Kristjan Jespersen, Kedar Uttam (Copenhagen Business School)				Last update November 2024		

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Coffee cultivation is responsible for a large amount of deforestation, with an annual loss of roughly 130,000 hectares of forest due to land conversion (Coffeebarometer, 2024). To adhere to EUDR regulation, coffee importing companies can adopt the practice of refraining from sourcing coffee originating from deforested regions. Major coffee players such as the Netherlands-based JDE Peets are planning to potentially exclude certain smaller coffee producing countries and smallholders from supply chains if they cannot show that their coffee was not grown on deforested land. However, this has put small-scale coffee farmers in Africa and especially Ethiopia at risk (Angel & Kurniawati, 2023). Coffee cultivation is mostly done on small-scale farms, with about 12.5 million farms worldwide that have only a few hectares of land each. 95% of coffee farms are under 5 hectares, and 84% are under 2 hectares (Coffeebarometer, 2024).

The EUDR mandates that businesses digitally outline their supply chains, extending the mapping process to the specific geo-locations where raw materials originated. Providing such geo-located data could encompass tracing numerous small coffee farms in remote areas. As companies frequently lack direct interactions with farmers, they may depend partly on information from various local intermediaries, some of whom they neither directly engage with nor completely trust (Angel & Kurniawati, 2023). This could make the practice of excluding non-compliant farmers less transparent, as the information that connects farmers to sustainability and forest status in coffee growing areas might not be reliable. The efficiency of the practice is also questionable since poor internet access in some developing countries hinders the mapping process. Additionally, challenges such as disputes over land ownership, inadequate law enforcement, and incidents of clan violence pose risks in gathering data on farm ownership (Angel & Kurniawati, 2023). While it might seem like the practice enables adherence to EUDR, the effectiveness to tackle deforestation might be jeopardised if certain companies choose to redirect raw materials from countries facing compliance challenges to markets outside the EU (Birrmetrics, 2023).

The social acceptance of the practice and its feasibility depends largely on the number of farmers who are able to demonstrate compliance and adapt to the new regulation. Hence, there needs to be adequate infrastructure and support to facilitate farmers' compliance. While examples of coffee unions and farmers in Africa implementing environmental standards can be found, there are millions of other coffee farmers across Africa who if left behind might eventually look for alternative markets (Ghaedi, 2024). This might impede the objective of protecting biodiversity and forests in producing countries. Transitioning from coffee to the case of cocoa in Ivory Coast, approximately 20-30% of the cocoa is cultivated in protected forests by nearly one million individuals, raising concerns about potential social unrest if their livelihoods are jeopardised. Relocating them poses practical challenges that would



require substantial funding and support (Angel & Kurniawati, 2023). This underscores the need for initiatives such as The Team Europe Initiative (TEI) on deforestation-free value chains, unveiled at COP28.

TEI aims to offer increased technical support and capacity building to partner governments, companies, and producers. This initiative involves the Sustainable Agriculture for Forest Ecosystems (SAFE) program, co-financed by the European Commission and the German Federal Ministry for Economic Cooperation and Development, and potential funding for scaling up from the Netherlands. SAFE implements its activities in Brazil, Ecuador, Indonesia, and Zambia, with plans to include the Democratic Republic of the Congo and Vietnam in 2024. The SAFE project focuses on assisting smallholders in transitioning to sustainable, deforestation-free value chains and helping producing countries prepare for the EUDR. Additionally, a new Technical Assistance Facility dedicated to deforestation-free value chains will be introduced in 2024, providing flexible support and expertise tailored to partner countries' specific needs, including areas such as needs assessments, geolocation, land-use mapping, and traceability systems (European Commission, n.d.).

While this alignment of financial resources and technical support is designed to enable smallholders to comply with EUDR, it is crucial to recognize that failure to meet the required standards, despite the support, could lead to the unintended consequence of exclusion of smallholder farmers from value chains. Such exclusion would have significant economic and social impacts, making it essential to take proactive steps to minimise the financial risks smallholders face during this transition. Therefore, the barriers they may encounter such as limited access to technology or knowledge, high costs of compliance, or challenges in land-use verification must be carefully addressed.

Ultimately, the inclusion of compliant smallholders is not just a goal but a necessity for the success of deforestation-free value chains. Their livelihoods and the broader sustainability of coffee cultivation depend on ensuring that they are equipped to meet the evolving demands of global markets without being left behind.

5.33 Mass balance

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology	Agriculture Forestry	Private regulation	Supply-side (Global)	All FRC (beyond EUDR)	Efficiency Limitations	Has relevant limitations
Link to key reference Subsite of the RSPO website on supply chain models				Link to training video www.emma4eu.eu/learn/case-studies/		
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The mass balance (MB) approach permits the blending of certified and non-certified products. However, it does not ensure traceability to the source and requires extra due diligence to verify if the non-certified volumes in the supply chain are free from deforestation or conversion-related activities (CDP, 2024; European Commission, n.d.). It is utilized in several established programs focused on sustainable and/or responsible sourcing, such as the Forest Stewardship Council (FSC), the Better Cotton Initiative (BCI) and the Roundtable on Sustainable Palm Oil (RSPO). This case will look into the RSPO example.

The RSPO employs a MB model as a strategy for sustainability labelling in which certified and conventional palm oil are mixed. Quantities are controlled and closely monitored to ensure that the volume of certified product sold aligns with the quantity introduced into the supply chain. Products carry the RSPO MIXED label when they contain certified sustainable palm oil (CSPO) drawn from the MB model. MB model helps in reducing segregation



and transaction costs while capitalising on economies of scale and efficiency gains. Although advantageous for suppliers, the MB model diminishes market transparency for consumers, as the actual amount of CSPO in a product becomes uncertain due to the mixing of certified and conventional sources (Gassler & Spiller, 2018).

The proponents of the MB model argue for the pragmatic adoption of MB as a means to foster inclusive transformation in production and consumption markets. Their stance emphasises the need to avoid letting perfection impede progress, advocating for a balanced approach. Whereas the opponents contend that the EUDR must prohibit the adoption of MB by operators, claiming that it falls short in ensuring that commodities and products entering the EU market remain untethered to deforestation or forest degradation (The sustainable palm oil choice, 2022).

In terms of MB model's social acceptance and considering the feasibility criteria, Gallemore & Jespersen (2019) highlighted the struggle faced by manufacturers under the MB approach in ensuring that all aspects of social and environmental requirements are met, especially since customers require detailed information concerning traceability and transparency within supply chains. They also noted how palm oil processors and traders complained of having problems balancing production based on customers' demand which requires traceable oil only instead of RSPO MB products.

According to a choice experiment by Gassler & Spiller (2018), consumers expressed a preference for over half of the palm oil in a certified product to originate from certified sustainable sources. The RSPO 50% MIXED label runs counter to these preferences. A partial product claim allowing the use of 50% palm oil from MB supply chains cannot reliably ensure a physical CSPO content of 50% in a specific consumer good. This label may mislead consumers, who are prone to associating the indicated percentage on the product label with the actual physical palm oil content.

The concept of MB does not effectively support or contribute to the EUDR based on several key criteria: effectiveness, efficiency, transparency, reflexivity, limitations, and feasibility.

From an **effectiveness** standpoint, the mass balance approach falls short in addressing the primary goal of the EUDR, which is to ensure that commodities entering the EU market are free from deforestation and forest degradation. By allowing the blending of certified and non-certified products, the MB model dilutes the traceability of products to their source, making it difficult to verify whether non-certified volumes in the supply chain are truly free from deforestation or conversion-related activities (CDP, 2024; European Commission, n.d.). This lack of traceability undermines the fundamental objective of the EUDR to eliminate deforestation-linked products from the EU market.

In terms of **efficiency**, the MB model may provide benefits, such as reducing segregation costs and capitalizing on economies of scale, which are attractive to suppliers and industries like the RSPO. However, these efficiency gains come at the expense of the regulation's core intent. The efficiency of blending certified and non-certified products does not compensate for the additional burden placed on operators, who must perform extra due diligence to verify whether non-certified volumes are deforestation-free. This additional verification process adds complexity and uncertainty, limiting the model's overall efficiency when applied within the framework of the EUDR.

Transparency is another area where the MB model is fundamentally incompatible with the EUDR. The mixing of certified and conventional products under the mass balance system leads to ambiguity, as consumers and regulators cannot clearly determine the proportion of deforestation-free content in a given product. For example, under the RSPO's MB model, products can carry the RSPO MIXED label, but the actual physical content of CSPO in those products is uncertain. This lack of transparency not only diminishes consumer trust but also runs counter to the EUDR's requirement for clear and reliable information on product origins (Gassler & Spiller, 2018).

In terms of **reflexivity**, while the MB model's proponents argue for its pragmatic application as a means to foster gradual transformation in production and consumption markets, this argument conflicts with the EUDR's stricter standards. The call for "not letting perfection impede progress" reflects a trade-off between incremental change



and regulatory compliance. However, given that the EUDR mandates that products entering the EU must be verifiably deforestation-free, the MB model's reliance on partial claims of sustainability does not sufficiently meet this reflexivity criterion. The MB model's flexible approach may work in some voluntary sustainability programs but is inadequate in the context of binding regulation like the EUDR.

The **limitations** of the MB model are starkly highlighted when examining its failure to meet the EUDR's specific requirements. The EUDR prohibits the use of supply chains that allow the mixing of deforestation-free and potentially deforestation-linked commodities, as such practices obscure the origins of products. This renders the MB model non-compliant with the regulation, as it does not guarantee that the products placed on the EU market are entirely deforestation-free. The MB model's inherent limitation in ensuring full traceability to deforestation-free sources makes it unsuitable for contributing to the EUDR's goals (European Commission, n.d.).

Lastly, regarding **feasibility**, while the MB model might be feasible for industries like palm oil under programs like RSPO, its implementation within the EUDR framework would require substantial modifications to supply chain practices. Segregation of deforestation-free commodities at every step of the supply chain would increase costs and complicate logistics. Additionally, manufacturers have expressed concerns about the MB model's inability to meet consumer demands for traceable and transparent products. The study of Gallemore and Jespersen (2019) illustrates how manufacturers struggle to balance production under the MB system, especially as customers demand fully traceable oils rather than MB-labelled products.

In conclusion, the mass balance model, while offering some benefits in terms of cost-efficiency and scalability, does not align with the stringent requirements of the EUDR. Consequently, commodities must be segregated from those of unknown origin or non-deforestation-free commodities at every step of the supply chain (European Commission, n.d.). Its lack of traceability, transparency, and full alignment with the EUDR's goals of deforestation-free products makes it an inadequate approach. Thus, the MB model should not be adopted under the EUDR framework if the EU is to meet its objectives of eliminating deforestation-related commodities from its market.

5.34 Conservation liability in the palm oil industry

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture Forestry	Industry self-regulation	Supply-side (Global)	Palm oil	Effectiveness Efficiency Transparency Feasibility Reflexivity Limitations	Relevant, with identified limitations
Link to key reference -				Link to training video -		
Authors (Institution) Kristjan Jespersen, Kedar Uttam (Copenhagen Business School)				Last update November 2024		

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This case is based on a study conducted by Pasaribu et al. (2023) that developed an approach connecting conservation financing with the business value chain, with an emphasis on the environmental risk of deforestation. The key strategy involves connecting sourcing areas to downstream firms' conservation liability. This approach enables businesses to evaluate sourcing risks and potentially assign conservation responsibilities based on their sourcing footprint.



Efforts to calculate a firm's conservation finance liability, as demonstrated in the study by Pasaribu et al. (2023), provide a structured approach to quantifying deforestation impacts at the site level, specifically in production areas such as plantations. The first step in their methodology involves the quantification of deforestation occurring within the production sites, which is highly relevant to the EUDR's objectives of eliminating deforestation-linked commodities from the EU market. By measuring site-specific impacts, particularly at the plantation level, the methodology offers **effectiveness** in assessing the environmental risks associated with firms' sourcing strategies.

This data is critical in contributing to the **transparency** required by the EUDR, as it enables firms to report on the deforestation impacts linked to specific locations where they source their raw materials. By providing measurable, verifiable data on deforestation rates within concessions, companies can more accurately assess their environmental footprint. Furthermore, such detailed reporting supports compliance with the EUDR, which mandates that companies ensure commodities entering the EU are deforestation-free.

In terms of **efficiency**, quantifying deforestation at the production site level streamlines the process for firms to calculate their conservation finance liability. Rather than relying on broad estimates of environmental impact, this methodology allows companies to pinpoint deforestation impacts at the source, thereby making it easier to allocate conservation responsibilities proportionally based on actual site-specific data. This targeted approach enhances resource allocation and reduces the need for broader, more costly assessments across entire supply chains.

The methodology also demonstrates **reflexivity**, as it enables firms to integrate environmental impact assessments into their broader sustainability and Corporate Social Responsibility (CSR) strategies. By understanding the deforestation risks associated with particular sourcing areas, companies can make more informed decisions about where to source from and how to mitigate their environmental impact. This aligns with the EUDR's aim to not only prevent deforestation but also promote more sustainable sourcing practices among European enterprises.

However, there are **limitations** to this approach, particularly in how it calculates conservation finance liability based solely on deforestation within concessions. While this focus is aligned with the EUDR's immediate concerns, it does not account for other environmental impacts such as biodiversity loss or the degradation of ecosystem services. These broader ecological factors are also critical to long-term sustainability and could be included in a more comprehensive assessment of environmental liability.

From a **feasibility** standpoint, the approach is practical for firms seeking to comply with the EUDR. The use of quantifiable, site-specific deforestation data simplifies the process of environmental reporting, making it more feasible for companies to meet the regulatory requirements of the EUDR. However, the scalability of this methodology may present challenges, particularly for firms with complex supply chains that source from multiple regions or countries with varying environmental risks.

In conclusion, the first step of the methodology outlined by Pasaribu et al. (2023), which involves quantifying deforestation at the site level, provides an effective, transparent, and feasible approach to calculating firms' conservation finance liabilities in relation to the EUDR. While it has limitations in addressing broader environmental impacts, it offers a practical starting point for firms to assess their environmental risks and align their sourcing strategies with the EUDR's stringent deforestation-free requirements.

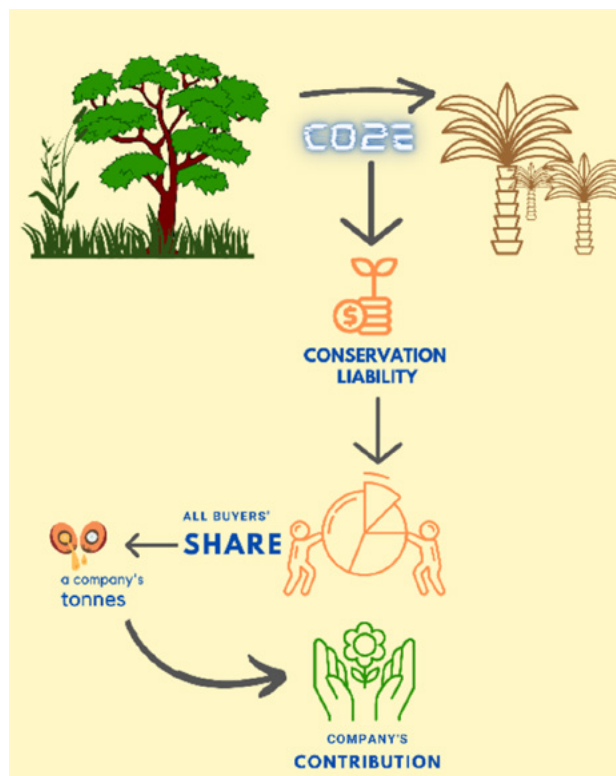


Figure 8: Conservation liability model in the palm oil industry. Source: Pasaribu et al. (2023)

5.35 Artificial intelligence applications aimed at curbing deforestation

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Technology	Agriculture Forestry	Data-based Science-based Technology		All FRC (beyond EUDR)	Effectiveness Efficiency	Relevant, with identified limitations
Link to key reference -				Link to training video -		
Authors (Institution) Kristjan Jespersen, Kedar Uttam (Copenhagen Business School)				Last update November 2024		

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Technological Solutions: curbing illegal deforestation remains a significant challenge due to the lack of robust and readily accessible data on forest cover and change. While advancements in satellite technology offer real-time monitoring and detailed surveillance capabilities, the sheer volume of data generated by drone surveys and satellite imagery presents new obstacles: slow, labour-intensive, and expensive processing. This section explores the potential of Artificial Intelligence (AI) as a tool for addressing these challenges within the framework of ecological economics (Gallemore et al., 2022).

Opportunities:

- **Enhanced Accuracy:** AI algorithms like Convolutional Neural Networks can significantly improve forest monitoring accuracy. Examples include data science companies achieving human-level accuracy (85%) in identifying plant and tree species from image data.



