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The role of open geospatial data in assessing non-compliance with the EU Deforestation Regulation



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About Trase

Trase is a data-driven transparency initiative that revolutionises our understanding of the international trade and financing of agricultural commodities which drive tropical deforestation. Its unique supply chain mapping capabilities bring together disparate, publicly available data to connect consumer markets to deforestation and other impacts in producer countries. Trase's free online tools and actionable intelligence enable governments, companies, financial institutions and civil society organisations to take practical steps to address deforestation. Trase is a global not-for-profit partnership co-founded in 2015 by the Stockholm Environment Institute and Global Canopy.

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Front cover image: Soy plantation in the Brazilian Amazon (Marizilda Cruppe).

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Introduction

Geospatial data on forest cover, land use and deforestation will be essential for the successful implementation of the due diligence requirements of the EU Deforestation Regulation (EUDR) by operators, as well as for requirements on Member State competent authorities to implement a risk-based approach to planning annual checks and in conducting checks on operators' and traders' due diligence and high-risk shipments.

There are a large and growing number of datasets and products on forest cover, land use and deforestation including official government data, open datasets from researchers and civil society initiatives, and proprietary datasets from service providers. The majority of these datasets are built from open access satellite data including Landsat 8, Landsat 9, Sentinel 1 and Sentinel 2, and utilise data processing systems such as SEPAL and Google Earth Engine.

Yet data remains a key challenge for EUDR readiness. Challenges include **differences in the definitions** as existing datasets were not developed for the purpose of the EUDR and are therefore not aligned with the criteria and definitions adopted in the EUDR. Beyond definitional alignment there are also **some challenges** including **limitations in accuracy** in terms of the minimum mapping unit, **difficulties in differentiating forests and perennial crops** such as cocoa, and the **complexity and fragmentation** of the data landscape.

Despite these challenges, existing open datasets provide a cost-effective resource that can be utilised to credibly assess risks of non-compliance with both the EUDR's deforestation-free and legality requirements (the two fundamental requirements that EUDR products must satisfy in order to be allowed on the EU market, listed in Article 3 of the EUDR). Operators and competent authorities using these datasets need to understand their limitations in the context of the EUDR, how these can be mitigated through combining datasets, and what datasets are appropriate for different uses (e.g. assessing plot-level compliance in a complex heterogeneous landscape such as agroforestry systems in Côte d'Ivoire, or assessing risks of mixing and laundering along a particular supply chain, or informing risk-based approaches by competent authorities to identify checks to carry out).

This report sets out:

1. The data needed to assess risks of non-compliance with the EUDR deforestation-free requirement with a focus on geospatial datasets.
2. Publicly available global geospatial datasets on forest cover, deforestation and forest degradation, commodity production areas and their alignment with the EUDR definitions for the deforestation-free criteria.
3. Case studies on how geospatial datasets can support the assessment of non-compliance risks for the legality criteria in Brazil, Côte d'Ivoire and Indonesia.
4. The ways in which existing publicly available geospatial data can be effectively used for EUDR implementation and enforcement by competent authorities.

Data needs and data availability to assess risks of non-compliance with the EUDR deforestation-free criteria

Geospatial data needs for the EUDR deforestation-free requirement

'Relevant commodities' and 'relevant products' can only be placed on the EU market if they have been produced on land that has not been subject to deforestation after 31 December 2020 (Article 3(a)). Deforestation is defined as the conversion of forest to agricultural use. In the case of wood products, relevant commodities can only be placed on the EU market if they have been harvested from forest without inducing forest degradation after 31 December 2020. Forest degradation is defined as a) the conversion of primary forest or naturally regenerating forest into plantation forest or other wooded land, or b) primary forest into planted forest.

Operators intending to place relevant commodities and products on the EU market must conduct due diligence on each shipment to ensure there is no risk or only a negligible risk that their products do not comply with the deforestation-free requirement. This due diligence process firstly requires operators to collect relevant information that includes the geolocation of all plots of land where the relevant commodities and products were produced (Article 9(1)(d)) as well as adequately conclusive and verifiable information that the relevant products are deforestation-free (Article 9(1)(g)). Operators must then carry out a risk assessment using this information to establish whether there is a risk that the relevant products intended to be placed on the market or exported are non-compliant (Article 10).

As well as assessing the risk of non-compliance for all of the relevant plots of land, this risk assessment requires operators to take into account a number of risk criteria. The most relevant for the deforestation-free requirement include the presence of forests in the country of production or parts thereof (Article 10(2)(b)), the prevalence of deforestation or forest degradation in the country of production or parts thereof (Article 10(2)(f)), as well as two criteria on the risk of mixing: the complexity of the relevant supply chain and the stage of processing of the relevant products (Article 10(2)(i)) and the risk of circumvention of this Regulation or of mixing with relevant products of unknown origin or produced in areas where deforestation or forest degradation has occurred or is occurring (Article 10(2)(j)).

Area-level risk assessment of deforestation and forest degradation is necessary to assess non-compliance risks against these four criteria. Relevant sourcing areas could be a country or subnational region, a sourcing radius from the plots of land, a sourcing radius or supply shed for the relevant primary aggregation point for the relevant commodity such as a mill or slaughterhouse, or a defined set of production units such as a cooperative or production landscapes (Accountability Framework initiative (AFi)

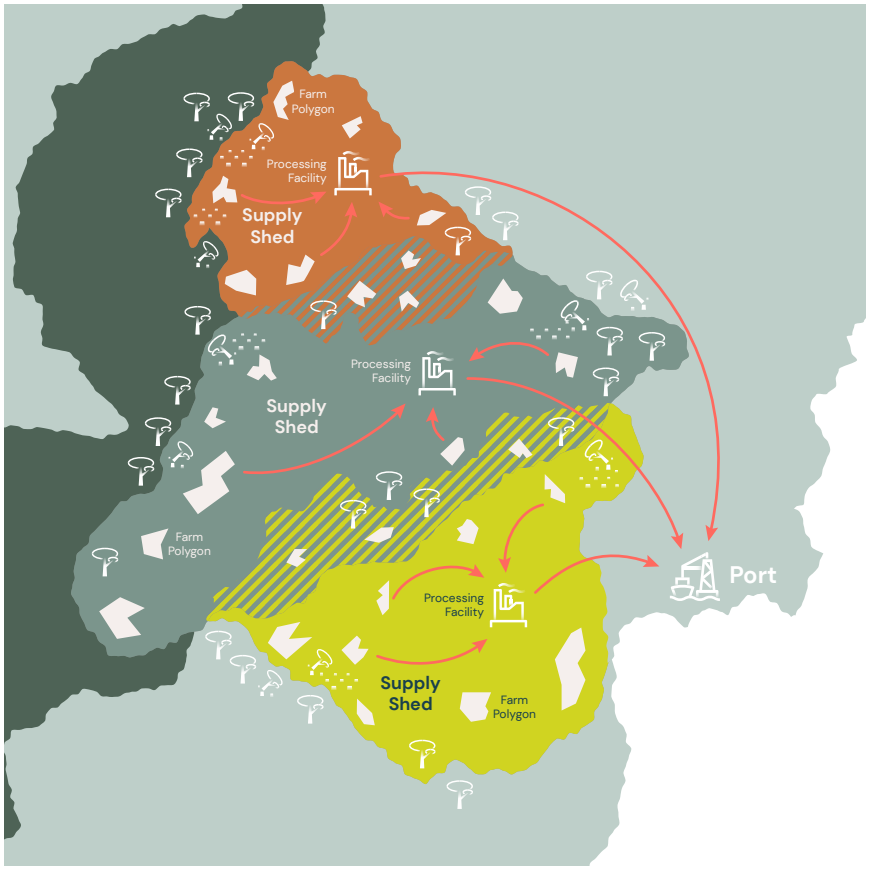
Operational Guidance on Supply Chain Management[1]). For example, to assess the risk of mixing (Article 10(2)(i) and Article 10(2)(j)) an area-level approach could identify any incidences of soy deforestation in farms within a set radius (e.g. 1 km) of the plots of land identified as the source of the soybeans being placed on the EU market. Any incidences of soy deforestation in nearby farms would indicate a significant risk of mixing of compliant and non-compliant soy, and the need for strong evidence for how these risks are adequately mitigated – the final step in the required due diligence process (Article 11).

