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Definitional confusion and collateral damage due to new deforestation-free trade policies

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Abstract

1. New policies for deforestation-free trade policies, such as the European Deforestation Regulation (EUDR), critically depend on the definition of forest, as mappable land cover and/or as rights-related land use type. Areas with a high tree cover combined with agricultural use and agroforestry are excluded from the official forest definition but are not separately mapped. Based on the definitional confusion and publicly available maps traders (and EUDR control agents?) erroneously perceive high risks of deforestation for EUDR-compliant forest-margin farmers practicing agroforestry. Laudable objectives and perceived rights to act do not prevent collateral damage to 'bystanders' in a contested space.
2. Designed to reduce the shared responsibility for demand-driven deforestation associated with seven 'forest-risk' commodities, the regulation requires a detailed account of production locations, to be checked against existing spatial information on deforestation. However, the 'non-mandatory' EU-forest map for the 2020 reference date claims, for example, 25% more forest than what the government of Indonesia reports internationally. In Indonesia the risk of misrepresentation as forest on the 'indicative' EU forest map was 31% for tree crop monocultures (other than oil palm) and 63% for agroforests (rubber, cacao or coffee). The EUDR maps are not fit for the purpose for which they were designed.

3. In our analysis expected collateral damage is due to: Oversight (of social impacts on smallholders), Overconfidence (ignoring the considerable gap between the forest definition and available tree cover data), Overkill (the high precision of required production data is not aligned with capacities for valid interpretation) and Overreach (through a forest definition that has exclusion of agricultural use as key element).
4. Options respecting the common-but-differentiated responsibility of local and national governments (Far together instead of fast alone) have been discarded. A focus on old-growth forest (primary or naturally regenerated forest of high conservation value) could leave regulation of other tree cover to more local institutions. EUDR design flaws can still be corrected if collateral damage is recognized and taken seriously by the EU authorities.

Introduction

Private-sector and government commitments to 'zero deforestation' have come in many forms in the past decades. An analysis of the various efforts (Pasiecznik and Savenije 2017) prioritized the need to agree on clear definitions and standards (what is a forest? what is deforestation? van Noordwijk et al. 2017) and for national and local governments to become more involved — since failure to address broader governance challenges may reduce the positive impact of private-sector zero-deforestation initiatives. However, the European Union regulation on deforestation-free products (EUDR; EU 2023) appears to fall short on both accounts.

The EUDR builds on a long history of policy efforts to manage and control the conversion of forests to other land-uses, both inside and outside of the EU (Kleinschmit et al. 2024, Börner et al. 2020). Community-based rules (Ostrom 1990), national policies (including infrastructure, land use and business permits, policing, taxes, subsidies, internal migration; Williams 2003), international conventions (Atmadja et al. 2022, Do and van Noordwijk 2023), promoting tree-based agriculture and non-forest timber production (Palm et al. 2005, van Noordwijk 2019a),institutional change (Colfer and Capistrano 2012), landscape approaches to jurisdictional land use planning for 'green growth' (Minang et al. 2014), private-sector pledges (Brady et al. 2021, Lambin and Furumo 2023), and voluntary certification supporting consumer choices (Mithöfer et al. 2017, Lusiana et al. 2023) have shaped the current forest conversion debate. Awareness of its global footprint (EC 2013, Kothke et al. 2023), accepting oversimplified attributions to commodity trade (Pendrill et al. 2022), and noting a slow rate of progress on voluntary commitments and country pledges (Bazzan et al. 2023, Wardell et al. 2021), has led the EU to unilateral action[*]. Unfortunately, in practice this meant insufficient operationalization of the Common-But-Differentiated-Responsibility (CBDR) principles of international climate and biodiversity conventions, the Global Biodiversity Framework (GBF) and UNFCCC discourses on Nationally Determined Contributions (NDCs). (IICA 2024).

The EUDR implies that any operator or trader who places one of seven 'forest-risk' commodities (cattle, wood, cocoa, soy, palm oil, coffee, rubber, and some of their derived products) on the EU market, or exports from it, must prove ('due diligence') that the products were obtained legally in their country of origin, and that they do not originate from land deforested after 31 December 2020 or have contributed to forest degradation. The application of the regulation hinges on the definition and its public and legal interpretation of the key terms, including 'forest', 'deforestation', 'agricultural use' and

'agroforestry'. Following the FAO, the EUDR defines deforestation as the conversion of forest to other land use (agricultural or urban); it explicitly differs from a land-cover based concept that matches direct remote sensing data (FAO 2022).

Agroforestry, the agricultural use of forests and trees, is a well-established sustainable production model for 'forest-risk' commodities (incl. coffee, cacao and rubber) but has only recently been recognized as a legally valid use of land in the EU (Mosquera-Losada et al. 2009). Agroforestry is important for both the adaptation and mitigation agenda in climate policy (Zomer et al. 2016, van Noordwijk et al. 2014, 2023a) and – under specific circumstances - appreciated for reducing pressures that can lead to further deforestation (Tomich et al. 2011). Agroforestry systems usually have sufficient tree cover to look like a forest in remote sensing imagery but any agricultural use falls outside the EUDR forest definition. Where agroforestry existed in 2020, its products can be EUDR compliant. However, where existing maps indicate agroforestry locations as being 'forest', traders may avoid the products as risky – an unintended consequence of EUDR, where agroforestry is an afterthought, and not recognized in the underlying problem analysis.