- **Real-Time Monitoring:** Organizations like Rainforest Connection (RFCx) utilize AI-powered acoustic monitoring systems to detect sounds of chainsaws and provide real-time alerts to rangers, aiding in the swift apprehension of illegal activities. This approach also contributes to wildlife protection by creating a cloud-based database of animal sounds for research and conservation efforts (Shivaprakash et al., 2022).
- **Improved Data Reliability:** Initiatives like Global Forest Watch (GFW) integrate AI with crowdsourcing platforms, allowing individuals to contribute to tree-counting efforts and enhancing forest management and illegal deforestation tracking (Shivaprakash et al., 2022).
- **Faster Data Analysis:** AI can significantly expedite data analysis, enabling near-real-time identification of deforestation hotspots. GFW's platform, for example, uses AI to analyze satellite data and pinpoint locations requiring immediate law enforcement intervention (Shivaprakash et al., 2022).
- **Capacity Building:** AI-powered monitoring systems can empower local communities. The Temb  people in Brazil, in collaboration with RFCx, utilize AI-powered alerts to identify illegal logging, poaching, and smuggling activities, enabling them to protect their territory (Shivaprakash et al., 2022).

Ecological Considerations: while AI presents promising solutions, critical considerations are crucial from an ecological economics perspective:

- **Equity and Accessibility:** Unequal access to technology and data could exacerbate existing inequalities and marginalization of local communities. Equitable technology sharing and capacity building are essential for inclusive conservation efforts (Teixeira et al., 2023).
- **Sustainability and Ethical AI Development:** The environmental impact of AI development and implementation needs careful consideration. Renewable energy sources should power AI systems, and data collection practices must adhere to ethical standards and respect for indigenous knowledge and rights (Teixeira et al., 2023).
- **Addressing Underlying Causes:** AI-powered monitoring remains a tool, not a solution in itself. Addressing the root causes of deforestation, such as poverty, corruption, and unsustainable resource management practices, requires holistic and multi-pronged approaches (Gallemore et al., 2022).

By acknowledging these considerations, the application of AI within the framework of ecological economics can be leveraged to achieve long-term success in combating deforestation while promoting sustainable and equitable forest management.

5.36 Payment for Ecosystem Services

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture Forestry	Private regulation	Supply-side (Global)	All FRC (beyond EUDR)	Effectiveness Efficiency Limitations	EUDR not in focus / has a wider/different scope
Link to key reference -				Link to training video www.emma4eu.eu/learn/case-studies		
Authors (Institution) Kristjan Jespersen, Kedar Uttam (Copenhagen Business School)				Last update November 2024		

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While Payment for Ecosystem Services (PES) programs offer promising incentives for combating deforestation, a nuanced understanding of their potential and limitations is crucial. PES programs offer financial compensation to individuals, communities, or landholders who engage in activities that conserve and protect ecosystems. In the context of deforestation, this translates to payments for:

- **Preserving Standing Forests:** Monetary rewards incentivize the protection of existing forests, encouraging long-term conservation over short-term economic gains from activities like timber extraction (Wunder et al., 2008).
- **Reducing Deforestation Rates:** PES programs can provide financial support to communities or regions actively reducing deforestation, fostering positive behavioral changes and promoting sustainable land management practices (Chan et al., 2017; Wunder et al., 2008).
- **Engaging in Sustainable Forest Management Practices:** PES can incentivize practices that maintain forest health and ecosystem services in the long term. This could involve rewards for selective logging, agroforestry, or implementing fire management protocols (Chan et al., 2017).

There is a wider logic behind PES, beyond the direct payment and monitoring mechanism:

- **Enhance Economic Viability of Forest Protection:** PES programs can counterbalance the short-term economic allure of activities like agriculture or resource extraction, making forest conservation a more viable option for individuals and communities (Chan et al., 2017).
- **Encourage Behavioral Shifts:** The promise of financial rewards can incentivize individuals and communities to modify their land management practices towards sustainable forest protection (Wunder et al., 2008, 2020).
- **Promote Responsible Land Stewardship:** PES programs can foster long-term sustainability by encouraging responsible land management practices that ensure the continued health and ecological services provided by forests (Chan et al., 2017; Wunder et al., 2008).

While PES offers valuable tools, Chan et al. (2017) mention several challenges that warrant consideration, in order to tackle the limitations and challenges:

- **Displacement or Leakage:** PES programs can lead to unintended consequences, such as 'leakage,' where deforestation simply shifts to other locations if not addressed comprehensively.
- **Equity and Accessibility:** Poorly designed PES programs can exacerbate existing inequalities if they fail to consider social justice and equitable distribution of benefits. This underscores the importance of inclusive program design and ensuring vulnerable communities are not negatively impacted.
- **Monitoring and Enforcement:** Effective monitoring and enforcement are crucial to ensure that PES funds are utilized for their intended purpose, and that deforestation is demonstrably reduced. Robust monitoring systems and transparent enforcement mechanisms are essential for program success.
- **Limited Applicability:** PES might not be suitable in all contexts, particularly in areas with weak governance or unclear land rights. Successful implementation requires strong governance structures and secure land tenure for program participants).

PES programs are most effective when combined with other strategies, such as:

- **Strong Legal Frameworks:** Clear and well-enforced laws and regulations prohibiting illegal deforestation provide a vital foundation for PES programs to operate effectively (Chan et al., 2017).
- **Improved Governance:** Effective governance fosters transparency, accountability, and participation in decision-making processes, ensuring that PES programs operate equitably and efficiently (Wunder et al., 2008, 2020).



- **Promoting Sustainable Livelihoods:** Providing alternative income opportunities for local communities can alleviate pressure on forest resources and incentivize participation in conservation efforts (Chan et al., 2017).

While PES programs present a valuable tool for combating deforestation, their effectiveness hinges on careful design, implementation, and monitoring. By acknowledging limitations and integrating PES within a broader strategy that promotes responsible land management, sustainable livelihoods, and strong governance frameworks, PES can be a powerful tool for achieving long-term forest conservation and enhancing ecosystem services.

5.37 Selo Verde

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Public policy / regulation Private regulation	Supply-side (Specific countries)	Cattle, Coffee	Effectiveness Transparency Limitations	Relevant, with identified limitations
Link to key reference Selo Verde Pará (Version 2.3)				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Rita Raleira, Joana Faggin (AidEnvironment)				Last update August 2024		

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Summary of the case study: Selo Verde is a public and transparent traceability system, with an openly available platform, that cross-references data on agricultural production and socioenvironmental compliance of rural properties. It was launched in 2021 in cooperation between state agencies (SEMAS in Pará and IEF in Minas Gerais state), Universidade Federal de Minas Gerais (UFMG), and Centro de Inteligência Territorial (CIT), with the support of Norway's International Climate and Forest Initiative (NICFI), Climate and Land Use Alliance (CLUA), and Amazon Web Services. The platform integrates public information on land use from several federal, state, and municipal governmental agencies to assess occurrences of illegal deforestation, environmental irregularities, and land tenure, creating a transparent traceability system of commodities, among other agriculture practices (Tulio & Nascimento, 2022).

Specifically, the Selo Verde Platform:

- Integrates daily data from 30 datasets produced by 12 governmental agencies ;
- Identifies environmental irregularities and land tenure issues;
- Assesses compliance with the Brazilian Forest Code and other socio-environmental legislation;
- Assesses compliance with the Monitoring Protocol for Cattle Suppliers in the Amazon, developed by the Federal Prosecutor's Office (Ministério Público Federal or MPF) as part of the Conduct Adjustment Term (TAC in Portuguese);
- Traces direct and indirect suppliers/producers of the commodities covered (cattle and coffee).

⁵ Secretaria de Estado de Meio Ambiente e Sustentabilidade do Pará (Environmental State Agency of Pará)

⁶ Instituto Estadual de Florestas de Minas Gerais (State Forest Institute of Minas Gerais)

⁷ Such as Secretaria de Meio Ambiente e Sustentabilidade do Pará (SEMAS)/ Instituto Estadual de Florestas de Minas Gerais (IEF), Instituto de Terras do Pará (ITERPA), Agência de Defesa e Agropecuária do Pará (ADEPARÁ), Instituto Nacional de Pesquisas Espaciais (INPE), Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), MapBiomias, Instituto Nacional de Colonização e Reforma Agrária (INCRA), and Fundação Nacional dos Povos Indígenas (FUNAI);



Innovation

The Selo Verde platform promotes transparency and traceability being an innovative tool to promote the *balance between new technologies and the EUDR implementation*. In the cattle sector and it starts its implementation in Pará, one of the largest cattle producing states in Brazil. Its implementation is already extended into Minas Gerais state, covering also coffee, and other states have already expressed their interest to implement it as well. The platform is a good example of balance between the Brazilian cattle regulatory environment and the technological progress. It merges real-time datasets with information from different state agencies, universities, and civil society organizations into a single open access platform.

Evaluation against assessment criteria

Effectiveness: The Selo Verde platform is well-aligned with the requirements of the EUDR, and it was developed with the aim to also respond to such demand-side regulations (Lopes Machado, et al., 2023). In the case of the cattle supply chain, even though only properties of direct suppliers can be consulted in the platform, the analysis indicates the presence of non-compliant suppliers up to the fifth tier of indirect suppliers (ADP secretariat et al., 2023). This allows for an analysis of the socio-environmental status of properties of direct and indirect cattle suppliers. However, two shortcomings can be identified regarding EUDR requirements. First, the traceability system used by Selo Verde in the cattle sector focuses on the movement of groups of animals, not allowing for single animals to be traced to their specific plots of land of production, as required under the EUDR (ADP secretariat et al., 2023). Second, besides checking if commodities were produced in areas infringing legal parameters such as environmental regulations, land rights and slave-like labour, Selo Verde does not offer any further information on all EUDR requirements on legal compliance (ADP secretariat et al., 2023).

Efficiency: Selo Verde is a publicly accessible platform and does not require any membership or usage fee. Its costs are mostly related to the maintenance of its operational activities (Tulio & Nascimento, 2022). A downside is that the platform requires operators to know the CAR code of at least the direct suppliers of the slaughterhouses to be able to check directly on the platform whether they are deforestation-free and compliant with legal requirements. Obtaining this information might be challenging as it might not be shared throughout the supply chain.

Transparency: Selo Verde was developed by public entities in collaboration with a public university, research institutes. The methodological architecture and results from the analysis are publicly available for consultation. However, some of the access to more detailed information concerning personal information on farms and ranchers or commercially sensitive information, is restricted to government entities and authorities (ADP secretariat et al., 2023; Tulio & Nascimento, 2022).

Feasibility: Selo Verde has already been included as a public policy tool in relevant producing regions of Brazil, starting with Pará and extending to Minas Gerais. Meanwhile, in the state of Maranhão, there is a beta version of the platform being finalised for launching, and the states of Acre and Bahia have already voiced their interest in implementing the initiative in their respective state areas (F. Nunés, personal communication, 27 February 2024). Coffee is included in the state of Minas Gerais and the expansion to other states and commodities is already under development (ADP secretariat et al., 2023; F. Nunés, personal communication, 27 February 2024; Tulio & Nascimento, 2022). Additionally, there was a bill proposed in the Brazilian National Congress in 2020, which is still undergoing the necessary proceedings, aiming at establishing a national system inspired by Selo Verde (Projeto de Lei Selo Agro Verde, 2020). Reflexivity: After undergoing review and feedback from stakeholders, the platform

⁸ "A nossa plataforma 'Selo Verde' está em linha com o que a União Europeia vai exigir do Brasil como um todo. Esse relatório foi feito antes mesmo da legislação europeia entrar em vigor. Nós nos antecipamos a um possível problema que pudesse acontecer." Citation extracted from a news article by SEMAS-PA, retrieved from <https://www.semas.pa.gov.br/2023/06/22/governo-do-para-apresenta-selo-verde-a-membros-do-parlamento-europeu-em-belem/>



is now in its 2.3 version, being updated to a real-time integration of data from the databases incorporated instead of static data of the previous versions. This shows that the platform has the flexibility and technological capacity to adapt to changes and to be extended to other products and states, which indicates that this tool is potentially suitable to trace several of the commodities currently covered by the EUDR that are produced and exported from Brazil.

Limitations: Selo Verde is still geographically limited to Pará (cattle) and Minas Gerais (cattle and coffee), and the tool is highly dependent on political willingness to cover other regions and commodities within the country. These limitations are also linked to different levels of access to public data related to other commodities and states. Lastly, Selo Verde does not disclose sensitive information which is not publicly available on the platform, including, for instance, GTA data on cattle movements (Bieber, 2023). This decreases Selo Verde's performance in terms of transparency and may hinder the possibility of having access to relevant data to assert compliance with the EUDR.

Conclusion

Selo Verde is a prominent tool that, by integrating publicly available data, provides a socio-environmental diagnosis of commodity-producing properties concerning conformity with the Brazilian Forest Code and other socio-environmental legal requirements. Its maintenance costs are relatively low, but there is a need for a continuous update as new datasets become available. It has the potential to be expanded to other states in Brazil covering also other relevant commodities, such as leather and soy. However, Selo Verde faces significant challenges in addressing important gaps in the Brazilian cattle supply chain, namely 'cattle laundering' and animal movements between bordering properties or indirect suppliers. The platform complies with all the elements of the analytical framework assessment criteria, being the key elements: 1) effectiveness due to its alignment with the EUDR requirements; 2) transparency due to its open access data and external assessment done by a monitoring committee; and 3) limitations due to its geographic and commodities coverage in Brazil, currently covering cattle in Pará and cattle and coffee in Minas Gerais.

5.38 Beef on Track

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Public policy / regulation Private regulation	Supply-side (Specific countries)	Cattle	Transparency Limitations Effectiveness	Has relevant limitations
Link to key reference Beef on Track website				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Rita Raleira, Joana Faggin (AidEnvironment)				Last update August 2024		

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Summary of the case study

The Beef on Track programme was established in 2020 as a monitor, report, and verify (MRV) system to harmonise the implementation of the Term of Adjustment of Conduct (TAC) and the Public Livestock Commitment (CPP in Portuguese), two Brazilian deforestation-free agreements applicable to the cattle sector (4th Council for the Environment and Cultural Heritage, 2021; Freitas & De Marcello, 2023). The governance of the Beef on Track

⁹ One of the seven official councils of MPF which focuses on issues related to flora, fauna, conservation areas, environmental management, legal reserves (Forest Code), the coastal zone, mining, transgenics, water resources and the preservation of cultural heritage, among others.



programme is shared by the Public Prosecutor's Office (MPF in Portuguese) and its Fourth Council for the Environment and Cultural Heritage, together with Imaflora, a Brazilian environmental NGO which assumed the role of facilitator of this programme. The Beef on Track programme covers 144 of the 158 meatpackers operating in the Brazilian Amazon biome. The meatpackers covered must be signatories of at least one of the agreements mentioned above (TAC or CPP), while they can also be signatories of both (Freitas & De Marcello, 2023). The programme's MRV system includes a Monitoring Protocol, an Audit Protocol, and a Public Summary of the Audit Report. The Monitoring Protocol covers eleven or twelve criteria (depending on the agreement(s) signed by each company) (4th Council for the Environment and Cultural Heritage, 2021). The Monitoring Protocol for the TAC includes eleven criteria: (1) not having illegal deforestation, (2) not overlapping with Indigenous Territories and (3) Protected areas, (4) not having Federal and (5) state environmental embargoes, (6) having an environmental registration (CAR system) (7) without recorded changes in the property's boundaries, (8) having an environmental license, (9) not being linked to slavery labour practices, (10) presenting Animal Transit Guides (GTA) for cattle trading operations, and (11) respecting the productivity rate regarding the number of animals and the size of the property. The CCP has an additional criteria not allowing any type of deforestation (legal or illegal).

Innovation

Beef on Track key innovation is the aim to harmonize monitoring protocols that can be used as compliance criteria for different types of sectorial agreements, from binding agreements such as the TAC between the Public Prosecutors' Office and meatpackers, to voluntary sectorial agreement such as the Public Livestock Agreement (CPP), between meatpackers, retailers and civil society. In this context, Beef on Track *is an innovative governance strategy for the implementation of any regulation*, as its technological approach (monitoring protocols) can be adapted to the EUDR specificities, for instance.

