Data requirements to tackle global deforestation through mandatory due diligence

Authors

Margot A. Wood, Conservation International, 2011 Crystal Drive, Suite 600
Arlington, Virginia, USA 2220, wood.margot@gmail.com / mwood@conservation.org, +1 925 330 1293

Fanny Gauttier, Conservation International Europe, Chaussée de Charleroi 112, 1060 Brussels, Belgium, fanny.gauttier@gmail.com / fgauttier@conservation.org, +32 47 033 8873

Helen Bellfield, Global Canopy, 3 Frewin Ct, Oxford OX1 3HZ, United Kingdom, h.bellfield@globalcanopy.org

Chris West, Stockholm Environment Institute York, Department of Environment and Geography,
University of York, YO10 5NG, United Kingdom, chris.west@york.ac.uk

Rosa A. Indenbaum, Stockholm Environment Institute, Linnégatan 87D, 104 51 Stockholm, Sweden, rosa.indenbaum@sei.org, +46 70 266 7253

Abstract

The world's forests are highly threatened, mainly by agricultural expansion, driving biodiversity loss and greenhouse gas emissions, and disproportionately impacting rights and livelihoods of indigenous peoples and local communities. Zero-deforestation voluntary commitments to address deforestation have not significantly reversed deforestation and have made even less progress in related human rights violations. A regulation to address deforestation in agricultural supply chains will likely be prepared in the European Union (EU) to mandate due diligence requirements. We summarize how adequate risk identification and assessment require availability of and access to specific data. We review current data landscapes, flexibility required to adapt to supply chain complexities and capacities, required investments in current data systems, and constraints associated with data. We provide recommendations for forest risk commodity due diligence regulations, including: (1) To improve baseline data, prioritize sub-national data generation and access, improve remotely sensed maps of sourcing areas, and prioritize investment in public data platforms; (2) to adapt to supply chain complexities, regularly review commodities in the scope of the regulations; (3) for implementation, existing tools such as certification schemes can play a role for risk assessment, though cannot be a prerequisite to conduct due diligence. We outline data needs to allow for sufficient mitigation measures; (4) finally we recommend financial and technical support for developing countries and producers, which should improve the availability and quality of data. We conclude that increased data availability and quality to successfully implement a EU due diligence regulation on forest-risk commodities would benefit many demand-side market policies.

Keywords

Section 1: Introduction

1.1 Global deforestation trends

The world's forests are highly threatened, with an estimated 1.3 million square kilometers lost between 1990 and 2016 (European Commission, 2019; Khokhar & Tabary, 2016). Deforestation is a major cause of biodiversity decline with forests harboring most global terrestrial biodiversity (*The State of the World's Forests 2020*, 2020). Deforestation is also a significant source of greenhouse gas emissions, with land use change acting as the second largest contributor to climate change after fossil fuel combustion, accounting for nearly 12% of all emissions (European Commission, 2019; Shukla et al., 2019).

Global deforestation is driven by agriculture, with the majority of tropical deforestation specifically linked to production of forest risk commodities (Curtis et al., 2018). These risk commodities include globally traded goods and raw materials whose extraction or production contributes significantly to global deforestation and degradation (Client Earth et al., 2019; Partzsch, 2020; Rautner et al., 2013). The increasing demand for timber and agricultural products feeds this expansion, with major demand-side markets committing to identify and address their "imported deforestation", defined as indirect or direct forest or natural ecosystem loss caused by commodities consumed by importing nations (IUCN Congress Motion, 2020; Kissinger et al., 2012).

Along with environmental impacts, deforestation also has dramatic negative impacts on rights and livelihoods of indigenous peoples and local communities (Mamo, 2020; Ricketts et al., 2010). Strengthening and respecting rights of indigenous peoples and local communities has been shown as key to positively impact conservation efforts (Accountability Framework, 2020; Burger, 2020; Gibbs et al., 2016; IPBES, 2019; United Nations, 2020). However, the worrying increase in violence against indigenous and environmental defenders on the frontiers of global commodity production (Front Line

Defenders, 2021; Global Witness, 2020) illuminates the issues facing indigenous peoples and local communities (Brown, 2019; Watts & Vidal, 2017).

1.2 Mandatory due diligence emerging as a solution to tackle deforestation in commodity supply chains

A wave of voluntary commitments were made by governments and companies in the 2010s, promising to address deforestation driven by international demand for agricultural commodities. These included multi-stakeholder commitments, such as the New York Declaration on Forests, the Amsterdam Declarations, corporate group commitments such as the Consumer Goods Forum 2010 Zero Net Deforestation resolution, and sectoral and individual company commitments, such as the G4 Cattle Agreement signed by Brazil's largest meatpackers (Amsterdam Declaration Signatory Countries, 2015; Climate Summit, 2014; Gibbs et al., 2016; Greenpeace, 2020; The Consumer Goods Forum, 2018). While these commitments varied in timelines, objectives, scope, and commodity coverage, many had a 2020 deadline and unfortunately have not been achieved (Lambin 2018; Garrett, 2019).

While these commitments were foundational first steps, progress on achievement shows little evidence of effectiveness (Garrett et al., 2019). The commitments failed for a variety of reasons including unclear definitions and criteria, lack of transparency, reliance on self-reported progress report data, future or missing implementation deadlines, supply chain transparency and traceability barriers, shifting deforestation borders, and smallholder marginalization (Forest 500 Annual Report, 2019; Garrett et al., 2019; Lambin et al., 2018; Ludwig, 2018). Meanwhile, there is also a lack of adequate commitment coverage, with coverage drastically lower in soy, cattle, and paper sectors, compared to palm oil and timber sectors (Forest 500 Annual Report, 2017; Trase, 2020).

A lack of evidence that voluntary commitments are effective to halt deforestation has led various stakeholders, and those in Europe in particular, to call for regulatory measures, especially when facing urgent deforestation and climate change challenges. Mandatory due diligence is a valid regulatory instrument to mitigate risk of deforestation in agricultural commodity supply chains, and several stakeholders including NGOs and companies expressed their support to this approach (Barry Callebaut et al., 2019; Blankenbach & Bardwell, 2019; Client Earth et al., 2019; European Palm Oil Alliance, 2020; Myers, 2019). As defined by the Organization for Economic Cooperation and Development (OECD), due diligence is a process companies carry out to identify, prevent, mitigate, and account for how they address actual and potential adverse impacts in operations, supply chain, and business relationships (OECD, 2018).

