Coffee — Colombia

Full EUDR Article 9 mapping for coffee in Colombia (v1.0)

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EUDR Coffee — Regulation Overview

commodity	coffee
regulation	EU Regulation 2023/1115 (EUDR)
article9_fields	geolocation, supplier_identification, deforestation_free_date, due_diligence_statement
cutoff_date	2020-12-31
enforcement_large	2024-12-30
enforcement_sme	2025-06-30
primary_country	Colombia
schema_version	1.1
last_updated	2026-05-27

Scope of the EUDR for Coffee

EU Regulation 2023/1115 — the European Union Deforestation Regulation (EUDR) — entered into force on 29 June 2023. It targets seven commodity groups linked to global deforestation: cattle, cocoa, coffee, oil palm, rubber, soya, and wood. For coffee, the regulation covers all forms placed on the EU market: green (unroasted) beans, roasted beans, ground coffee, soluble/instant coffee, coffee extracts and concentrates, and coffee husks and skins. The Combined Nomenclature (CN) codes covered include 0901 (coffee, whether or not roasted or decaffeinated), 2101 11 (extracts, essences, and concentrates of coffee), and associated derivative codes.

Article 9 — Mandatory Due Diligence Information

Article 9 of the EUDR specifies the information that operators and traders must collect, verify, and retain before placing coffee on the EU market or exporting it from the EU. The mandatory fields are:

- **Geolocation of production plots:** For plots larger than 4 hectares, a polygon boundary (set of latitude/longitude coordinate pairs) is required. For plots equal to or smaller than 4 hectares, a single GPS point (latitude/longitude with sufficient decimal precision — at least 5 decimal places, ~1.1 m accuracy) is acceptable. This is the field that presents the greatest compliance challenge for smallholder coffee producers in Colombia, where the average finca cafetera is 1.5–2.0 hectares.
- **Supplier identification:** Name, address, and where applicable, registration/tax identification number of each actor in the supply chain — from finca to exporter. In Colombia, the FNC's cédula cafetera (coffee farmer ID card) serves as a farm-level identification instrument that can map to this requirement.
- **Deforestation-free verification:** Evidence that the production land was not subject to deforestation (conversion of forest to agricultural use) or forest degradation after the cutoff date of 31 December 2020. Verification may use satellite imagery (Sentinel-2, Planet Labs, Landsat), national monitoring systems (IDEAM/SMBYC in Colombia), or third-party audits.

- **Due diligence statement (DDS):** A formal declaration submitted through the EU Information System (TRACES or the dedicated EUDR IT platform) before the product enters the EU market. The DDS must reference the geolocation data, confirm deforestation-free status, and be linked to the specific consignment.
- **Legality:** Confirmation that production complied with the relevant laws of the country of production, including land use, environmental protection, labour rights, tax obligations, and indigenous/community land rights (FPIC — Free, Prior, and Informed Consent).

Enforcement Timeline

The regulation applies in two phases based on operator size:

- **Large operators (non-SMEs):** Enforcement from 30 December 2024. This covers the major EU importers (e.g., Neumann Kaffee Gruppe, VOLCAFE, Sucafina, Louis Dreyfus Company) and large roasters (Nestlé, JDE Peet's, Lavazza, illycaffè).
- **SME operators and traders:** Enforcement from 30 June 2025. This phase brings smaller importers, specialty roasters, and trading houses into scope.

After enforcement, any operator placing non-compliant coffee on the EU market faces penalties determined by each EU Member State, which must be "effective, proportionate and dissuasive." Penalties may include fines proportional to environmental damage and market value, confiscation of products, temporary exclusion from public procurement, and prohibition from using the simplified due diligence procedure.

Country Benchmarking System

The European Commission will classify producer countries into three risk tiers:

- **Low risk:** Simplified due diligence (reduced documentation requirements). Countries with negligible deforestation rates and robust governance frameworks may qualify.
- **Standard risk:** Full due diligence as described in Article 9. This is the default tier and where Colombia is expected to be classified initially.
- **High risk:** Enhanced due diligence with additional verification requirements, increased sampling rates for checks, and more frequent audits. Countries with high deforestation rates and weak enforcement may be classified here (e.g., parts of the Amazon frontier in Peru or Brazil).

The benchmarking assessment considers: rate of deforestation and forest degradation, rate of expansion of agriculture for relevant commodities, production trends, and information from indigenous peoples and local communities. The initial country benchmarking list was expected by 30 December 2024 but has been subject to delays. Colombia's classification will significantly impact the compliance burden on its ~540,000 coffee-farming families.