Evaluation against assessment criteria

Effectiveness: the Beef on Track programme promotes transparency by making the summary of some state audit reports available on its platform while granting the possibility of the full reports being requested directly to the participant meatpackers, which include information on the non-compliances found and the actions taken towards them. This allows for an overview of the programme's due diligence process and facilitates reporting, aligning well with the EUDR requirements (Freitas & De Marcello, 2023). Regarding traceability, although there are ongoing efforts to expand the programme to indirect suppliers, a downside is that the monitoring protocol is only applied to direct suppliers of cattle, not always covering all the plots of land where the cattle went through during the life cycle. Regarding the EUDR zero-deforestation requirement, while the TAC signatories need to comply only with the non illegal deforestation criteria (Freitas & De Marcello, 2023), the CPP signatories need to comply with a zero-deforestation criteria. However, almost three times more meatpackers are signatories only of the TAC compared to those signatories of the CPP or both, TAC and CPP¹⁰ (Freitas & De Marcello, 2023).

Efficiency: meatpackers are responsible for monitoring their cattle suppliers against the Beef on Track's Monitoring Protocol criteria, either by dedicated staff with the necessary expertise or by an outsourced party. Companies are also responsible for hiring auditing teams to verify their cattle purchases and compliance with the criteria set. Both demands carry costs for the companies related to the additional staff and administrative services required (Imaflora, 2023). Additionally, adhering companies are included in the open access platform of the programme, which can be used for free by buyers to check information on the company, namely on their socio-environmental performance and compliance (4th Council for the Environment and Cultural Heritage, 2021).

Transparency: the Beef on Track Platform is a hub that enables access to systems, tools, data and technical information

¹⁰ The Beef on Track platform discloses the summary of the Pará state audit report is aiming at doing the same for other states' reports. The full reports can be requested directly to meatpackers, but they can refuse to share them because of the inclusion of commercially strategic data.



for a deforestation-free beef chain. An expert team with strategic partners in Brazil and abroad develops it. Through the platform, producers, meatpackers, tanneries, retailers, investors, and civil society can find the information and materials that will help them implement and/or check compliance with the agreements signed and monitor the progress being made (Souza et al., 2020). Besides the platform, the monitoring and auditing protocols are publicly available and can be consulted, increasing the programme's transparency and enabling public participation.

Feasibility: the Beef on Track programme is grounded on a multistakeholder process involving different public and private actors and has a wide acceptance among the companies it applies to (Freitas & De Marcello, 2023). Furthermore, Beef on Track is an implementing arm of the TAC established by MPF, which entails that there is political support for the programme. All of this has contributed to its wide coverage in the geographic area of application, which, together with the established monitoring and verification system, make Beef on Track a good starting point for companies to fully comply with the EUDR (Freitas & De Marcello, 2023).

Reflexivity: the protocol is flexible enough to adapt to new circumstances and requirements as it can incorporate more information and data. This represents a good opportunity (and departure point) to ensure better alignment with EUDR requirements, which has the potential to cover more of the relevant commodities in the scope of the regulation, namely leather and other regions of the country (Freitas & De Marcello, 2023). An important improvement of Beef on Track for better alignment with the EUDR requirements would be increasing its capacity to monitor indirect suppliers, which is not yet implemented due to the limited access to the necessary public data (Freitas & De Marcello, 2023).

Limitations: Beef on Track's major limitation concerns availability and access to reliable public data. This interferes significantly with the possibility of monitoring crucial aspects for the assurance of compliance with EUDR requirements, namely those related to compliance with the legality and traceability requirements (Freitas & De Marcello, 2023). This is mostly related to the fact that there are currently no public databases collecting the necessary information or that, for different reasons, the data is not publicly available and must be specifically requested from and ceded by the responsible, competent authorities without guarantees on if or when this will happen. This is not necessarily a gap of the Beef on Track programme, but it does decrease its performance about EUDR compliance (Freitas & De Marcello, 2023).

Summary conclusion

The Beef on Track platform is a feasible tool to monitor the supply chain of slaughterhouses operating in the Amazon biome and can potentially improve traceability if it includes monitoring indirect cattle suppliers to the slaughterhouses (currently, it covers only direct suppliers). Another improvement would be integrating the zero-deforestation criteria into the monitoring protocol linked to the TAC agreement, which currently covers only illegal deforestation, thus not being aligned with the zero-deforestation criteria of the EUDR. The platform complies with all the elements of the analytical framework assessment criteria, being the key elements: 1) low effectiveness due to its partial alignment with the EUDR requirements, specially the free-deforestation one; 2) transparency due to its publicly available data summarized; and 3) limitations due to its partial coverage of the supply chain, currently covering only direct cattle suppliers.



5.39 PRIMI+COTI initiatives

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Private regulation	Supply-side (Specific countries)	Cattle	Efficiency Transparency Limitations	Relevant, with identified limitations
Link to key reference Website of the PRIMI protocol				Link to training video -		
Authors (Institution) Rita Raleira, Joana Faggini (AidEnvironment)				Last update August 2024		

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Summary of the case study¹²

The Individual Traceability and Indirect Monitoring Programme (*Programa de Rastreabilidade Individual e Monitoramento de indiretos*, PRIMI) complements the Certification of Origin and Traceability Implementation (COTI). PRIMI+COTI is a private, sector-led monitoring voluntary protocol that allows beef and leather producers to provide evidence of their sustainable production. The sustainability criteria include cattle originating from deforestation-free areas, which do not overlap with indigenous lands and protected areas, have not received environmental embargoes, or engaged in slave-like labour. This protocol covers cattle supply chains from the initial stages of production (initial birth and breeding farms) to the slaughterhouse. PRIMI provides a blockchain-based platform where traceability and risk assessment data are integrated and made accessible to livestock farmers and other interested parties, such as slaughterhouses, meatpackers, tanneries, cattle auctions, by-product manufacturers, retailers, and the consumer market at large. All the data relative to the origin of the animals can also be accessed and tracked via a QR code. The programme is applicable throughout the entire Brazilian territory and to all types of rural properties dedicated to cattle ranching, independently of the phase of the animals' life cycle in which it focuses, as it relies on ear tagging and the individual classification of the animals included in the programme (PRIMI, n.d., 2023). PRIMI was internationally launched in the second half of 2023 covering the Pará state, starting with a focus on leather and involving 40 regional farms. PRIMI data will be publicly available through an online platform, and the traceability will work by the identification number attached to the product.

Innovation

The PRIMI+COTI initiative key innovation is the traceability of individual animals within all the cattle supply chain. The traceability of individual animals solves some of the most relevant gaps of the cattle supply chain in Brazil: the moving of the animals among different cattle-producing properties along the animal life cycle. Because of that, PRIMI+COTI innovated in the balance between the EUDR traceability requirements providing a technology that allows it in an individual animal level covering their entire life cycle, meaning that the deforestation can be monitored in all the geographies (plot of land) that this animal was before being slaughtered.

Evaluation against assessment criteria

Effectiveness: PRIMI's adherent properties comply with a series of socio-environmental criteria aligned with current requirements of the EUDR. The traceability of the animals is one of the programme's core features, and aligns with EUDR requirements on traceability to the plot of land for the covered products, including leather. The protocol starts with the individual identification of animals at any stage of their life cycle through an ear tag following the norms from the Brazilian System for Individual Identification of Cattle and Buffaloes (SISBOV) (PRIMI, 2023).

¹² If not otherwise state, the main resource of this case study is: R. Andrade, personal communication, 23 February 2024



When reaching a slaughterhouse, the tagged animal's hide receives an ID number before reaching a tannery, and afterwards, this ID number is laser tagged in all leather piece(s) processed from that specific hide. This ensures that the leather products exported from Brazil that were produced under the PRIMI programme can be traced to the farms of origin of the animal in Brazil (PRIMI, 2023). This traceability system is also applicable to beef products, but it has not been integrated into PRIMI initiative so far. The monitoring information collected and analysed under the programme include, among others, the checking of legal or illegal clearance of native vegetation in the Amazon, Cerrado and Atlantic Forest biomes after December 31st 2020 (EUDR cut-off date); and some illegalities such as environmental embargoes, overlappings with protected areas and links to slave labour practices (PRIMI, 2023).

Efficiency: the adherence to the PRIMI has a high cost to the cattle producer, mostly linked to animal ear tag, estimated as BRL 20 /animal (roughly EUR 3.7 /animal), including also the analysis and verification process. The aim is to reduce or eliminate these costs for producers by pulling investment from downstream actors and collaborating partners. One of the underlying principles of PRIMI+COTI is to establish collaborative partnerships that can deliver the improvement and implementation of the programme in alignment with relevant stakeholders. The National Wildlife Federation (NWF), for instance, through the traceability and monitoring tool - Visipex, and Imaflora, which assists in tackling issues of non-compliance by supporting sustainable practices among cattle producers.

Transparency: regarding the data collected and monitoring performed in the programme, anyone can consult this through the animal/product ID number or QR code and the open access platform featured in the programme¹³. Besides this, it will also be possible to have access to the audit certification number and thereby to the auditing process conducted.

Feasibility: the social acceptance of the PRIMI+COTI initiatives has been growing steadily, and it has benefitted from the collaboration with the private and public sectors through the partnerships established. Nonetheless, there is some resistance towards individual traceability, deemed inviable and/or too difficult to implement in a relatively short time and not scalable in a country with an estimated cattle herd of 234 million animals in 2022 (IBGE, 2024).

Reflexivity: structurally, the programme shows evidence of accommodating changes and incorporating new features in case new market demands emerge or new data is publicly available.

Since its launching, PRIMI has already integrated new specifications for the socio-environmental criteria to adapt to new regulations entering into force, such as introducing the analysis of legal and illegal deforestation considering the EUDR cut-off date of December 31st 2020.

Limitations: the main limitation the programme faces now is its high implementation costs, which limits its expansion to cover a relevant part of the cattle herd within the Brazilian territory. The high costs directly lead to lower adherence to the programme, considering that producers might refrain from integrating the initiative if they must carry the costs of tagging, monitoring and verification. A premium price transfer (paid by the tanneries due to the raw material being produced with higher sustainability standards), not yet structured, could support a mechanism to decrease its implementation costs on the producer side.

Synergies: regarding synergies with other cases, PRIMI+COTI uses the same individual traceability approach as SISBOV, guaranteeing that animals already part of SISBOV can more easily be integrated into this programme. Also, several farms that have adhered to the programme already complied with the criteria set by the Beef on Track monitoring protocol, which in many aspects overlaps with that of PRIMI. This means that by meeting the socio-environmental criteria of one of these, the farm is already fairly set to comply with the other and hence able to integrate both and yield the benefits both can deliver.

¹³ The data that will be available includes traceability information associated with the animal/product (geolocation coordinates of the properties crossed), CAR information, and all other details that can be publicly disclosed according to the privacy laws in force in Brazil



Conclusion

The PRIMI+COTI initiative seems to cover the gap of other initiatives that aim to monitor the cattle supply chain. This is mainly because it includes tagging individual animals in different production phases (birth, breeding, fattening) covering the entire supply chain, including direct and indirect cattle suppliers. A central challenge is the programme's cost, mainly on tagging animals. These costs are not yet distributed within the upstream and downstream sectors of the supply chain, and for now, needs to be covered by the cattle producer. At the same time, individual animals' traceability initiatives are currently the most efficient strategy to tackle deforestation and other legal problems within the cattle supply chain in Brazil, which has a complex dynamic of numerous indirect cattle suppliers. PRIMI is still only covering the leather supply chain, and its expansion to beef products is challenging due to the complexity of the downstream supply chain. The platform complies with all the elements of the analytical framework assessment criteria, being the key elements: 1) efficiency and transparency, for covering the traceability gap of the cattle supply chain (covering all the indirect suppliers) and due to its publicly available data consulted through an online platform, and 2) Not so feasible and with significant limitations due to its high costs (still on the producer) and the low impact (so far only 125,000 animals are tagged in a universe of more than 200 million animals within the country).

5.40 Brazilian Amazon Soy Moratorium

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Private regulation	Supply-side (Specific countries)	Soy	Effectiveness Efficiency Feasibility Limitations	Relevant, with identified limitations
Link to key reference Website of the Amazon Soy Moratorium				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Rita Raleira, Joana Faggini (AidEnvironment)				Last update August 2024		

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Summary of the case study

The Amazon Soy Moratorium (ASM) is a voluntary zero-deforestation agreement covering soy production in the Amazon, aiming to halt soy-driven deforestation in the Brazilian Amazon biome. It involves the private sector and civil society, having been endorsed by the Brazilian government, namely through the Ministry of Environment (Carvalho et al., 2019; Heilmayr et al., 2020; Lopes, Chiavari, et al., 2023). The ASM is a market-based mechanism that implied a ban on the purchase, trade, and financing of soy from recently deforested areas in the Amazon (after the established cut-off date - ultimately defined as July 2008 to align with the Brazilian Forest Code reviewed in 2012) and from areas embargoed by IBAMA or included in the slave-like labour list from the Brazilian Ministry of Labour¹⁴ (Amaral et al., 2021; Heilmayr et al., 2020; Paim, 2021; Piatto & De Souza, 2017). The ASM was established in May 2006 in the aftermath of public protests and a Greenpeace report¹⁵ denouncing the linkages between three large soy traders and deforestation in the Amazon, leading the Brazilian Association of Vegetable Oil Industries (ABIOVE) and the National Association of Grain Exporters (ANEC), responsible for

¹⁴ The list is publicly accessible and is updated annually. The latest version is from 2023 and can be consulted here: https://www.gov.br/trabalho-e-emprego/pt-br/assuntos/inspecao-do-trabalho/areas-de-atuacao/cadastro_de_empregadores.pdf

¹⁵ Greenpeace (2006). Eating up the Amazon. Retrieved from <https://www.greenpeace.org/usa/wp-content/uploads/legacy/Global/usa/report/2010/2/eating-up-the-amazon.pdf>



purchasing 90 percent of the soy produced in the Amazon, for taking action to avoid reputational risks (Amaral et al., 2021; Gibbs et al., 2015; Heilmayr et al., 2020). The ASM was renewed annually or biannually until 2016, when it was renewed indefinitely and became a permanent agreement (Amaral et al., 2021; Lopes Chiavari, et al., 2023).

Innovation

The intersectorial agreement aspect of the ASM, which is now endorsed by the Brazilian Government and renewed indefinitely, is its key innovation element. At the time, when it was implemented, in 2006, it was also an innovative strategy to deal with a complex challenge - tackle deforestation linked to soy production in the Amazon biome, which have been addressing in a quite successful way despite all the trials to block it. In the EUDR context, the *ASM provides a relevant technology linked to the governance arrangement* that is essential to implement such agreement: private sector, civil society, and governments.

Evaluation against assessment criteria

Effectiveness: the MVR system of ASM provides relevant information on compliance with EUDR requirements. Considering that ASM includes commitments to zero deforestation, including legal and illegal deforestation after July 2008, there is a good alignment with the deforestation-free requirement of the EUDR. Furthermore, ASM's prohibition on deforestation and land conversion for soy production targets specifically the plots of land within the property where soy is produced (Gibbs et al., 2015), by which the spatial analysis and monitoring performed can provide for the geolocation information that respects the traceability requirements of the regulation. The monitoring also includes checks on whether farmers and properties have any active environmental embargoes or have been included in the slave-like labour registry, which provides some relevant input regarding compliance with the legality requirement of the EUDR.

Efficiency: the information and documents utilised for monitoring and verification are gathered under a management framework through which stakeholders can easily access the necessary information, including the list of non-compliant suppliers (Piatto & De Souza, 2017). ASM signatory trading companies must also establish their management system to ensure purchasing practices and contracts follow the ASM requirements. These must be audited by a third party directly hired by the signatory company (Soy Working Group, 2022).

Transparency: the ASM is compounded in specific reports submitted to the GTS and the respective companies yearly. These reports are then scrutinised and can lead to recommendations on the auditing process or companies' performance (Piatto & De Souza, 2017). The transparency fostered through this process allows stakeholders access to information that can feed into the due diligence requirements under the EUDR and help them report on the required data. Moreover, the active participation promoted contributes to the improvement of ASM, which helps it reach its intended goals and facilitates possible alignments with other initiatives and market demands, including the EUDR.

Feasibility: it has been reported that, between 2006 and 2016, less than 1 percent of the deforested areas after the cut-off date of the ASM was replaced by soy plantations. This demonstrates that there has been a high level of compliance with the ASM and that it can be considered a successful initiative (Amaral et al., 2021; Gibbs et al., 2015). Its success has also resulted from the social acceptance from private actors, civil society, and the federal government that joined efforts to build and strengthen this initiative (Vibian et al., 2021). The fact that it has had this success has also increased the appetite for the expansion of this initiative to other areas of Brazil, such as the Cerrado biome (Vibian et al., 2021). However, no similar agreement has effectively materialised so far.

¹⁶ The GTS is a multi-stakeholder group with an executive and coordinating role that oversees the implementation and monitoring strategies of ASM. The GTS is formed by representatives of the soy sector affiliated with ABIOVE and ANEC, civil society organisations (Greenpeace, Imaflora, IPAM, The Nature Conservancy, and WWF), the Brazilian government (namely by the Ministry of the Environment), the National Institute for Space Research (INPE), IBAMA, Banco do Brasil, and the European Soy Consumer Group (Imaflora et al., 2022; Piatto & De Souza, 2017).