Historically, due diligence approaches have been used to tackle severe environmental and human rights risks in specific raw materials supply chains, often combined with market access restrictions for high-risk products. For example, due diligence has been used to address illegal timber trade in several key markets, such as Australia (Australian Illegal Logging Prohibition Act 2012), the USA (amendment to the Lacey Act, 2008), and the EU (EU Timber Regulation, 2010). It has also been used to address conflict minerals - e.g. Dodd Frank Act Section 1502 (2010) in the USA and EU Conflict Minerals Regulation (2017) (Dodd-Frank Wall Street Reform and Consumer Protection Act, 2020; European Commission, 2020b). These due diligence frameworks have successfully increased knowledge of sourcing regions and associated risks of illegality (Pepke et al., 2015).

With some governments considering regulatory options to minimize deforestation risk of selected agricultural commodities, mandatory due diligence is feasible and effective to decrease deforestation in agricultural supply chains (Bager et al., 2021). At the EU level, this approach was highlighted as the most

effective in "European added-value assessment" from the European Parliament Research Services on "An EU legal framework to halt and reverse EU-driven global deforestation"(European Parliament, 2020) and the feasibility study ordered in 2018 by the European Commission on options for "Stepping up EU action against deforestation and forest degradation" (COWI A/S, 2018). The UK government has recently pioneered mandatory due diligence through a revision of the Environmental Bill forbidding large companies from using commodities not in compliance with relevant local laws in producer countries, and this bill imposes an obligation for companies to undertake due diligence for some commodity supply chains (to be later defined in secondary legislation) (DEFRA, 2020).

The deforestation embodied in the EU final consumption represents approximately 10% of the global share, and when looking at bilateral trade from 1990-2008, the EU27 imported almost 36% of all deforestation embodied in traded crop and livestock products (Cuypers et al., 2013; European Commission, 2021). EU action to tackle its forest footprint would therefore have significant global impacts on ecosystems and the local communities that depend on these ecosystems (Partiti, 2020).

However, over the past decade, limited action has been taken towards achieving deforestation objectives outlined by the European Commision. The European Commission feasibility study in 2018 identified gaps and policy options to step up EU action against deforestation, and highlighted the following commodities as critical to the EU global forest footprint: maize, soy, coffee, cocoa, palm oil, rubber, timber and wood pellets, beef, and leather (COWI A/S, 2018). A follow up communication laid out key actions both on the demand and supply sides, including the need for demand-side regulatory and non-regulatory measures, and these actions were solidified in the "EU Biodiversity Strategy for 2030" and the "Farm to Fork Strategy" (European Commission, 2019, 2020c, 2020a). In February 2020, the Commission launched an impact assessment on regulatory and non-regulatory measures to reduce the forest impacts of products placed on the EU market, which included mandatory due diligence

(European Commission, 2021). Finally, and importantly, in October 2020 the European Parliament adopted a legal framework resolution to "Halt and Reverse EU-driven Global Deforestation" (European Parliament, 2020), which calls on the European Commission to enact a due diligence regulation for companies within the EU market, and for those companies to demonstrate that their products do not originate from converted or actively degrading natural forests or other natural ecosystems, and are not produced in, or linked to, violation of human rights. The EU could therefore impose mandatory due diligence requirements on selected agricultural commodities in the near future, on the basis of sustainability criteria, which would likely go beyond solely addressing illegal deforestation.

Imposing due diligence requirements on companies to tackle imported deforestation in agricultural supply chains requires that companies have access to data to properly identify and assess supply chain risks. The companies participating in the pilot project on implementation of the OECD-FAO Guidance for Responsible Agricultural Supply Chains identified supply chain mapping as one of the biggest challenges for identifying, assessing, and prioritizing risks, regardless of the company's position within the supply chain, both for product traceability and accessing information from suppliers (OECD & FAO, 2019). This remains a significant challenge for companies, with evidence of low implementation and significant challenges within the OECD framework (OECD & Food and Agriculture Organization of the United Nations, 2016; Sarfaty, 2015).

The challenge of accessing quality data to support action to address imported deforestation was also recognized by the European Commission in its 2019 communication, which states that understanding the impact of markets on the world's forests and encouraging the consumption of deforestation-free products will require better monitoring of trade flows down to national, regional, and local levels, and better access to timely information. It also states that while there are some existing initiatives that try to achieve this, only a few have been developed into truly accessible platforms for a wide range of actors

to inform decisions (European Commission, 2019). The communication identified the need to establish an EU Observatory on deforestation, forest degradation, changes in the world's forest cover, and associated drivers to facilitate access to information on supply chains for public entities, consumers, and businesses (European Commission, 2019).

Whilst information gaps on supply chain transparency have been identified as a barrier to implementing zero-deforestation commitments, a structured assessment of these information gaps in the context of a due diligence regulation has not been undertaken in the literature. To address this, first, we outline the steps companies need to undertake to identify and assess relevant risks in their supply chains to comply with a due diligence regulation. Second, we assess current data availability, gaps, and barriers. Third, we identify the priority issues to be considered and addressed to ensure any future regulation is successfully implemented. We deem our analysis relevant for governments (including, but not limited to the EU) developing due diligence regulations addressing impacts of agricultural commodity supply chains on the world's forests and communities, as well as for data providers looking to support such processes, and for companies that will be required to comply with these regulations. Considering first the EU ambition to present a regulation in 2021 aimed at minimizing the risk of deforestation and forest degradation associated with products on the EU market, second the related calls from a wide range of stakeholders to include mandatory due diligence in this future regulation, and third the major impact it could have on global supply chain, we use the EU example as the basis to develop our recommendations. That being said, our recommendations have been developed to be applicable to any country or region seeking to implement a similar regulation.

Section 2: Risk identification and information needs for due diligence

We outline the process through which a company could conduct risk identification and assessment actions for a forest risk commodity due diligence regulation. We identify information requirements at each step in a due diligence process. Finally we review current relevant data landscapes against these requirements to identify data gaps and challenges that need to be addressed to improve efficacy and implementability of any due diligence legislation, which will be addressed in Section 3.