Moral appeal of new measures relies on an agreed reference frame. In the case of the EUDR an 'avoidable deforestation' storyline was built at the EU level, but not negotiated with sourcing countries and adapted to local contexts of 'EU-distant' stakeholder communities. The effectiveness of policy issue and implementation cycles (agenda setting, shared understanding, ambitious goals, policy design, means of implementation and evaluation) (Tomich et al. 2004, van Noordwijk 2019b) relies on building coalitions that agree on goals and empower means of implementation). The early part of policy issue cycles (Fig. 1) typically involves simplification to gain focus, while the real-world complexity re-emerges when goals are linked to means of implementation and policy evaluation, often initiating new cycles. The EU-centric coalitions for EUDR only partially considered consequences for local stakeholders and communities.

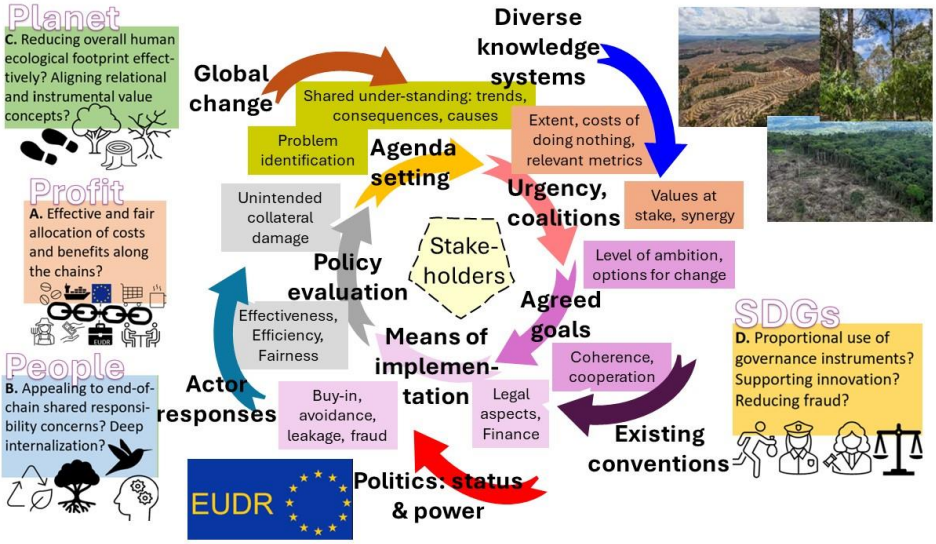

Figure 1. Policy issue cycle and associated adjacent aspects for the EU Deforestation Regulation with four (A…D) aspects for evaluation (Leimona et al. 2024)(EUDR; SDGs = Sustainable Development Goals)

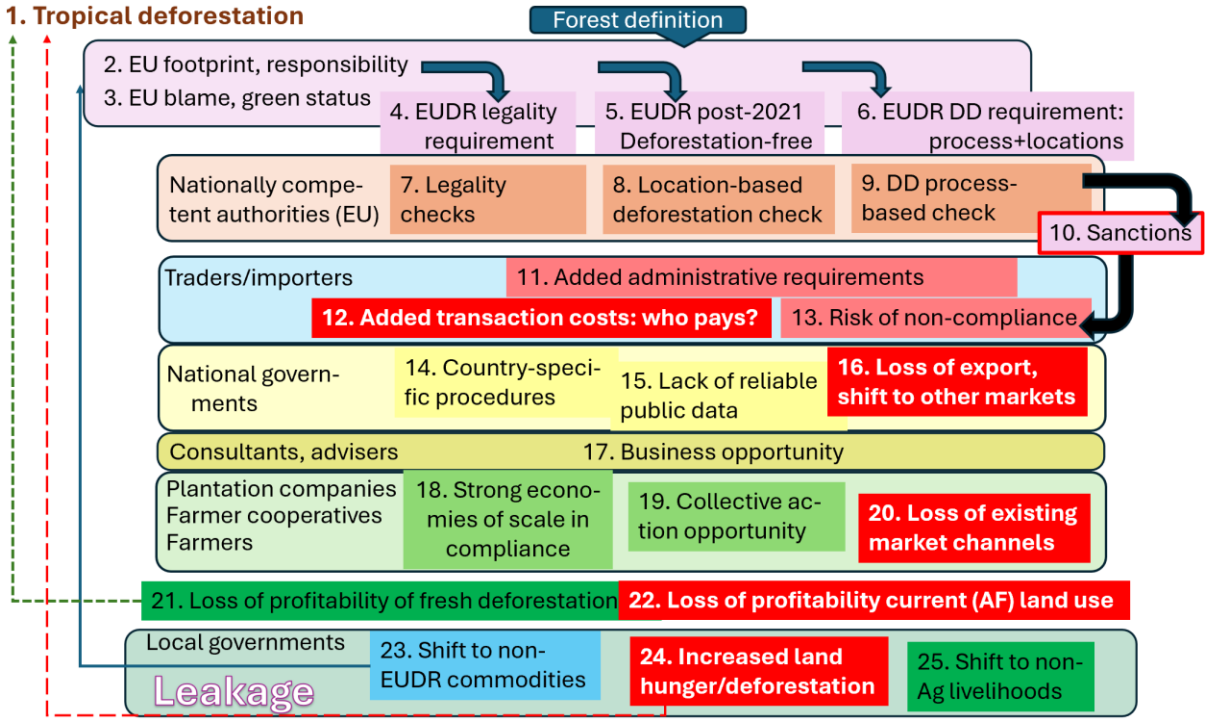

Figure 2. Transformation of key characteristics of the EU Deforestation Regulation (EUDR) along a value chain of stakeholders, potentially increasing deforestation (AF = agroforestry; DD = due diligence)