Reflexivity: throughout the years, the available tools and agreed-upon methodologies have been improved to increase their effectiveness with each iteration. An example of this is that, initially, the polygons used in the monitoring process compounded more than 100 hectares of deforested area, which created issues of resolution and accuracy. Currently, 25 hectares is the polygon size used, allowing for more precise readings on the deforestation events and soy conversion taking place (Piatto & De Souza, 2017).

Limitations: although there have been high levels of compliance with the moratorium and evidence of the initiative's success, it does not prevent all the issues that permeate soy production and still lead to the maintenance of soy-linked deforestation. For instance, soy laundering – a strategy by which soy produced in non-compliant areas is sold to signatory companies through compliant properties/plots – is an ongoing practice that is not always easy to detect, especially since ASM signatory companies do not control their suppliers' purchases (W. D. Carvalho et al., 2019; Paim, 2021). A known limitation of the ASM is its geographical coverage, only the Amazon biome. With this geographical limitation, the ASM also enables soy leakage, promoting a dislocation of unsustainable soy production practices to other ecosystems where soy-linked deforestation is not covered by the same type of agreement, such as the Cerrado biome (W. D. Carvalho et al., 2019; Paim, 2021).

Synergies between good/bad practices: the ASM goes beyond a no-deforestation commitment, being one of the first voluntary-based sectoral commitments aiming for a zero-deforestation strategy in the soy sector, even if limited to the Brazilian Amazon biome. Additionally, the ASM strengthened satellite monitoring to address deforestation and successfully integrated and coordinated the work between government, industry, and civil society sectors.

Conclusion

The ASM transformative potential serves as a supply chain governance model that can eventually be expanded to other commodities (i.e., beef and palm oil) and producing areas (i.e., Cerrado biome). Nonetheless, gaps between the moratorium and the regulation still exist. Soybean triangulation¹⁷, as well as indirect suppliers and intermediaries, are, in most cases, not covered by the ASM MVR systems. This hinders compliance with the EUDR's requirement to provide the geolocation coordinates of the soy production plot in the EU market (Imaflora et al., 2022; Piatto & De Souza, 2017). Among the analytical framework criteria, the ASM key points are in: 1) Effectiveness, efficiency and feasibility, due to its high contribution to decrease soy-linked deforestation in the Amazon since 2006 and due to its innovative governance model, guaranteeing, for instance, the governmental adoption of the ASM as a public policy (i.e., as a parameter to access public bank credit programs); 2) Limitations, as it only covers the Amazon biome while there is an increasing pressure from soy expansion on the Cerrado biome.

5.41 Soft Commodity Forum

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
CSR	Agriculture	Private regulation	Demand-side (Global)	Soy	Effectiveness Transparency Feasibility Limitations	Has relevant limitations
Link to key reference SCF subsite at WBCSD website				Link to training video -		
Authors (Institution) Rita Raleira, Joana Faggin (AidEnvironment)				Last update August 2024		

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¹⁷ Also called soy laundering, this strategy implies that farmers with several farms attempt to launder "dirty" soy by selling it through and as if it was produced on "clean" farms.



Summary of the case study

The Soft Commodities Forum (SCF) Led by the World Council for Sustainable Business Development (WBCSD), the SCF reunited leading global commodity traders under a common, pre-competitive project looking at tackling the sustainability challenges they all share (Guimarães et al., 2023; WBCSD, 2023b; Zu Ermgassen et al., 2020, 2022). The SCF is a collaborative business engagement initiative involving some of the largest grain traders worldwide – ADM, Bunge, Cargill, LDC, COFCO International, and Viterro. The SCF's aims to tackling deforestation and conversion linked to soy in the Brazilian Cerrado, specifically in the so-called 'priority' municipalities where around 70 percent of soy-driven deforestation takes place (Guimarães et al., 2023; Zu Ermgassen et al., 2020, 2022). Having purchased 42% percent of the soy exported from Cerrado between 2004 to 2020¹⁸ (Trase.earth), SCF members focused their zero-deforestation efforts on this region started by monitoring 61 priority municipalities, covering about 26 percent of the soy planted area in the Cerrado biome in the 2021/2022 harvesting year (WBCSD, 2023b). The municipalities' selection is based on the area of planted soy (more than 5,000 hectares), existing rates of soy-driven deforestation, and SCF members' purchasing history (Zu Ermgassen et al., 2020).

Innovation

SCF key innovation approach contributes to a better balance between technologies (monitoring tools), decision-making (choosing sourcing areas/suppliers not directly linked to deforestation) and policy implementation. In the case of the EUDR, it lacks the links to the required data by its due diligence process, but the SFC shows that a monitoring capacity by the largest traders is already in place as they are able to monitor not only their direct suppliers but are continuously committed to expand this monitoring capacity to their indirect suppliers.

Evaluation against assessment criteria

Effectiveness: SCF has three work streams – land use monitoring, stakeholder engagement, and landscape transformation. The land use monitoring stream has been developed to address deforestation and conversion risks linked to soy production in the Brazilian Cerrado biome, and is the one more directly related to the EUDR implementation. The SFC members are committed to 1) tracing soy to its production site (farm of origin), 2) Identify existing deforestation and conversion risks, as well as other possible socio-environmental issues, 3) define the actions needed (which are rather addressed through the other two workstreams), and 4) measure and report on progress towards increasing the sourcing of deforestation and conversion-free (DCF) soy originating from the defined priority municipalities (WBCSD, 2023a). Considering that the six members of SCF are large grain traders likely to export and/or import soy to and from the EU market, they will need to prepare for compliance with the requirements of the EUDR, namely on deforestation-free, legality, and due diligence. Thus, monitoring their soy suppliers, knowing the origin of the products and whether they are DCF, already provides them with some information necessary to assert whether EUDR compliance is met.

Efficiency: One of the strategies adopted by the SCF is to focus their efforts on a limited geographical area with a higher concentration of risks, namely the 61 priority municipalities in Cerrado. The hotspot approach adopted by SCF has the potential benefit of reducing the initial investment required from these companies while still addressing an important area of impact directly linked to their operations. This focus also allows them to invest in supporting interventions that can facilitate meeting their commitments and comply with EUDR requirements. For instance, SCF members have also developed and invested in the Farmer First Clusters initiative to help farmers implement forest-positive practices in soy-producing areas, which contributes to their ultimate goal of having DCF soy supplies and lowers the risk of non-compliance with EUDR requirements (WBCSD, 2023a).

Transparency: the progress reports and newsletters, published respectively annually and quarterly, increase the SFC's transparency. Since 2022, SCF has also taken steps towards increasing transparency by starting to publicly

¹⁸ Date obtained through [Trase earth](https://trase.earth) and cited in the journal article mentioned.



disclose data on the individual performance of member companies concerning their respective soy supplies from the 61 priority municipalities, including the percentages of verified and unverified DCF soy volumes and direct and indirect supply (WBCSD, 2023a). This contributes to some extent to the transparency and reliability of the data obtained regarding the reporting necessary under the EUDR and the robustness of the information provided. However, the sample seems limited and possibly skewed since it focuses exclusively on traceable suppliers (WBCSD, 2023b).

Feasibility: the SCF shows that monitoring soy suppliers is a feasible practice and that there are already enough and developed tools for it being used and adopted by most of the largest soy traders. Additionally, the actions to promote further participation and engagement of indirect supplies have received support from ABIOVE¹⁹, which can be seen as an indication that there is good acceptance of the approaches and actions promoted by the group among relevant players in the sector (WBCSD, 2022).

Reflexivity: additionally, the hotspot approach adopted by SCF, with its monitoring focus on direct soy supplies, narrows down the transformative impact of the group's actions and curbs oversight over the existing risks in non-direct segments of the supply chain. As production areas and expansion frontiers tend to shift, the associated socio-environmental risks such as deforestation will follow their trend (Zu Ermgassen et al., 2022), requiring that the methodologies and scope adopted under hotspot approaches are adapted to the changes. In the case of the SCF, even though its scope was already broadened from 25 to 61 priority municipalities in the Cerrado biome, one-third of the soy associated with deforestation in the biome still takes place outside of these focus municipalities (Zu Ermgassen et al., 2020, 2022).

Limitations: The SCF's monitoring methodology to ensure a DCF soy supply tends to prioritize direct supply over indirect suppliers, considering that only the former are classified as verified DCF soy volumes. At the same time that SCF members have increased their direct sourcing from Cerrado priority municipalities (Zu Ermgassen et al., 2022), no monitoring alternatives have been integrated into their methodology that could allow for an assessment of socio-environmental risks in their indirect supply stream. This will likely create additional non-compliance issues with the EUDR requirements. Additionally, the hotspot approach adopted by SCF narrows down the transformative impact of the group's actions as production areas and expansion frontiers tend to shift, and have an increased association to socio-environmental risks, including deforestation (Zu Ermgassen et al., 2022).

Regarding synergies with other cases, the SCF has synergies with the Amazon Soy Moratorium (ASM), and it is, somehow, a response from the soy trading sector to the market pressure of having a similar mechanism to the ASM extended to the Cerrado biome, where most of the soy-cultivation expansion happened in the last decade.

Conclusion

The SCF exemplifies that traceability mechanisms in the soy sector are feasible and have been already being implemented by most of the largest traders in the sector. However, SCF lacks the monitoring coverage of the traders' indirect soy suppliers, and the strategy to just increase direct suppliers in a specific hotspot could contribute to the leakage mechanism, where only part of the suppliers comply with a certain market mechanism, leaving or increasing bad practices in less restrictive markets. The key analytical framework criteria linked to the SCF initiative are: 1) Effectiveness, as individual corporate commitments, such as the SCF, have not decreased deforestation risks for the companies involved (Zu Ermgassen et al., 2020); 2) Transparency, as the progress reports are audited and publicly available; 3) Feasibility, as it shows that monitoring deforestation within the soy supply chain is an already implemented toll by the largest global soy traders/ and 4) Limitations: considering that even if the volume from indirect suppliers is part of the SCF members' progress reports, they are not traceable to a farm level, which might be detrimental to the alignment of the initiative with the requirements of the EUDR.

¹⁹ Brazilian Association of Vegetable Oil Industries



5.42 Rainforest Alliance

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology	Agriculture	Private regulation	Supply-side (Global)	Agricultural FRC (beyond EUDR)	Effectiveness Efficiency Transparency Feasibility	Relevant
Link to key reference Website of Rainforest Alliance				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Michael Mbogga, Fred Babweteera (MAKERE University)				Last update May 2024		

For quick navigation: [Click here to go back to Case study overview table](#)

The Rainforest Alliance is an international non-profit organisation working at the intersection of business, agriculture, and forests to ensure their activities are environmentally sound. Its aim is to build an alliance to protect forests, improve the livelihoods of farmers and forest communities, promote their human rights, and help them mitigate and adapt to climate change. The Rainforest Alliance works with farmers and supply chains for commodities such as coffee, cocoa, and bananas. Coffee and cocoa combined contribute to 30% of total forest loss, with coffee responsible for 25% and cocoa for 5% (Dow Goldman et al., 2020). The Rainforest Alliance certification program helps farmers produce better crops, adapt to climate change, increase productivity, and reduce costs. These benefits provide companies with a steady and secure supply of certified products.

Additionally, sourcing Rainforest Alliance Certified products helps businesses meet consumer expectations and safeguard their brand's credibility. Their program focuses on four commodities: coffee, cocoa, tea, and bananas. To earn Rainforest Alliance certification, farms are audited against a Sustainable Agriculture Standard, which includes comprehensive environmental, social, and economic guidelines rooted in four sustainability principles. The Rainforest Alliance works with more than two million farmers in about 60 countries around the world. Recognising the EUDR, the Rainforest Alliance introduced a policy in December 2023 to help its farmers and supply chain actors comply with the requirements of the EUDR, particularly for coffee and cocoa (Rainforest Alliance, 2023a, 2023b, 2024).

In addition to its standard requirements, to help actors comply with the EUDR, it has introduced four additional requirements. These include: i) enhancing the traceability of traded products, ii) engaging farms and suppliers to self-select EUDR-aligned requirements in the existing certification program, iii) facilitating geodata collection at the farm level and submitting this geospatial data in line with EUDR requirements, and iv) ensuring internal and external stakeholders have a comprehensive understanding of how Rainforest Alliance certification can benefit them and their supply chain in meeting EUDR compliance. Additionally, the Rainforest Alliance may share information regarding compliance with the above requirements, including geolocation data and deforestation risk assessments, under the EUDR Data Sharing Policy.



5.43 Kyagalanyi Coffee exporter

Thematic Area/Areas	Sector	Type of approach	Supply chain orientation	FRC scope	Assessment criteria	Evaluation
Compliance Technology CSR	Agriculture	Industry self-regulation	Supply-side (Specific countries)	Cocoa	Efficiency Feasibility	Relevant, with identified limitations
Link to key reference Website of the private initiative				Link to training video www.emma4eu.eu/learn/case-studies/		
Authors (Institution) Michael Mbogga, Fred Babweteera (MAKERE University)				Last update May 2024		

For quick navigation: [Click here to go back to Case study overview table](#)

Kyagalanyi Coffee Limited is Uganda's largest coffee exporter, founded in 1992. The company sources robusta and arabica coffee from the major producing regions in the country. It runs sustainability initiatives that provide technical training to improve productivity and coffee quality, and address climate change impacts on farming communities in the Mt. Elgon, greater Rwenzori, and greater Masaka regions. Kyagalanyi Coffee is a subsidiary of Volcafe, a Swiss-based company. The company runs the Volcafe Responsible Sourcing (RS) programme. The objective of the Volcafe RS Standard is to promote sustainability in coffee value chains. This standard links the organisation's sustainability efforts to the commercial needs of its clients by offering responsibly sourced coffee and providing key information on value chain risks, challenges, and opportunities. It complements existing sustainability schemes and offers another sustainability solution to coffee roasters and retailers seeking to fulfil their responsible sourcing commitments.

To achieve this, the company operates Volcafe Verified and Volcafe Excellence. Volcafe Verified signifies the achievement of baseline standards for responsible sourcing, with Volcafe Excellence building on this to achieve deeper economic, environmental, and social progress for coffee communities. Volcafe Verified focuses on continuous improvement, environmentally sustainable coffee production, and promoting responsible citizenship and safe work practices. Volcafe Excellence enhances Volcafe Verified by providing agronomy training and support to coffee producers, ensuring full traceability back to the farm, and offering robust assurance with a 100% inspection rate. Kyagalanyi Coffee sources coffee from more than 100.000 farmers.

However, only 30% or 30.000 of these farmers are able to comply with existing certifications, such as AAA from Nespresso. They are confident that coffee from these 30.000 farmers will meet the requirements of the EUDR. Compliance with the EUDR has brought new challenges. For example, many farmers in Uganda are smallholders, with land holdings of less than 1 hectare and producing less than 1 tonne annually. This implies that a 30-tonne container of coffee destined for Europe can potentially come from more than 50 farms. One complication arises from the long value chain: smallholders sell coffee to small aggregators, who sell to medium-sized aggregators, and from there the coffee is sold to coffee hullers. Compliance will require training these value chain players to use electronic devices to track the coffee beans from the original sources.



6. SUMMARY CONCLUSIONS WITH POLICY AND IMPLEMENTATION RECOMMENDATIONS

General conclusions

This report concludes that for the EUDR implementation a strong guidance and stewardship of DFSC is needed. Key elements for implementation include the new risk-based approach towards eliminating deforestation and forest degradation risks, new technical requirements such as geo-location information requirements, and more comprehensive legality requirements. The EUDR as a demand-side measure aligns with the EU's international commitments and overarching policies such as the European Green Deal. The EUDR builds on experiences with implementing and enforcing other regulations such as the EUTR and its due diligence approach or the US Lacey Act and its declaration requirement.

The EUDR itself is an innovative and ambitious piece of legislation, as the case studies on the legal elements show. Furthermore, the EUDR seeks to stimulate synergistic developments in other policies and governance mechanisms in terms of ratcheting up the ambitiousness and robustness of socio-environmental standards. The EUDR, for instance, motivates the adoption of DFSC commitments and policies by the private sector operating in the EU, not only in the directly regulated sectors but also beyond, such as in the financial sector.

