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PERSPECTIVE

Beyond imperfect maps: Evidence for EUDR-compliant agroforestry

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Abstract

1. Not all good intentions lead to effective and fair policy designs, as their implementation creates new problems. The European Union Deforestation Regulation (EUDR) may be an example. In targeting 'deforestation-free' trade, it forces a complex social–ecological reality into an oversimplified forest–non-forest representation. The forest definition used refers to tree cover but excludes farmer-managed agroforestry (AF).
2. Not all tree cover indicates forest, as forest-like forms of agriculture (AF) exist, for example producing much of the worlds' cacao, coffee and rubber. The EUDR design trusts maps and relies on detailed spatial data to verify the deforestation-free claims needed for access to EU markets. Tree cover is observable in remote sensing; the intended exclusion of AF is not.
3. No map is perfect but for global forest maps prepared for EUDR use there is 18% chance a forest pixel is considered non-forest in other data, all supposedly based on the same forest definition and cut-off date. Map errors imply two types of risk: non-compliant imports to the EU (that 'fraud prevention' tries to avoid) or unjustified exclusion (collateral damage).
4. Globally, the EUDR maps claim 12% more forest in 2020 than national data compiled by FAO suggests; in specific countries, the gap is wider. The probability that an AF garden producing coffee cocoa or rubber is (erroneously) mapped as forest is two-thirds for a study in Indonesia. Elsewhere similar problems have been noted.
5. Data sources beyond direct earth observation will be needed to legally establish pre-2021 agroforestry as a source of EUDR-compliant commodity trade. We present a typology for such evidence. Evidence can be based on direct observations on the ground or remotely, based on what people say and on accounts of what they did.

KEYWORDS
agroforestry, cacao, coffee, forest definition, rubber

1 | INTRODUCTION

What seemed to be straightforward, preventing products of recent deforestation from reaching European markets, proved to have many devils in the details. The European Union Deforestation Regulation (EUDR; EU, 2023) is popularly associated with 'deforestation-free' trade (Lambin & Furumo, 2023; Pasiecznik & Savenije, 2017; Pendrill et al., 2022). However, all production of four of the seven listed 'agricultural' commodities (cacao, coffee, oil palm, rubber) is based on historical deforestation; the only question is when the deforestation occurred.

The EUDR has three key requirements for 'due diligence':

A Well-documented location of origin,
B Compliance with national laws and rules in the country of origin,
C With reference to the EU forest definition, produced on land either deforested before 31 December 2020 or (in case of wood products) still forest and nondegraded.

Procedures to claim EUDR compliance (per the December 2025 start date of full implementation) are primarily based on A, which is not trivial given the mixing and blending that characterize most supply chains. An assumption critical to the EUDR in its current implementation is that C can be asserted transparently based on A. Such a link allows 'nationally competent' authorities in importing countries,[1] designated for this role, to verify or reject the claims made.

The forest definition chosen by the EU combines directly observable criteria of 'land cover' (directly observable on the ground or by remote sensing) with the exclusion of any agricultural 'land use' (based on identifying the 'user'). As such, it requires a prior definition of 'agriculture', with 'agroforestry' identified as agricultural use of trees and forests (van Noordwijk, 2019b). The 'EU-JRC 2020 forest map' provided by the EU authorities for EUDR use has no legal value per se but may serve as a tool to comply with the regulation.[2] It is based on forest cover in various existing datasets, with some subsequent filtering of known tree crop plantations, but without systematic consideration of agroforestry (Bourgoin et al., 2024). Several commercial companies (Alkema et al., 2024; Rothe et al., 2024) claim to have developed better maps. However, verifying agencies will have to judge EUDR compliance based on public maps (or trust the reputation of the proprietary certifier, which has so far been ruled out by the EU authorities). Alternatively, the EU will have to investigate due diligence claims that do not match public forest data. This will be costly and will (where ground-truthing is needed) require the cooperation of local authorities, who have often felt excluded from the process so far despite EUDR requirement B.

Here, we aim for two contributions to the ongoing debates on (1) the consequences of the dual aspects (biophysical land cover and institutional land use) of the forest definition chosen by the EU and (2) the categorization of evidence that can be called upon where claims of EUDR compliance for agroforestry products are contested.

We will briefly review:

- The design of EUDR and the public debate it triggered,
- the intricacies of forest definitions and available spatial data on agricultural tree cover,
- reliability of maps and commonly used metrics,
- the categorization of evidence types in similar policy domains.