The primary issue that EUDR tries to solve for its policy initiators (1-3 in Fig. 2) becomes transformed through three performance indicators (4-6 in Fig 2) into a cascade of derived problems (4–25 in Fig. 2) as perceived by other stakeholders, each with their own ways to circumvent or deal with the new rules for their game.

Methods

We designed research on the risks of collateral damage by the EUDR to agroforesters to quantify risks of misclassification as forest of tree cover in gardens that produce listed commodities and to explore conceptual and definitional confusion around 'forest' as boundary object in policy designs. Building on recent analyses of values and decisions (Pascual et al. 2023, van Noordwijk et al. 2023b), punitive, economic, social and intrinsic levels of internalization of externalities (van Noordwijk et al. 2023c). A recent analysis of certification in planet-people-profit value chains (Leimona et al. 2024) distinguished between four relevant value concepts and provided an initial assessment of the EUDR, that deserves further analysis and corroboration (Table 1).

Table 1. Interacting value categories in the analysis of certification in planet-people-profit value chains (Leimona et al. 2024)

Values	Explanation	EUDR consequences for
Economic value chains (Profit)	From farmgate to consumer: prices, volumes, profit margins, risk	Administrative loads Transaction costs, Risk Exclusion by risk-aware traders
Social values (instrumental and relational) along the economic value chain ***(People)***	Includes consumer concerns for product quality and price, but also for social and environmental aspects of the chain; self-esteem, informed consent and perceived sovereignty along the chain	Perception of 'footprint guilt' for EU consumers with consequences for raising the environmental (but not social) baseline for voluntary certification schemes; Producing country sense of pride and sovereignty is negatively affected
Ecological values (Planet)	Local-to-global impacts on biodiversity and climate change impacts	Impacts on deforestation rates likely depending on the allocation of freshly deforested lands to non-EUDR commodities and alternative livelihood options for people in forest-margin settings
Good governance	Synergy across Sustainable Development Goals, Definitional clarity, Subsidiarity, Readiness, Proportional use of power, Due diligence on unexpected side effects and mitigation of anticipated collateral damage	Lack of coordination with climate and biodiversity conventions and accounting rules Lack of timely dialogue with countries affected Apparent lack of foresight on consequences for agroforestry smallholders.

Results

Forest as boundary object in policy design

The EUDR used the FAO forest definition[†] as key reference but did not follow all its ramifications. The definition combines positive (a land cover with trees; directly observable with quantitative thresholds distinguishing forest from e.g. woodlands), and negative institutional criteria (absence of agricultural use or agroforestry). The two criteria for a forest status allow for (Figure 3A) 'non-forests with trees' and 'forests without trees' (temporarily, the FAO Forest Resources Assessments (FRA; FAO 2020) uses a five-year time limit). The JRC-map of global forest cover on the EUDR reference date (31 December 2020) was published for use by EUDR stakeholders. It is non-legally binding with respect to EUDR and non-exclusive of other maps, but the JRC-map is now commonly used as risk indicator for commodity sourcing by intermediaries and will likely be used in compliance tests by 'national competent authorities' in importing countries. Unfortunately, there is a considerable gap between this tree-cover-based data and the forest definition used for the EUDR with its exclusion of agricultural use.

Forest definition and delineation are not optimized for current debates but are part of the institutional foundation of forestry as a discipline (Putz and Redford 2010, Himes and Dues 2024). The medieval European origin of the word forest (in *sylva forestis*) refers to boundaries (*forex*) of local versus state-based authority, rather than to the presence of trees (Buis 1985). Forest authority (e.g., in protecting hunting rights, and later timber harvests) was juxtaposed to villagers' agriculture, regardless of the use of trees in the latter. Societal appreciation of identifiable forest characteristics keeps changing and may now, in a European context, include perceived beauty and degree of naturalness (Probst et al 2024).

Ambiguity of the forest concept was not a problem in the past, but a quantitative definition of forests became relevant in the 1990's when concerns over ongoing deforestation were linked to the global carbon balance (4) in the Kyoto protocol of the UNFCCC ('climate convention'). Forest definitions and their inclusion of plantation forestry became hotly debated (Murdiyarso et al. 2008, van Noordwijk et al. 2008b, van Noordwijk and Minang 2009, Chazdon et al. 2016). Within the agreed carbon accounting schemes, however, trees inside and outside forests can be assessed quantitatively at landscape scale, regardless of definitional boundaries. In an ecological-social 'cascade' model (van Noordwijk 2021) that links structure to function, anthropocentric services, values, actors and rights (Fig. 3B), the prevailing forest definition is dominated by differentiated rights and actors, not by differentiated ecological functions or vegetation structure.