The 43 case studies assessed in this report are only a snapshot of the current wider pool of tools and processes developed to comply with the EUDR between December 2023 and May 2024. Existing tools will continue to evolve, and new ones will emerge. Notably, the EUDR fast-tracked the development and adoption of traceability tools. At the same time, the EUDR's new minimum standards for private regulation such as forest and agricultural commodity certification can also involve trade-offs such as the potential abandonment of developing more ambitious sustainability certification requirements (e.g. regenerative agricultural practices) due to the focus on developing EUDR-aligned modules. In the long term, however, private regulation and industry-self regulation (e.g. corporate deforestation-free pledges, CSRs) will likely need to develop new standards that go beyond the EUDR's minimum requirements to maintain their added value (e.g. for marketing purposes and managing reputational concerns).

The EUDR also poses challenges, such as its impact on the competitiveness of the European economy, which is burdened with legal requirements that do not exist in other jurisdictions and markets. The EUDR requires public authorities to provide technical tools to those affected and required to comply with the legislation and guidance, as well as interpretations of new legal terms. As of the writing of these conclusions (end of September 2024), the EU falls short in providing guidance on the country benchmarking, a tested digital registry for due diligence declarations (EU Information System) and FAQs on interpretation. This report identifies a trade off in developing ambitious socio-environmental standards to be implemented in a comparatively short transition period and developing the necessary guidance for the private sector and EU Member State public authorities to ensure predictability and efficient implementation in a timely manner. While it is widely recognised by many different stakeholders that demand-side regulation is needed to help stop global deforestation, there is growing concern that operators may not have all the tools to comply, that interpretation is unclear, and that there is bureaucratic waste, as without benchmarking all countries would fall into the standard risk category and require a higher level of inspection intensity. Furthermore, some tools such as scientific testing of FRC origins have high levels of effectiveness in supporting EUDR compliance and enforcement efforts but their large-scale implementation feasibility is limited by issues such as higher costs and longer time periods.

This report shows that many actors affected by the EUDR, as well as those who can assist with compliance, have adjusted their approaches. Politically, economically and technically, actors are preparing to overcome major



obstacles and resolve open questions. Several case studies show that achieving DFSC also supports other objectives that are important to companies or society as a whole, such as a stable, reliable and predictable supply of raw materials, the formalisation of sectors or social improvements for workers, indigenous peoples and local communities.

The following sections explore policy conclusions, recommendations for implementation and innovation potential in the three EMMA4EU focal areas including (1.) compliance, (2.) technology and (3) CSR based on the cross-case summary analysis of the 43 practices.

Compliance - Policy conclusions

For compliance, a first conclusion is that collaborative, pre-competitive initiatives, with the support of public bodies in EU Member States (e.g. competent authorities) and executive bodies of the EU (e.g. European Commission), should be encouraged to further develop key definitions, clarify key concepts and identify data sets for compliance: in the short period of time since the adoption of the EUDR, and in the relatively short period to prepare for its implementation and compliance, the innovative and ambitious nature of the regulation, and the broad scope of the forest risk commodities and products under regulatory scope, has triggered a proliferation of new, renewed, improved and value-added solution-oriented practices such as tools, technologies and platforms. Users of all types are seeking to identify and understand the value and contribution of these solutions to support compliance efforts and figure out how robust, serious and complete they are. Generic key definitions and key concepts could help to evaluate the available solutions, make them interoperable and enable complementarity to foster their effectiveness, efficiency, transparency and reflexivity. A good example of this approach is the Accountability Framework Initiative (case study #6).

Second, based on the EUDR specific and related case study descriptions, it can be concluded that the EUDR is an innovative regulation that follows the EU's 'better regulation' guidelines (EC 2021).

The term 'better regulation' refers to the European Commission's regulatory policy, whereby it seeks to design and prepare EU policies and laws in such a way that they achieve their objectives in the most efficient way (EC 2021). Key principles and tools are preparation of EU policies in an open and transparent way, informed by the best available evidence, including via the comprehensive involvement of stakeholders. This is to ensure that the EU acts in line with overarching EU principles of subsidiarity and proportionality, i.e. only where necessary and in a way that does not go beyond what is needed to address the problem at hand. Last, but not least, better regulation seeks to secure the broad support of EU citizens and remains fit for purpose, future-proof and open to innovative solutions in a context of ever more rapid technological, societal and environmental change (EC 2021). Examples for "better regulation" from the EUDR, as assessed by its design (and not by its delayed implementation), include:

- The EUDR's benchmarking system and clear inspection rules based on evidence based objective risk assessments, international cooperation and policy dialogues between the EU and producer countries, and an adaptive approach to policy learning via "substantiated concerns"; (Case study #22)
- The EUDR's inspection obligations for competent authorities: In an exemplary way, the EUDR's inspection obligations follow the EU's better regulation approach, as the EUDR's inspection obligations are prescriptive in order to promote compliance, helping Member States to transpose, implement and apply EU law in a timely and correct manner. As a result, it contributes to the predictability of the regulatory environment. (Case study #23)
- • Cooperation between the EU and partner countries under the EUDR: unlike the initially voluntary but consequent legally binding partnership agreements (VPAs) under the EU FLEGT Regulation, the EUDR foresees a broader and more flexible model of international cooperation and policy dialogues with partner



countries. FLEGT VPAs could still be agreed and implemented as FLEGT licensed timber will be recognized to meet the legality standard under the EUDR. However, the new international partnership approach under the EUDR is fundamentally based on a bi- and multilateral policy dialogue approach. It seeks to initiate the development of innovative policy, governance and land use solutions to new and complex challenges in the producer countries. It does not necessarily support these solutions with direct market support or financial means. It rather offers capacity building and policy learning through knowledge exchange and participatory processes. (Case study #25)

- Substantiated concerns in the EUDR: The clear and prominent role of substantiated concerns in the EUDR is a result of the reflexive 'learning from experience' situation and is based on the use of the same term 'substantiated concerns' compared to the predecessor regulation, EUTR, and the further adaptation of this approach. The EUDR offers new access to justice for third parties that can strengthen their influence to hold public and private actors accountable when supportive evidence exists. (Case study #26).

Compliance - Recommendations for implementation

Practitioners such as market operators, regulatory agencies, enforcement authorities and civil society observers should make themselves acquainted with the EUDR provisions, and available tools and practices that generate data or support data management for the purpose of supporting legal compliance with the EUDR. Numerous solutions and initiatives such as mapping and data processing tools provide data on deforestation risks and deforestation drivers. This report describes and assesses the potentials and limitations of a variety of such technical tools. Particular examples for technological innovations include:

- Trase that provides Spatially Explicit Information on Production Consumption Systems (SEI-PCS) with data pools that can be navigated with the aim to support legal compliance. (Case Study #1)
- EUFO (European Forest Observatory) that provides basic data such as a map of the forest cover and forest cover change in the EUDR's cutoff year of 2020 (Case Study #5, Case study #29)
- Publically available remote sensing solutions: such as Global Forest Watch (Case study #18; Case study #29), EU Forest Observatory (Case study #29), and Natural Lands Map (Case study #29), and examples of commercial remote sensing services such as Satelligence (Case study #7), explorer.land (Case study #30) as well as KANOP and NADAR (Case study #29).

Compliance - Innovation potential

First, clear potential for innovation can firstly be found in recent initiatives for new or improved EUDR compliance support tools and technologies: many tools and practices have added value or are in the process of harmonising with the EUDR, usually resulting in greater ambition or additional features such as geolocation. The new EUDR due diligence requirements for operators are both an impetus for innovation and a challenge. A key example includes stepped up efforts to gather and manage new geolocation data for the due diligence declaration. In this way, the EUDR is leading the development of innovative solutions to complex supply chain management challenges such as ensuring deforestation-free and legal FRC sourcing (Case study #24). Policymakers could encourage and support targeted actions to further develop initiatives, tools and voluntary sustainability standards (VSS) that align with the EUDR and its purpose, definitions and requirements or technical solutions. Examples of innovative compliance tools and technologies with their potentials and limitations include:

- World Forest ID (Case study #20) and other forensic timber tracing initiatives (Case study #11)



Technology driven initiatives developing scientific methods to identify origin and species in support of DFSC due diligence and potentially towards EUDR compliance with their potentials and limitations include:

- Verité: Provides knowledge and new skills on labour and human rights abuses in global supply chains, research, tools, training and consultancy. Resources are freely available and thus provide easy access to those that seek supporting information to show compliance with corresponding legislations. (Case study #8)
- Produce, Conserve and Include (PCI) government strategy: A public law-based legal approach that provides tools, programmes that can potentially support compliance regarding specific legislations such as the EUDR but also on humans rights aspects and additional sustainable production policies. (Case study #9)
- Brazil's CAR (*Cadastro Ambiental Rural*): Existing public systems for registering and controlling agricultural production that can be used to support DDS and verify DFSC and commodity legality. (Case study #14)
- VSS and verification tools that can support DDS and compliance efforts, while not replacing the obligatory requirements for economic operators include FSC (Case study #28), Selo Verde (Case study #37), Beef on Track (Case study #38), COTI+PRIMI initiatives (Case study #39) and Rainforest Alliance (Case study #42).

Second, innovation may be catalyzed via new and/or improved information platforms and collaboration initiatives: deforestation and forest degradation are complex economic, social and environmental phenomena that require collaborative platforms and initiatives to address these complex issues based on mutual learning and co-regulation. The different platforms and initiatives that are described in the cases can provide decision support for compliance. This relates to risk assessments, traceability across national sectors, navigation tools for practitioners to navigate legal requirements, and multi-stakeholder agreements to halt deforestation. Innovative examples with their potentials and limitations include:

- Sourcing Hub: Proven tool (for EUTR and CSR purposes) that specifically supports risk assessment in the EUDR's DDS. (Case study #16)
- Risk Information Alliance: New multi-partner platform that joins forces to harmonise and implement risk assessments by collecting risk information and country risk assessments. (Case study #21)
- ViSeC (Visión Sectorial del Gran Chaco Argentino): Initially aimed at local forest protection in the Gran Chaco forest that developed into a national and sector-wide solution geared at supporting compliance efforts with the EUDR's due diligence requirements for soy and cattle. (Case study #19)
- ELAN platform by Global Nature Fund and OroVerde: New platform providing information and step-by-step navigation towards EUDR compliance. Goes beyond EUDR-FRC in terms of DFSC. (Case study #31)
- Amazon Soy Moratorium: Long standing platform approach that can gain new value through its potential contribution in proving EUDR compliance. (Case study #40)

Compliance - Further issues to consider

While a focus on compliance is crucial to ensure effective implementation of the EUDR, there are also risks involved. Exclusion of non-compliant suppliers (Case study #32) is the case for an industry self-regulation that aims to generate compliance by negative market incentives. It could be a consequence of forced compliance, while it carries serious risks that can cause social and environmental damage. Therefore, this practice is not recommended in an overall assessment as it has relevant limitations and social, political or even environmental impacts. Another issue to consider is that **mass balancing** (Case study #33). This practice is assessed as not EUDR compliant when the non-certified/verified volume is not accompanied by EUDR compliant information. EUDR could be a catalyst for improvements in such mass balancing systems which are currently widely in use as supply chain control systems.



Technology - Policy conclusion

Connected and interrelated data mining and analysis have a significant potential to support the implementation of DFSC, document DDS and serve as complementary approaches towards compliance and policies. Incentives and public programs should facilitate further development and improvement of such tools: data generation and data mining tools that provide insights into deforestation risks, map deforestation drivers, map supply chains and geolocate FRC origins, among others, provide powerful insights into DFSC and EUDR compliance. They can also assist in monitoring the achievement of CSR goals when implementing DFSC policies.

Technology - Recommendations for implementation

EUDR adds value to DFSC-related and existing technologies, while providers need to rethink, evolve and improve their solutions: several technological tools existed prior to the adoption of the EUDR. The EUDR has the potential to add value to such technological solutions, but also to challenge them with new definitions, new concepts and new requirements. Vendors of such solutions will need to evolve their solution to realise this potential, remain relevant and support further legal developments (e.g. interpretations of the EUDR).

Technology - Innovation potential

New technological solutions and offers are coming up: the EUDR appears to have the potential to generate the need, demand for, use cases and added value to kick-start the development of new technologies or to bring them to a level of practical application. Among some of these technologies are blockchain technology, genetic tracing of commodities, and the use of AI to identify specific drivers of deforestation based on remote sensing data and to map supply chains, among others.

Technology - Issues to consider

While technology tools can provide new insights by data mining and intercorrelating data as well as new levels of efficiency, it might pose issues to consider upon those economic actors that need to show compliance. **Operators as well as relevant traders that handle EUDR-FRCs remain responsible for their compliance and need to understand and administer all technological tools.** For this, the following elements should be considered carefully: Costs (e.g., material costs, staff, expertise), time (e.g. time to develop the tool, testing time), transparency of methodologies (e.g. evaluation criteria), and accountability (e.g. who holds solution service providers accountable? Is it a tangible contribution towards the economic actor's compliance requirements?). Only if an economic operator has these critical resources at its disposal and issues are under control, the use of a specific technological solution is advisable. To make a decision on what levels a technological tool is used towards compliance, it is advised to study its capabilities, test its implementation and check in a role-play-like test a potential competent authority inspection.

Corporate Social Responsibility - Policy conclusions

Financial sector's sustainable policies have the potential to be crucial for advancing DFSC: Financial sector's actors play a pivotal role in promoting sustainable land-use practices through their policies and investment strategies. When these policies are ambitious, serious, and transparent, as exemplified by BNP Paribas' top ranking in the Forest 500 report, they directly support the EU's Stepping-Up Action Plan's Priority 4: Redirecting



finance to more sustainable land-use practices (Case study #2). Additionally, sustainability strategies that integrate DFSC can exert significant indirect leverage by encouraging the phase-out of destructive supply chains. The Dutch Pension Fund's sustainability policy illustrates how financial sector initiatives can support this priority, further emphasising the importance of redirecting finance towards sustainability. Therefore, it is crucial for financial sector policies to prioritise sustainability and transparency to effectively contribute to the EU's environmental goals. (Case study #15). It is hence recommended to include financial institutions in further revisions of the EUDR's regulatory scope. Thus far, sustainable financing criteria and indicators for the forest sector have not been agreed upon under the EU Taxonomy Regulation, and the EUDR's review and possible revisions are yet to come on the policy agenda.

Civil society, observers and solution providers have the potential to play a tangible and critical role, and should be embraced for monitoring, advocating for and facilitating DFSC-related CSR: Civil society, observers, and solution providers play a crucial role in monitoring, advocating for, and facilitating DFSC as part of CSR initiatives. These entities operate as watchdogs, enhancing transparency and accountability in private sector commitments to reduce deforestation, thereby promoting corporate behavioural change. Initiatives like the Forest 500 by Global Canopy (Case study #3) and the Accountability Framework (Case study #6) provide standardised best practices and key definitions, aiding the private sector and informing legislative processes. Tools such as the Universal Mill List (Case study #17) and the Forest Stewardship Council (Case study #28) exemplify collaboration between the private sector and sustainability bodies, supporting sustainable supply chains. Platforms like ELAN (Case study #31) and the Soft Commodity Forum (Case study #41) further assist companies in transitioning towards deforestation-free supply chains, aligning with regulations such as the EUDR. The collective efforts of these civil society actors are essential for driving progress towards sustainable forest management and product sourcing, beyond the scope of EUDR.

Corporate Social Responsibility – Recommendation for implementation

Contextual activities to protect ecosystem services, integrity of landscapes and biodiversity can be powerful actions towards broader sustainability beyond DFSC and could be considered to build holistic sustainability strategies: contextual activities aimed at protecting ecosystem services, landscape integrity, and biodiversity are critical components of a comprehensive CSR strategy. While initiatives such as oil palm agroforestry (Case study #12), conservation liability in the palm oil industry (Case study #34), and payment for ecosystem services (Case study #36) may not directly ensure compliance with the EUDR, they could significantly contribute to the broader goal of sustainable FRC supply chains and DFSC. By incorporating these initiatives into their overall sustainability strategies, companies can enhance their CSR efforts, promote biodiversity, and protect vital ecosystem services.

Corporate Social Responsibility - Innovation potential

The EUDR has the potential to drive business behaviour change, which could be documented by pertinent, while still anecdotal examples: the EUDR and the emphasis on DFSC are driving innovative changes in business operations. Companies are implementing strategies to gain greater control and monitoring of their supply chains, as seen in Ritter Sport's direct cocoa supply chains and ownership of plantations (Case study #27). Similarly, Kyagalanyi Coffee's DFSC-focused action program showcases innovative approaches in the coffee sector (Case study #43). These initiatives reflect a broader trend of businesses adopting new practices and technologies to enhance transparency, sustainability, and compliance with the EUDR, thereby advancing responsible and sustainable supply chain management.