In addition to implementing checks on operators' due diligence systems and specific relevant products (Article 18 and Article 19), competent authorities need to use a risk-based approach to identify the checks to be carried out (Article 16(3)) and high-risk shipments that require immediate action (Article 17). Relevant risk criteria include the relevant commodities, the complexity and the length of supply chains, including whether mixing of relevant products is involved, and the stage of processing of the relevant product, whether the plots of land concerned are adjacent to forests, and the assignment of risk to countries or parts thereof in accordance with the benchmarking system. Similar to the due diligence process, area-level risk assessment is necessary to assess these risk criteria.

1. Available at: https://accountability-framework.org/fileadmin/uploads/afi/Documents/Operational_Guidance/OG_Supply_Chain_Management-2020-5.pdf

Figure 1: Operators and competent authorities need to conduct area-level risk assessments under the EUDR

Risk assessment of areas that surround the geolocated plots of land including supply sheds of the processing facility and port is important in assessing the risk of products mixing with non-compliant or unknown products. Source: Trase.



For both plot-level and area-level risk assessments on non-compliance with the deforestation-free criteria, operators and competent authorities need to identify:

For relevant commodities excluding wood:

- Is there forest cover at the end of 2020?
- Has there been deforestation after 2020?
- Has there been deforestation before 2020?
- Is there agricultural use after 2020?
- Is there agricultural use before 2020?

For wood products:

- What is the forest type at the end of 2020? (e.g. primary, naturally regenerating forest, plantation and planted)?
- What is the forest type after 2020?
- What is the land use after 2020?

This requires geospatial datasets both for plots of land and the surrounding landscape (relevant areas include country, subnational region, supply shed of aggregation points, production landscape) covering:

- Forest cover and forest types
- Agricultural use
- Deforestation
- Other wooded land

Data availability for assessing compliance risks associated with the EUDR deforestation-free requirement

a. Forest cover and forest types types

What is needed? Geospatial data on forest cover at the end of 2020 that is aligned with the EUDR definition is needed to determine whether plots of land have been subjected to deforestation after the cut off date. Forest is defined under the EUDR as "land spanning more than 0,5 hectares with trees higher than 5 metres and a canopy cover of more than 10%, or trees able to reach those thresholds in situ, excluding land that is predominantly under agricultural or urban land use" (Article 2 (4)). Geospatial data of forest types at the end of 2020, including primary forest, naturally regenerating forest, plantation forest and planted forest, are also required to assess compliance on forest degradation. As well as datasets on forest cover, datasets on agricultural use can support the correct classification of forests; for example, by identifying areas of agricultural use such as agroforestry systems that are excluded from the EUDR definition of forest, but can easily be misclassified as forest.

What is available? There are a wide number of publicly available global maps of forest cover at the end of 2020 (Annex 1). These include the Hansen Global Forest Change (GFC) dataset on tree cover loss and the Joint Research Centre Tropical Moist Forest (TMF) dataset. These global datasets have been widely adopted and are peer reviewed. However, they have a number of issues in the context of the EUDR which include lack

of harmonisation with the EUDR definition of forest, and known limitations such as issues in misidentifying perennial and/or agroforestry crops such as cocoa and coffee as forest rather than agricultural use. These issues are also found in proprietary datasets. National forest cover maps may provide more accurate information than global products; however, they also may not be aligned with the EUDR definition of forest. For example, Indonesia's forests are defined as land with a minimum area of 0.25 hectares and that contains trees with canopy cover of at least 30%, capable of reaching a minimum height of 5 metres at maturity (Forestry Ministerial Decree No. P.14/2004).

Critically, different forest cover maps can show different results when analysing the same area due to their different definitions of land cover and use, as well as different technical specifications that can lead to different false positives and false negatives in identifying forest. In addressing these alignment gaps, the European Commission's Joint Research Centre (JRC) produced a baseline map for forest cover at the end of 2020 (JRC GFC 2020) that is aligned with the EUDR definition of forest by combining and synthesising existing datasets on forest cover (including GFC and TMF datasets), as well as datasets on agricultural use to produce a binary global map of the presence or absence of forest at 10-metre resolution. This JRC map still has a number of accuracy issues that include challenges in mapping dry forests and misclassifying cocoa and coffee as forest. A second version of the map addresses a number of these issues and future versions are expected to continue to improve in accuracy. The JRC has also produced a global map of forest types for the year 2020 (JRC GFT 2020) that combines available global datasets that indicate or are proxies for primary forest, naturally regenerating forest, planted forest, or plantation forest including the Spatial Database of Planted Trees (SDPT), forest plantations datasets, and the forest integrity index. An updated version is expected to be published in 2025.

Another example of harmonisation efforts is the recent land use map developed by the government of Côte d'Ivoire for 2020 in coordination with the JRC to better enable EUDR compliance by their producers. A number of land use products also provide a mapping across different land use classifications that can be used to provide a more nuanced view of alignment with the EUDR. For example, MapBiomas Collection 9 provides a table that cross-references MapBiomas land use/land cover classes with Food and Agriculture Organization (FAO), Brazilian Institute of Geography and Statistics (IBGE) and National Greenhouse Gas (GHG) Emissions Inventory classes[2] (Annex 3).

2. Available at: https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2025/02/ATBD-Collection-9-versao2-v2.pdf

b. Deforestation and forest degradation

What is needed? Geospatial data on deforestation before the end of 2020 is needed to identify if deforestation occurred before the cut-off date. Deforestation after the cut-off date is needed to identify risks of non-compliance from the conversion of forest to agricultural use. Forest degradation requires data on forest types and on other wooded lands before and after the cut-off date.