2.1 A framework for identifying and assessing risks within a due diligence regulation

Risk identification and assessment are core components of a due diligence process. Figure 1 schematically illustrates the process through which a company could identify and assess deforestation and associated human rights risks in their operations and supply chains, and highlights when mitigation measures could be required. Although this is a simplification of the process, it identifies the key questions that a company would need to answer and address. While the due diligence process and associated legislative information will depend on the specific scope, definitions, and potential sustainability criteria, it would likely include the following three steps:

1. **Identify whether the commodity or product is within scope:**

   A company must assess if a product contains an ingredient identified as within the scope of the regulation (i.e. A forest risk commodity - soy or palm oil). This allows the company to understand whether due diligence is required for a product. Depending on the legislation, this could also include risk thresholds, such as percentage of high-risk ingredient in a product, total volume of a high-risk commodity used by a company, or cut-off date excluding commodities produced on land converted after a specific year. In the case of a cut-off date, the company

would need to proceed to steps 2 and 3 to ascertain whether the commodity was produced on land converted before or after this date (Figure 1).

2. **Identify suppliers and business partners in supply chains:**

   If a product falls within the scope (Step 1), the next step is to map the related supply chain. At least two criteria within a supply chain can trigger further risk assessment and mitigation measures; first, unidentified suppliers or unknown sources within the supply chain, which, for example, can include purchases through spot trading on commodity exchanges. Second, identified suppliers that do not provide sufficient information demonstrating compliance with sustainability requirements under due diligence legislation. This, for example, can include an absence of clear policies and systems to prevent or mitigate negative impacts on forests, ecosystems or human rights, or gaps in product traceability reporting.

3. **Identify the product source location and associated sustainability risks:**

   Direct or indirect traceability of product supply chains to the farm or plantation through verifiable information from suppliers, is ultimately needed to concretely assess links to environmental or social impacts. This level of traceability is essential in high-risk regions where mitigation measures are required. Less granular risk assessments can help prioritize high-risk regions (Accountability Framework, 2019).
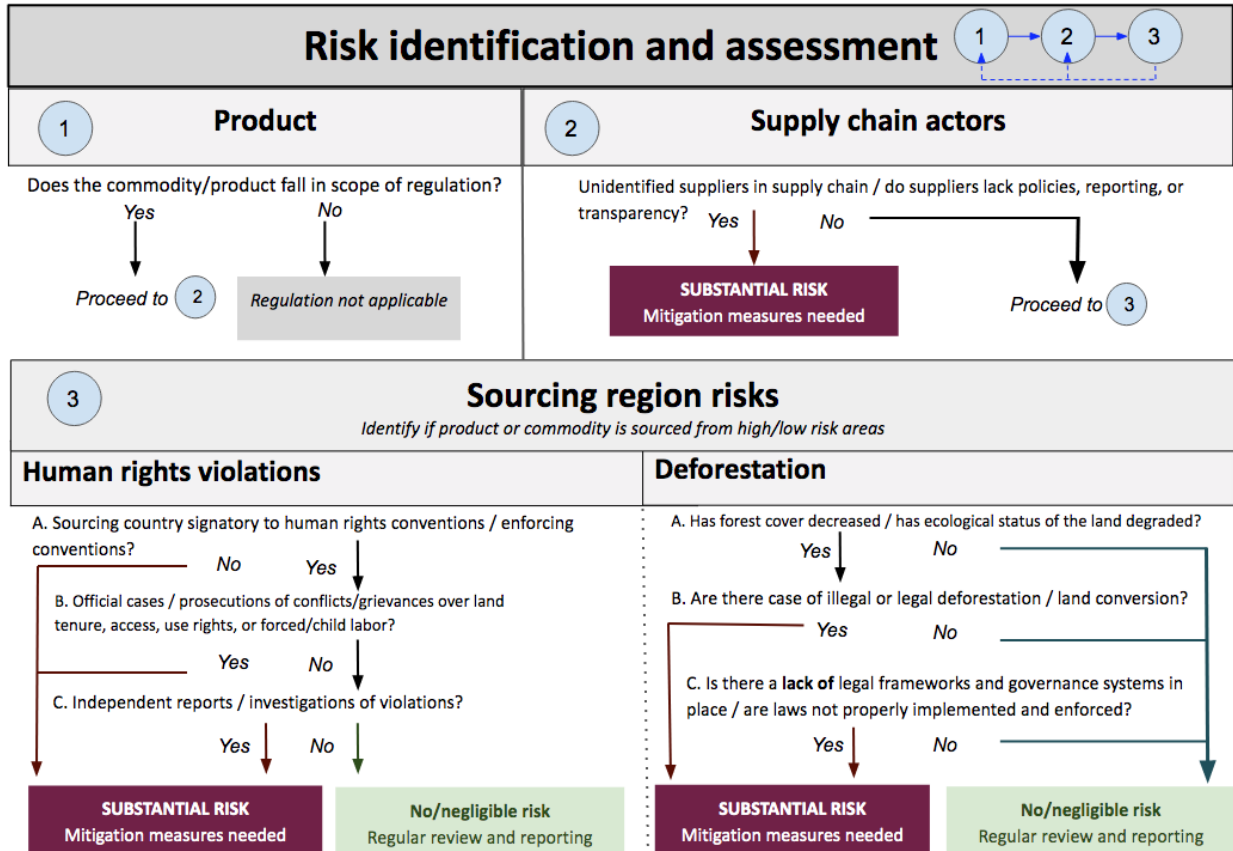
Figure 1: Example framework outlining the potential steps in a due diligence process to identify and assess specific risks on human rights and deforestation, highlighting if or when mitigation measures may be required.

2.2 Current data landscape to support companies undertaking due diligence

Building on this framework (Figure 1) we identify data requirements for each of the three main stages of risk assessment: (1) Identifying relevant products, (2) mapping supply chains, (3) identifying sourcing regions and risks; within each stage, we review the current availability of data, and identify critical data gaps.

2.2.1 Identifying relevant products

A company's first step is to assess whether a product falls under the scope of a due diligence regulation on forest-risk commodities (Table 1). Harmonized System (HS) codes, which classify traded products, have been used for this purpose (e.g. EU Timber Regulation), but this approach can lead to gaps as processed products that could contain forest risk commodities may be omitted (e.g. lasagna may contain forest risk commodities in the form of beef mince or embedded soy feed in meat or dairy used as ingredients, under HS code 1902)(Table 1).