Corporate Social Responsibility - Further issues to consider

To flower and have market success, CSR-driven changes towards DFSC need a supportive legal framework that specifically eliminates or weakens competition with unsustainable practices: while voluntary CSR-driven changes are welcome and lead the way by example, they might not have the leverage to generate sector-wide changes, as they can be undercut (by legal and compliant, but low-cost practices without extra effort towards sustainability) or even driven out of business by unfair (illegal, non-compliant, non-ethical) competition. For supporting CSR-driven changes, 'hard' laws are critically needed, as they eliminate illegal and non-compliant competition. CSR efforts then still provide marketing advantages (e.g. Ritter Sport as a global brand, Case study #27), allowing companies to aim high, and strive through ambitions and transparency. This allows them to gain competitive advantages over legal, but unethical competition. The EUDR is a 'best practice' regulation in support of CSR-driven changes, specifically towards DFSC.



7. REFERENCES

- 4th Council for the Environment and Cultural Heritage. (2021). Monitoring protocol for cattle. Suppliers in the Amazon. Ministerio Público Federal de Brasil & Imaflora. https://www.beefontrack.org/wp-content/uploads/2022/10/1653923455-protocolo_monitoramento_gado_a4_40p_ingles_1.1_-_060-8767_v2.pdf
- ABP. (2024). Duurzaam en Verantwoord Beleggingsbeleid ABP. Een goed pensioen in een leefbare wereld.
- ADP secretariat, University of Minas Gerais, & State of Pará. (2023). Meeting Deforestation Requirements: Exploring the role of SeloVerde, Pará and Minas Gerais in meeting emerging market requirements on legal compliance and zero deforestation. <https://ad-partnership.org/wp-content/uploads/2023/02/Policy-Brief-Selo-Verde-EU-UK-regulation-v2023-0125.pdf>
- Agência BNDES de Notícias. (2023). BNDES bloqueia empréstimos a propriedades rurais desmatadas ilegalmente. BNDES. <https://agenciadenoticias.bndes.gov.br/detalhe/noticia/BNDES-bloqueia-emprestimos-a-propriedades-rurais-desmatadas-ilegalmente/>
- Alexander, A. (2023). Innovation for zero-deforestation sustainable supply chain management services: A performance measurement and management approach.
- Alexander, A., Kumar, M., Walker, H., & Gosling, J. (2024). Innovation for zero-deforestation sustainable supply chain management services: A performance measurement and management approach. Supply Chain Management: An International Journal, 29(3), 620–641. <https://doi.org/10.1108/SCM-02-2023-0088>
- Alkema, S., Masselink, R., Wielaard, N., & Wolters, M. (2024). Making open forest data safe for EUDR compliance.
- Alves-Pinto, H., Newton, P., & Pinto, L. (2013). Certifying sustainability: Opportunities and challenges for the cattle supply chain in Brazil. CCAFS Working Paper, 57. <https://ccafs.cgiar.org/resources/publications/certifying-sustainability-opportunities-and-challenges-cattle-supply#.VMkj5FqmGMU>
- Amaral, D. F., De Souza Ferreira Filho, J. B., Chagas, A. L. S., & Adami, M. (2021). Expansion of soybean farming into deforested areas in the Amazon biome: The role and impact of the soy moratorium. Sustainability Science, 16(4), 1295–1312. <https://doi.org/10.1007/s11625-021-00942-x>
- Andrade, R. (2024, February 23). Interview about the COTI initiative [Personal communication].
- Angel, M., & Kurniawati, D. (2023, December 19). Coffee firms turning away from Africa as EU deforestation law looms. Reuters. <https://www.reuters.com/markets/commodities/coffee-firms-turning-away-africa-eu-deforestation-law-looms-2023-12-19/>
- Anonymous. (2024). EU regulation; an opportunity for farmers and the environment | Monitor. <https://www.monitor.co.ug/uganda/oped/commentary/eu-regulation-an-opportunity-for-farmers-and-the-environment-4768844>
- Atisa, G. (2020). Policy adoption, legislative developments, and implementation: The resulting global differences among countries in the management of biological resources. International Environmental Agreements: Politics, Law and Economics, 20(1), 141–159. <https://doi.org/10.1007/s10784-020-09467-7>
- Batistella, M., Bolfe, É. L., & Moran, E. F. (2013). Agroforestry in Tomé-Açu: An Alternative to Pasture in the Amazon. In E. Brondízio & E. Moran (Eds.), Human-Environment Interactions. Human-Environment Interactions (Vol. 1). Springer.
- Baumüller, J., & Sopp, K. (2021). Double materiality and the shift from non-financial to European sustainability reporting: Review, outlook and implications. Journal of Applied Accounting Research, 23(1), 8–28.



- Berning, L., & Sotirov, M. (2023). Hardening corporate accountability in commodity supply chains under the European Union Deforestation Regulation. *Regulation & Governance*, 17(4), 870–890. <https://doi.org/10.1111/rego.12540>
- Berning, L., & Sotirov, M. (2024). The coalitional politics of the European Union Regulation on deforestation-free products. *Forest Policy and Economics*, 158, 103102. <https://doi.org/10.1016/j.forpol.2023.103102>
- Beske-Janssen, P., Schaltegger, S., & Johnson, P. M. (2015). 20 years of performance measurement in sustainable supply chain management – what has been achieved?". *Supply Chain Management: An International Journal*, 20(6). <https://doi.org/10.1108/SCM-06-2015-0216>
- Bhagwat, S. A., & Willis, K. J. (2008). Agroforestry as a Solution to the Oil-Palm Debate. *Conservation Biology*, 22(6), 1368–1369.
- Binsztok, L. (2017, April 12). Implementing and Scaling up the CGF Zero Net Deforestation Commitment. The Consumer Goods Forum. <https://www.theconsumergoodsforum.com/blog/2017/04/12/implementing-and-scaling-up-the-cgf-zero-net-deforestation-commitment/>
- Birrmetrics. (2023, December 30). Ethiopian Coffee Industry at Risk: Unintended Effects of EU Deforestation Regulation - Birr Metrics. <https://birrmetrics.com/ethiopian-coffee-industry-at-risk-unintended-effects-of-eu-deforestation-regulation/>
- Bischoff, O., & Seuring, S. (2021). Opportunities and limitations of public blockchain-based supply chain traceability. *Modern Supply Chain Research and Applications*, 3(3), 226–243. <https://doi.org/10.1108/MS CRA-07-2021-0014>
- Boeschoten, L. E., & et al. (2022). Clay and soil organic matter drive wood multi-elemental composition of a tropical tree species: Implications for timber tracing. *Science of The Total Environment*, 849, 157877.
- Boeschoten, L. E., & et al. (2023). A new method for the timber tracing toolbox: Applying multi-element analysis to determine wood origin. *Environmental Research Letters*, 18(5), 054001.
- Bundesministerium für wirtschaftliche Zusammenarbeit und & BMZ. (2019). Entwaldungsfreie Lieferketten. Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ), Fachreferat 121 (Internationale Agrarpolitik, Landwirtschaft, Innovation). https://www.giz.de/en/downloads/Factsheet%20Entwaldungsfreie%20Lieferketten_Programm%20Nachhaltige%20Agrarlieferketten%20und%20Standards.pdf
- Busse, C. (2024). Why Global Forest Watch is not suited for ensuring compliance with the EUDR. <https://www.nadar.earth/insights/why-gfw-is-not-suited-for-eudr-compliance>
- Capano, G., & Lippi, A. (2017). How policy instruments are chosen: Patterns of decision makers' choices. *Policy Sciences*, 50(2), 269–293. <https://doi.org/10.1007/s11077-016-9267-8>
- Carvalho, S. H. C. D., Cojoianu, T., & Ascui, F. (2023). From impacts to dependencies: A first global assessment of corporate biodiversity risk exposure and responses. *Business Strategy and the Environment*, 32(5), 2600–2614.
- Carvalho, W. D., Mustin, K., Hilário, R. R., Vasconcelos, I. M., Eilers, V., & Fearnside, P. M. (2019). Deforestation control in the Brazilian Amazon: A conservation struggle being lost as agreements and regulations are subverted and bypassed. *Perspectives in Ecology and Conservation*, 17(3), 122–130. <https://doi.org/10.1016/j.pecon.2019.06.002>
- Catá Backer, L., & McQuilla, B. M. (2023). The algorithmic law of business and human rights: Constructing private transnational law of ratings, social credit and accountability measures. *International Journal of Law in Context*, 19, 32–50. <https://doi.org/10.1017/S1744552322000453>
- CDP. (2024). CDP Technical Note: Reporting progress on Deforestation- and conversion-free value chains. CDP



- Carbon Disclosure Project. https://cdn.cdp.net/cdp-production/cms/guidance_docs/pdfs/000/004/231/original/CDP_technical_note_-_forests_implementation.pdf?1677259683
- Cesar de Oliveira, S. E. M., Nakagawa, L., Russo Lopes, G., Visentin J., C., Couto, M., Silva D., F., Pavani B., F., Loyola, R., & West, C. (2024). The European Union and United Kingdom's deforestation-free supply chains regulations. Implications for Brazil. *Ecological Economics*, 217, 108053. <https://doi.org/10.1016/j.ecolecon.2023.108053>
- Chan, K. M. A., Anderson, E., Chapman, M., Jespersen, K., & Olmsted, P. (2017). Payments for Ecosystem Services: Rife With Problems and Potential—For Transformation Towards Sustainability. *Ecological Economics*, 140, 110–122. <https://doi.org/10.1016/j.ecolecon.2017.04.029>
- Chen, J.-Y. (2022). Responsible sourcing and supply chain traceability. *International Journal of Production Economics*. <https://doi.org/10.1016/j.ijpe.2022.108462>
- Chervier, C., Piketty, M. G., & Reed, J. (2020). A tentative theory of change to evaluate jurisdictional approaches to reduced deforestation. *Frontiers in Forests and Global Change*, 3, 498151. <https://doi.org/10.3389/ffgc.2020.498151>
- Cheyns, E., Benoit, D., Marcel, D., Fouilleux, È., & Guéneau, S. (2017). The standardization of sustainable development through the insertion of agricultural global value chains into international markets. In E. Biénabe, A. Rival, & D. Loeillet (Eds.), *Sustainable Development and Tropical Agri-Chains* (pp. 283–303). Springer. http://dx.doi.org/10.1007/978-94-024-1016-7_23.
- Chloris Geospatial. (2022). Catalyzing High-Integrity Nature-Based Solutions at Scale. <https://static1.squarespace.com/static/65ae8dc337ea664cbf34181c/t/6616ec2300d4ac6f813361dd/1712778276842/Introducing-the-Chloris-Platform.pdf>
- Coffeebarometer. (2024). <https://coffeebarometer.org/>
- Consumer Goods Forum. (2020). Forest Positive Coalition. The Consumer Goods Forum. <https://www.theconsumergoodsforum.com/environmental-sustainability/forest-positive/>
- DeValue, K., Takahashi, N., Woolnough, T., Merle, C., Fortuna, C., & Agostini, A. (2022). Halting deforestation from agricultural value chains: The role of governments. FAO. <https://doi.org/10.4060/cc2262en>
- Dietz, T., Biber-Freudenberger, L., Deal, L., & Börner, J. (2022). Is private sustainability governance a myth? Evaluating major sustainability certifications in primary production: A mixed methods meta-study. *Ecological Economics*, 201, 107546. <https://doi.org/10.1016/j.ecolecon.2022.107546>
- Directorate General for Environment (European Commission). (2021). Study on certification and verification schemes in the forest sector and for wood-based products: Report. Publications Office. <https://data.europa.eu/doi/10.2779/126030>
- Directorate-General for Environment (European Commission). (2021). EU biodiversity strategy for 2030: Bringing nature back into our lives. Publications Office of the European Union. <https://data.europa.eu/doi/10.2779/677548>
- Dow Goldman, E., Weisse, M., Harris, N., & Schneider, M. (2020). Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fiber, Cocoa, Coffee, and Rubber. World Resources Institute. <https://doi.org/10.46830/writn.na.00001>
- Dryzek, J. S. (2016). Institutions for the Anthropocene: Governance in a Changing Earth System. *British Journal of Political Science*, 46(4), 937–956. <https://doi.org/10.1017/S0007123414000453>
- Earth Innovation Institute. (2017). Jurisdictional Sustainability: A Primer for Practioners. February. <http://earthinnovation.org/publications/jurisdictionalsustainability-primer/>



- EarthSight. (2018). Complicit in corruption—How billion-dollar firms and EU governments are failing Ukraine's forests. https://fe8a03e2-1131-44e7-a06a-fb468c2a30d4.filesusr.com/ugd/624187_673e3aa69ed84129bdfef91b6aa9ec17.pdf
- EarthSight. (2021). FSC hall of shame: The ethical wood label's long line of scandals. <https://www.earthsight.org.uk/news/blog-fsc-hall-of-shame-the-ethical-wood-label-long-list-of-scandals>
- EarthSight. (2024). Ikea's House of Horrors. <https://www.earthsight.org.uk/ikeahouseofhorrors>
- Environmental Investigation Agency. (2015, October 21). Stealing the Last Forest. <https://eia.org/report/st/>
- Erasmus K.H.J. zu Ermgassen et al. (2020). Using supply chain data to monitor zero deforestation commitments: An assessment of progress in the Brazilian soy sector. *Environ. Res. Lett.*, 15, 035003. <https://doi.org/10.1088/1748-9326/ab6497>
- EU. (2024). Shaping Europe's digital future. Blockchain Strategy. <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy>
- EuREDD Facility. (2017). Unlocking supply-chain data to reduce deforestation: The Trase initiative. <https://euredd.efi.int/unlocking-supply-chain-data-reduce-deforestation-trase-initiative/>
- European Commission. (n.d.-a). Fact sheet: Team Europe Initiative on Deforestation-free Value Chains. Retrieved 13 July 2024, from https://international-partnerships.ec.europa.eu/document/download/9ee0c9c2-9f3f-470f-896b-63a6a22e32fa_en?filename=factsheet-tei-deforestation-free-value-chains-05122023_en.pdf
- European Commission. (n.d.-b). Traceability—European Commission. Retrieved 21 September 2024, from https://green-business.ec.europa.eu/deforestation-regulation-implementation/traceability_en
- European Commission. (2003). Communication from the Commission to the Council and the European Parliament—Forest Law Enforcement, Governance and Trade (FLEGT)—Proposal for an EU Action Plan. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52003DC0251>
- European Commission. (2019a). Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions: Stepping up EU Action to Protect and Restore the World's Forests. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0352>
- European Commission. (2019b). Press release: The European Green Deal [Text]. European Commission - European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6691
- European Commission. (2021a). Better regulation: Guidelines and toolbox. https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation/better-regulation-guidelines-and-toolbox_en
- European Commission. (2021b). Commission staff working document fitness check on 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 (the EU Timber Regulation) and on Regulation (EC) No 2173/2005 of 20 December 2005 on the establishment of a FLEGT licensing scheme for imports of timber into the European Community (FLEGT Regulation). (SWD(2021) 328 Final, p. 49). European Commission.
- European Commission. (2021c). Commission staff working document impact assessment minimising the risk of deforestation and forest degradation associated with products placed on the EU market. (SWD(2021) 326 Final Part1/2, p. 87). European Commission.
- European Commission. (2021d, July 14). Delivering the European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en
- European Commission. (2022a). COP27: EU launches Forest Partnerships [Text]. European Commission - European



Commission. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_6653

European Commission. (2022b). The innovation principle. https://research-and-innovation.ec.europa.eu/system/files/2022-07/ec_rtd_factsheet-innovation-principle.pdf

European Commission. (2023a). Global Gateway: EU and Member States launch global Team Europe Initiative on Deforestation-free Value Chains - European Commission. https://international-partnerships.ec.europa.eu/news-and-events/news/global-gateway-eu-and-member-states-launch-global-team-europe-initiative-deforestation-free-value-2023-12-09_en

European Commission. (2023b, March 1). Global Gateway: Striving to be the first climate-neutral continent. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en

European Commission. (2024). EU and Rwanda sign a Memorandum of Understanding [Text]. European Commission - European Commission. https://ec.europa.eu/commission/presscorner/detail/en/IP_24_822

Ewerton, M., & Prescott, C. (2022). Landscape and Jurisdictional Approaches. Opportunities to finance a nature-positive net-zero transition. Factsheet. CDP. https://cdn.cdp.net/cdp-production/comfy/cms/files/files/000/007/019/original/CDP_CM_Factsheet_2022.pdf

Forests and Finance. (2023). Banking on biodiversity collapse. Tracking the Banks and Investors driving Tropical Forest Destruction. Rainforest Action Network.

Freitas, A., & De Marcello, M. (2023). How to achieve zero deforestation in the cattle sector. Best practice in Brazil and the new EU regulation on deforestation-free products. FERN. https://www.fern.org/fileadmin/uploads/fern/Documents/2023/How_to_achieve_zero_deforestation_in_the_cattle_sector.pdf

Fripp, E. (2023). Traceability and transparency in supply chains for agricultural and forest commodities. A review of success factors and enabling conditions to improve resource use and reduce forest loss. <https://files.wri.org/d8/s3fs-public/2023-10/traceability-transparency-supply-chains.pdf?VersionId=3HZoYFHW6eQ7CZ7DEDurlJoeJRzg9gsK>.