What is available? There are a wide number of publicly available datasets and monitoring tools on deforestation (Annex 2). These are mainly based on the forest cover datasets mapped in Annex 1 and include both annual maps and near-real time alerts. There are also national government forest monitoring systems, although with exceptions like Brazil, this data is usually not publicly accessible. These deforestation datasets face similar challenges to the forest cover datasets on the alignment of definitions with the EUDR. Annual products are generally published with a lag of several months as the data is processed. Deforestation alerts are published much more frequently and can therefore be more timely than annual products for non-compliance risk assessments; however, this timeliness is traded off with reduced accuracy. Alerts may be false positives such as natural disturbances from haze or issues in the satellite data that have not been corrected.

On forest degradation, updates to the JRC harmonised map of forest types and the key underlying datasets are currently irregular. There is no existing global dataset that aligns fully with the FAO's definition of 'other wooded lands'; however, there are datasets on natural lands that can provide a proxy. Similarly, while forest degradation is defined in the EUDR as either the conversion of primary forests or naturally regenerating forests into plantation forests or into other wooded land or primary forests into planted forests, forest degradation datasets or alerts may provide useful contextual information or early warning signs.

c. Agricultural use and commodity extent

What is needed? Deforestation is defined as the conversion of forest to agricultural use (including agricultural tree plantations). Geospatial data on agricultural use is therefore needed to determine if a forest has been converted to agricultural use before or after the cut-off date. Data on agricultural plantations and agroforestry (which is excluded from the EUDR forest definition) can also be used to mask forest cover (as in the EU JRC GFC 2020 map) to more accurately map forests in line with the EUDR definition.

What is available? There are a number of global cropland maps; however, crop-specific spatially explicit datasets are much more limited, either in spatial or temporal coverage, particularly for agricultural tree plantations. This leaves significant gaps across many producer regions. In particular, there are gaps on smallholder oil palm, rubber, coffee and cocoa – especially where cocoa and coffee are grown in agroforestry systems that can be easily misclassified as forest.

Assessing non-compliance risks using geospatial data

No single source of geospatial information will be sufficient to effectively assess the compliance of a plot of land under the EUDR. There will always be errors within remote sensing data products, and so understanding limitations and known errors is essential when using this data, especially where they have not been designed for the EUDR. This is a significant advantage of open datasets that have been peer reviewed and whose methods and results are open to scrutiny and replicable.

Combining different datasets and utilising multiple datasets can increase confidence in the risk assessment. For example, Whisp (What is in that plot), an open-source solution developed by the FAO, assesses plot-level compliance risk against multiple open forest cover, land use cover and deforestation datasets using a convergence of evidence approach (Box 1). While Whisp has been developed for plot-level compliance, this approach is also relevant to area-level risk assessments that are needed to assess the risk of mixing and laundering of non-compliant and unknown products as well as in risk-based approaches to identify the checks to be carried out. Similarly, while deforestation alert systems have limitations in their accuracy and harmonisation with the EUDR, they can also be used within a convergence of evidence approach.

Understanding the limitations of datasets and where these limitations are likely to be most relevant is essential in interpreting why results may differ between datasets and and can support the targeted use of visual interpretation of high-resolution optical imagery and ground truthing within risk assessments. This is **very important** to avoid the wrongful exclusion of producers from the EU market or the misclassification of a plot of land as compliant. Similarly, area-level risk assessments should not be used to encourage the exclusion of producers that are in high-risk regions, but to help competent authorities assess the adequacy of operators' risk assessment and risk mitigation measures.

Whisp (Open Foris – FAO)

An open-source data solution developed by the FAO that uses a 'convergence of evidence' approach to overcome the challenge that maps on forests and land use have different classifications and definitions. Whisp uses a decision-tree approach that uses multiple maps to assess the risk of deforestation in plots of land for agricultural use after the cut-off date at the end of 2020. It enables users to upload their own plots of land and to assess risks against the more than 100 underlying data layers.[3]

3. Available at: https://openforis.org/solutions/whisp/

Case studies on how geospatial data can support the assessment of non-compliance risks with the EUDR legality requirement in Brazil, Côte d'Ivoire and Indonesia

Data needs for the EUDR legality requirement

Relevant commodities and products can only be placed on the EU market if they have been produced in accordance with the relevant legislation of the country of production (Article 3(b)). Relevant legislation is defined as the applicable laws in the country of production concerning the legal status of the area of production in terms of (a) land use rights, (b) environmental protections, (c) forest-related rules, (d) third parties' rights, (e) labour rights, (f) human rights protected under international law, (g) free, prior and informed consent (FPIC) and (h) tax, anti-corruption, trade and customs regulations.

The focus on the legal status of the area of production highlights the relevance of geospatial datasets in assessing the risk of non-compliance with the legality criteria. Relevant geospatial datasets include land use maps, land registries, protected areas, indigenous and community territories and lands, and environmental licenses. The majority of relevant datasets will be official government data held by public agencies at national, state or municipal level. In many cases these datasets are not complete, not digitised or not publicly accessible. There are also publicly available open datasets such as the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) World Database on Protected Areas and LandMark maps of indigenous and community lands. However, these datasets may not be aligned with government datasets and are in many cases incomplete. Therefore – while they are useful resources – they need to be treated with caution.

Case studies on data availability for the EUDR legality requirement in Brazil, Côte d'Ivoire and Indonesia

The accessibility and complexity of national legal frameworks, the lack of clarity on implementation and enforcement, and access to relevant data to demonstrate legal compliance (which is often owned by governments), present significant challenges for both companies in collating and verifying evidence of the legality of production, and for competent authorities in checking the adequacy of risk assessments and mitigation measures by operators.

A complete review of relevant legal frameworks and relevant data availability is beyond the scope of this study. However, the following three case studies, summarised from in-depth reports, highlight the relevance and challenges of using geospatial data in supporting the risk assessment of non-compliance with the EUDR legality requirement.

Soy production and the Forest Code in Brazil

The Forest Code (Law no. 12.651/2012) is the main national policy on conserving native vegetation, including forests. A study on the risks of non-compliance of soy produced in the Amazon and Cerrado in 2020 with Brazil's Forest Code using by Trase and Instituto Centro de Vida (ICV) concluded that there was strong evidence that 16% of soy (3 million hectares) was non-compliant with the Forest Code and that a further 58% of soy (11 million hectares) was produced by farms showing signs of potential breaches of the Forest Code, but whose compliance status could not be made clear with publicly available data. This would suggest a non-negligible risk that 74% of soy farms in this region would be **non-compliant with the EUDR legality requirement** unless and until the relevant Forest Code non-compliance is disproven or remedied.