Table 1: Indicative summary of high-level data needs, options, and gaps to identify if a product falls in the scope of a due diligence regulation.

Identifying regulation relevant products	Examples of type of data	Examples of existing tools and methods	Gaps & Issues
Forest risk commodities (as main product, component, ingredient or raw material)	HS Codes eg. European Union Combine Nomenclature Ingredients lists (e.g. food and cosmetic products) Labels (voluntary schemes) Supplier data	European Union Timber Regulation use of HS codes Mandatory product labeling	Markets without the identification of ingredients e.g. vegetable oils Derivatives Embedded forest risk commodities as feed in meat products
Risk threshold: Volume or quantity	Supplier data and contracts Quantitative Identification Declaration (QUID) Food and Agriculture	Soy Footprint Calculator (RTRS) Soy Measurement Guidelines (Consumer Goods Forum) Conversion factors	Lack of reporting on ingredient volumes

	Organization for the United Nations and industry association conversion factors	International Cocoa Council	

Assessing whether a product is within the scope of the regulation is more complex for processed products, with ingredient lists as important sources of information. Derivatives, such as fatty acids, further complicate the process, particularly in cases where derivatives can be produced from different oils or when product labelling is unclear (e.g. vegetable oils)(Table 1). In these cases, further supplier information is needed to understand the derived product's source. If a due diligence regulation has a volume threshold, data gaps on ingredient quantities will be a challenge since many products do not include information on ingredient quantities unless covered by specific requirements, such as the EU's Quantitative Identification Declaration (QUID) rules (IDH & KPMG, 2017).

If 'embedded' forest-risk commodities such as animal feed in meat or dairy products (e.g. soy feed from South America) are covered by the regulation, volume requirements or feed requirements per volume of product could be required to determine if the product is within scope (Table 1). A UK retailer pilot study on soy risk exposure found soy feed ratios for meat and dairy products varied significantly. While supplier disclosed data are required to understand volumes and feed origin, in the absence of supplier data, industry and market average conversion factors are used (Consumer Goods Forum, 2016; de Vries & de Boer, 2010; IDH & KPMG, 2017; Röös et al., 2013; RTRS, 2020; Schreiber et al., 2018).

If the regulation provides a temporal threshold, such as a cut-off date on deforested or converted lands, specific information on the sourcing areas of products and when production took place would be required to determine whether a product is in scope (see 2.2.3 for an assessment of these data requirements).

2.2.2 Identifying suppliers and business partners in supply chains

To accurately identify risks, companies must increase traceability within their supply chains and map all actors, business relationships, processing facilities, and production regions. This becomes more complicated with commodities that are aggregated or have bulking stations during various points in the supply chain, seen with palm oil and soy. Mapping beyond direct (Tier 1) suppliers relies on supplier disclosed data; and supply chain traceability and supplier information remains a key challenge for companies across agricultural supply chains (OECD & FAO, 2019). Reasons for these data gaps include the presence of long supply chains with many indirect suppliers, large smallholder supply bases for certain commodities like coffee and palm oil, and the cost and time-consuming nature of requesting, collecting, and processing data down the supply chain (Dauvergne, 2018; Heron et al., 2018). Data sources are emerging to supplement traceability data gaps, such as grain and cattle movement data and per-shipment data, such as customs declarations, cargo manifests and/or bills of lading (zu Ermgassen et al., 2020).

Several commercial tools and services have emerged to address these information gaps and to facilitate supplier disclosure. These include company-developed data tools (e.g. Olam's AtSource), and data service providers (e.g. SupplyShift, Ecovadis, Carbon Disclosure Project (CDP) Supply Chain, Provenance, Sourcemap, Satelligence, Global Forest Watch Pro). There are also a handful of supply chain transparency initiatives that include data on supply chain mapping, assets, company legal structures, company policies, and reporting on deforestation and associated human rights risks (e.g. Trase, Universal Mills List, CDP Forests Disclosure, Sourcemap, Forest 500, Sustainability Policy Transparency Toolkit (SPOTT), World Wildlife Fund (WWF) Scorecards). However, much of the supply chain data remains private. Despite these tools and datasets there remain significant coverage gaps across

platforms, regions, commodities, and companies (Doremus, 2008; Gardner et al., 2019; Lambin et al., 2018; Taylor & Streck, 2018).

The fragmentation in approaches to collecting supply chain information may lead to confusion, inefficiencies, and duplication of effort; particularly as many upstream suppliers supply multiple downstream companies. Furthermore, existing disclosed supplier data do not have standardized formats, reporting frequencies, or reporting information, which includes, for example, different metrics and the lack of common company identifiers (Egels-Zandén et al., 2015; Fraser et al., 2020). In response to this, a number of voluntary initiatives (e.g. Accountability Framework Initiative, Task Force on Climate-Related Disclosures, Taskforce on Nature-Related Disclosures, Science Based Targets) have emerged to develop commonly understood definitions and standardized monitoring and reporting frameworks.

Table 2: Indicative map of data needs, options, and gaps to map suppliers

	Potential data requirements	Types of data used	Examples of existing tools and methods	Gaps and issues
Supplier identity	Supplier names and addresses; subsidiary and asset locations; indirect suppliers names, addresses, locations	Company and industry disclosures via websites or annual reports; corporate identifiers	Company legal entity and hierarchy data: Global Legal Entity Identifier Foundation Corporate Registries (e.g. National registry	Opaque company ownership and group structures; high costs of accessing data

				of Legal Entities (CNPJ) in Brazil, and the Companies List and Database (AHU) in Indonesia)	Gaps in asset level data and verified common identifiers
				Public transparency platforms (e.g. Open Corporates, Trase Finance)	High volume of indirect suppliers (spot trading, purchasing from aggregators) and large supply bases.
				Financial service providers (e.g. Factset, Bloomberg, Refinitiv)	Limited leverage of downstream companies to request supplier data
				Asset data: Public transparency platforms (e.g. the Universal Mills List, Trase Logistics Map)	
				Industry and licensing facility information (e.g. Brazil's Federal Inspection Service (SIF))	