FSC. (2022). FSC's position and 10 recommendations to improve the new EU rules for deforestation-free products. Fsc.Org. <https://fsc.org/en/newscentre/eudr/fscs-position-and-10-recommendations-to-improve-the-new-eu-rules-for-deforestation>

FSC. (2024a). Introducing FSC Blockchain. Transforming Supply Chain Integrity. <https://fsc.org/en/blockchain>

FSC. (2024b, January 16). Deforestation and forest degradation. Fsc.org. <https://fsc.org/en/deforestation-and-forest-degradation>

Gallemore, C., Delabre, I., Jespersen, K., & Liu, T. (2022). To see and be seen: Technological change and power in deforestation driving global value chains. *Global Networks*, 22(4), 615–630. <https://doi.org/10.1111/glob.12383>

Gallemore, C., & Jespersen, K. (2019). Offsetting, Insetting, or Both? Current Trends in Sustainable Palm Oil Certification. *Sustainability*, 11(19), 5393. <https://doi.org/10.3390/su11195393>

Gardner, T.A., et al. (2019). Transparency and sustainability in global commodity supply chains. *World Dev*, 121, 163–177. <https://doi.org/10.1016/j>.

Gassler, B., & Spiller, A. (2018). Is it all in the MIX? Consumer preferences for segregated and mass balance certified sustainable palm oil. *Journal of Cleaner Production*, 195, 21–31. <https://doi.org/10.1016/j.jclepro.2018.05.039>

Gibbs, H. K. (2015). Brazil's Soy Moratorium. *Science*, 347, 377–378.

Gibbs, H. K. (2016). Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the



Brazilian Amazon? Conservation Letters, 9, 32–42.

Gibbs, H. K., Rausch, L., Munger, J., Schelly, I., Morton, D. C., Noojipady, P., Soares-Filho, B., Barreto, P., Micol, L., & Walker, N. F. (2015). Brazil's Soy Moratorium. *Science*, 347(6220), 377–378. <https://doi.org/10.1126/science.aaa0181>

Global Canopy. (2023). Forest 500 Assessment methodologies 2023. <https://forest500.org/publications/assessment-methodologies-2023/#:~:text=The%20assessment%20methodologies%20show%20how,forest%20risk%20commodity%20supply%20chains>.

Global Canopy. (2024a). 2024: A decade of deforestation data – Forest 500. <https://forest500.org/publications/2024-a-decade-of-deforestation-data/>

Global Canopy. (2024b). Forest 500 significantly expands, ahead of momentous year for deforestation action. <https://forest500.org/analysis/insights/forest-500-significantly-expands-ahead-of-momentous-year-for-deforestation-action/>

Global Canopy. (2024c). Supply Chain Transparency. <https://globalcanopy.org/what-we-do/supply-chain-transparency/>

Global Forest Watch. (2023, June 23). 3 Ways Global Forest Watch Can Support the EU Law on Deforestation-free Supply Chains | GFW Blog. Global Forest Watch Content. <https://www.globalforestwatch.org/blog/data-and-tools/satellite-data-eu-regulation-deforestation-free-supply-chains>

Global Forest Watch. (2024). Forest monitoring designed for action. <https://www.globalforestwatch.org/>

Global Nature Fund. (2024). ÜBER UNS. <https://www.globalnature.org/34516/HOME/Ueber-uns/resindex.aspx>

Guimarães, A. L., de Castro Chaves Stabil, M., & Moutinho, P. (2023). Private Governance: Multistakeholder Initiatives and Moratoriums. In *Sustainability Challenges of Brazilian Agriculture. Governance, Inclusion, and Innovation* (pp. 427–444). Springer International Publishing.

Gustafsson, M., Schilling-Vacaflor, A., & Lenschow, A. (2023). Foreign corporate accountability: The contested institutionalization of mandatory due diligence in France and Germany. *Regulation & Governance*, 17(4), 891–908. <https://doi.org/10.1111/rego.12498>

Hansen, M. C., Krylov, A., Tyukavina, A., Potapov, P. V., Turubanova, S., Zutta, B., Ifo, S., Margono, B., Stolle, F., & Moore, R. (2016). Humid tropical forest disturbance alerts using Landsat data. *Environmental Research Letters*, 11(3), 034008. <https://doi.org/10.1088/1748-9326/11/3/034008>

He, Z., & Turner, P. (2022). Blockchain applications in forestry: A systematic literature review. *Applied Sciences*, 12(8). <https://doi.org/10.3390/app12083723>

Heilmayr, R., Rausch, L. L., Munger, J., & Gibbs, H. K. (2020). Brazil's Amazon Soy Moratorium reduced deforestation. *Nature Food*, 1(12), 801–810. <https://doi.org/10.1038/s43016-020-00194-5>

Heldt, L., & Beske-Janssen, P. (2023). Solutions from space? A dynamic capabilities perspective on the growing use of satellite technology for managing sustainability in multi-tier supply chains. *Int. J. Production Economics*, 260, 108864. <https://doi.org/10.1016/j.ijpe.2023.108864>

Hoffmann, G. (2023, March 30). Kakao—Ohne Mücke geht es nicht. UBi. <https://www.unternehmen-biologische-vielfalt.de/ohne-muecke-geht-es-nicht/>

IBGE. (2024). Rebanho de Bovinos (Bois e Vacas) no Brasil. <https://www.ibge.gov.br/explica/producao-agropecuaria/bovinos/br>



- Imaflora. (2023). FAQ – BOI NA LINHA. <https://www.boinalinha.org/faq/>
- Imaflora, Soy Working Group, ABIOVE, & ANEC. (2022). Report of independent audit of the Amazon soy moratorium. https://www.soyontrack.org/wp-content/uploads/2024/02/1666289572-report_of_independent_audit_of_the_amazon_soy_moratorium_-_ing_-_w5103614_alt1.pdf
- Indonesian Embassy in Brussels. (2023). 17 Like Minded Countries Convey Official Concern Regarding The Eudr | Portal Kementerian Luar Negeri Republik Indonesia. <https://kemlu.go.id/portal/en/read/5234/berita/17-like-minded-countries-convey-official-concern-regarding-the-eudr>
- Isenhour, C. (2014). Trading Fat for Forests: On Palm Oil, Tropical Forest Conservation, and Rational Consumption. *Conservat Soc*, 12, 257–267.
- Joint Research Centre. (2024). EU Observatory on deforestation and forest degradation. Joint Research Centre, European Commission, <https://forest-observatory.ec.europa.eu/>, Last Access.
- Jung, S., Rasmussen, L. V., Watkins, C., Newton, P., & Agrawal, A. (2017). Brazil's National Environmental Registry of Rural Properties: Implications for Livelihoods. *Ecological Economics*, 136, 53–61.
- Kamilaris. (2019). The rise of blockchain technology in agriculture and food supply chains. *Trends in Food Science & Technology*, 91, 640–652. <https://doi.org/10.1016/j.tifs.2019.07.034>
- Kanop. (2024). Supply Chain Monitoring for EUDR Compliance. <https://kanop.io/eudr-compliance-software-solution>
- Khasanah, N., Noordwijk, M., Slingerland, M., Sofiyudin, M., Stomph, D., Migeon, A. F., & Hairiah, K. (2020). Oil Palm Agroforestry Can Achieve Economic and Environmental Gains as Indicated by Multifunctional Land Equivalent Ratios.
- Köthke, M. (2020). Implementation of the European Timber Regulation by German importing operators: An empirical investigation. *Forest Policy and Economics*, 111, 102028. <https://doi.org/10.1016/j.forpol.2019.102028>
- Leenoi, P. (2024). EUDR' Ensuring that Exports to the EU are Deforestation-free. <https://www.krungsri.com/en/research/research-intelligence/eudr-2023>.
- Lima de Freitas, J. (2003). Assessing how the beneficiaries perceive the constraints and benefits of fsc certification: A case study of brazilian smallholders, Master Thesis. https://web.archive.org/web/20221024010012id_/https://open.library.ubc.ca/media/download/pdf/24/1.0421271/3
- Lopes, C. L., & Chiavari, J. (2023). Salvemos o CAR! <https://www.climatepolicyinitiative.org/wp-content/uploads/2023/05/NT-Salvemos-o-CAR.pdf>
- Lopes, C. L., Chiavari, J., & Segovia, M. E. (2023). Brazilian Environmental Policies and the New European Union Regulation for Deforestation-Free Products: Opportunities and Challenges. *Climate Policy Initiative*. <https://www.climatepolicyinitiative.org/wp-content/uploads/2023/10/Brazilian-Environmental-Policies-and-the-New-European-Union-Regulation-for-Deforestation-Free-Products.pdf>
- Lopes, C. L., Machado, L., & Chiavari, J. (2023). Onde Estamos Na Implementação Do Código Florestal? Radiografia Do CAR e Do PRA Nos Estados Brasileiros—Edição 2022. <https://www.climatepolicyinitiative.org/pt-br/publication/onde-estamos-na-implementacao-do-codigo-florestal-radiografia-do-car-e-do-pra-nos-estados-brasileiros-edicao-2022/>
- Low, M. C., & et al. (2022). Tracing the world's timber: The status of scientific verification technologies for species and origin identification. *IAWA Journal*, 1–22.
- Macdonald, K., Diprose, R., Grabs, J., Schleifer, P., Alger, J., Bahrudin, C., B., C., P., D., D., G., R., H., & Hopkinson,



- W. (2023). Jurisdictional Approaches to Sustainable Commodity Governance. Sustainable Global Supply Chains Discussion Papers Number 4. <https://doi.org/10.57671/sgscdp-2304>.
- Mazur, E., Sims, M., Beatty, C., & Daldoss Pirri, M. (2023). Natural Lands Map Provides Baseline for Companies' No Conversion Targets. Land & Carbon Lab. <https://www.landcarbonlab.org/news-updates/natural-lands-map-companies-no-conversion-targets>
- McDermott, C. L., & Sotirov, M. (2018). A political economy of the European Union's timber regulation: Which member states would, should or could support and implement EU rules on the import of illegal wood? Forest Policy and Economics, 90, 180–190. <https://doi.org/10.1016/j.forpol.2017.12.015>
- Miccolis, A., Noordwijk, M., & Amaral, J. (2022). Oil palm in Brazil: Lessons from policies and agroforestry.
- Milhorance, C., & Bursztyn, M. (2018). Emerging Hybrid Governance to Foster Low-emission Rural Development in the Amazon Frontier. Land Use Policy, 75, 11–20. <https://doi.org/10.1016/j.landusepol.2018.03.029>
- Mongabay. (2021). Investigation: Dutch, Japanese pension funds pay for Amazon deforestation. <https://news.mongabay.com/2021/02/investigation-dutch-japanese-pension-funds-pay-for-amazon-deforestation/>
- Nagel, S. S. (1986). EFFICIENCY, EFFECTIVENESS, AND EQUITY IN PUBLIC POLICY EVALUATION. Review of Policy Research, 6(1), 99–120. <https://doi.org/10.1111/j.1541-1338.1986.tb00651.x>
- Nepstad, D., Irawan, S., Bezerra, T., Boyd, W., Stickler, C., Shimada, J., & Carvalho, O. (2013). More food, more forests, fewer emissions, better livelihoods: Linking REDD+, sustainable supply chains and domestic policy in Brazil, Indonesia and Colombia (Vol. 4, Issue 6, pp. 639–658). <https://doi.org/10.4155/cmt.13.65>
- Nienaber, M., & Ainger, J. (2024, September 12). Scholz Asks EU to Delay Deforestation Law in Latest Criticism. Bloomberg.Com. <https://www.bloomberg.com/news/articles/2024-09-12/brazil-slams-eu-deforestation-law-for-lacking-understanding>
- Nunés, F. (2024, February 27). Interview on Selo Verde with F. Nunes at Centro de Inteligência Territorial (CIT) [E-Mail].
- OpenForests. (2024a). explorer.land—Explore and support impactful nature-based projects worldwide. Explorer. Land. <https://explorer.land/x/projects>
- OpenForests. (2024b, April 11). Mapping trusted nature-based projects—Explorer.land. <https://home.explorer.land/>
- OroVerde. (2024). Über uns. Wir schützen Regenwald—Die Tropenwaldstiftung OroVerde. <https://www.regenwald-schuetzen.org/ueber-uns>
- OroVerde, & Global Nature Fund. (2023). Risikoanalyse. Elan! - Entwaldungsfreie Lieferketten - Aktiv Für Mehr Nachhaltigkeit. <https://www.entwaldungsfreie-lieferketten.de/2-risikoanalyse>
- OroVerde, & Global Nature Fund. (2024). Lieferketten gestalten, Wälder schützen. Elan! - Entwaldungsfreie Lieferketten - Aktiv Für Mehr Nachhaltigkeit. <https://www.entwaldungsfreie-lieferketten.de/>
- Paim, M. (2021). Zero deforestation in the Amazon: The Soy Moratorium and global forest governance. Review of European, Comparative & International Environmental Law, 30(2), 220–232. <https://doi.org/10.1111/reel.12408>
- Palencia, G. (2024, September 19). Coffee growers look to postpone EU deforestation requirement. Reuters. <https://www.reuters.com/markets/commodities/coffee-growers-look-postpone-eu-deforestation-requirement-2024-09-19/>
- Pasaribu, K. N., Jespersen, K., Gallemore, C. T., & Delabre, I. (2023). Estimating Buyers' Contribution to Conservation



Finance in the Palm Oil Industry: A Spatial Footprint Approach. <https://doi.org/10.2139/ssrn.4601098>

Paulson Institute, the Nature Conservancy and Cornell Atkinson Centre for Sustainability. (2020). Financing Nature: Closing the Global Biodiversity Financing Gap.

Piatto, M., & De Souza, L. I. (2017). 10 anos da moratória da soja na Amazônia: História, impactos e a expansão para o cerrado. Imaflora.

Preferred by Nature. (2013, April 25). Open Source Policy. <https://www.preferredbynature.org/library/document/open-source-policy>

Preferred by Nature. (2023). Report with interview data from the project: Enabling Effective Implementation and Enforcement of the EU Timber Regulation in 6 Key Timber Importing Countries LIFE18 GIE/DK/000763 – Support EUTR II.

Preferred by Nature. (2024, June 11). Global sustainability organisations form alliance to share risk information. <https://www.preferredbynature.org/news/global-sustainability-organisations-form-alliance-share-risk-information>

PRIMI. (n.d.). PRIMI - Individual Traceability and Indirect Monitoring Program. PRIMI Protocol. Retrieved 14 July 2024, from <https://www.primiprotocol.com/en/sobre>

PRIMI. (2023). Descriptive Memorandum of Individual Traceability and Indirect Monitoring Program. PRIMI Protocol. <https://www.primiprotocol.com/en/documentos>

Produce, Conserve, Include. (2019). Produce, Conserve, Include Strategy: Providing Proof of Concept of the Jurisdictional Approach in Mato Grosso, Brazil". Knowledge Repository—UNEP. <http://hdl.handle.net/20.500.11822/28871>

Produce, Conserve, Include. (2024a). Target Monitoring. Mato Grosso Produce, Conserve and Include Strategy. <https://www.pcimt.org/images/BalancodasMetasPCIEstadualINGLES.pdf>

Produce, Conserve, Include. (2024b). The PCI Strategy. The biggest global effort to mitigate climate change ever devised by a subnational state. <https://www.pcimt.org/en/institutional-en/the-pci-strategy>

Projeto de Lei Selo Agro Verde, PL 4734/2020, Câmara dos Deputados Brasil (2020). <https://www.camara.leg.br/proposicoesWeb/fichadetramitacao?idProposicao=2263447&fichaAmigavel=nao>

Race to Zero. (2023). Mobilizing private capital for nature to meet climate and nature goals.