The FAO-based forest definition is reflected in three 'deforestation pathways': one directly from 'forest with trees' to 'non-forest without trees' (arrow 1 in Fig. 3A), another pathway (arrows 3 and 5) that has 'forest without trees' as intermediate stage, and a third (arrows 2 and

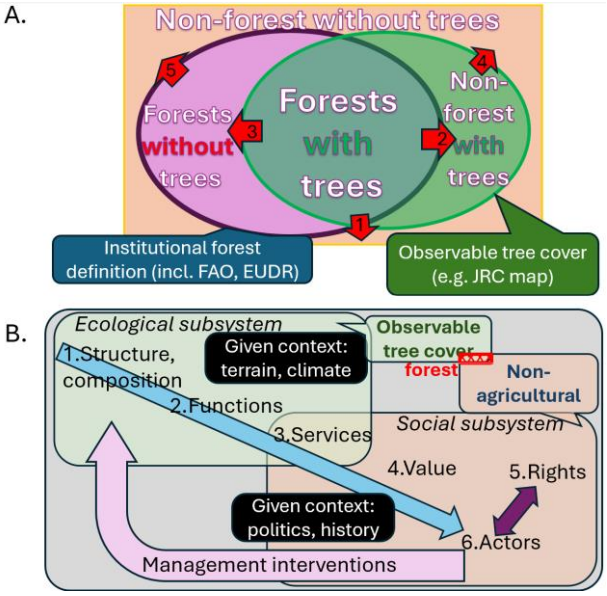

Figure 3. Forest definition options; A. Venn diagram of two forest concepts, a tree-based vegetation cover and a specific institutional regime, that lead to four types of land and five arrows that can be understood as 'deforestation', B. Options for defining land cover based on a structure, function, services, value, rights, actor, management cascade

4) that has 'non-forest with trees' as an element. Any involvement of coffee or cacao trees implies deforestation. 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) stays within the domain of forest institutions. Rules in the FAO forest definition (FAO , 2023) ensure that rotational timber plantation management is deforestation-free but may involve forest degradation. Under FAO rules all rubber is deforestation-free by definition, as rubber stands can be used for harvesting rubber wood at the end of a production cycle and are considered to be forest. Yet, rubber is included in the EUDR scope. Both EUDR and FAO definitions are clear that 'fruit tree plantations' are considered to be agriculture; however, botanically speaking all trees except for Gymnosperms are fruit trees (van Noordwijk et al. 2022). Coffee, cacao or rubber planted in land

with a history of swidden-fallow cycles can be hard to assess (Villamor et al. 2014, Mulyoutami et al. 2023) due to ambiguity in how swidden-fallow rotations ('shifting cultivation') are handled. Fallow-forest clearing may appear as 'deforestation' (van Noordwijk et al. 2015, van Noordwijk et al. 2008a, Mertz et al. 2012). Commodity companies often prefer to target forested land even where existing low-production agricultural land exists, because the transaction costs of negotiating with the government are lower than those for negotiating with communities of swidden-fallow smallholders. The EUDR may shift this balance if swidden-fallows are classed as non-forest. Very large areas of forest in tropical countries have been substantially modified by past cycles of swidden agriculture, followed by periods of fallow often accompanied by enrichment planting of trees that have uses for local communities.

A.

FAO statistics		Forest function categories	EUDR	JRC map	Vegetation-based	B & C	More detailed legend
Forest	1	Conservation forest	1	1	Old-growth forest	1	National parks
				1			Other conservation
		(Watershed) Protection forest	1	1	Forest on steep slopes or deep peat	1	Steep slopes
				1			Deep peat
		Production forest	1	1	Logged forest	1	Sustainably managed
				1	Over-logged, depleted	0/1	Potential for recovery?
		Plantation forestry	1/0	1	Long rotation (<25 y)	0/1	Potential for recovery
				1	Short rotation (<25 y)	0	Depleted, Shrub
		Conversion forest (planned deforestation)	1/0	1	(Over)Logged forest	0/1	Permit swap feasible?
				0	Shrub	0	Shrub, Fire-climax grass
Agriculture	0	Other land uses	0	1	Agroforest & tree crop plantations	1	Agroforests
				Some		0/1	Tree crop plantations
			0	0	Open-field agriculture	0	Upland crops
				0			Paddy fields
Urban			0	0	Peri-urban (incl. parks, homegardens)	0	Roads, industries, houses
				Some			(Peri-)urban trees

B.

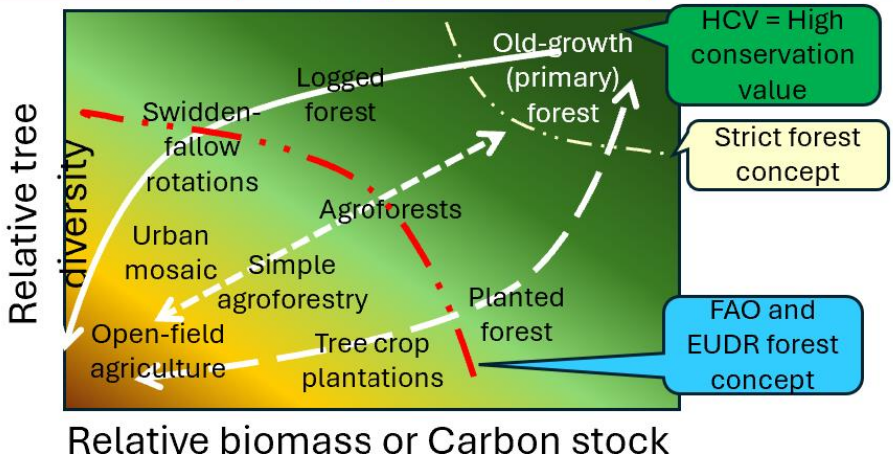

Figure 4A. Comparison of land classifications in FAO and EUDR documents (B&C = biodiversity and carbon stock), B. Biplot of relative biomass and tree diversity (Sari et al. 2020) as basis for understanding forest definitions

