

GEOS-EUDR – Technical and Policy Brief No.1

Ensuring EUDR Compliance: Evaluating Global Forest Maps for Deforestation Monitoring

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■ Executive Summary

The European Union Deforestation Regulation (EUDR) mandates that products derived from the commodities beef, cocoa, coffee, soy, timber, rubber, palm oil and their derivatives must be deforestation-free after 31 December 2020. This regulation places new demands on both producers and regulators to prove and verify compliance using spatial data and maps.

This technical and policy brief draws on a **systematic review of 21 global forest tree cover datasets** and their assessment of applicability as EUDR-reference maps (Freitas Beyer et al. 2025)¹. **Only eight datasets meet key spatial, temporal, and definitional criteria for EUDR compliance checks, and only two datasets matched all three EUDR forest definition criteria: canopy cover ($\geq 10\%$), tree height ($\geq 5\text{m}$), and minimum mapping unit ($\geq 0.5\text{ ha}$).** The findings reveal significant over- and underestimation patterns, inconsistencies in forest definitions, and regional data limitations. The brief provides actionable recommendations for operators and competent authorities when applying map products for deforestation verification, and outlines key insights for decision and policy makers how to support deforestation monitoring.

The assessment of global forest and tree cover datasets reveals that **dataset selection matters immensely** for EUDR compliance. While Earth Observation maps offer powerful tools for monitoring, their limitations (especially regarding resolution, forest definitions, and regional suitability) must be carefully considered. This technical and policy brief underscores the **need for context-aware, multi-source verification approaches, and stronger coordination between data providers, map users such as operators, and regulators.**

■ Background of study

The EUDR is part of the EU's Green Deal and Forest Strategy, and requires that commodities from Cattle, Cocoa, Coffee, Oil palm, Rubber, Timber, Soy and their derivatives be "deforestation-free," meaning that no deforestation occurred in the production areas after 31 December 2020.

Verification under the EUDR relies on submitting due diligence statements that must include the geolocation of production plots, including a statement that the imported commodity or derived product is deforestation-free. Earth Observation data, such as global forest and tree cover maps may serve as primary reference tool in such a case, although many of these maps were not designed with legal compliance in mind. Such datasets differ widely in their spatial resolution, definition of forest, and capacity to distinguish between natural forests and plantations.

To address this gap, Freitas Beyer et al. (2025) evaluated 21 publicly available global datasets, examining their fitness for EUDR-related verification, by assessing their alignment with the EUDR's forest definition and reference year, as well as sufficiency of spatial resolution and accuracy (see **Figure 1** for methodological approach).

¹ Freitas Beyer, J., Köthke, M., & Lippe, M. (2025). *Assessing the Suitability of Available Global Forest Maps as Reference Tools for EUDR-Compliant Deforestation Monitoring*. Remote Sensing 17, 3012. DOI: 10.3390/rs17173012

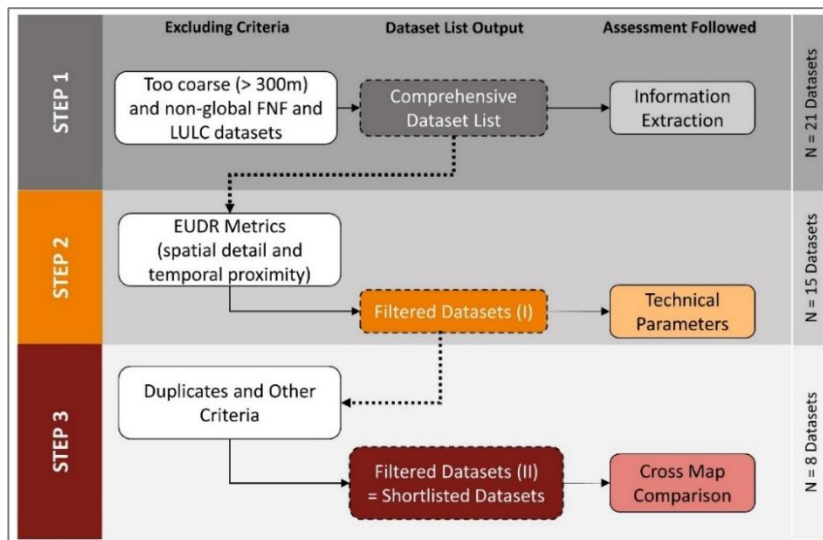


Figure 1. Schematic overview of the assessment process. Step 1 gathers all available global forest/non-forest (FNF) and land use/land cover (LULC) maps, resulting in 21 datasets. Steps 2 and 3 describe the assessments used to evaluate each dataset’s suitability for the EUDR, including criteria applied to exclude unsuitable maps. Note: This study evaluated maps produced and published up to November 2024

■ Key Findings

1. Only eight out of 21 global maps meet key spatial, temporal, and definitional criteria for EUDR compliance checks (see Figure 2 for references of the 8 maps).

2. Only two datasets—*JRC GFC v2*² and *PALSAR-2 FNF*³, matched all three EUDR forest definition criteria: canopy cover ($\geq 10\%$), tree height ($\geq 5\text{m}$), and minimum mapping unit (≥ 0.5 ha) (see Figure 2 for more details).