2 | EUDR DESIGN AND PUBLIC DEBATE

The public debate on EUDR can be analysed as part of an 'issue cycle' of public policy change with progress markers in four connected knowledge-action chains (van Noordwijk, 2019a): setting the agenda and shared understanding, commitment to goals, means of implementation and assessment–learning–adjustment. These chains overcome denial, blame game and conspiracy stages. Along such public policy issue cycles, instrumental and relational values interact (Pascual et al., 2023). Motivation to engage along an 'internalization' scale (van Noordwijk et al., 2023) shifts from self-realization (especially for the initiators of the policy) to peer pressure (coalitions), financial incentives (for those with power to oppose) and avoiding punishment. Selective appeals to the various basic elements of human morality (Haidt & Kesebir, 2010) by participants in the debate challenge real dialogues, as analysed for debates on oil palm (Lusiana et al., 2023), peatland (Abdurrahim et al., 2023) and deforestation reduction (REDD+; Do & van Noordwijk, 2023). In the eyes of actors along the supply chains from (tropical) forest margins to European consumers, the issues of primary concern can change in character and be transformed (Table 1) blending environmental, economic, social and governance rationality and value systems (Leimona et al., 2024). The primary goals are translated into means of implementation (secondary targets for the administrators and control agencies involved), rolled out to a complex web of actors addressing tertiary issues for them on how to minimize risks of non-compliance, and this may finally lead to change on the ground, including land use change. For every layer, the dominant moral and technical issues and motivation to engage will differ, as does the power to voice concerns.

A complex political powerplay on the EUDR in late 2024 led to a 1-year delay in enforcement of the due diligence statements from importers of seven 'forest risk' commodities, but no change in design of the means of implementation. The aspects that played a role in the public debate included (Table 1):

- Continued commitment to the agreed goals (1, 2, 3) but doubts that they can be achieved with current procedures,
- an EUDR intervention logic that was not based on what people in forest margins will do differently (EC, 2021) (1, 24–27),
- a change in power balance within the European Parliament, a decrease in support for 'green' policies (2, 3),

[1] https://www.live-eo.com/article/eudr-competent-authorities---updated-list.
[2] https://forest-observatory.ec.europa.eu/forest/.

TABLE 1 Primary, secondary, tertiary and quaternary issues for a range of EUDR stakeholders, based on our reading of the policy debates, with implicit (or explicit) reference to morality dimensions (harm/care, fairness, authority, liberty, loyalty, purity; Haidt & Kesebir, 2010) and summary of EUDR critique (bottom row) (from van Noordwijk et al., 2024, 2025).

Primary *rationale* for policy; purity, avoidable planetary harm	Secondary: *Means* of implementation; authority and loyalty	Tertiary: *Risks and costs* along the supply chain: Liberty, distributional fairness	Quaternary: Land user *options*; modifying behaviours; social, economic and environmental impacts
(1) Consequences of (tropical) deforestation	(5) WTO compliance through applicability of rules within the EU	(13) Increased administrative requirements	(21) Strong economies of scale in claiming compliance
(2) EU footprint, responsibility	(6) Forest definition: uniform or adjustable to locality and context	(14) Transaction costs, who pays?	(22) Collective action opportunity for farmer groups
(3) EU culpability, blame, green image	(7) Lack of synergy with other forest-related policies	(15) Risks of non-compliance, risk avoidance in selecting product origins	(23) Loss of profitability of existing agroforestry
(4) Loss of profitability for further deforestation as '*theory of change*'	(8) Due diligence process requirements and burden of proof	(16) Export country: sovereignty concerns, seeking recognition for role	(24) Shift to other (domestic or non-EU) market channels for same products
	(9) Legality checks in country of origin: how documented?	(17) Lack of reliable public data	(25) Shift to non-EUDR commodities (requiring more land?)
	(10) Location data as basis for compliance: map reliability	(18) Loss of export options, shift to other markets	(26) Shift to non-agricultural livelihoods (urban, overseas)
	(11) Controlling agency: 'nationally competent'	(19) Business opportunity for consultants	(27) Net effect on deforestation of 23–26?
	(12) Sanctions and legal contestation	(20) Vested interests of powerful actors	(28) Net effect on Sustainable Development Goals (SDGs)?
Limited synergy with the SDG agenda and its internalization; '*overreach*'	'*Overconfidence*' in command-and-control procedures and adequacy of maps	'*Overkill*', not supporting 'common but differentiated responsibility'	'*Oversight*' of social impact on smallholders at forest margins

- administrative details that were not ready in time for market operators and control agents to be adequately prepared (8, 11, 13); the April 2025 procedural simplification, for example in mandated reporting frequency, did not address the issues discussed in this paper.
- inadequacy of the tree cover map that the relevant EU agency had prepared as a benchmark for what the EU considered to be forest in December 2020 (6, 7, 10—see next sections for details),
- diplomatic efforts to repair damaged relationships with bypassed source countries (16),
- domestic forest industries in European countries that realized the consequences of the rules (5, 6, 7),
- diversity of national forest definitions and agroforestry concepts within the EU (6, Lawson et al., 2024—see next section for details),
- Collateral damage to smallholders, especially those operating agroforestry systems (23, van Noordwijk et al., 2025).

Pressure from large companies that had invested in their own preparedness and objected to delays which favoured their competitors that had been slower to respond (19, 20). In the light of the above, and building on four (economic, social, ecological and governance) value categories at stake in quality assurances of production conditions in forms of 'certification' (Leimona et al., 2024), (van Noordwijk et al., 2024) conclude that there was (bottom row in Table 1) Oversight (of impacts on smallholders), Overconfidence (ignoring the considerable gap between the forest definition and available tree cover data), Overkill (the required high precision of production location data is not aligned with valid interpretation capacities) and Overreach (through a forest definition that has the exclusion of agricultural use as key element, rather than biodiversity and carbon storage protection).