Supplier risk	Risk management policies and reporting, records of previous company impacts/violations/grievances	Third party datasets (public or private) that collate data on companies and policies, investigative reports, government sanctions	Company policy data: Assessment and disclosure initiatives e.g. Forest 500, SPOTT, Supply Change, CDP Forests, Monitac	Lack of transparent corporate reporting on environmental and social policies, grievances.
			Past violations: NGO investigative reports e.g. Chain Reaction, Rapid Response, Global Witness etc., Roundtable on Sustainable Palm Oil complaints tracker, government fines and embargoes e.g. IBAMA, audits e.g. Federal Prosecutor (MPF) audits slaughterhouse compliance with Conduct Adjustment Terms (TAC)	Lack of common definitions and standard reporting metrics

Piecemeal investigative reports; lack of accountability |

2.2.3 Identifying product source location and associated sustainability risks: Supply chain traceability

and compliance

Effective due diligence requires robust supply chain traceability data to assess the likelihood of sourcing products from high-risk areas, based on potential sustainability criteria. Many sustainability risks are linked to production and processing facilities. Products therefore need to trace the supply chain, which is achieved through full supply chain traceability to point of production (or to landscape, if sufficient monitoring systems are in place to meet sustainability requirements); traceability to supplier with adequate traceability and control systems on product sourcing; or using credible assurance systems such as chain of custody certification. Moving from traceability challenges discussed in Section 2.2.2, this section focuses on sustainability data requirements, and gaps.

Identifying production locations and risks such as deforestation can be done via satellite imagery and resulting land use monitoring and classification maps. Recent improved availability and processing of satellite imagery data on land use and land use change have been an important step forward to help identify production locations and monitor production activities. There has been an explosion of both civil society and researcher-based land use change products and commercial offerings (Moffette et al., 2021). However, there are still gaps in the availability of data on commodity driven deforestation. The link between production systems and conversion is hampered by the ability to quickly and easily classify remotely sensed imagery into production maps. Global coverage of commodity production (crops, pasture, plantations) is often at too crude a scale, or too dated, to be valuable for real-world monitoring (Goldman et al., 2020). Data quality and coverage vary across countries and commodities, and approaches and datasets are often fragmented with different time series, classifications, and geographic

scopes. These gaps are particularly problematic for measuring compliance on cut-off dates for

deforestation, where a robust time-series of commodity deforestation and production maps are

required to identify where and when land was first cleared. This is even more challenging for illegal

deforestation where further spatial data are required on country deforestation legality (e.g. Brazilian

deforestation licenses or Indonesian concession data), though are often not readily available. And if

available, this information is difficult to interpret due to conflicting laws between sectors and

administrative levels and overlapping spatial boundary data for concessions (Gaveau et al., 2017; Rajão

et al., 2020).

Data coverage of deforestation associated human rights impacts and social risks are even more poorly

understood and mapped. Data reporting remains dependent to a great extent on investigative reports

by civil society or 'whistleblowing'. Often, land and environmental defenders who report on violations

are particularly at risk in many regions due to the political and governance situations resulting in

sporadic sectoral, spatial, and temporal coverage (Ghazoul & Kleinschroth, 2018; Global Witness, 2020).

These issues are further confounded by issues on lack of legal recognition and mapping of indigenous

lands, though there have been recent mapping efforts of indigenous lands globally (*LandMark Map*,

2020).

Certification schemes are often used by companies as sustainability assurance systems (Forest 500). For

example, under the EU timber regulation, certification or other third-party verification schemes may be

used in risk assessment and risk mitigation procedures, provided they meet the criteria in the regulation

(Commission Implementing Regulation (EU) No 607/2012 of 6 July 2012, 2012). However, certification

coverage varies widely across commodities; a recent study mapped deforestation-free certification

coverage of EU imports and found that palm oil (78%), soy (13%), and beef (0%) deforestation-free

certification coverage was drastically different, and incompletely reported (European Parliament, 2020).

Furthermore, the majority of certified volumes are "book and claim" (downstream companies buy

credits from certified suppliers) and "mass balance" (reported as proportion of certified commodity

because certified commodities are mixed with conventional commodities), with the minority of

certification schemes reporting segregated volumes (certified commodities are identified and separated

from the non-certified products so that origin of production is maintained). There also remains

credibility and legitimacy challenges with a number of certification schemes (Larsen et al., 2018).

Section 3: A path forward for due diligence in data-constrained environments

Companies implementing mandatory due diligence will require significant data improvements, with

increased usability of those data, as described in Section 2. In Section 3, we discuss the need for flexibly

in data-constrained environments, and we lay out the key role of governments to improve existing data

and to facilitate use. We end this section with perspectives on global impact in terms of data of demand-

side forest-risk commodity due diligence regulations.

3.1 Effective policy design and implementation in changing data contexts

3.1.1. Future-proofing the commodity scope

Product-specific due diligence policies need to account for future changes in risk profiles of

commodities. Deforestation and related human rights risks can change, for example, when new frontiers

are deforested or when changes in political contexts impact legislation on and enforcement of

deforestation (Conectas Human Rights, 2018; Ingalls et al., 2018; Nakamura et al., 2018; Teixeira, 2019).

It is important that the scope of commodities covered by the regulation is reviewed regularly based on

trends and projections, and updated where necessary to address emerging risks. The narrower the

commodity scope, the more future-proofing flexibility is needed. This can be exemplified by the coffee

sector; while currently documented coffee-driven deforestation is lower than other forest-risk

commodities, coffee demand is predicted to increase while coffee production is predicted to shift due to

climate change, encroaching on higher elevation forests (Imbach et al., 2017; Pendrill et al., 2019).

Future-proofing and regular review ensures that regulations are responsive to these types of changes,

and also preventive through incorporating the precautionary principle (European Commission et al.,

2017).

3.1.2. Adopting a flexible approach to accommodate supply chain complexity and capacity

Companies will experience different challenges in implementing product-specific due diligence

depending on their size, capacity, supply chain position, and type of exposure. For example, traders are

likely to be exposed to large volumes of unprocessed commodities whereas retailers are likely to be

exposed to small volumes of commodities embedded in processed products. Small and medium

companies (SMEs) may find it harder to conduct due diligence compared to large companies with more

resources (European Commission, 2020d). Existing due diligence guidelines can serve as a basis to

address these issues, such as the United Nations (UN) Guiding Principles on Business and Human Rights

provision on expectations of SMEs according to capacity (United Nations, 2011).