In national classifications and forest data, the institutional aspect of a forest definition usually prevails (Fig. 4A), with further subdivisions of 'forest' by prioritized function, rather than current land cover. The successive FRA studies by the FAO have helped (Nesha et al. 2021) in streamlining the national inventories on which the data are based but many countries maintain their own interpretation of the 'agricultural use' part and report forest data that are under the authority of forest institutions (usually supported by applicable forest law). A total reported global forest area for 2015 of 4.082 billion ha forest in the FRA, can be directly compared to 4.311 or 4.968 billion ha if a 25% or 10% tree cover criterion (Zomer et al. 2016, Hansen et al. 2013) is used, suggesting that the trees outside forest (at 10% tree over) add 22% to the nationally recognized forest area. For individual countries the FRA results can be slightly (1.6%) higher than the tree cover data (Brazil) or substantially lower (28.3% in DR Congo or 26.9% in Indonesia; Lesiv et al. 2022). In this additional tree cover 'forest-risk' commodities can be produced, legally from the perspective of the country but illegally from the perspective of the EUDR implementers that rely on the JRC maps. Quality assessment of the JRC map is currently based on the fraction of forest pixels correctly classified in a given dataset (controlling Type I error), not on the non-forest, commodity-producing pixels erroneously identified as forest (Type II error), nor on institutional scrutiny of the ground-truth data set used (Xu et al. 2024).

National forest concepts

The 'national legality' requirement of the EUDR for commodity production systems and supply chains can refer to a wide range of forest attributes, including the bundle of rights (esp. harvest and management) for the production locations used, social aspects of labour employed, the payment of dues and taxes, and/or export permits. For example, palm oil export permits in Indonesia are contingent on the companies supplying targeted amounts to a lower-remuneration domestic market. Where national legality refers to the use of (converted) state or community forest lands, the multiplicity of forest concepts (using the same word for different meanings) can be confusing. The criteria for EU-forests differ substantially from how forests are understood in a national definition, while also not matching agreed global standards for national carbon accounting to which the EU has made commitments.

The 'agricultural use exclusion' aspect of the EUDR forest definition is central to national forest delineations, often based on long-term negotiation processes. A substantial simplification of EUDR procedures may be possible: any commodity produced outside 'nationally legal' forests (e.g., *kawasan hutan* in Indonesia, 'non-permanent' forest estate in Cameroon, or 'agriculture tree plantation such as fruit trees' in Vietnam). can be EUDR compliant, regardless of recorded post-2020 tree cover change. In the United Kingdom (UK) discussion of a mechanism parallel to the EUDR (de Oliveira et al. 2024) national legality received more prominence than in EUDR articulations. Legal plans for agricultural use prior to 2021 can be interpreted as sign that land was no longer in the forest category. This issue will require further debate. A counter argument based upon reliance on national delineations of 'permanent forest estate' as simple indication of non-agricultural use, is that part of the 'planned deforestation' of current maps has not yet occurred and with new insights and value concepts should be reconsidered. In both Malaysia and Indonesia permits to convert natural forest to oil palm have been used as legalization for logging, leaving severely depleted lands behind rather than actual plantations. Efforts to 'swap' new concessions

and their permits for forest conversion (planned deforestation) for rights to such already degraded and underutilized lands have proven to be complex in the economic and political reality of the landscapes (Carlson et al. 2012, Ariesca et al. 2023).

Probability of misclassification

For Indonesia more detailed tree cover classifications exist that can be compared to the JRC-map of pre-2021 forest cover (Bourgoin et al. 2024) and they show considerable discrepancies. The label 'forest cover' is not justified, as the JRC essentially mapped tree cover, incompletely accounting for the second part of the EU forest definition. Where the FRA data indicated around 90Mha of forest in Indonesia in 2020, the JRC mapped 118 M ha and the 10% tree cover estimate (Hansen et al. 2013) is 130 M ha (including large areas of oil palm plantations, for example).