3 | INTRICACIES OF FOREST DEFINITIONS

The term forest can refer to any level in a structure–function–benefit–rights–actor–value cascade that spans the land cover–land use continuum (Figure 1a). Current internationally used forest definitions combine a land cover (structure) and land use (institutional) perspective (Figure 1b), with a clear binary distinction between private open-field agriculture (lower left) and old-growth closed-canopy forest (upper right), and many 'in-betweens' such as 'trees outside forest', trees in agriculture, swidden-fallow cycles and agroforestry.

The forest definition that the EU chose to use ('land spanning more than 0.5 hectares with trees higher than five meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land predominantly under agricultural or urban land use.') combines an actual land cover criterion with two land use criteria (potential tree cover, excluding agriculture), and the word 'predominantly' on which perspectives may differ. It requires the prior definition of 'agriculture' and declares 'agroforestry' to

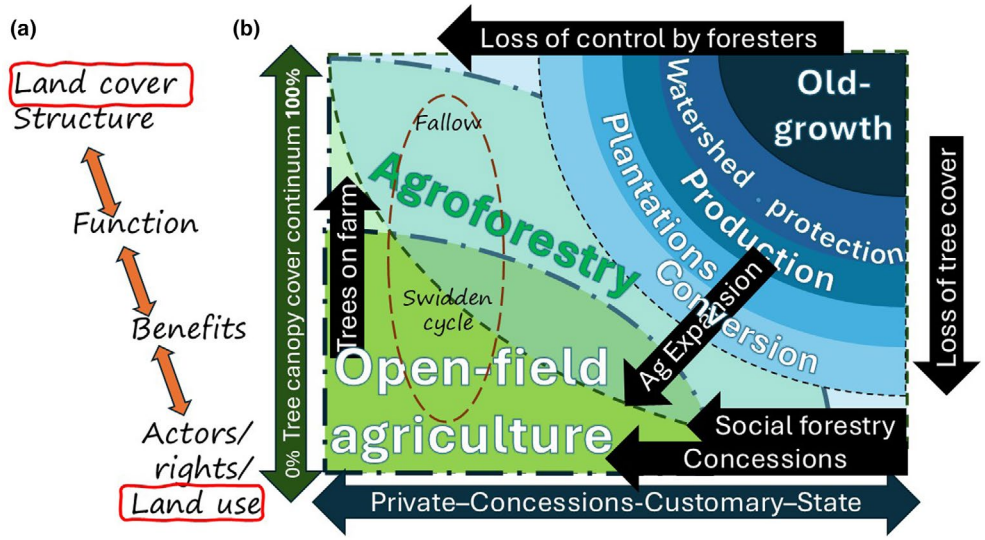

FIGURE 1 (a) The land cover–land use cascade, (b) Biophysical and institutional gradients in which open-field agriculture and closed-canopy forests coexist with many intermediate forms, challenging the definition of a binary forest–non-forest concept.

mean agricultural use. The potential rather than actual tree cover requirement allows rotational timber plantations to be harvested and replanted within the forest category.

More than 40% of agricultural lands (based on FAO data) include at least 10% tree cover (Zomer et al., 2016). In Southeast Asia, agroforestry may be 18% of total land area (Lesiv et al., 2022), for example. Advances in Earth observation science have strengthened the land cover dimension of the forest and deforestation concepts (the *Y*-axis in Figure 1b), while institutional perspectives on 'non-agricultural' land use (the *X*-axis in Figure 1b) are the most selective element of FAO and EU forest definitions (Zalles et al., 2024). The FAO (2023) definition of deforestation is 'the conversion of forest to other land uses independently of whether human-induced or not'; the EUDR definition (EU, 2023) is restricted to conversion to 'agricultural use', which may be hard to prove from land cover data alone. Forest definition and delineation are not optimized for current debates but are part of the institutional foundation of forestry as a discipline (Himes & Dues, 2024; Putz & Redford, 2010) and the political economy of landscapes (Galudra & Sirait, 2009; Peluso & Vandergeest, 2001). In many national definitions, there is no strict exclusion of agricultural use of 'forest lands': continued institutional control by forest agencies is the defining element, allowing inclusion of agroforestry.

Any harvest of coffee, cacao or oil palm demonstrates agricultural use (agroforestry) and as such implies deforestation, regardless of the present tree cover. The main question is when (not whether) this occurred. The rules in the FAO forest definition (FAO, 2023) imply that all rubber is deforestation-free, as rubber stands can be used to harvest rubber wood at the end of a production cycle and are considered forest. However, rubber is included in the EUDR scope as an agricultural product (EC, 2021). There is a considerable delay before 'loss of tree cover' can be interpreted as 'deforestation', if 'temporarily unstocked' land (e.g. due to logging, fire, or hurricanes) remains within the domain of forest institutions. The next FAO forest resource assessment (FAO, 2023) will distinguish various classes within the general concept of 'forest', including forms of agroforestry, similar to existing interpretations by others (Lesiv et al., 2022). Differences in forest concept between national laws, international common practice and EUDR cause confusion (Figure 2).

4 | HOW (UN)RELIABLE ARE MAPS?