Interaction with Existing Certification Schemes

The EUDR explicitly states that existing voluntary sustainability certifications (Rainforest Alliance, UTZ — now merged into Rainforest Alliance, 4C, FairTrade International) do not automatically confer EUDR compliance. However, these certifications may partially satisfy due diligence requirements — particularly around farm-level traceability, environmental management plans, and audit trails. Operators using certified supply chains still need to independently verify geolocation and deforestation-free status against satellite data for the post-2020 cutoff date.

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EUDR Coffee — Colombia Supply Chain Profile

commodity	coffee
regulation	EU Regulation 2023/1115 (EUDR)
article9_fields	geolocation, supplier_identification, deforestation_free_date, due_diligence_statement
cutoff_date	2020-12-31
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Colombia's Coffee Sector at a Glance

Colombia is the world's third-largest arabica coffee producer and the second-largest global exporter of washed arabica. The sector comprises approximately 540,000 coffee-farming families (caficultores) spread across roughly 853,000 hectares in 22 departments and 590 municipalities. The average farm size is 1.5–2.0 hectares, making Colombia's coffee sector overwhelmingly smallholder-based — a structural characteristic that creates both compliance challenges (fragmented geolocation data) and opportunities (high traceability potential through cooperative networks).

Key Production Departments

Coffee production is concentrated in the Andean highlands between 1,200 and 2,000 metres above sea level. The six leading departments by production volume are:

- **Huila:** Colombia's #1 coffee department by volume. Located in the southern Andean corridor. Known for micro-lot specialty coffees. Altitude ranges from 1,200–1,900 masl. Approximately 83,000 coffee farms. Municipalities of Pitalito, Acevedo, and La Plata are flagship origins. Relatively low deforestation risk in core coffee zones, though frontier expansion toward the Amazon foothills (Caquetá border) warrants satellite monitoring.
- **Nariño:** Second-largest producer, bordering Ecuador. Extreme altitude coffee (1,600–2,300 masl) with slow cherry maturation yielding high cup quality. About 40,000 farms. The departments of Buesaco, La Unión, and Sandoná are key. Deforestation risk is moderate — the Pacific lowlands adjacent to coffee zones are biodiversity hotspots under pressure from illicit crops and cattle ranching.
- **Antioquia:** Historic coffee heartland. Includes the Eje Cafetero municipalities of Andes, Jardín, Ciudad Bolívar. Approximately 78,000 farms. Established infrastructure and cooperative networks make traceability relatively mature. Deforestation risk is lower in core zones but elevated in northeastern Antioquia (Bajo Cauca region).

- **Cauca:** High-altitude specialty origin. Inzá and Popayán micro-regions produce competition-grade lots. About 95,000 farms (many indigenous and Afro-Colombian communities). FPIC considerations under EUDR Article 9 legality requirements are particularly relevant here.
- **Tolima:** Central Andean corridor. Planadas, Ataco, and Rioblanco are key municipalities. Approximately 63,000 farms. Historically affected by armed conflict; post-peace-agreement land formalization processes intersect with EUDR land tenure verification requirements.
- **Caldas:** Part of the traditional Eje Cafetero (Coffee Axis). Manizales, Chinchiná, and Palestina are major origins. Mature cooperative infrastructure (Cooperativa de Caficultores de Manizales). Lower deforestation risk due to long-established coffee landscapes and protected areas (Los Nevados National Park buffer zone).

The FNC and Colombia's Coffee Institutional Framework

The Federación Nacional de Cafeteros (FNC) is a private entity with public functions, representing Colombia's coffee growers since 1927. For EUDR purposes, the FNC's institutional infrastructure is highly relevant:

- **Cédula Cafetera (Coffee ID):** A farmer-level identification card linked to farm plots registered in SICA. This can serve as the supplier identification field required by Article 9. Each cédula links to farm location, area planted, variety, and estimated production.
- **SICA (Sistema de Información Cafetera):** The FNC's comprehensive coffee information system containing georeferenced data on over 540,000 farms. SICA holds GPS coordinates of farm centroids and, for many farms, plot boundaries. This is Colombia's single most valuable existing dataset for EUDR geolocation compliance. However, SICA data quality varies — older records may have lower GPS precision (3–4 decimal places instead of the 5+ required), and boundary polygons are not available for all farms.
- **FNC Extension Service (Servicio de Extensión):** Over 1,500 extensionistas (field agents) who visit farms regularly. This network provides a ground-truth verification mechanism that, combined with satellite data, could form a robust MRV (Monitoring, Reporting, Verification) system for EUDR compliance.
- **Almacafé:** The FNC's logistics arm managing dry mills and export warehousing. Almacafé's lot tracking systems can link exported consignments back to cooperative purchase points and, through SICA, to individual farms.