3. Accuracy Bias and Misclassification Risks

- **Overestimation Risk:** Most maps suggest a **tendency to classify non-forest areas as forest**, leading to **false positives (indicated by a producer's accuracy/ user accuracy ratio > 1 ⁴)**.
- **Underestimation Risk:** Tree height maps potentially **exclude sparse or dry forests** (indicated by **negative mean bias errors**).

4. Regional Variability in Map Estimates

Compared to FAO Forest Resource Assessment 2020 data⁵:

- **For Europe and North America**, forest areas are largely **overestimated** (up to +86%)
- **For Africa**, some datasets significantly **underestimate forests** (up to -38%).
- **For South America**, **more consistent** estimates exist, especially in dense forest zones, but a high risk of class confusion exists in tree-based systems, such as agroforestry, plantations and regenerating forests.

² Global Forest Cover map for year 2020 (GFC 2020) version 2 (Bourgoin et al. 2023, <http://data.europa.eu/89h/e554d6fb-6340-45d5-9309-332337e5bc26>)

³ Global 25 m Resolution PALSAR-2 Forest/Non-Forest Map (FNF) Ver.2.0.0 (Shimada et al. 2014, DOI: 10.1016/j.rse.2014.04.014)

⁴ For methodological details see Freitas-Beyer et al. 2025.

⁵ <https://www.fao.org/forest-resources-assessment/past-assessments/fra-2020/en/>

5. Definition and Structural Challenges

- None of the global maps assessed in this study fully meet the EUDR requirements in terms of definitions and accuracy.
- Forest definitions vary by country and dataset, introducing mismatches in classification thresholds.
- Almost all maps define plantations and agroforestry as forest, which may not align with the EUDR’s regulatory scope.
- Datasets lack granularity to detect smallholder plots or mixed-use landscapes, critical for some commodities like cacao, coffee, or rubber.

Dataset	EUDR Metrics			Non-forest tree-based systems included in forest cover?	Accuracy Analysis	
	Spatial	Temporal	Forest Definition		Tendency	
					Missing true deforestation	Increment in non-compliant production
JRC GFC v2 (Bourgoin et al. 2023)	●	●	●	Yes		✓
ESRI-10m (Karra et al. 2021)	●	●	○	Yes	--	--
Dynamic World (Brown et al. 2022)	●	●	○	Yes		✓
GLC-FCS30D (Liu et al. 2020)	○	●	○	Yes		✓
FROM-GLC10 (Gong et al. 2019)	●	●	○	Not explicitly reported		✓
Forest Extent-GLAD (Potapov et al. 2022)	○	●	●	Yes		✓
PALSAR-2 FNF v2.0.0 (Shimada et al. 2014)	●	●	●	Yes	--	--
ETH-2020 (Lang et al. 2023)	●	●	●	Yes		✓

Strong match
 Partial match
 Marginal match

Figure 2. Overview of the eight shortlisted dataset, providing details on EUDR and accuracy metrics, complemented by additional qualitative insights. **Note:** Two datasets, *ESRI-10m* and *PALSAR-2 FNF v2.0.0* did not report all metrics; Strong Match indicates full alignment with optimum values (year = 2020, resolution ≤ 10 m, 3 parameters matched); Partial Match reflects moderate but not optimal alignment (year 2015–2020, resolution 10–30 m, 1–2 parameters matched); Marginal Match denotes very weak alignment (year = 2015, resolution = 30 m, no parameters matched).

Access and further information on each shortlisted dataset can be found in:

<https://doi.org/10.3220/253-2025-90>

■ Recommendations for operators and competent authorities when applying map products for deforestation verification

1. Use of Better-Fitting Map References

- Using the eight shortlisted datasets rather than the twenty-one datasets reviewed is a more reliable way of ensuring compliance with EUDR terminology. However, **no single dataset fully meets all EUDR requirements on a global scale**, and all the assessed maps contain different levels of uncertainty. While some maps perform better than others, the eight shortlisted maps appear to be less suited for the context of Europe and North America, and some substantially underestimating forest areas in Africa.

2. Use Multiple Map Datasets

- **Using a combination of Earth Observation maps** over a range of mapping themes (e.g., commodity-specific, forest type, crop type), with different spatial resolutions, data sources (e.g., optical and radar), and classification methods, supports cross-validation of deforestation-free claims more effectively.

3. Promote Region-Specific Mapping

- **It is not advisable to only rely on global map products but to double-check results with available local, national, or region-specific information.** This can minimize false positives and avoid false negatives. This is particularly important in data-poor regions where high-resolution reference maps incorporating locally validated forest definitions can provide a more reliable basis for verification.

■ Recommendations for policy and decision-makers

1. Building Monitoring Capacity

- **Supporting the EU member states' national competent authorities for EUDR enforcement with training and resources** to assess deforestation risks using Earth Observation tools. Promote science-driven, public-private collaborations for developing benchmarking methods and to support open access to high-quality geospatial data in standardized formats and through public repositories.

2. Harmonize Forest Definitions

- **Foster international alignment on forest classification standards**, especially on thresholds for canopy cover, tree height, and minimum mapping unit. This would ease interoperability across datasets and between national and EU-level compliance systems.

3. Encourage Use of Time-Series and Alert Systems

- **Incorporate dynamic monitoring products** (e.g., integrated deforestation alerts available on <https://www.globalforestwatch.org>) and **commodity-specific maps** to capture intra-annual forest change and plantation dynamics—important for verifying deforestation and forest degradation events.

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