4.1 | Type I and type II error

A comparison between two land use/cover classifications from different sources will show similarities and differences. Discrepancies can be due to the quality, range and quantity of information—both from the ground and satellite—available to the classifier, the classification technique and the way definitions are operationalized. Beyond the fraction of spatial units (pixels) in which the two maps agree, an overall 'quantity disagreement' (proportions of categories regardless of location) can be distinguished from an 'allocation disagreement' (the specific locations in which entities are found) (Pontius & Millones, 2011). An 85% agreement at pixel level is generally seen as an acceptable map–a threshold not yet reached by the EU-JRC_2020_forest map according to Bourgoin et al. (2024). If one map is taken as 'reference' (or independent sample points) and the other as 'map to be evaluated for use', the disagreement consists of type I errors, false positives and type II errors, false negatives. If decisions to accept or reject EUDR compliance claims on a reference map, the consequences of type I and type II errors are asymmetric: policy failure if shipments are accepted while they contain products of recent deforestation, or 'collateral damage' to producers excluded while they did comply (van Noordwijk et al., 2025). As is presented in basic statistical courses and discussed in a legal context by Radford (1988), the likelihood of type I and type II errors are inversely related. 'Avoiding fraud' by

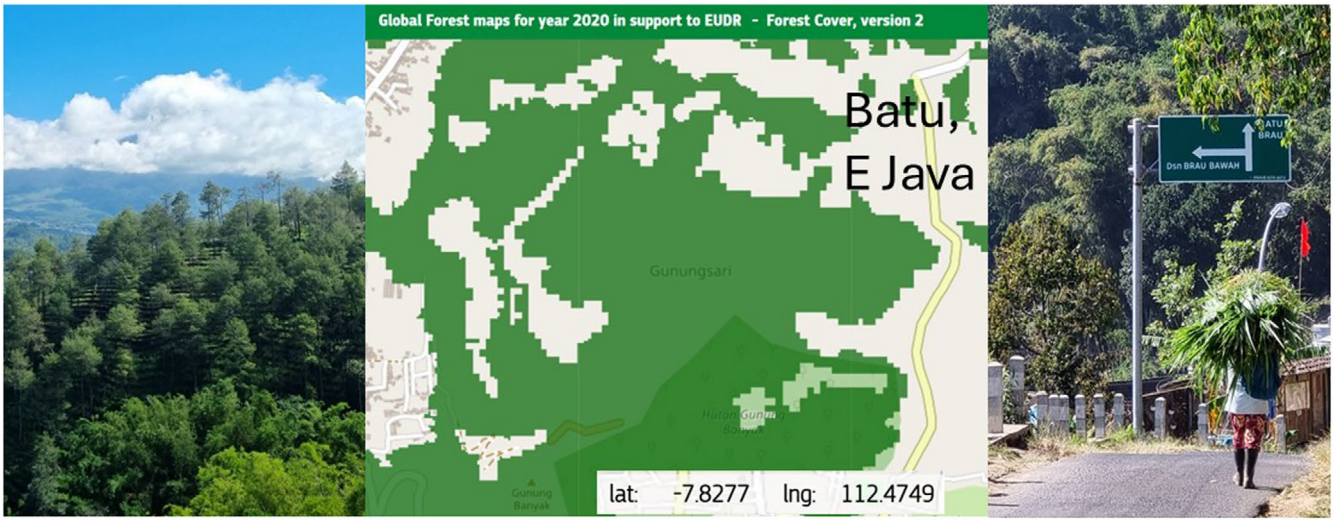

FIGURE 2 Example of the confusing multiplicity of forest concepts for a location in East Java (Indonesia) that is classified in the EU-JRC 2020maps as forest (https://forest-observatory.ec.europa.eu/forest/rmap) is part of the Indonesian forest domain ('kawasan hutan') consisting of pine tree plantations on former food crop terraces intercropped with fodder grasses in agroforestry contracts and, as such, does not meet the EU definition of forest.

reducing type I error increases the risk for 'collateral damage' (type II error). Statements with a 15% chance of error are generally not seen as convincing evidence in courts (Radford, 1988), while accepted uncertainty depends on the gravity of consequences of error. Recent scandals in several European countries followed policies where fraud prevention was prioritized and risks of collateral damage downplayed (van Noordwijk et al., 2025).

As the EU policy claims to have 'zero tolerance' of aggregated type I error (any location that contributes to a shipment that has recently been deforested), the accepted aggregated Type II error increases with the number of independent spatial entities in a shipment. For example, there is an 80.3% chance that a shipment is erroneously rejected if it consists of ten independent locations, each with 85% chance of correct map representation (basic statistical texts explain the probability that a sample of ten beads from a bag with 15% red beads includes at least one red one is calculated as $1-(0.85)^{10}$). A single due diligence statement can contain up to one thousand separate locations.

4.2 | Error probability conditional to EUDR commodity production

General map reliability metrics, for example, in a forest versus non-forest binary map, are not particularly relevant, as for any location involved in a shipment, we know that the current status of land is 'non-forest' by definition. We need to know the conditional probability for a production location pixel to have been agricultural (or agroforestry) in December 2020 while it was incorrectly mapped as 'EU-JRC 2020 forest'.