EU Export Flows and Market Share

The European Union is Colombia's largest coffee export destination. Key EU market dynamics:

- **Germany:** Receives approximately 25% of Colombian green coffee exports. Hamburg is the primary entry port. Major importers include Neumann Kaffee Gruppe (via subsidiary Racafé in Colombia), VOLCAFE, and Bernhard Rothfos.
- **Belgium:** Antwerp serves as a re-export hub for coffee entering the broader EU market. Significant volumes are processed in Belgium for distribution across Northern Europe.
- **Italy:** Major destination for Colombian coffee destined for espresso blends. Lavazza, illycaffè, and Segafredo are key buyers. Italy values Colombian washed arabica for its clean cup profile and blend compatibility.
- **Spain:** Growing market for Colombian origin coffee, both commodity and specialty segments.

Total Colombian coffee exports to the EU typically represent 35–40% of the country's annual production of approximately 12–14 million 60-kg bags. At current market prices (C-price plus Colombian differential), the EU-bound volume represents USD 1.5–2.0 billion in annual export revenue — illustrating the economic stakes of EUDR compliance for Colombia.

Deforestation Risk Zones in Colombian Coffee Landscapes

While Colombia's core coffee zones (Eje Cafetero, northern Huila) are long-established agricultural landscapes with low recent deforestation, several frontier zones present elevated risk:

- **Caquetá-Huila border (Amazonian foothills):** Coffee expansion into previously forested areas at lower altitudes. IDEAM's SMBYC (Forest and Carbon Monitoring System) flags this corridor as an active deforestation frontier driven by cattle ranching, with coffee sometimes following as a secondary crop.
- **Putumayo:** Southern frontier department with both coffee production and active deforestation linked to road expansion and colonization.
- **Norte de Santander:** Border department with Venezuela. Deforestation driven by illicit crops and mining. Coffee zones in the Catatumbo region are adjacent to high-deforestation areas.
- **Sierra Nevada de Santa Marta:** Unique high-altitude origin with both indigenous territories and deforestation pressure from encroaching agriculture.

For EUDR compliance, operators sourcing from these higher-risk sub-regions will need to provide more robust satellite evidence and possibly third-party field verification to demonstrate that their specific plots were not deforested after 31 December 2020.


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EUDR Coffee — Geolocation & Traceability Requirements

commodity	coffee
regulation	EU Regulation 2023/1115 (EUDR)
article9_fields	geolocation, supplier_identification, deforestation_free_date, due_diligence_statement
cutoff_date	2020-12-31
enforcement_large	2024-12-30
enforcement_sme	2025-06-30
primary_country	Colombia
schema_version	1.1
last_updated	2026-05-27

Geolocation Specifications Under Article 9

The EUDR's geolocation requirement is the most technically demanding element of compliance for the coffee sector. The regulation distinguishes two cases based on plot area:

- **Plots > 4 hectares:** A polygon boundary is required — a set of latitude/longitude coordinate pairs (WGS84 datum) defining the perimeter of the production area. The polygon must be sufficiently precise to enable satellite-based deforestation monitoring. For Colombian coffee, this applies primarily to larger estates (haciendas) in departments like Caldas, Quindío, and parts of Antioquia.
- **Plots ? 4 hectares:** A single geolocation point (latitude, longitude) is sufficient. Given that the vast majority of Colombian coffee farms are under 4 hectares, the point-based requirement applies to the bulk of the sector. However, precision matters: coordinates must have at least 5 decimal places (approximately 1.1-metre accuracy at the equator) to enable meaningful satellite cross-referencing.

GPS Data Collection Methods for Smallholder Coffee Farms

Collecting geolocation data from 540,000 Colombian coffee farms requires scalable, cost-effective methods:

- **Smartphone GPS (assisted GPS/A-GPS):** Modern smartphones achieve 3–5 metre horizontal accuracy under open sky conditions. The FNC's extensionistas can use mobile apps (e.g., ODK Collect, KoBoToolbox, or custom apps) to record GPS waypoints during farm visits. Challenges: canopy cover in shade-grown coffee can degrade GPS accuracy to 10–15 metres; multipath errors in mountainous terrain are common.
- **Handheld GPS receivers:** Dedicated devices (Garmin eTrex, Trimble R1) offer 2–3 metre accuracy with SBAS correction. More expensive than smartphones but more reliable under canopy. Already used by some FNC extensionistas for SICA updates.