Brazil's publicly available data on forest cover, deforestation and its environmental registry is unique. However, even in this context gaps in data availability create challenges in assessing non-compliance risks with the Forest Code. This would be greatly improved if Brazilian state governments and federal agencies prioritised the public availability of deforestation licenses as required by Brazil's Freedom of Information Law (Law 12.527/2011) and the public availability of other important information including full details of validated the Rural Environmental Registry (CAR), embargoed areas (administrative sanctions applied by environmental agencies for unauthorised deforestation), a list of farmers who have adhered to Environmental Regularization Programmes (PRA) and a database of reserve quotas (CRA).

See the full report: Soy and legal compliance in Brazil: Risks and opportunities under the EU deforestation regulation (2023). Trase & ICV.[4]

4. Available at: https://resources.trase.earth/documents/Briefings/soy-and-legal-compliance-in-brazil-report.pdf

Table 1: Mapping geospatial datasets required to assess compliance with Brazil's Forest Code (based on Trase & ICV 2023)

Relevant area legislation under EUDR	Relevant legislation	Brief description of legal mechanism	Datasets and sources to evidence compliance
(a) Land use rights	Forest Code – Environmental Rural Registry (CAR)	The CAR is a mandatory public registry for all rural properties in Brazil that integrates information on rural property boundaries and their conservation areas (i.e. Legal Reserves). It provides the basis for monitoring environmental compliance at farm level. As it is a self-declaratory procedure, competent environmental agencies have to validate the information provided by landowners.	Information on properties registered in the CAR system is publicly available through the National System of Environmental Rural Registry (SICAR) website. In addition to the properties boundaries, the SICAR database contains a description of the status of the registration, including whether given property information has been validated or not. A 2023 study by Climate Policy Initiative on the implementation of the Forest Code assessed that in 2023 2.7% of CAR properties had been completely analysed.
(b) Environmental protection	Forest Code – Deforestation licenses	The Forest Code allows limited deforestation on private land, but landowners must first obtain a deforestation licence from competent environmental agencies. To receive a licence, applicants must fulfil several requirements, such as proving that there are no abandoned areas within the farm, carrying out field surveys for threatened species, and adopting compensatory measures when threatened species are present.	Deforestation licence records are publicly available for the states of Amazonas, Pará, Mato Grosso, Rondônia, Goiás, Minas Gerais, Ceará e Rio Grande do Sul. In addition, deforestation licences can be accessed through the National System of Control of the Origin of Forest Products (Sinaflor), which has centralised deforestation licences at a federal level. However, it is important to note that the information within the system remains incomplete. For further information see Valdiones et al., 202116.
(b) Environmental protection	Forest Code – Environmental Regularisation Programme (PRA)	The PRA comprises a set of actions and initiatives that must be undertaken by landowners to adapt and promote the environmental regularisation of their properties. Landowners with a deficit of Legal Reserve can regain compliance through the regeneration or restoration of the native vegetation within the property or by using compensation mechanisms when the area to be compensated was deforested before 22 July 2008.	The availability of spatially explicit data concerning the farms who adhered to PRA remains limited. Currently, Mato Grosso stands out as one of the few states that provides this information in a comprehensive and accessible format.

(b) Environmental protection	Forest Code – Environmental Reserve Quotas (CRA)	CRA is an instrument created by the Forest Code to allow offsetting of Legal Reserve deficits between rural properties. Each quota corresponds to one hectare of native vegetation and can be generated by landowners that have a surplus of vegetation according to the minimum required under the Legal Reserve mechanism. The quotas can be used to compensate for the lack of Legal Reserve in other rural properties, provided they meet certain conditions.	A consolidated dataset that offers information regarding implemented quotas is currently absent.

Cocoa production, classified forests and protected areas in Côte d'Ivoire

The 2019 Forest Code (Law No. 2019-675) makes it illegal for cocoa to be grown in national parks, nature reserves and classified forests with the exception of "designated enclaves" for cocoa in classified forest areas and non-industrial cocoa in agroforests under specific management rules (a new forest category that has reclassified severely degraded forest areas). An EUDR preparedness check by the European Forest Institute (EFI) highlights some of the challenges in assessing compliance with the Forest Code.

There is currently no publicly available official dataset on protected areas in Côte d'Ivoire, although official government data has been made available on request from the Ministry of Forests and Water and has been shared with Cocoa & Forests Initiative signatories. UNEP-WCMC's World Database on Protected Areas (WDPA) is the most comprehensive global publicly available geospatial dataset on protected areas. However, while the dataset is regularly updated with submissions from governments and civil society, it is not an official public dataset and there are discrepancies between official government data and WDPA. The EFI study concluded that there were significant differences between the WDPA data (8.6 million hectares) and official government data (5.9 million hectares) on protected areas. This difference may be due to outdated information or discrepancies in the inclusion of information such as "designated enclaves" in forest areas (which may be protected areas) where cocoa production is allowed.

Similarly, the lack of publicly available data on the boundaries of classified forests and "agricultural enclaves" provides challenges to assessing non-compliance risks with the Forest Code. It is estimated by the Côte d'Ivoire Coffee-Cocoa Council (CCC) that 30% of cocoa is produced in classified forests. To date only three forests have been officially reclassified as agroforests. These also require concession contracts and management plans approved by the Forest Administration to legally produce cocoa which are not publicly accessible. The public availability of government geospatial data on forest classification, agroforests, protected areas and enclaves would support operators and competent authorities in their assessment of legal compliance.

See the full report: Preparedness check of Côte d'Ivoire for the EU Deforestation Regulation (2024). Cocoa Insight. European Forest Institute.[5]

5. Available at: https://efi.int/sites/default/files/files/flegtredd/Sustainable-cocoa-programme/Cocoa%20insights/EUDR%20preparedness%20check%20CIV_EN.pdf

Palm oil production and land use rights in Indonesia

Palm oil plantations require a certificate for the right to cultivate: a HGU for company plantations and STD-B for smallholders (for which they require relevant land titles such as a Freehold Title (SHM); a Certificate of Land Ownership (SKT), a Certificate of Land Compensation (SKGR) or Customary land). However, a study from Madani on EUDR readiness shows that there are important gaps in the number of certificates. Of the 19 million hectares of oil palm plantations for which permitting data was available in 2023, only 9.8 million hectares had a HGU, a further 5.9 million hectares had completed the HGU process, and 3.9 million hectares were still in progress. Similarly, the study notes that Indonesia has issued STD-B for only around 82,000 hectares out of approximately 8 million hectares of smallholder land.

It is illegal for palm oil to be produced in Indonesia's forest estate. However, studies estimate that there are more than 3 million hectares of palm oil planted in the forest estate (around a fifth of all of Indonesia's palm oil area). Indonesia is aiming to address some of these legal issues through the 2020 Job Creation Act that provides mechanisms for the legalisation of palm oil in forest estates.