An accuracy assessment (Colditz et al., 2025) of version 2 of the EU-JRC global forest cover map for the year 2020 (Bourgoin et al., 2025), using regional expertise in land cover interpretation partially independent of what had been used in constructing the EU-JRC map, found a commission error for forest (areas erroneously mapped as forest) of 18% and an omission error (areas not classified as forest that meet the definition) of 8%. According to Colditz et al. (2025) minimizing the type I error was seen as more relevant for the map design than the existence of type II error. However, others involved in the EUDR evidence chains may have other opinions on this. Map accuracy decreased for dry and open forests or landscapes with small forest/non-forest mosaics.

Global tree cover data, regardless of 'agricultural' or 'forest' land classification, indicated 4.31 and 4.97 billion ha if a 25% or 10% tree cover criterion was used (Zomer et al., 2016). The EU-JRC global forest area (in version 2) maps 4.56 billion ha, in between the 10 and 30% tree cover indications, but 12% more than the international reference of the FAO Global Forest Resources Assessment for the year 2020 (4.08 billion ha). The maps do not simultaneously show the FAO classification (supported by national data), but the areas where the two maps disagree will certainly deserve further scrutiny, as they may have a more-than-proportional probability of producing the EUDR listed commodities. The FAO map, compiled from national data indicates the land area the government declared to be forest, using institutional criteria beyond tree cover, in line with the definition used. In the EU-JRC map, specific and recognizable forms of agricultural tree cover, such as oil palm plantations, have been filtered out, but other forms of agricultural use have not.

The quantity disagreement, globally 9.3% in EU-JRC version 1 and 12% in EU-JRC Version 2, varied between countries. For example, the FRA results were slightly (1.6%) higher than the EU-JRC forest data for Brazil and substantially lower in DR Congo (28.3%) and Indonesia (26.9%).

Reymondin et al. (2025) comparing 19 map sources for Ghana with a focus on cocoa found precision score of 83% ± 12% and

REAU 2010 Indonesia land cover	EU-JRC 2020 forest map		% error
	Forest, ha	Non-forest, ha	
Rubber agroforest	5,589,114	3,023,734	65
Other agroforests (incl. coffee, cacao)	1,795,971	1,256,049	59
Subtotal agroforests	7,385,085	4,279,783	63
Rubber monoculture	8,525,722	8,597,000	50
Other monocultures (incl. oil palm, coffee, cacao)	2,798,785	12,382,629	18
Subtotal monocultures	11,324,507	20,979,629	35
Total tree crop areas	18,709,592	25,259,412	43

TABLE 2 Cross-tabulation of land cover indications on the REALU maps for Indonesia (Ekadinata et al., 2011) and the EU-JRC 2020 forest map (Bourgoin et al., 2024).

79% ± 8% for the two best-performing maps (and many lower precision scores for other maps), with all maps claiming to strictly apply the FAO forest definition (without clarifying how agroforestry was excluded). For Indonesia, we have evidence that agroforestry is an important part of the difference.

4.3 | Indonesia as case study

A closer analysis for Indonesia where the FRA data indicated around 90 Mha of forest in 2020, the EU-JRC mapped 118 Mha and the 10% tree cover estimate (Hansen et al., 2013) is 130 Mha (including large areas of oil palm plantations, for example). As part of early efforts to broaden forest protection efforts to reducing emissions from all land uses (REALU) in a landscape approach (Bernard, 2013), a wall-to-wall land cover classification was developed for Indonesia that includes various forms of agroforestry in its legend, based on extensive ground-truthing (Ekadinata et al., 2011). These maps have been updated for 2010, but did not, largely for institutional reasons, become a national standard. Areas that were agroforestry in 2010 had, by the EUDR definitions, been deforested before 2020, and should not be included in the 2020 forest map. A cross-tabulation of this REALU map and the EU-JRC 2020 forest map (Bourgoin et al., 2024)—after harmonization of the coordinate systems—showed that 18.7 Mha with clear 'agricultural use' were included in the EU-JRC forest map as 'forest' (Table 2). This 18.7 M ha was 15.9% of the total forest area indicated in the EU-JRC map and consisted of rubber monoculture (7.2%), rubber agroforest (4.7%), other (non-rubber) tree crop monocultures (2.4%) and other agroforestry systems (1.5%). The probability that products from land with tree crop monoculture plantations (in 2010) in Indonesia are mis-classified as being derived from 'forest' in 2020 (and by definition falsely labelled as 'deforestation') is 35%, and for rubber plantations in 2010, 50%. The same probability is 65% for rubber agroforests and 59% for other types of agroforest, as classified in the 2010 maps. Across all agroforests, the misclassification probability was 63%; for all tree crop systems, it was 43%. The current data don't allow for confidence intervals around these error estimates, but the maps certainly are not error-free.

If EUDR compliance decisions are based on such maps, it is likely that rejections will be challenged in court and other evidence will be needed to judge type I and type II errors in a specific context.

5 | EVIDENCE CATEGORIES

The three defining elements of EUDR compliance will require different steps for verification by 'nationally competent' authorities. We propose the following terminology (Figure 3):

Point A. Geolocational data can be checked for consistency (are they on land? Reasonable elevation? Not 'overbooked'?), as replicating previously accepted coordinates may be the easiest type of fraud. The national competent authorities of the importing countries would be required to make these judgements.