- **RTK/PPK GNSS:** Real-Time Kinematic or Post-Processed Kinematic systems achieve centimetre-level accuracy. Overkill for EUDR point requirements but valuable for polygon boundary mapping of larger plots. High equipment cost (USD 5,000–15,000) limits deployment to cooperatives or aggregation points.
- **Drone-based photogrammetry:** UAVs equipped with RTK GNSS can map plot boundaries with centimetre precision. Useful for polygon generation on medium-to-large farms. Regulatory constraints (Colombian CAA/Aerocivil drone regulations) and cost limit broad deployment.
- **Satellite-derived boundaries:** Using very high-resolution (VHR) optical imagery (Planet SkySat at 50 cm, Maxar WorldView at 30 cm) to digitize farm boundaries. Scalable but requires manual or AI-assisted delineation. The EU Joint Research Centre (JRC) is developing tools for this approach.

SICA as a Geolocation Foundation

The FNC's SICA database represents the most comprehensive existing geolocation resource for Colombian coffee. SICA contains:

- Farm centroid coordinates for over 540,000 registered fincas
- Parcel-level data including area planted to coffee (hectares), coffee variety (Castillo, Caturra, Colombia, Typica, Bourbon), plant age, and shade tree species
- Historical update records from extensionista visits

SICA's limitations for EUDR compliance include: variable coordinate precision (some older records use 3–4 decimal places), incomplete polygon coverage (most farms have centroids only, not boundaries), and update frequency (some records may not reflect recent changes in planted area). Upgrading SICA to EUDR-grade precision is a priority project that several CLP-affiliated startups and international development partners are supporting.

Satellite Verification for Deforestation-Free Status

The deforestation-free verification step requires comparing the geolocated plot against historical satellite imagery to confirm no forest loss occurred after the 31 December 2020 cutoff. Key platforms and data sources:

- **Global Forest Watch (GFW):** Operated by the World Resources Institute (WRI). Provides annual tree cover loss data based on Landsat imagery (30 m resolution). Free and publicly accessible. The GFW API can be queried programmatically with geolocation coordinates to check for alerts. Limitation: 30 m resolution may miss small-scale deforestation on fragmented smallholder plots.
- **IDEAM/SMBYC:** Colombia's Instituto de Hidrología, Meteorología y Estudios Ambientales operates the Sistema de Monitoreo de Bosques y Carbono. SMBYC produces quarterly deforestation bulletins at 12.5-metre resolution (using Sentinel-1 SAR data) — significantly more granular than GFW. The Early Warning System (AT-D) provides near-real-time alerts. IDEAM data is the authoritative national source and should be the primary reference for Colombian coffee EUDR compliance.
- **Copernicus/Sentinel-2:** EU's own satellite constellation providing 10-metre multispectral imagery with a 5-day revisit time. Free data via Copernicus Open Access Hub. Sentinel-2 NDVI time series can detect forest-to-agriculture conversion. The EU may require Sentinel-2 as the baseline verification source given it is an EU-operated system.
- **Planet Labs (PlanetScope):** Commercial constellation providing daily 3-metre imagery globally. High temporal frequency enables detection of rapid land use change. Planet's Forest Carbon Diligence product is specifically designed for EUDR-style verification. Cost: commercial subscription required.
- **NICFI (Norway's International Climate and Forests Initiative):** Provides free access to high-resolution Planet basemaps (4.77 m) for tropical countries, including Colombia. Monthly mosaics since September 2020 — almost exactly aligned with the EUDR cutoff date. NICFI data is the most cost-

effective high-resolution source for Colombian coffee EUDR verification.

Traceability Architecture: From Farm to Port

EUDR compliance requires an unbroken chain of custody linking the exported consignment to the geolocated production plot. For Colombian coffee, this chain typically involves:

1. **Farm level:** Caficultor harvests cherry, performs wet processing (despulpado, fermentation, washing) on-farm. Parchment coffee (café pergamino) is dried. The farm is identified by cédula cafetera number and SICA GPS coordinate.
2. **Purchase point (punto de compra):** Parchment coffee is sold to a cooperative, private buyer (comercializador), or directly to the FNC at a guaranteed minimum price (precio de sustentación). The purchase transaction records the seller's cédula cafetera, volume (kg), and quality grade. This is the critical aggregation point where farm-level traceability must be maintained.
3. **Dry mill (trilladora):** Parchment is hulled to produce green (excelso) coffee. Almacafé operates the FNC's trilladoras. Lot identity must be preserved or, if blending occurs, the lot must carry geolocation data for all contributing farms.
4. **Export warehouse:** Green coffee is graded, sampled, and prepared for shipment. The ICO (International Coffee Organization) export certificate and Colombian export documentation (DEX — Declaración de Exportación) are prepared.
5. **Port (Buenaventura, Cartagena, Santa Marta, Barranquilla):** Container loading. The DDS (Due Diligence Statement) must be submitted to the EU Information System before the shipment clears EU customs.