Another challenge highlighted by the study on land rights is the slow recognition of indigenous territories. The Indigenous Territory Registration Agency (BRWA) has recorded 1,336 maps of indigenous territories covering 26.9 million hectares spread across 32 provinces and 155 districts/cities in Indonesia. However, as of 2022, only 667 maps covering 13.76 million hectares have been legally recognised through regional regulations. Similarly the designation of customary forests (hutan adat) has been very slow, despite approximately 1 million hectares of customary forest zone being set aside for recognition.

Although this official data is not publicly accessible, much is available via sources such as Nusantara Atlas and Simontini.

See the full report: Strengthening Indonesia's Readiness to Navigate the European Union Deforestation-Free 1 Regulation through Improved Governance and Inclusive Partnership (2024) Madani.[6]

6. Available at: https://madaniberkelanjutan.id/wp-content/uploads/2024/03/Madani-Update-EUDDR-ENG_Final.pdf

Conclusion

This report concludes that:

- Publicly available datasets have a key role in supporting risk assessments of non-compliance under the EUDR – both at the plot level and for area-level risk assessment that will be critical for assessing the risks of mixing with non-compliant products.
- Area-level risk assessments that go beyond the plot will be critical for assessing the adequacy of a company's risk mitigation measures in addressing risks of laundering and mixing with non-compliant and unknown products.
- Area-level risk assessment will also support risk-based approaches by competent authorities to target checks.
- Open and peer-reviewed data is cost effective and enables transparency on limitations, scrutiny and replication.
- Existing datasets have not been developed for EUDR and there are gaps in alignment as well as accuracy challenges.
- No single dataset is a silver bullet, therefore the use of multiple datasets is required to build a picture on what is happening through a convergence of evidence approach.
- It is critical not to oversimplify decisions and for competent authorities to understand and investigate why different datasets may lead to different conclusions and where to invest more resources in understanding risks of non-compliance, such as utilising higher resolution optical imagery and/or ground truthing.

Annex 1 – publicly available forest cover maps

Many of these datasets have not been developed specifically for the EUDR. However, they can be combined with other datasets on land cover to improve alignment. For example, datasets on tree cover (such as UMD Global Forest Change or ESA World Cover) can be combined with datasets on agricultural plantations to produce a forest cover map that is more aligned with the EUDR forest definition that excludes agricultural plantations.

Global forest cover maps

Dataset	Provider	Description	Spatial resolution (metres)	Spatial coverage	Temporal coverage	Update frequency	Forests definition alignment with the EUDR	Link
Global map of forest cover – version 2 (GFC 2020)	European Commission, Joint Research Centre (JRC).	Global map of forest cover provides a spatially explicit representation of forest with standing trees for the year 2020 that combines a number of forest datasets.	10m	Global	2020	Irregular	Yes	Bourgoin, Clement; Verhegghen, Astrid; Degreve, Lucas; Ameztoy, Iban; Carboni, Silvia; Colditz, Rene; Achard, Frederic (2024): Global map of forest cover 2020 - version 2. European Commission, Joint Research Centre (JRC) [Dataset] PID. Available at : http://data.europa.eu/89h/e554d6fb-6340-45d5-9309-332337e5bc26
Global map of forest types - version 1(GFT 2020)	European Commission, Joint Research Centre (JRC).	Global map of forest types for primary forest, naturally regenerating forest and planted forest (including plantation forests) combines available global datasets that are proxies.	10m	Global	2020	Irregular	Yes	Bourgoin, Clement; Verhegghen, Astrid; Carboni, Silvia; Ameztoy, Iban; Ceccherini, Guido; Colditz, Rene; Achard, Frederic (2024): Global map of forest types 2020 - version 0. European Commission, Joint Research Centre (JRC) [Dataset] PID. Available at: http://data.europa.eu/89h/037ca376-ba92-49db-a8f7-0c277c1e5436

Tropical moist forest (TMF) undisturbed 2023	European Commission, Joint Research Centre (JRC).	Map of Tropical moist forest (TMF) classes (10,11,12) that represent undisturbed forest cover in 2020.	30m	Global (but tropical moist forests)	2020 (time series is 1990 - 2024)	Annual	Forests are not defined using a minimum height or canopy density threshold and include all closed primary and secondary forests in the humid tropics. These forest classes exclude tree plantations and focus on natural forests.	C. Vancutsem, F. Achard, J.-F. Pekel, G. Vieilledent, S. Carboni, D. Simonetti, J. Gallego, L.E.O.C. Aragão, R. Nasi. Long-term (1990-2019) monitoring of forest cover changes in the humid tropics. Science Advances 2021. Available at: https://forobs.jrc.ec.europa.eu/TMF
UMD Global forest change-v1.10: Tree cover (2000) and tree cover loss (2001-2020)	Hansen	Map of tree cover in 2020 that is based on canopy coverage 10%. This is based on tree cover map in 2000 with tree cover losses from 2001 - 2020 removed)	30m	Global	2020 (time series is 2000 - 2023)	Annual	Tree cover map that covers woody vegetation with a minimum height of at least five meters and 10% canopy coverage (note users can select canopy coverage threshold and Global Forest Watch uses 30%).	Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Available at: https://doi.org/10.1126/science.1244693

ESA World Cover (Tree and mangrove classes (i.e., 10 and 95) for 2020.	The European Space Agency (ESA)	Tree and mangrove classes (i.e. 10 and 95) for 2020.	10m	Global	2020 (with longer time series)	Annual	Tree cover land use class includes any geographic area dominated by trees with a cover of 10% or more. This includes agricultural plantations. Mangrove land use class includes salt-tolerant tree and other plant species.	D. Zanaga, R. Van De Kerchove, D. Daems, W. De Keersmaecker, C. Brockmann, G. Kirches, J. Wevers, O. Cartus, M. Santoro, S. Fritz. (2022). ESA WorldCover 10 m 2021 v200. Available at: https://worldcover2021.esa.int/download
SBTN Natural Lands Map v1, 2024	Science Based Targets Network's Land Hub in collaboration with WRI's Land & Carbon Lab, the World Wildlife Fund and Systemiq.	Map of natural and non natural lands - with natural land classifications including forests and other vegetation types	30m	Global	2020	Annual	AFI definition based on FAO. This only includes natural forests rather than the EUDR definition of all forests that includes planted and plantation forests.	Mazur, E., Sims, M., et al., SBTN Natural Lands Map v1, 2024. Available at: https://sciencebasedtargetsnetwork.org/wp-content/uploads/2024/09/Technical-Guidance-2024-Step3-Land-v1-Natural-Lands-Map.pdf
Spatial Database of Planted Trees (SDPT) v2	Map of planted forests and tree crops	Global Forest Watch, WRI	30m	127 countries	2020	Irregular	Map of planted forests (included in the EUDR definition) and agricultural tree crops (excluded in the EUDR forest definition).	Richter, Jessica, Elizabeth Goldman, Nancy Harris, David Gibbs, Melissa Rose, Suzanne Peyer, Sarah Richardson, and Hemalatha Velappan. "Spatial database of Planted Trees (SDPT version 2.0)." (2024). Available at: https://www.globalforestwatch.org/blog/data-and-tools/updated-planted-trees-map-near-global-coverage/