Point B. Will require procedures and evidence that depend on the exporting countries and their existing national certification systems for legal compliance (Leimona et al., 2024). This is likely to be based on different forest definitions and may be more restrictive: for example, 15–20% of Indonesian oil palms growing within the 'forest zone' (Purwanto et al., 2020) are (or were planted) illegal, but as they were planted before 2020, they can meet the criteria for point C. Similarly for cacao planted under forests in Ghana (Benefoh et al., 2018), or coffee planted in ex-swiddens in central Vietnam.

Point C will, as far as the EU has communicated, be mostly checked by comparing geolocation with the mapped 2020_EU_forest. There are three routes for evidence to support EUDR compliance claims even if the location is mapped as '2020_forest':

C1_AF: The tree crops currently harvested were planted before 2021,

C2_AF: the land already was non-forest in 2020 as evident from pre-2021 agricultural harvests (of any type; date to be established), even if subsequently tree cover was reduced,

C3_AF: the land already was not forest in 2020 as part of a swidden-fallow rotation.[3]

[3]In some European countries, on-farm woodlots are considered 'forest' if not cut before age 25 years; a similar age limit for agricultural fallows to become forest may be logical—but requires EU clarification.

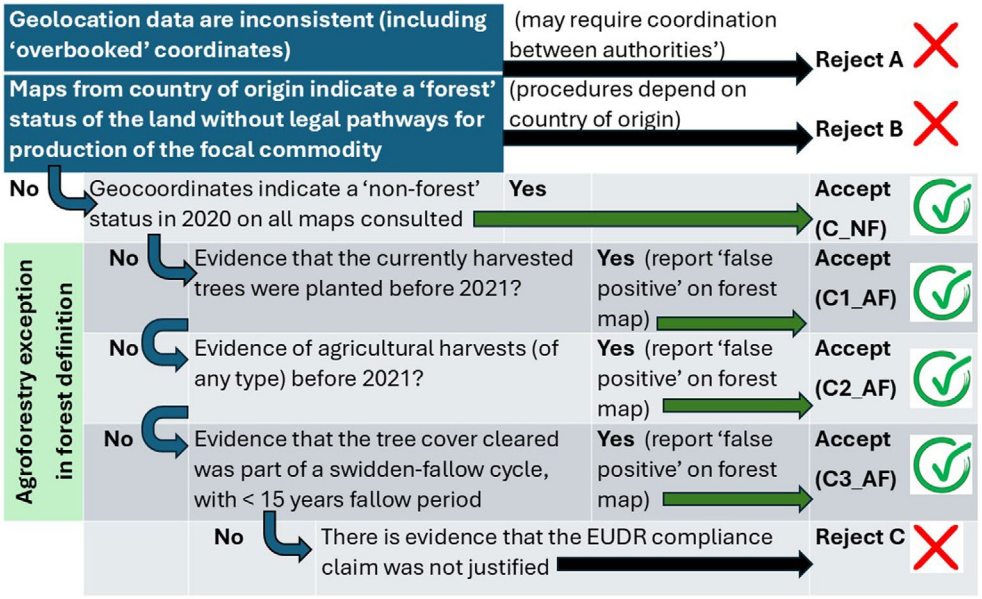

FIGURE 3 The proposed decision tree for accepting or rejecting shipments is claimed to be EUDR compliant.

Evidence for the 'claim' of C1-C3_AF in the due diligence statement can be obtained from various sources. The three 'method families' distinguished by the IPBES Values and Valuation assessment (Termansen et al., 2022) can be used here: the evidence can be based on direct observables (by a trusted observer), on what people say ('statement based') and on what they do ('behaviour based'). Table 3 suggests a typology of evidence on this basis. It will require further review and refinement. In some cases, a single type of evidence may be sufficient, for example if tree crops can be shown to have been in the ground by December 2020 (I.1). In other cases (e.g. current tree sizes are possible if planted after 2020; Figure 4), multiple sources of partial evidence can allow a valid 'due diligence' evaluation of a plot as 'deforestation-free' in the EUDR sense. The treatment of swidden-fallow rotations as agricultural systems that can after a given time (10 or 25 years?) revert back to forest remains particularly controversial (Figure 5).

6 | SUGGESTED NEXT STEPS

Recent EU communication products on EUDR clarify that 'agroforestry' is outside the scope of EUDR but do not acknowledge challenges related to existing spatial data. Our proposed evidence categories may reduce the gap and provide a way forward to a smooth EUDR implementation process. Practical application, however, will undoubtedly lead to refinement. Ideally, the 'national competent authorities' that will determine further operational practice on the EUDR regulations can play some role in establishing the 'strength' of the various types of evidence when applied at international borders. It would help if more locally grounded institutions established credible and legitimate 'positive' maps of areas that are EUDR compliant due to forest conversion before 2021, reducing the need for subsequent monitoring of tree cover change in the context of the EUDR.

Although four of the seven 'forest risk' commodities are based on tree crops grown in 'forest habitats' with challenges for current maps, the evidence may be more straightforward for livestock and soybeans. For wood products, 'forest degradation' is at least as important as 'deforestation', but it has its own challenges in generic forest definitions, as the likelihood and time frame for recovery vary with circumstances.