Adopting a flexible approach that accounts for relative exposure, supply chain complexity, and company

capacity will support effective implementation by reducing the burden on companies and focusing

resources on highest risk supply chains. This is particularly relevant given companies will face

information gaps and complex data landscapes during implementation, as described in Section 2. Table

3 provides illustrative examples of how a flexible approach might be formulated across different

company types and sizes. In this example, small companies would be expected to undertake rapid

exposure assessments with limited supplier engagement, with more in-depth risk assessment required

in cases where high portions of products are sourced from high-risk regions. For a large retailer, in recognition of the complexity of their supply chains with many product lines, this type of company would be expected to prioritize high-risk products and supply chains, and conduct more extensive risk assessments and targeted mitigation. Traders would likely have to undertake fairly exhaustive risk assessments on their complete supply chain due to relatively close proximity to supply-side risks and large volumes of exposure.

Table 3: Example of flexible due diligence implementation approach according to supply chain position, size (a proxy of likely capacity), and exposure.

Company size (proxy of capacity)	Type	Exposure	Examples of risk assessment expectations
Small	Manufacturer	Low volumes of deforestation-risk material; relatively few product lines	Rapid exposure assessment with limited supplier engagement Further action required (e.g. more in-depth supplier engagement) if high proportion of material is sourced from high-risk areas

Large	Retailer	Many product lines; some containing large quantities of deforestation-risk material; long supply chains (for example ready-meals)	Initial rapid exposure assessment with limited supplier engagement Triage supply chains with high volumes linked to high-risk areas. Target granular risk assessment and mitigation actions for these supply chains
Large	Trader	Large volumes of unprocessed deforestation-risk product lines	Undertake intensive and fairly extensive analysis of their suppliers to allow a granular assessment of risk in particular land-conversion or social violation hotspots.

3.2. Providing a supportive data environment

Due diligence processes should be based on best available information to ensure mitigating actions are appropriate and prevent unintended consequences, such as disproportionate mitigation measures, shifting production regions, exacerbating local livelihood issues, or disadvantaging smallholders. As detailed in Section 2, data landscapes that surrounds imported deforestation-risk commodities, whilst rapidly improving, are complex and piecemeal, and data quality varies substantially across commodities and regions. However, governments can play a significant role in facilitating access to quality data to support companies in conducting due diligence, as outlined below.

3.2.1. Supporting continuous improvement of existing datasets

First, countries enacting due diligence regulations should improve public availability and accessibility of existing datasets. Per-shipment import data on commodity, volume, importer, exporter, and port of export would provide a more granular and accurate understanding of links between imports and high-risk production locations and suppliers. The EU collects these data in customs documentation but only discloses in aggregate. In contrast, the USA customs information is public via the Automated Commercial Environment System and packaged by third parties like the Port Import Export Reporting Service (PIERS) (US Department of Homeland Security, 2021). In the EU, these data need to be made available by customs agencies across all member states; this would not only benefit EU member states but also increase international data availability given EU data cover many international trade flows.

Second, to improve availability, quality, and coverage of remotely sensed data linked to commodity deforestation, countries should invest in current satellite monitoring systems and commodity classification maps derived from satellite products. The ability to monitor on-the-ground changes to land use, and to link specific commodity-production systems at high resolution is essential for granular risk

assessments and monitoring mitigation actions. An example of such an investment is recent, free access

to high-resolution satellite imagery by Norway's International Climate and Forest Initiative to monitor

deforestation (NICFI, 2020). However, access alone does not necessarily allow for imagery interpretation

or production of commodity maps to support due diligence; further interpretation and tailored alerts

from imagery are needed to support mitigation actions. Currently, a plethora of land use monitoring

initiatives and datasets exist, providing imagery interpretation. Often, it is therefore not a lack of raw

imagery data that prevent adequate analysis from being conducted; instead it is the importance of

building and supporting existing resources to improve their accessibility (see Section 3.2.2) or to expand

their coverage, timeliness, or quality (Global Forest Watch, 2002; Hansen et al., 2016; Musinsky et al.,

2018).

3.2.2. Public information systems and standardized datasets to improve data use

Government and public research organizations play a critical role as 'infomediaries' in collation,

organization, and translation of information to make it accessible to decision makers. Importantly, these

organizations also play a critical role ensuring data are robust, evidence-based, and publicly available to

allow for use.

Specifically, public support should:

a) Improve data access, with a focus on public datasets spread across multiple repositories or with high

barriers to use (e.g. located in complex databases, or with inadequate documentation). Investments

should also be made to increase public access to relevant private data sets, with corporate disclosure as

an important mechanism to increase private data availability.

b) Standardized company reporting: Currently, voluntarily disclosed data do not have standard formats,

causing monitoring and comparability issues. Through mandatory due diligence requirements,

governments should ensure that company reporting is publicly available and standardized to enable systematic and transparent compilation of information.

c) Data interpretation: Recommendations and guidance should be issued on assessing and addressing data uncertainties, conflicting information across data scales (sub-national vs. national variations), and integrating private information alongside public information. These changes would decrease data uncertainties, and dissuade inaction driven by such uncertainties.

d) Integration of new data into existing platforms: New or improved data from research, NGO, or consultant communities should be assessed for robustness and reliability, and translated into corporate-relevant formats on existing platforms. There is a need for strengthened data integration to facilitate access and lower cost.

If we assume a regulation is implemented according to the 'flexible' approach described above, the importance of a transparent, supporting data environment becomes apparent. For example, (illustrated in Figure 2) consider a risk assessment process from the perspective of manufacturing company (A):

The manufacturer (A) currently sources from suppliers in country Y, producing a relevant commodity across a wide geographic area with relatively high deforestation rate. The manufacturer therefore undertakes risk assessments and identifies the 'average' risk associated with production in another country (country X) is lower than in country Y. In response, the manufacturer proposes a move from sourcing from country Y to country X (see Figure 2a) .