Brazil forest cover maps								
Mapbiomas Brazil	Mapbiomas	MapBiomas Project - Collection 9 of the Annual Land Use Land Cover Maps of Brazil - classes Floresta	30m	Brazil	1985 - 2023	Annual	The MapBiomas land classification mapping across FAO, IBGE and Mapbiomas are a little unclear e.g. Mapbiomas savannah formations includes both forests and other wooded land classes (WS) under FAO but with the exception of the Pantanel, these savannah classes maps to IBGE land classifications (Sa, Ta, Sd, Td) that IBGE maps to forests under FRA, not other wooded lands (WS) This shows complexity of harmonisation, especially in complex mosaic landscapes.	Souza et al. (2020) – Reconstructing Three Decades of Land Use and Land Cover Changes in Brazilian Biomes with Landsat Archive and Earth Engine – Remote Sensing, Volume 12, Issue 17, Available at: https://doi.org/10.3390/rs12172735
IBGE	Land Use and Land Cover Map of Brazil	IBGE	250m	Brazil	2000, 2012, 2014, 2016, 2018	Biannual	IBGE forest definitions do not fully align with EUDR as IBGE has a more detailed and specific classification of forests, considering the different types of forests within the biomes.	Instituto Brasileiro de Geografia e Estatística (IBGE) Land Use and Cover in Brazil (2018). Available at: https://www.ibge.gov.br/en/geosciences/environmental-information/land-use-and-cover/18428-land-use-and-cover-in-brazil.html

Côte d'Ivoire forest cover maps								
Côte d'Ivoire BNETD 2020 Land Cover Map	National Study Office Techniques and Development (BNETD-CIGN)	2020 national land cover map (BNETD-CIGN) v.2	10m	Côte d'Ivoire	2020	Unknown	National definition and FAO definition Validated by JRC with 91% accuracy	Available at: https://africageoportal.maps.arcgis.com/apps/webappviewer/index.html?id=88c2493e722546c09c2a0a8b394c4454
Indonesia forest cover maps								
Mapbiomas Indonesia	Mapbiomas	MapBiomas Project - Collection 2 of the Annual Land Use Land Cover Maps of Indonesia	30m	Indonesia	2000 - 2022	Annual	Natural vegetation formations dominated by trees that have not shown any disturbance, or areas that have been logged and/or burned that have regrown, have consistently high densities, grow and develop in dry/wet land habitats.	Available at: https://mapbiomas.nusantara.earth/
SIMONTANA	Indonesian Ministry of Environment and Forestry	SIMONTANA (National Forest Monitoring System)	30m (Landsat)	Indonesia	2000 - 2022	Annual	Includes primary, secondary and plantation forests MMU 6.25 ha	Sistem Monitoring Hutan Nasional (SIMONTANA). Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia. Available at: https://nfms.menlhk.go.id/
Nusantara Atlas	Primary forests	The Tree Map	30m	Indonesia	2023	Annual	Primary forests	Gaveau, D. L., Locatelli, B., Salim, M. A., Husnayaen, Manurung, T., Descals, A., ... & Sheil, D. (2022). Slowing deforestation in Indonesia follows declining oil palm expansion and lower oil prices. PloS one, 17(3), Available at: https://doi.org/10.1371/journal.pone.0266178

Annex 2 – deforestation and forest degradation

Deforestation in the EUDR is defined as the conversion of forests (including planted and plantation forests) to agricultural use (including plantations for relevant commodities other than wood). Forest degradation in the EUDR is defined as the conversion of primary forests or naturally regenerating forests into plantation forests or into other wooded land or primary forests into planted forests.

Deforestation and disturbance global data products								
Dataset	Provider	Description	Spatial resolution (metres)	Spatial coverage	Temporal coverage	Update frequency	Definitions of forest and deforestation	Link
Alerts								
GLAD _L forest alerts	UMD	Tree cover loss alerts using Landsat data	30m	Pan-tropics	Near-real time (frequency of observations every 8 days)	Daily	Loss of tree cover (5m, 30% canopy coverage), most reliable in dense tropical forest with 60% canopy coverage	Hansen MC, Krylov A, Tyukavina A, Potapov PV, Turubanova S, Zutta B, et al. Humid tropical forest disturbance alerts using Landsat data. Environmental Research Letters. 2016;11(3):034008. Available at: https://glad-forest-alert.appspot.com/ and Global Forest Watch
GLAD S2 forest alerts	UMD	Tree cover loss alerts using Sentinel-2 data in humid tropical primary forests	10m	Amazon basin	Near-real time (frequency of observations every 5 days)	Daily	Loss of primary forests	Hansen MC, Krylov A, Tyukavina A, Potapov PV, Turubanova S, Zutta B, et al. Humid tropical forest disturbance alerts using Landsat data. Environmental Research Letters. 2016;11(3):034008. Available at: https://glad.earthengine.app/view/s2-forest-alerts and Global Forest Watch

RADD forest disturbance alerts	Wageningen University	Tree cover loss alerts using Sentinel-1 radar data in the humid tropics.	10m	Humid tropics	Near-real time (frequency of observations every 6 - 12 days)	Daily	New disturbances in primary tropical forests.	Reiche, J., Mullissa, A., Slagter, B., Gou, Y., Tsendbazar, N.-E., Odongo-Braun, C., Vollrath, A., Weisse, M. J., Stolle, F., Pickens, A., Donchyts, G., Clinton, N., Gorelick, N., & Herold, M. (2021). Forest disturbance alerts for the Congo Basin using Sentinel-1. Environmental Research Letters, 16(2), 024005. Available at: https://doi.org/10.1088/1748-9326/abd0a8
OPERA Land Surface Disturbance Alert	DIST-ALERT". UMD/GLAD and NASA	Global vegetation disturbance in near-real-time using harmonized Landsat-Sentinel-2 (HLS) imagery	30m	Global	Near-real time (frequency of observations every 2 - 4 days)	Daily (weekly on Global Forest Watch)	Vegetation disturbance (not aligned with forests definition)	Hansen, M.. OPERA Land Surface Disturbance Alert from Harmonized Landsat Sentinel-2 product (Version 1). 2024, distributed by NASA EOSDIS Land Processes Distributed Active Archive Center. Available at: https://doi.org/10.5067/SNWG/OPERA_L3_DIST-ALERT-HLS_V1.001
MCD64A1 Version 6.1 Burned Area data product	NASA	Map of spatial extent of recent fires	500m	Global		Monthly	Burned area of vegetation.	Giglio, L., Justice, C., Boschetti, L., & Roy, D. (2021). MODIS/Terra+Aqua Burned Area Monthly L3 Global 500m SIN Grid V061 [Dataset]. NASA EOSDIS Land Processes Distributed Active Archive Center. Available at: https://doi.org/10.5067/MODIS/MCD64A1.061