Solar et al. (2025) found for Peru the country with a large share of its cocoa and coffee exported to the EU comprising more than 300,000 producers (mostly family farms) that the process of implementing the EUDR involves complex challenges related to legality and due diligence, geolocation of plots, implementation costs and country-risk benchmarking. Unilateralism and absence of procedural equity were discussed by McDermott et al. (2025). As analysed for Brazil and Indonesia by von Lüpke et al. (2025), the questioned legitimacy of international policy actors in domestic policy processes has in recent years limited the effectiveness of international climate funding to address climate change and deforestation; in Brazil, competing coalitions debate the implementation of the national forest law, while in Indonesia, finance is confined to technocratic policy spheres, leaving critical decisions to the political economy sphere. Muradian et al. (2025) concluded for Brazil, Colombia and Indonesia that despite the potentially positive symbolic effect in mobilizing a global agenda for combating deforestation, the EUDR faces several drawbacks and risks associated with its choice for supply (value) chains as the unit of intervention and its high degree of unilateralism; better use of a territorial approach, and connections to social movements are the recommended remedy. The EUDR is motivated by the goal of biodiversity conservation, carbon storage and hydrological integrity of the landscape (clean water, buffered surface flows, groundwater recharge). For the public acceptance of the regulation in consumer countries, it is important to know to what extent the conversion from forest

TABLE 3 Types of evidence that can support the 'agroforestry' status of land prior to 2021 in the context of EUDR compliance.

Observables	II. What people say	III. What people do
Ground-truthing:	Local land use terminology:	Administratively:
I.1. Stem diameter, tree height and/or litter thickness support a pre-2021 planting date of the commodity trees (C1)	II.1. Plot is referred to locally with a term that matches the nationally accepted agroforestry concept (C2)	III.1. Existing documents show that relevant land use registration aligns with a pre-2021 agroforestry status (B, C2)
I.2. No indication through intact stumps or fresh charcoal of recent conversion from large-diameter forest stands (C2, C3)	II.2. Local language includes multiple words for 'forest' categories that allows distinction of various 'use' categories, incl. AF within the local landscape and the focal plots (C1)	III.2. Existing documents show that payment of land tax align with a pre-2021 agroforestry status (B, C1)
I.3. Plot-level pictures (with date information) support a pre-2021 AF interpretation in local context (C2)	II.3. Local testimonies allow to reconstruct land use history (what changed from what to what and when) (C2)	III.3. Existing documents show that existing permits align with a pre-2021 agroforestry status (B, C1, C2) or swidden-fallow (C3)
Product properties:		
I.4. Chemical and isotope signature of sold products supports their inferred region of production (verifying A)	II.4. Stated reliance on agroforestry product income sources matches a pre-2021 agroforestry classification (C2)	III.4. Historical sales records for the surrounding landscape match a pre-2021 agroforestry land use classification for the focal areas (C2, C3)
Remote sensing:		
I.5. Time-line suggests pre-2021 clearing of plots currently used (C1), with specified reliability of the land cover interpretation		III.5. Locally constructed land cover or land use maps match a pre-2021 AF status of the focal areas (C2, C3)
I.6. Inferred tree height of preceding vegetation below Y% of natural vegetation in local circumstances (Y could be 50%, for example) (C2, C3)		III.6. Interpreting co-variates (as 'supportive evidence'): Human population density, road network, terrain properties (moderate slopes?)

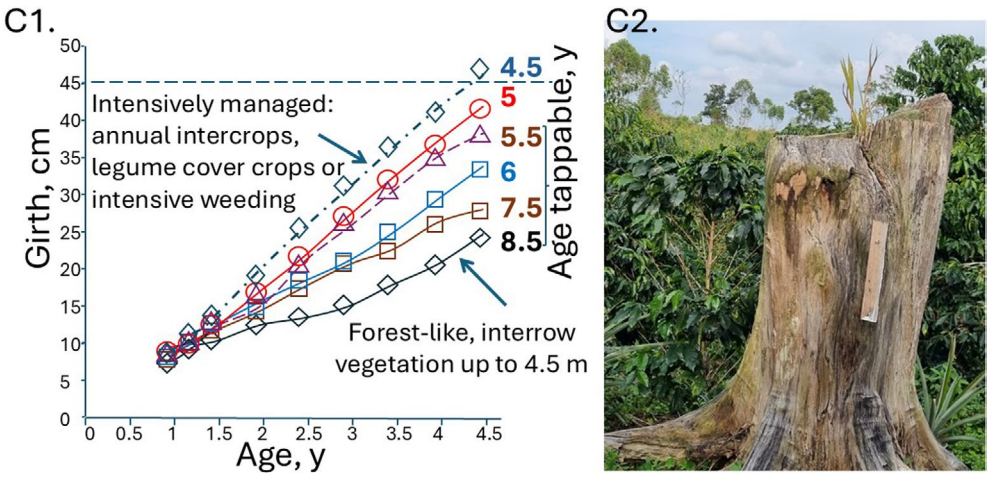

FIGURE 4 Examples of evidence types C1 and C2; C1: Increase in rubber stem diameter under intensively managed and forest-like conditions, with a tappable girth reached after 4.5–8.5 years (Wibawa, pers. comm.); C2: Stump of a recently cut *Eucalyptus* tree next to 1.5-year-old coffee in an agricultural landscape (where this *Eucalyptus* is not native or naturalized).