We overlayed the binary JRC Forest map for December 2020 (Bourgoin et al. 2024) – after harmonization of the coordinate systems -- with maps with a more detailed legend based on 2010 satellite imagery (Ekadinata et al. 2011) and calculated the probability that pixels classified as tree-crop related land uses in 2010 (with clear 'agricultural use') would be included as 'forest' in 2020, in contradiction to the EUDR forest definition. Of the total 'forest' area identified by the JRC map, a total of 18.7 M ha was already deforested in 2010 and converted to tree crop monocultures or agroforests. The 15.9% misclassified forest pixels consisted of 7.2% rubber monoculture, 4.7% rubber agroforest, 2.4% other (non-rubber) tree crops and 1.5% other agroforestry systems. 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 is 63%, for all tree crop systems, 43%. In landscapes where 'reforestation' of grasslands that are maintained by frequent fires (Garrity et al. 1996) has frequently failed, agroforestation by farmer groups that cooperate to control fire in *Imperata* grasslands can be successful (Burgers and Farida, 2017). Even outside the government-declared forest zone and with a clear agricultural use history of plots, agroforestation sites in Indonesia are mapped as if they are forests after around four years of tree development, classifying the areas a 'high risk' for non-EUDR compliance in the currently emerging trade regimes.

Critique of EUDR implementation rules

In a rather polarized (pro or contra) public debate, such as that around the EUDR, space is needed to consider and address unexpected and undesirable consequences of the choices made, while supporting the goals of reduced deforestation as a global public good. Four main issues emerged from analysis of the multiple value chains involve (Leimona et al. 2024).

Oversight – Although in the discussions leading up to the EUDR the likely impacts on smallholder producers at the start of supply chains was mentioned, no explicit mitigation measures were included. Social responsibility of trade is the subject of parallel regulations.

Overconfidence -- Consistent implementation of the EUDR forest definition in open-access maps for high-resolution geolocation data is more difficult than foreseen. There is little (if any) recognition in the EUDR documentation of the complexity of the forests versus agroforestry concepts and definitions used, and of the gap

between the land cover evidence that remote sensing provides versus the institutional (or legal) interpretation of de facto or de jure 'agricultural use' that the formal definitions imply. The considerable gap between the forest definitions and current tree cover maps could become a major subjects of litigation.

Overkill **--** The very detailed spatial data requirements for 'Due Diligence' reports would only lead to valid acceptance/rejection decisions by the 'national competent authorities' of importing countries if a broadly accepted reference exists for 'forests' at the grandfather date. As the previous section showed, current maps designed for that purpose fail. Data showing at least five years without tree-cover after 2020 will be needed to assert deforestation by the FAO/EU definition, given the tolerance for 'temporarily unstocked' forest. The simple spatial coincidence of commodity crop production and 'indicative forest status in Dec 2020' will not be legal grounds for rejection, as absence of commodity production before the reference date cannot be assessed correctly. All places that produced listed commodities (or any other form of agriculture) before 2021 are EUDR compliant from the EU perspective but can be illegal from the producer country perspective. For example, the 15-20% of the oil palms in Indonesia that grow inside the designated forest domain, are illegal from a national perspective (with several historical processes in the background, Purwanto et al. 2020), but conversion before 2020 is outside the EUDR scope. In a similar context, Peña-Alegría (2024) described how Peru recently changed its environmental and land use rights laws to legalize factual commodity production within what formally still were forest lands, to avoid EUDR hurdles in export.

Overreach **--** Considerable 'collateral damage' can directly ensue from the 'any-tree' forest concept, rather than a focus on primary and naturally regenerating (logged) forest for which a 'global commons' argument can be made. A coarser jurisdictional scale of accountability for remaining old-growth forests can be far simpler, have lower transaction costs and can be at least as effective. Subsidiarity, leaving policy implementation decisions to the lowest governance level that is feasible, has been accepted as general policy principle in the EU (Jordan and Jeppesen, 2000). The EUDR assigned implementation power to 'nationally competent' authorities in importing countries, at considerable distance (physically, ecologically and socially) from the production landscapes. Greater freedom to harvest trees is likely to increase planted tree cover (Stewart et al. 2021). While biodiversity conservation is increasingly focused on stakeholder engagement, the various dimensions of power are key concepts in understanding success and failure of conservation efforts (Lécuyer et al. 2024), a conclusion relevant for landscapes where deforestation is to be controlled.

The EUDR operates in a polycentric context where both laws of exporting and importing countries must be respected. The reversal of burdens of proof by an obligation to 'due diligence' means in essence that everybody is assumed to be guilty of illegal deforestation, unless they can prove otherwise. 'Due diligence' is more easily said than done. A corporate responsibility for due diligence via management processes has been indicated in the United Nations Guiding Principles on Business and Human Rights, but in a context of polycentricity it is seen as open-ended (Partiti, 2021). A legal review (McDonald, 2019) noted that "there is no 'general principle of due diligence' in international law", and the degree of fact-finding required from a specified party needs to be made explicit.