Annual products								
Global Forest Change annual tree cover loss	UMD	Annual tree cover loss	30m	Global	2000-2023	Annual	Loss of tree cover (5m, 30% canopy coverage)	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., , S. A., Tyukavina, A., Thau, D., Stehman, S. V., Goetz, S. J., Loveland, T. R., Kommareddy, A., Egorov, A., Chini, L., Justice, C. O., & Townshend, J. R. G. (2013). High-Resolution Global Maps of 21st-Century Forest Cover Change. Science, 342(6160), 850–853. https://doi.org/10.1126/science.1244693. Data available at: https://glad.earthengine.app/view/global-forest-change.
Tropical moist forest (TMF) 2023	European Commission, Joint Research Centre (JRC).		30m	Global (but tropical moist forests)	2020 (time series is 1990 - 2023)	Annual	Forests are not defined using a minimum height or canopy density threshold and include all closed primary and secondary forests in the humid tropics.	C. Vancutsem, F. Achard, J.-F. Pekel, G. Vieilledent, S. Carboni, D. Simonetti, J. Gallego, L.E.O.C. Aragão, R. Nasi. Science Advances 2021. Available at: Long-term (1990–2019) monitoring of forest cover changes in the humid tropics.

MapBiomas Collection	Mapbiomas	Annual deforestation	30m	South America & Indonesia	1985 - 2022 or 2023 in South American countries and 2000 - 2022 in Indonesia	Annual	Forest classes are mapped for each country and do not fully align with FAO definition	Available at: https://brasil.mapbiomas.org/en/o-projeto/
National deforestation systems in focus countries (Brazil, Indonesia, Côte d'Ivoire)								
Prodes	INPE	National deforestation monitoring system that has expanded to cover all of Brazil's biomes. It generates annual deforestation statistics. The data is publicly available for download on the Terrabrasilis platform.	30m	Brazil	Time series varies for different products - Legal Amazon (1988 - 2023) - Cerrado 2001 - Legal Amazon (1988 - 2023) - Cerrado 2001 - Legal Amazon (1988 - 2023) - Cerrado 2001	Annual	MMU of 6.25 ha is > 0.5 ha in EUDR. Deforestation is focused on primary forests and is incremental (does not include areas of regrowth)	National Institute for Space Research (INPE). Coordination-General Office of Earth Sciences. Brazilian Biomes monitoring program. Prodes – Annual Monitoring of Native Vegetation Suppression – Amazon/Cerrado/Pantanal/Caatinga/Atlantic Forest/Pampa – Available at: https://terrabrasilis.dpi.inpe.br/downloads/

DETER alerts	INPE	National deforestation alerts system. It generates daily alerts. These alerts are published 2 weeks later on the public TerraBrasilis platform.	60m	Amazon, Cerrado and Pantanal, Brazil	Near-real time (frequency of observations every 5 days) Current system established in 2015	Daily	MMU of 3 ha is > 0.5 ha in EUDR. Masks non-forest areas and Prodes deforested areas	National Institute for Space Research (INPE). Coordination-General Office of Earth Sciences. Brazilian Biomes monitoring program. Deter – Daily Monitoring of the Suppression and Degradation of Native Vegetation – Alerts – Amazon/Cerrado/Pantanal – Available at: https://terrabrasilis.dpi.inpe.br/downloads/
MapBiomas Alerta	MapBiomas	MapBiomas Alerta gathers, organizes, and consolidates deforestation information from various official and independent monitoring systems in Brazil. These systems utilize satellite imagery with resolutions ranging from 10 meters to 60 meters to generate deforestation alerts. These are validated using 4 m Planet high resolution imagery.	10 - 60 m	Brazil	Monthly inputs from different underlying alert systems.	Weekly	The MapBiomas land classification mapping across FAO, IBGE and Mapbiomas are a little unclear e.g. Mapbiomas savannah formations includes both forests and other wooded land classes (WS) under FAO but with the exception of the Pantanel, these savannah classes maps to IBGE land classifications (Sa, Ta, Sd, Td) that IBGE maps to forests under FRA, not other wooded lands (WS) This shows complexity of harmonisation, especially in complex mosaic landscapes.	MapBiomas Alert Project - Validation and Refinement System for Deforestation Alerts with High-Resolution Images. Available at: https://alerta.mapbiomas.org/en/

MapBiomas Brazil	MapBiomas	MapBiomas Project - Collection 9 of the Annual Land Use Land Cover Maps of Indonesia	30m	Brazil	1985 - 2023	Annual	The MapBiomas land classification mapping across FAO, IBGE and Mapbiomas are a little unclear e.g. Mapbiomas savannah formations includes both forests and other wooded land classes (WS) under FAO but with the exception of the Pantanel, these savannah classes maps to IBGE land classifications (Sa, Ta, Sd, Td) that IBGE maps to forests under FRA, not other wooded lands (WS) This shows complexity of harmonisation, especially in complex mosaic landscapes.	Souza et al. (2020) – Reconstructing Three Decades of Land Use and Land Cover Changes in Brazilian Biomes with Landsat Archive and Earth Engine – Remote Sensing, Volume 12, Issue 17, Available at: https://doi.org/10.3390/rs12172735
Mapbiomas Indonesia	Mapbiomas	MapBiomas Project - Collection 2 of the Annual Land Use Land Cover Maps of Indonesia	30m	Indonesia	2000 - 2022	Annual	Natural vegetation formations dominated by trees that have not shown any disturbance, or areas that have been logged and/or burned that have regrown, have consistently high densities, grow and develop in dry/wet land habitats.	Available at: https://mapbiomas.nusantara.earth/

Nusantara Atlas	The Tree Map	Platform that maps annual deforestation and combines with data on near real-time alerts and concessions	30m	Indonesia	2001 - 2024	Annual	Primary forests	Gaveau, D. L., Locatelli, B., Salim, M. A., Husnayaen, Manurung, T., Descals, A., ... & Sheil, D. (2022). Slowing deforestation in Indonesia follows declining oil palm expansion and lower oil prices. PloS one, 17(3), Available at: https://doi.org/10.1371/journal.pone.0266178