However, independently, a trading company (B), with operations in country X undertakes risk assessment with high granularity, and identifies high-risk deforestation in a specific production location. Any switch of supply by manufacturer (A) (which includes purchases from trader (B) or indeed other traders operating in the same landscape as B) therefore may actually lead to higher overall risk to the

manufacturer than in the previous configuration. This is because the manufacturer is proposing a shift

from more dispersed average deforestation, to concentrated deforestation (see Figure 2b).

Under robust due diligence scenarios, it is expected that manufacturer (A) would identify trading

company B as high-risk before any contracts are signed, and via this process obtain B's risk assessment,

which may ultimately lead to 'blacklisting' of this company in preference for companies that sources

from lower risk areas in the same country. Efficacy of this response, however, is likely to be dependent

on resources available. For example, small companies may (as described in Section 3.1.2) have relatively

limited capacity, and without centralized information sharing, may not have resources to undertake

these efforts effectively independently. Furthemore, extending this example, one might imagine that in

response to the manufacturer threatening to withdraw from country Y, another trader (C) which already

supplies the manufacturer voluntarily discloses information proving sustainable production (see Figure

2c). In the absence of sufficient data standardization, however, manufacturer (A) may not be in a

position to determine whether this disclosure is sufficiently robust to override its own initial risk

assessment.

Ultimately, this leaves manufacturer (A) in an unclear position on the most sustainable decision.

Presence of guidance on data sharing and data interpretation, and development of a central,

harmonized, data framework, would significantly reduce the likelihood of implementation problems,

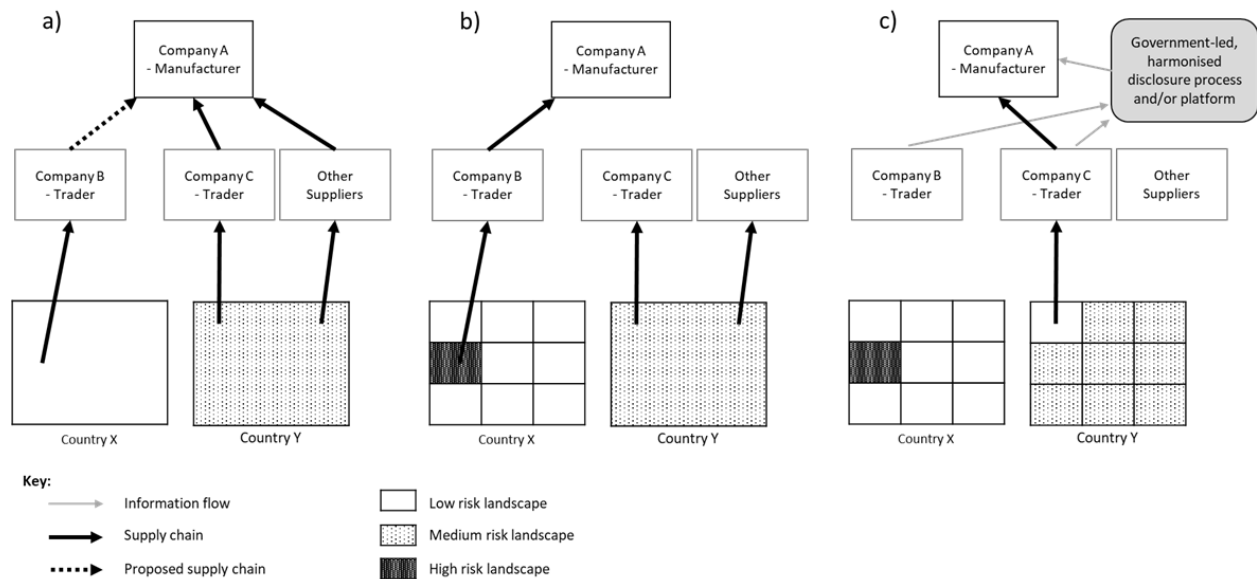such as those illustrated (see Figure 2).

Figure 2. Example of risk assessment implementation challenges and how harmonized data processes

may assist. a) Company A intends to change sourcing to Country Y from Country X on the basis of a

coarse risk assessment which suggests Country Y is a deforestation hotspot. b) Company B's own,

detailed, analysis reveals that it is actually exposed to high deforestation risk in Country X because of its

particular sourcing profile. In the absence of, for example, harmonized data sharing, Company A is not

able to make an adequate assessment of overall risk exposure although in reality a switch to Company B

would increase its overall risk exposure. c) Information sharing by both Company B and Company C, via a

harmonized process, reveals that the latter operates in an area of low risk within Country Y. Company A

can then make informed decisions about its sourcing - in this case moving all its supply within Country Y

to Company C.

Governments can also develop early warning systems for companies, notifying of deforestation risks and

enabling prevention. The European Commission acknowledged in its 2019 communication a need to

further harness the EU's earth-observation and supply chain data, and to combine research and

monitoring capacity to develop early warning systems (European Commission, 2019). The French

government recently granted access to customs data through the Ministry of the Ecological and Just Transition to develop a rapid alert mechanism on deforestation, to be embedded in its online platform ("La France Veut Relancer Sa Stratégie de Lutte Contre La Déforestation Importée," 2020; Ministry of Ecological Transition, 2021). This rapid alert mechanism will provide targeted information to companies on deforestation in production regions, based on import data combined with satellite monitoring of forest cover.

3.3. Global impacts of due diligence regulations

While due diligence regulations on forest-risk commodities originate from the demand-side, they may have considerable impact globally in terms of data availability and access. The EU, as a major consuming market, is currently well-placed to introduce such a regulation. This would have implications beyond the EU and could support improvements in data availability and adequacy beyond the EU borders. Strengthening datasets for implementing such a regulation requires increased cooperation with producer and processing countries. Equally, because consumer markets are likely to share suppliers and high-risk sourcing regions, such improved datasets on environmental and social risks would support collective action by companies operating in other global markets.

3.3.1. Ground-truthed data and local actors in producing countries

In addition to continued investment in technologies, like remote sensing, imagery classification, and monitoring downstream supply chains, it is crucial to improve validation of data via ground-truthing or auditing activities in production countries.