Rainforest Alliance. (2023a). Alignment with the European Union Deforestation Regulations (EUDR). Rainforest Alliance. <https://www.rainforest-alliance.org/resource-item/alignment-with-the-european-union-deforestation-regulations-eudr/>

Rainforest Alliance. (2023b). EUDR Data Sharing Policy. Rainforest Alliance. <https://www.rainforest-alliance.org/resource-item/eudr-data-sharing-policy/>

Rainforest Alliance. (2024). Rainforest Alliance certification: A Crucial Step to EUDR Compliance. <https://www.rainforest-alliance.org/wp-content/uploads/2023/11/EUDR-onesheet.pdf>

Reiche, J., Mullissa, A., Slagter, B., Gou, Y., Tsendbazar, N.-E., Odongo-Braun, C., Vollrath, A., Weisse, M. J., Stolle, F., Pickens, A., Donchyts, G., Clinton, N., Gorelick, N., & Herold, M. (2021). Forest disturbance alerts for the Congo Basin using Sentinel-1. Environmental Research Letters, 16(2), 024005. <https://doi.org/10.1088/1748-9326/abd0a8>

Ritter Sport. (2022, November 24). Transparente Lieferketten. <https://www.ritter-sport.com/transparente-lieferketten>



- Ritter Sport. (2024a). 2024_Ritter-Sport-commitment-on-sustainable-cocoa-cultivation.pdf. https://irp.cdn-website.com/6cb74a62/files/uploaded/2024_Ritter-Sport-commitment-on-sustainable-cocoa-cultivation.pdf
- Ritter Sport. (2024b). Sustainability. <https://www.ritter-sport.com/en/sustainability>
- Rogers, H., & Dora, M. (2024). Guest editorial: The interplay between new innovations, sustainability and food supply chains. *Supply Chain Management: An International Journal*, 29(3), 409–413. <https://doi.org/10.1108/SCM-05-2024-644>
- Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7). <https://doi.org/10.1080/00207543.2018.1533261>
- Sadler, B. (1996). Environmental assessment in a changing world: Evaluating practice to improve performance. Canadian Environmental Assessment Agency / International Association for Impact Assessment. <https://unece.org/DAM/env/eia/documents/StudyEffectivenessEA.pdf>
- Samberg, L., Sawicki, T., & Ukropcova, V. (2024). Time for transparency. Deforestation- and conversion-free supply chains. CDP. https://cdn.cdp.net/cdp-production/cms/reports/documents/000/007/775/original/CDP_Global_Forests_Report_2024.pdf
- Saunders, J. (2020, September 8). Ten Steps Towards Enforceable Due Diligence Regulations that Protect Forests. *Forest Trends*. <https://www.forest-trends.org/publications/ten-steps-towards-enforceable-due-diligence-regulations-that-protect-forests/>
- SBTI. (2023). SBTN Natural Lands Map: Technical Documentation. <https://sciencebasedtargetsnetwork.org/wp-content/uploads/2023/05/Technical-Guidance-2023-Step3-Land-v0.3-Natural-Lands-Map.pdf>
- Schleifer, P. (2023). *Global Shifts*. MIT Press. <https://mitpress.mit.edu/9780262545532/global-shifts/>
- Schubert, D. K. J., Thuß, S., & Möst, D. (2015). Does political and social feasibility matter in energy scenarios? *Energy Research & Social Science*, 7, 43–54. <https://doi.org/10.1016/j.erss.2015.03.003>
- Scully, P., & Hobig, M. (2019). Exploring the impact of blockchain on digitized supply chain flows: A literature review. *Sixth International Conference on Software Defined Systems (SDS)*: 10–13 June, 2019, 278–283.
- Sheil, D., Casson, A., Meijaard, E., Noordwijk, M., Gaskell, J., Sunderland-Groves, J., Wertz, K., & Kanninen, M. (2009). The Impacts and Opportunities of Oil Palm in Southeast Asia: What Do We Know and What Do We Need to Know? *CIFOR Occasional Papers*, 51.
- Shivaprakash, K. N., Swami, N., Mysorekar, S., Arora, R., Gangadharan, A., Vohra, K., Jadeyegowda, M., & Kiesecker, J. M. (2022). Potential for Artificial Intelligence (AI) and Machine Learning (ML) Applications in Biodiversity Conservation, Managing Forests, and Related Services in India. *Sustainability*, 14(12), 7154. <https://doi.org/10.3390/su14127154>
- Slagter, B., Reiche, J., Marcos, D., Mullissa, A., Lossou, E., Peña-Claros, M., & Herold, M. (2023). Monitoring direct drivers of small-scale tropical forest disturbance in near real-time with Sentinel-1 and -2 data. *Remote Sensing of Environment*, 295, 113655. <https://doi.org/10.1016/j.rse.2023.113655>
- Sotirov, M., Azevedo-Ramos, C. Rattis, L., Berning, L. (2022). Policy options to regulate timber and agricultural supply-chains for legality and sustainability: The case of the EU and Brazil. *Forest Policy and Economics* 144 (2022): 102818.
- Sotirov, M., Pokorný, B., Kleinschmit, D., & Kanowski, P. (2020). International Forest Governance and Policy: Institutional Architecture and Pathways of Influence in Global Sustainability. *Sustainability* 2020, 12, 7010;



doi:10.3390/su12177010

Souza, L. I. D., Piatto, M., & Garcia-Drigo, I. (2020). Pecuária bovina na Amazônia: A estreita linha entre a legalidade e a ilegalidade. <https://www.imaflora.org/public/template/site/default/pdf/boi-na-linha-pecuaria.pdf>

Souza, P., Herschmann, S., & Assunção, J. (2020). Rural Credit Policy in Brazil: Agriculture, Environmental Protection, and Economic Development. <https://www.climatepolicyinitiative.org/pt-br/publication/onde-estamos-na-implementacao-do-codigo-florestal-radiografia-do-car-e-do-pra-nos-estados-brasileiros-edicao-2022/>

Soy Working Group. (2022). Protocolo da Moratória da Soja. https://www.sojanalinha.org/wp-content/uploads/2024/02/1665499600-220913_protocolo_da_moratoria_da_soja-gts_2021-2022.pdf

Spencer-Hicken, S., Schutte, C. S. L., & Vlok, P. J. (2023). Blockchain feasibility assessment: A quantitative approach. *Frontiers in Blockchain*, 6. <https://doi.org/10.3389/fbloc.2023.1067039>

Stepfer, L., Kaulen, A., & Purfürst, T. (2024). Potential of blockchain technology in wood supply chains. *Computers and Electronics in Agriculture*, 24. <https://doi.org/10.1016/j.compag.2023.108496>.

Taebe, B. (2017). Bridging the Gap between Social Acceptance and Ethical Acceptability. *Risk Analysis*, 37(10), 1817–1827. <https://doi.org/10.1111/risa.12734>

Teixeira, T. A., Vilaça, N. L., Printes, A. L., Gomes, R. C. S., Torné, I. G., Araújo, T.-Y. A., & Dias, A. G. D. E. (2023). Development of a Monitoring System against Illegal Deforestation in the Amazon Rainforest Using Artificial Intelligence Algorithms. *ECSA 2023*, 21. <https://doi.org/10.3390/ecsa-10-16188>

The Sun. (2024). Delay implementation of deforestation regulation, Malaysian Palm Oil Council urges EU. <https://thesun.my/business-news/delay-implementation-of-deforestation-regulation-malaysian-palm-oil-council-urges-eu-CA13020211>

The sustainable palm oil choice. (2022). A mass balancing act. Sustainable Palm Oil Choice. <https://www.sustainablepalmoilchoice.eu/a-mass-balancing-act/>

Thompson, B. S. (2023). Impact investing in biodiversity conservation with bonds: An analysis of financial and environmental risk. *Business Strategy and the Environment*, 32(1), 353–368.

Trackgood. (2024). The Impact of Blockchain on EU supply chain and deforestation: An EUDR perspective. <https://trackgood.io/blogs/articles-transparency-esg-supply-chains/the-impact-of-blockchain-on-eu-supply-chain-and-deforestation-an-eudr-perspective>

Tracr. (2024). The future of diamond traceability. <https://www.tracr.com/>

Trase. (n.d.). A vision for Trase 2016-2020. Retrieved 31 August 2024, from <https://resources.trase.earth/documents/Trase-vision-for-2020.pdf>

Tropical Forest Alliance, & Preferred by Nature. (2024). Assessing traceability, monitoring and sustainability initiatives in key soft commodities mapping, categorization and recommendations focusing on eudr compliance. https://www.tropicalforestalliance.org/assets/Uploads/Assessing-Traceability-Monitoring-and-Sustainability-Initiatives-in-Key-Soft-Commodities_Final-Report.pdf

Tulio, F. G., & Nascimento, M. C. (2022). Cattle production in Brazil: The role of traceability mechanisms for ensuring sustainable production and forest protection. UK PACT – Green Recovery Challenge Fund. https://cdn.cdp.net/cdp-production/comfy/cms/files/files/000/006/543/original/CDP__UK_Pact_Cattle_production_in_Brazil__Green_Label_-_Case_Study.pdf

UK Government. (2021). Glasgow Leaders' Declaration on Forests and Land Use. <https://webarchive.nationalarchives.gov.uk/ukgwa/20230418175226/https://ukcop26.org/glasgow-leaders-declaration-on->



[forests-and-land-use/](#)

Umunay, P., Lujan, B., Meyer, C., & Cobián, J. (2018). Trifecta of success for reducing commodity-driven deforestation: Assessing the intersection of REDD+ programs, jurisdictional approaches, and private sector commitments. *Forests*, 9(10), 609. <https://doi.org/10.3390/f9100609>

UNIDO. (2024). What is CSR? UNIDO. <https://www.unido.org/our-focus-advancing-economic-competitiveness-competitive-trade-capacities-and-corporate-responsibility-corporate-social-responsibility-market-integration/what-csr>

Van Der Jagt, A. P. N., Kiss, B., Hirose, S., & Takahashi, W. (2021). Nature-Based Solutions or Debacles? The Politics of Reflexive Governance for Sustainable and Just Cities. *Frontiers in Sustainable Cities*, 2, 583833. <https://doi.org/10.3389/frsc.2020.583833>

Van Solinge, T., & et al. (2016). Organized Forest Crime: A Criminological Analysis with Suggestions from Timber Forensics. In International Union of Forest Research Organizations (IUFRO).

Varsei, M., Soosay, C., Fahimnia, B., & Sarkis, J. (2014). Framing sustainability performance of supply chains with multidimensional indicators". *Supply Chain Management: An International Journal*, 19(3), 242–257.

Vélez, E., Hasenack, H., Schirmbeck, J., & Shimbo, J. (2023). Desmatamento no bioma Pampa Relatório Anual do Desmatamento—RAD 2023.

Verina Ingram, Behagel, J., Mammadova, A., & Verschuur, X. (2020). The outcomes of deforestation-free commodity value chain approaches. <https://doi.org/10.13140/RG.2.2.10664.19207>

Vibian, J. D. S., De Araújo, L. A., & Cavazzini, L. S. (2021). OS IMPACTOS NA IMPLEMENTAÇÃO DA MORATÓRIA DA SOJA NO BRASIL E OS ÍNDICES DE CONSUMO INTERNACIONAL. *South American Development Society Journal*, 7(21), 254. <https://doi.org/10.24325/issn.2446-5763.v7i21p254-269>

WISEC. (n.d.). WISEC. Retrieved 31 August 2024, from <https://www.wisec.com.ar/en/home/>

Vlam, M., & et al. (2018). Developing forensic tools for an African timber: Regional origin is revealed by genetic characteristics, but not by isotopic signature. *Biological Conservation*, 220, 262–271.

Vogt, P., & Caudullo, G. (2022). Global analysis of forest attribute layers for the EU Observatory on Deforestation and Forest Degradation. Publications Office of the European Union. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC130494/JRC130494_01.pdf

Volkscrant. (2021). Oproep aan Wageningen Universiteit om foute beleggingen van pensioenfonds ABP aan te kaarten.

Voora, V., Larrea, C., Bermudez, S., & Balino, S. (2019). Global Market Report: Palm Oil (Sustainable Commodities Marketplace Series 2019). International Institute for Sustainable Development (IISD).

WBCSD. (2022, December 14). Soft Commodities Forum Progress Report 2022 – WBCSD. WBCSD. <https://www.wbcسد.org/resources/soft-commodities-forum-progress-report/>

WBCSD. (2023a). Soft Commodities Forum Progress Report 2023 – WBCSD. WBCSD. <https://www.wbcسد.org/actions/soft-commodities-forum/>

WBCSD. (2023b, August 4). Soft Commodities Forum (SCF) – WBCSD. <https://www.wbcسد.org/actions/soft-commodities-forum/>

Weihrach, D., Carodenuto, S., & Leipold, S. (2023). From voluntary to mandatory corporate accountability: The politics of the German Supply Chain Due Diligence Act. *Regulation & Governance*, 17(4), 909–926. <https://doi.org/10.1016/j.reg.2023.100711>



[org/10.1111/rego.12501](https://doi.org/10.1111/rego.12501)

Wolff, S., Lippe, Dr. R. S., Lippe, M., Malek, Z., & Schweinle, Dr. J. (2023). Does Forest Certification Reduce Deforestation in Logging Concessions? An Fsc Cross-Country Analysis. <https://doi.org/10.2139/ssrn.4449209>

Wolsink, M. (2018). Social acceptance revisited: Gaps, questionable trends, and an auspicious perspective. *Energy Research & Social Science*, 46, 287–295. <https://doi.org/10.1016/j.erss.2018.07.034>

World Business Council. (2022). Deforestation-free finance: A guide on tools and frameworks for financial institutions.

World Forest ID. (n.d.). World Forest ID. Retrieved 31 August 2024, from <https://worldforestid.org/>

Wunder, S., Börner, J., Ezzine-de-Blas, D., Feder, S., & Pagiola, S. (2020). Payments for Environmental Services: Past Performance and Pending Potentials. *Annual Review of Resource Economics*, 12(1), 209–234. <https://doi.org/10.1146/annurev-resource-100518-094206>

Wunder, S., Engel, S., & Pagiola, S. (2008). Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries. *Ecological Economics*, 65(4), 834–852. <https://doi.org/10.1016/j.ecolecon.2008.03.010>

WWF International. (n.d.). Zero Net Deforestation by 2020: A WWF Briefing Paper. Retrieved 19 July 2024, from http://awsassets.panda.org/downloads/wwf_2020_zero_net_deforest_brief.pdf

Xiong. (2020). Blockchain technology for agriculture: Applications and rationale. *Frontiers in Blockchain*, 3. <https://doi.org/10.3389/fbloc.2020.00007>.

Yanuardi, Y., Vijge, M. J., & Biermann, F. (2022). Social-ecological reflexivity of extractive industry governance? The case of the Extractive Industries Transparency Initiative in Indonesia. *Environmental Policy and Governance*, 32(5), 426–437. <https://doi.org/10.1002/eet.1988>

Yumda. (2022). Cocoa for Ritter Sport chocolate 100% traceable. <https://www.yumda.com/en/news/1178653/cocoa-for-ritter-sport-chocolate-100-traceable.html>

Zeitlin, J., & Overdevest, C. (2021). Experimentalist interactions: Joining up the transnational timber legality regime. *Regulation & Governance*, 15(3), 686–708. <https://doi.org/10.1111/rego.12350>

Zhunusova, E., Ahimbisibwe, V., Sen, L. T. H., Sadeghi, A., Toledo-Aceves, T., Kabwe, G., & Günter, S. (2022). Potential impacts of the proposed EU regulation on deforestation [1]free supply chains on smallholders, indigenous peoples, and local communities in producer countries outside the EU. *Forest Policy Econ*, 143, 102817.

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., & Gardner, T. (2020). Using supply chain data to monitor zero deforestation commitments: An assessment of progress in the Brazilian soy sector. *Environmental Research Letters*, 15(3), 035003. <https://doi.org/10.1088/1748-9326/ab6497>

Zu Ermgassen, E. K. H. J., Bastos Lima, M. G., Bellfield, H., Dontenville, A., Gardner, T., Godar, J., Heilmayr, R., Indenbaum, R., Dos Reis, T. N. P., Ribeiro, V., Abu, I., Szantoi, Z., & Meyfroidt, P. (2022). Addressing indirect sourcing in zero deforestation commodity supply chains. *Science Advances*, 8(17), eabn3132. <https://doi.org/10.1126/sciadv.abn3132>

Zwerts, J. A., Van Der Linde, C. M., Praamstra, G. J., Schipper, J., Trolliet, F., Waeber, P. O., & Garcia, C. A. (2024). Feasibility and effectiveness of global intact forest landscape protection through forest certification: The conservation burden of intact forest landscapes. *Frontiers in Forests and Global Change*, 7, 1335430. <https://doi.org/10.3389/ffgc.2024.1335430>



8. CITED LAWS

Council Regulation (EC) No 2173/2005 of 20 December 2005 on the establishment of a FLEGT licensing scheme for imports of timber into the European Community (OJ L 347, 30.12.2005).

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 (OJ L 295, 12.11.2010).

Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 (OJ L 150, 09.06.2023).

US Lacey Act. USCODE Title 16 - CONSERVATION. CHAPTER 53 - CONTROL OF ILLEGALLY TAKEN FISH AND WILDLIFE <https://www.govinfo.gov/content/pkg/USCODE-2010-title16/html/USCODE-2010-title16-chap53.htm>



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