Annex 3 – agricultural use and commodity maps

Commodity maps

Relevant commodity	Dataset	Description	Provider	Spatial resolution	Spatial coverage	Temporal resolution	Update frequency	Link
Soyabeans	Song et al 2021	Map of annual soybean expansion in South America	Song et al 2021	30m	South America	2000 - 2022	Annual	Song, X.P., Hansen, M.C., Potapov, P., Adusei, B., Pickering, J., Adami, M., Lima, A., Zalles, V., Stehman, S.V., Di Bella, C.M. and Conde, M.C., 2021. Massive soybean expansion in South America since 2000 and implications for conservation. Nature sustainability, 4(9), pp.784-792 doi:10.1038/s41893-021-00729-z Available at: https://data.globalforestwatch.org/datasets/soy-planted-area-/about
Cattle products (cattle pasture)	Land & Carbon Lab Global Pasture Watch	Map of the extent of cultivated grasslands and natural/semi-natural grasslands	Land & Carbon Lab Global Pasture Watch	30m	Global	2000 - 2022	Annual	Parente, L., Sloat, L., Mesquita, V. et al. Annual 30-m maps of global grassland class and extent (2000–2022) based on spatiotemporal Machine Learning. Sci Data 11, 1303 (2024). https://doi.org/10.1038/s41597-024-04139-6 Available at: https://landcarbonlab.org/data/global-grassland-and-livestock-monitoring/
Cattle products (cattle pasture	Mapbiomas Brazil	MapBiomas Project - Collection 9 of the Annual Land Use Land Cover Maps of Brazil Pasture map	MapBiomas	30m	Brazil	1985 - 2023	Annual	Souza et al. (2020) – Reconstructing Three Decades of Land Use and Land Cover Changes in Brazilian Biomes with Landsat Archive and Earth Engine – Remote Sensing, Volume 12, Issue 17, Available at: https://doi.org/10.3390/rs12172735

Cocoa	BNETD Land Cover map 2020	The map was produced by the Ivorian Government through a national institution, the Centre d'Information Géographique et du Numérique du Bureau National d'Études Techniques et de Développement (BNETD-CIGN), with technical and financial support from the European Union.	BNETD	10m	Côte d'Ivoire	2020	Every 2 years	BNETD (2024). Occupation des sols de la Côte d'Ivoire en 2020 (Version 2). Centre d'Information Géographique et du Numérique / Bureau National d'Études Techniques et de Developpement. Côte d'Ivoire, 2024. Data available at: https://arcg.is/0uHOi90
Cocoa	Cocoa farming map 2019-2021	High-resolution maps of cocoa plantations Ghana and Côte d'Ivoire	Kalischek et al. (2023)	10m	Côte d'Ivoire & Ghana	2019 - 2021	Irregular	Kalischek, N. et al. Cocoa plantations are associated with deforestation in Côte d'Ivoire and Ghana. Nat Food 4, 384–393 (2023). Available at: https://www.nature.com/articles/s43016-023-00751-8
Wood	Spatial Database of Planted Trees (SDPT) v2	Map of planted forests and tree crops	Global Forest Watch, WRI	30m	127 countries	2020	Irregular	Richter, Jessica, Elizabeth Goldman, Nancy Harris, David Gibbs, Melissa Rose, Suzanne Peyer, Sarah Richardson, and Hemalatha Velappan. "Spatial database of Planted Trees (SDPT version 2.0)." (2024). Available at: https://www.globalforestwatch.org/blog/data-and-tools/updated-planted-trees-map-near-global-coverage/

Wood	Tropical moist forest (TMF) plantation (classes 81-86)	Map of Tropical moist forest (TMF) classes (10,11,12) that represent undisturbed forest cover in 2020.	JRC					Vancutsem, C., Achard, F., Pekel, J.-F., Vieilledent, G., Carboni, S., Simonetti, D., Gallego, J., Aragão, L. E. O. C., & Nasi, R. (2021). Long-term (1990–2019) monitoring of forest cover changes in the humid tropics. Science Advances, 7(10). Available at: https://doi.org/10.1126/sciadv.abe1603
Oil palm		Annual oil palm plantation maps in Malaysia and Indonesia from 2001 to 2016	Xu et al (2020)	100m	Malaysia and Indonesia	2001 - 2016	Irregular	Xu, Y. et al. Annual oil palm plantation maps in Malaysia and Indonesia from 2001 to 2016. Earth System Science Data 12, 847–867 (2020). Available at: https://essd.copernicus.org/articles/12/847/2020/
Oil palm		High-resolution global map of smallholder and industrial closed-canopy oil palm plantations	Descals et al. 2021	10m	Pan-tropical	2019	Irregular	Descals, A., Wich, S., Meijaard, E., Gaveau, D. L. A., Peedell, S., & Szantoi, Z. (2021). High-resolution global map of smallholder and industrial closed-canopy oil palm plantations. Earth System Science Data, 13(3), 1211–1231. Available at: https://doi.org/10.5194/essd-13-1211-2021
Oil palm		Map of oil palm extent - smallholder and industrial	Gaveau et al 2022	Vector	Indonesia	2000 - 2019		Gaveau D.L.A, Locatelli B, Salim MA, Manurung T, Descals A, Angelsen A, et al. Slowing deforestation in Indonesia follows declining oil palm expansion and lower oil prices. Plos One. 2022.17(3): e0266178. Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0266178

Oil palm		Global map of industrial and smallholder oil palm	Descals et al (2024)	10m for 2016 - 2021 and 30 m for 1990 - 2021	Global	1990 - 2021	Irregular	Descals, Adrià, David LA Gaveau, Serge Wich, Zoltan Szantoi, and Erik Meijaard. "Global mapping of oil palm planting year from 1990 to 2021." Earth System Science Data Discussions 2024 (2024): 1-24. Available at: https://www.earth-system-science-data.net/home.html
Rubber	Rubber	Map of rubber extent. but has been recently critiqued for containing biases (and likely more accurate for mainland Asia). Revised datasets are in preparation.	Wang et al 2023 https://www.nature.com/articles/s41586-023-06642-z	10m	SE Asia & China	2021	Irregular	Wang et al., (2024) Wang, Y., Hollingsworth, P.M., Zhai, D. et al. High-resolution maps show that rubber causes substantial deforestation. Nature 623, 340–346 (2023). Available at: https://doi.org/10.1038/s41586-023-06642-z
Croplands	GLAD Global cropland expansion in the 21st century	Maps of cropland extent and change at a 30-metre resolution for 2000 through 2019.	Potapov et al (2021) - Nature paper	30m	Global	2003 - 2019	The cropland extent maps are available for five time periods (2000-2003, 2004-2007, 2008-2011, 2012-2015, and 2016-2019) periods.	Potapov, Peter, Svetlana Turubanova, Matthew C. Hansen, Alexandra Tyukavina, Viviana Zalles, Ahmad Khan, Xiao-Peng Song, Amy Pickens, Quan Shen, and Jocelyn Cortez. "Global maps of cropland extent and change show accelerated cropland expansion in the twenty-first century." Nature Food 3, no. 1 (2022): 19-28. Available at: https://www.nature.com/articles/s43016-021-00429-z
Croplands	Global area of temporary crops (crop specific for maize)	ESA global map of temporary crops	ESA	10m	Global		Annual but only 2020 and 2021 are available so far	Van Tricht, K. et al. WorldCereal: a dynamic open-source system for global-scale, seasonal, and reproducible crop and irrigation mapping. Earth System Science Data 15, 5491–5515 (2023). Available at: https://essd.copernicus.org/articles/15/5491/2023/

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