Active engagement with producing governments will be critical to success of such validation processes to ensure local validation of activities and remotely sensed products (Bellfield et al., 2015); and there must also be sufficient buy-in on validity of risk assessments conducted by downstream companies. In

Section (3.2.2), we make the case for investing in robust and standardized datasets. Importantly, compiled information must be appropriately balanced (i.e. to avoid bias) and representative of local contexts, to prevent discrimination and unfair impacts across producing countries and local producer livelihoods. A disproportionate bias towards data generated by downstream actors, or information compiled from modelling approaches or remote-sensing without validation by in-country auditing, may undermine data credibility and, ultimately, cooperation of producer organizations. Ongoing dialogue with local actors, following a rights-based approach that forms equitable partnerships to effectively manage progress towards sustainable development, is one mechanism to ensure data can be effectively validated to avoid unintended consequences (Bellfield et al., 2015; Chave et al., 2019; Klemmer et al., 2020; Paneque-Gálvez et al., 2014).

In addition to the role of upstream actors to validate data used for risk assessments, there are ultimately limits on what can be obtained without cooperation of producer organizations and producer jurisdictions. This is particularly true for information suitable for exposing and addressing deforestation-associated human rights violations, which cannot be remotely sensed. Deforestation-related human rights and social issues are often not monitored properly or not via official sources. Therefore, violations reported e.g. by local NGOs, media, or producers themselves, will likely provide the only realistic mechanism for capturing information. Efforts also need to be taken to improve transparency of information on human rights through alternative, more comprehensive sources, so they can be adequately assessed; a step which likely requires greater disclosure and cooperation from production regions.

3.3.2. Generating global impact through improved information on important sourcing regions

Deforestation associated with production of agricultural commodities is concentrated in a handful of tropical countries, and export of these commodities internationally is linked to a relatively small number

of commodity traders (Curtis et al., 2018; Kissinger et al., 2012; Trase, 2020). Therefore any effort to identify and monitor high-risk sourcing regions and suppliers as part of a due diligence regulation would be highly relevant to other consumer markets. Increased technical and financial support that a downstream market dedicates to implementation of such a regulation (in particular in cooperation with producer countries and other consumer markets) would be beneficial to tackling global imported deforestation (Folke et al., 2019). A recent example includes the move by a number of countries in Asia, including Japan, South Korea, China, and Viet Nam to adopt regulations to address imports of illegal timber, following adoption of similar regulations by first the USA, then Australia, and then the EU (European Union Forest Law Enforcement, Governance and Trade (FLEGT), 2012). This uptake reflects, in part, the need for timber producing and processing countries to meet legality requirements of newly regulated consumer markets.

Companies which operate in several markets may apply the most stringent requirements across their supply chains as a way of enhancing cost effectiveness, especially as downstream markets tend to rely on relatively small numbers of dominant upstream (multinational) companies. A due diligence regulation in influential downstream markets may have an impact beyond its supply chains, through potential application of requirements across a company's operations, meaning even smaller or emerging downstream markets would benefit from implementation of due diligence-based interventions of others (Michida & Nabeshima, 2012).

However, there is a risk where due diligence requirements diverge between markets, which interacts with development of coherent informational landscapes to support due diligence practices (see Section 3.2.2). For example, there is emerging divergence between foreseen EU regulations and the UK proposal, with the UK focusing on only larger companies and legality-based due diligence, in contrast to the EU which is likely to adopt a broader scope. Companies, or third-parties, in one focal region where

due diligence is implemented would likely focus most of their capacity on generation of data relevant to their legislative context. In the absence of standardization, any companies intending to source from regions outside of their direct legislative boundary (e.g. an EU-based company sourcing from the UK) would likely either be forced to account for divergent information sets in their risk assessment processes, or impose additional/alternative requirements on their supply chain to meet their regulatory obligations with additional resourcing consequences for one or both parties. In essence, the more due diligence legislations diverge from one another, the more difficult it will be for companies to successfully implement the standards; and if the legislations differ greatly, they could end up undermining one another. Where possible, therefore, countries should aim to align their legislations to support data harmonization and - where this is not possible - offer support to those companies who are integrating data from across various legislative contexts. Multilateral fora like the G7 and international conventions can support convergence between the different regulatory frameworks.

Section 4 Conclusions

Well designed and successfully enforced due diligence regulations on forest risk commodities could reduce deforestation and associated human rights violations in producer countries, improve the transparency and traceability of agricultural supply chains, and pave the way for other major markets to initiate similar policies. Furthermore, beyond the mitigation of harmful impacts of commodity supply chains, due diligence includes a complementary prevention component, where companies proactively prevent the risks in their supply chains.

Due diligence is highly dependent on the availability and quality of data and information. Access to quality data is especially critical for the companies that have to conduct due diligence for risk identification and assessment, and risk mitigation. Poor quality or non-existent data could lead

companies to undertake mitigation measures that are disproportionate. The stakes are high; poor data could lead to companies ending relationships with suppliers, risking smallholder livelihoods, when other less extreme measures could have been implemented, with better environmental and social results. A reliable data scenario, in contrast, would help to ensure that due diligence regulations are implemented in a fair, evidence-based, and transparent way, without perpetuating or reinforcing deforestation and associated human rights violations. Particular attention should be paid to this aspect if such regulations combine due diligence obligations with a market access restriction to non-compliant commodities and products, as this could lead to closing access to key markets (such as the EU) for producers that heavily depend on them.

The introduction of due diligence legislation in the EU provides a concrete opportunity to improve the data landscape. To do so, such legislation must be responsive to the emergence of new data, receptive of lower quality data, and strive to incorporate the best available data. With a complex and fragmented supply chain data landscape, due diligence regulations need to set clear scope, sustainability criteria, and definitions, as well as a clear process to prioritize the risks and put in place proportionate mitigation measures. These mitigation measures should include elements to strengthen the due diligence process, such as transparency obligations (e.g. reporting processes). Decision makers should also consider putting in place complementary measures to support due diligence regulations, such as increased political, financial and technical support to improve current data collection and datasets, monitoring systems, and transparency in developing countries.

Implementation of a policy which responds to these requirements is far from trivial; it requires policy makers and businesses to understand the data landscape, to be receptive to new forms of disclosure and data exchange, to design robust systems to mitigate risks associated with data shortages, and to

plan ahead for changes in the physical and data landscape which are likely to arise in the future. A due diligence regulation is achievable, though simultaneous investments in data availability and quality are urgently needed, for effective implementation and monitoring.

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