Commodity trade is only one of the factors in forest conversion processes with outcomes that are strongly influenced by many interacting, historical and current forces originating at local, national and global scales (Sassen et al. 2013, Game et al. 2014). A number of recent reviews (Lambin and Furumo, 2023, Pendrill et al. 2022) have challenged the oversimplified portrayal that EUDR documents repeat of commodity trade as dominant driver of tropical deforestation. Scale, actors and time courses of conversion of primary forests can overlap with those of production of a 'forest-risk' commodity, but do not have to (de Haas and Travieso, 2022, Brandt et al. 2024). If people in forest-margin landscapes no longer have access to commodity markets, their land use choices may increase forest conversion in a form of 'leakage'. High commodity prices were only associated with expansion into forests in Uganda under specific policy, accessibility, local and national land and forest governance factors (Sassen et al. 2013). Through lower farmgate price for the regulated commodities where these are based on recent deforestation the EUDR can reduce deforestation pressure (Fig 2 item 21); however, there is no guarantee that farmgate prices for deforestation-free commodities will increase, as the value chain has to absorb additional transaction costs and consumer prices will not voluntarily increase. Net positive effects on 'compliant' farmgate prices of the voluntary certification that the EUDR will replace by mandatory due diligence have been modest (Leimona et al. 2024). A recent Computable General Equilibrium study (Miranda et al. 2024) confirmed a persistent influence of commodity prices on agricultural land expansion, especially in forest-abundant regions, but economic and environmental governance quality matter. No direct link to concurrent deforestation rates at high temporal and spatial resolution was established. A study in Peru that included variation in road network density (Móstiga et al. 2024) found considerable variation in deforestation drivers at subnational scale, defying an expectation that trade restrictions as such will reduce deforestation rates. In Ghana and Côte d'Ivoire (Benefoh et al. 2018, Moraiti et al. 2024) cocoa expansion targets open-forest and lands-in-transition areas instead of closed-forest, but a considerable area with underplanted cocoa already existed in protected areas before Dec 2020. In Ghana planting trees is discouraged as by law every tree becomes property of the forestry department involving fees for tree harvesting licences (van der Haar et al. 2023, Kouassi et al. 2023, Tease et al. 2023).

Discussion: alternative policy designs as ways forward

Mapping agroforestry

As outlined above, the forest definition used by FAO and EUDR depends on the term 'agroforestry' and 'agricultural use', that require specification beyond what has been provided so far. Past and current definitions of agroforestry focus on the interactions between the two parent concepts (agriculture and forestry), at plot, farm, landscape or policy scale (Figure 5; van Noordwijk 2019a). The presence of trees in what is classified in FAO data sets as agricultural lands is possible (Zomer et al. 2016) but starts from the delineations of 'forest lands' and 'agricultural lands' that member countries provided, rather than from remotely sensed tree cover data or 'vegetation-based' forest concepts. Agroforestry practices on forest lands is often discussed as community-based or social forestry. Rather than pursuing a definition that segregates agroforestry from both its parents, recent agroforestry literature seeks a level playing field in multifunctional landscapes with their land and water use (van Noordwijk 2019a).

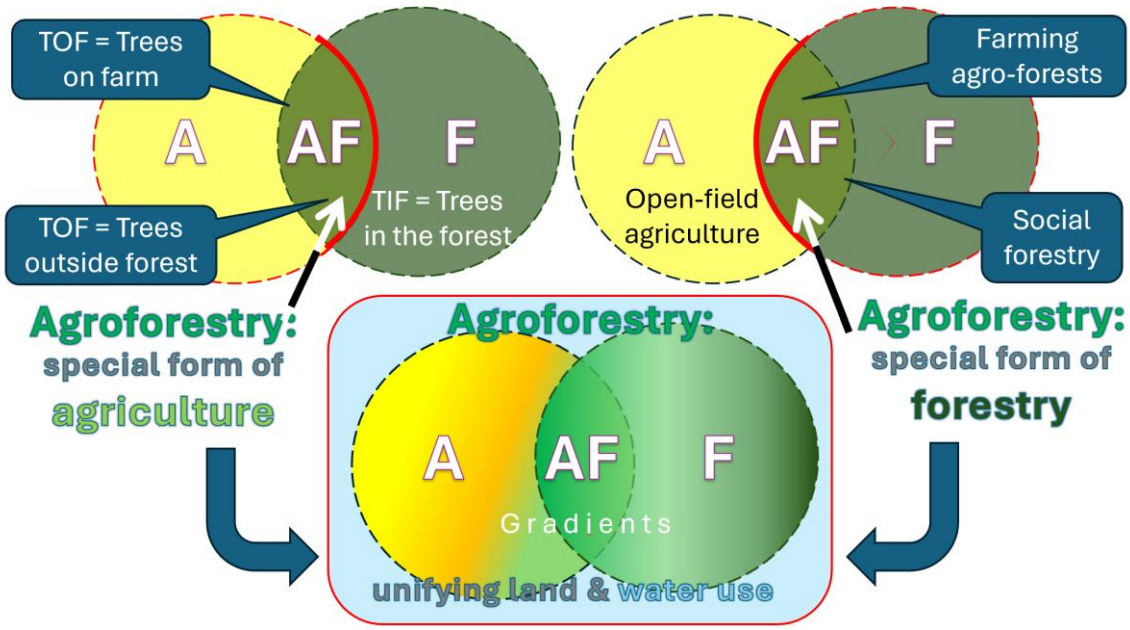

Figure 5. Definitions of agroforestry as a sub-set of agriculture (upper left; actor-based view on land use) or forestry (upper right; tree-cover based) compete with an agriculture-agroforestry-forest continuum, as part of an integrated land and water use perspective

From a political ecology, social and environmental, perspective agroforestry transitions have been distinguished in 'good', 'bad' and 'ugly' types based on the actors involved (Ollinaho and Kröger 2021), warning against an oversimplified portrayal.