to land use in which any of the listed commodities are produced affected one or more of the 'forest functions', but also what 'collateral damage' affected vulnerable groups (van Noordwijk et al., 2025). Current discussions with producing countries strive for greater acceptability of the rules but will have to consider evidence categories for agroforestry as a critical issue. More efforts are needed to bring smallholder systems into zero-deforestation supply chains (Eggen et al., 2024). The Enhanced Transparency Framework of the UNFCCC Paris Agreement (UNFCCC, 2022) clarifies that all countries need to submit 5-yearly 'national communications' and 'biennial update reports' on the change to and from forest land to cropland or grassland. Annex I countries (such as EU countries) are obliged to help other countries gradually improve their methodologies. By bypassing the country authorities

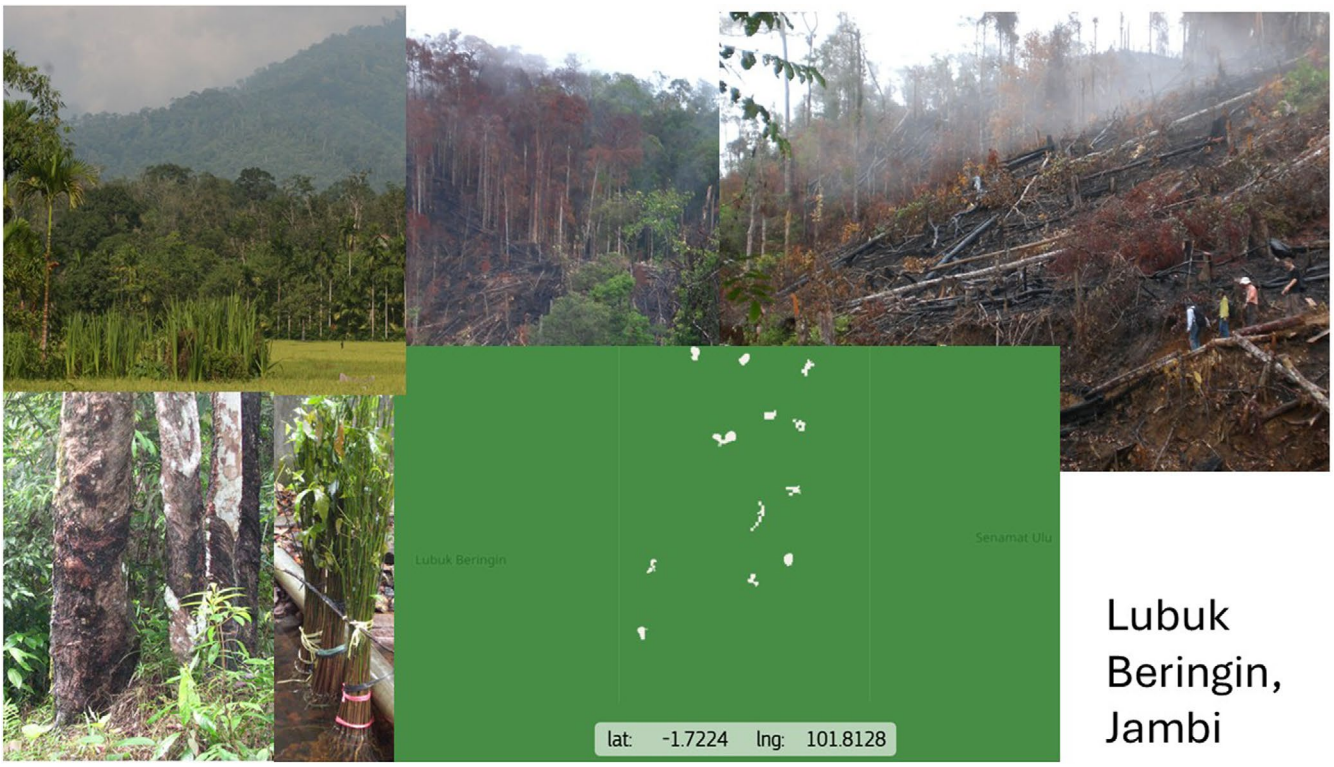

FIGURE 5 Example of a C3 case (van Noordwijk, 2020): Rubber agroforests in Jambi (Indonesia) that due to rubber harvests are non-forest for the EU although mapped as forest (https://forest-observatory.ec.europa.eu/forest/rmap).

involved, the EUDR processes do not match this commitment, as emphasized by Lawson et al. (2024).

More clarification is needed on the fuzzy agricultural fallow–forest transition. Harmonization of EUDR forest concepts with definitions used within (Lawson et al., 2024) and outside the EU countries for other policy domains will increase synergy and efficiency. Shifting focus toward protection of 'old-growth' forest (Lesiv et al., 2022) will reduce collateral damage, increase synergy with adjacent policies and public support.

AUTHOR CONTRIBUTIONS

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DATA AVAILABILITY STATEMENT

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