Strategic retreat to 'old-growth' forests

As indicated in Fig. 4B, a forest definition that is focused on 'old-growth' forest with high biodiversity value and carbon stocks would avoid most – but not all - of the overlap with production of the listed commodities (Sari et al. 2020), and would be a more salient, credible and legitimate boundary object (Clark et al. 2016). Within the RSPO debate on 'deforestation-free' oil palm, the HCV-forest concept was operationalized (Senior et al. 2015, Padmanaba et al. 2023). Re-orientation of EUDR on a stricter forest definition (Kormos et al. 2018) and replacing the negative ('non-agricultural use') by positive criteria on structural complexity (Steinfeld et al. 2023) and the degree of similarity to what old-growth looks like for the same climate zone, terrain condition and soil category, will not solve all problems of misclassification and collateral damage, but will have a clearer link to the stated goals of biodiversity conservation and climate change mitigation than what is now implemented. A shift in the 'scope' of EUDR to a stricter forest definition may not happen before the release of FRA2025, but that report will provide relevant distinctions within the forest domain, not very different from the forest typology and legend the recent IIASA study (Lesiv et al. 2022) applied.

Far together instead of fast alone

"If the EUDR is to be effective in combating deforestation, it needs to go through a thorough consultation process with the producer countries and provide support to smallholders so as to help them meet the requirements", as Tankam and Lecuyer (2024) noted. In 2019 the EU emphasized 'Work in partnership with producing countries'[§]. It appears that in subsequent choices, the EU has shifted to a top-down control mode. A recent review of the political ecology and economy of international forest governance (McDermott et al. 2024) concluded that "the EU aims to leverage its large market share to stop deforestation without the

need for agreement from non-EU countries on whether and how this goal should be prioritized and achieved". Relying more strongly and explicitly on national legislation of a 'permanent forest estate' that delimits 'non-forest use' to other parts of a country's territory can make the EUDR much less controversial. It supports the sovereignty of countries to design their own laws in accordance with ecological, social and historical circumstances.

Learning what works

At the start of the REDD+ ('Reducing Emissions from Deforestation and (forest) Degradation') program of the UNFCCC (UN climate convention) in 2008, a steep learning curve was initiated that brought a simple and attractive idea ('ensuring standing forests are worth more than those cut down') to a complex, messy, contested and slow implementation pathway, more aligned with the subsequently agreed Nationally Determined Contributions that cover all land use change (Atmadja et al. 2022, Do and van Noordwijk 2023). It seems that the parties designing the EUDR have insufficiently engaged with this learning curve and focused on their own 'simple and attractive idea'. A number of countries has been able to substantially reduce deforestation and associated carbon emissions, but this involved shared responsibility between international, national and subnational governance systems, creating rules within which private sector initiatives can be effective (Mithöfer et al. 2017, Börner et al. 2020, Kleinschmit et al. 2024). In particular, the 'jurisdictional' but sub-national scale has emerged as a very important one as it provides cross-sectoral linkages and can absorb a significant part of 'leakage'. Jurisdictional sourcing of forest-risk commodities starts to have a positive track record (Boshoven et al. 2021, Essen and Lambin 2021). Responsibilities and incentives would be more fairly distributed if the EUDR would complement rather than replace local motivation to protect remaining forests (30). The recent EU directive on corporate sustainability recommends ways to do so (EU 2024).

Conclusions

Claims of a 'forest' origin of targeted tree crops produced in areas that were classed as agroforests in pre-2020maps – as currently happens in EUDR practice -- is problematic and undermines the benefits of agroforestry for local livelihoods and ecosystem services. In Indonesia up to 2/3 of agroforests are wrongly classified as forests on the EU forest map. A clear statement from EU authorities that agroforests and tree cover on land with agricultural uses exist and are outside of the scope of the EUDR regulation may help to address this concern.. The present formulation of the policy hinders the land use options that are otherwise viable and desirable. Definitional confusion over forest as form of land cover (observable, linked to functions at risk) or land use (actor-based sectoral definitions, rights-oriented) needs to be addressed. Clarifying agricultural use rules relying on legality from the producer-country perspective can reduce the risk of misrepresentation on forest maps. In its current form the EUDR will lead to a segmentation of markets, providing a 'blameless' clean value chain for EU citizens but without guaranteed reduction of the global rate of deforestation. Vegetation-based monitoring of tree cover change will not provide the expected legal evidence of deforestation. Litigation challenging rejection of shipments may cause delays whilst legal uncertainty is resolved. At a time when climate and biodiversity conventions call for a global re-balancing of environmental and social responsibility, the EU regulation is likely to cause substantial transaction costs and perceptions of distrust. The EU does not provide evidence of having practiced the due diligence it requires

from market partners; There will be harmful impacts on the livelihoods of farmers practicing agroforestry on land mistakenly classed as forest. Jurisdictional accountability as a focus, rather than farm-level geolocations checked against high- resolution but inaccurate 'forest' maps, would shift scales of evaluation from commodity to landscape. It will also ensure that EUDR aligns with agreed UNFCCC and CBD implementation pathways.

Footnotes

*https://environment.ec.europa.eu/system/files/2023-06/FAQ%20-%20Deforestation%20Regulation_1.pdf

†https://forobs.jrc.ec.europa.eu/TMF;https://www.fao.org/3/I8661EN/i8661en.pdf

§https://ec.europa.eu/commission/presscorner/detail/en/FS_19_4549

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