Blockchain and digital platforms (Farmer Connect, IBM Food Trust, iFinca) can create tamper-evident records at each step. However, the critical weak link remains the purchase point, where parchment from multiple farms may be commingled. Maintaining lot segregation or digital mass-balance at this node is essential for EUDR compliance.


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EUDR Coffee — Due Diligence & Compliance Pathways

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enforcement_large	2024-12-30
enforcement_sme	2025-06-30
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The Three-Step Due Diligence Framework

Article 8 of the EUDR establishes a mandatory three-step due diligence process that every operator must complete before placing coffee on the EU market. This is not optional due diligence — it is a legal prerequisite for market access.

Step 1: Information Collection

The operator must collect all Article 9 information for the specific consignment:

- Geolocation coordinates (point or polygon) of every production plot that contributed to the consignment
- Description and quantity of the product, including Combined Nomenclature (CN) code
- Country of production (and, if applicable, parts thereof — i.e., department/municipality in Colombia)
- Supplier identification: name, postal/email address, and where applicable, registration number for each actor in the supply chain
- Buyer identification: name, postal/email address for the entity receiving the product in the EU
- Date or time range of production (harvest season)
- Adequately conclusive and verifiable information that the products are deforestation-free
- Adequately conclusive and verifiable information that the production was in compliance with the relevant legislation of the country of production

Step 2: Risk Assessment

Based on the collected information, the operator must assess the risk that the coffee is non-compliant. The risk assessment must consider:

- **Country or sub-national risk:** The Commission's benchmarking classification (low/standard/high risk) for the country or region of production. For Colombia, this may vary sub-nationally — Eje Cafetero is inherently lower risk than the Caquetá-Amazon frontier.

- **Prevalence of deforestation:** Historical deforestation rates in the specific sourcing area, assessed using satellite data (GFW, IDEAM/SMBYC, Sentinel-2).
- **Concerns related to the country of production:** Governance quality, enforcement capacity, corruption indices, land tenure formalization status, conflict-related displacement.
- **Complexity of the supply chain:** More intermediaries increase the risk of traceability breaks. Direct-trade and cooperative-channel supply chains present lower risk than spot-market purchases through multiple brokers.
- **Risk of circumvention:** Whether the product may have been mixed with non-compliant coffee, re-exported through a third country to disguise origin, or had fraudulent documentation.
- **Complementary information:** Satellite imagery analysis, existing certifications (Rainforest Alliance, 4C, FairTrade), third-party verification reports, and information from civil society organizations.

Step 3: Risk Mitigation

If the risk assessment reveals anything other than negligible risk, the operator must take adequate and proportionate risk mitigation measures. These may include:

- Requesting additional information or documentation from suppliers
- Commissioning independent third-party audits or field verification
- Obtaining satellite imagery analysis for the specific production plots for the post-2020 period
- Engaging with local stakeholders or civil society for ground-truth information
- For blended lots: obtaining geolocation and deforestation-free evidence for each contributing farm

Only when risk is assessed as negligible (after mitigation if initially elevated) may the operator proceed to submit the Due Diligence Statement.

The Due Diligence Statement (DDS)

The DDS is the formal declaration that the operator submits to the EU's EUDR Information System before the product enters the EU market. Key requirements:

- The DDS must be submitted electronically through the designated EU IT platform
- It must reference all Article 9 information and confirm that due diligence has been exercised
- The DDS receives a unique reference number that must accompany the product through EU customs
- Operators must retain all supporting documentation for at least 5 years from the date of the DDS
- Competent authorities in EU Member States may inspect the DDS and underlying documentation at any time during the retention period
- False or misleading DDS submissions constitute a violation subject to the full penalty regime

The Role of FNC's Cédula Cafetera in Compliance

Colombia has a structural advantage over many coffee-producing countries: the FNC's cédula cafetera system already provides a farm-level identification and registration mechanism that maps closely to EUDR requirements. A compliance pathway leveraging the cédula cafetera would work as follows:

1. The caficultor's cédula cafetera number serves as the supplier identification (linked to the national ID — cédula de ciudadanía)
2. SICA provides the geolocated farm data associated with that cédula cafetera
3. At the purchase point, the cooperative records the cédula cafetera number against the parchment coffee purchased, creating the first traceability link
4. Through the dry mill and export chain, the cédula cafetera-linked lot data flows forward

5. The exporter cross-references the farm's SICA coordinates against IDEAM/SMBYC and GFW data to verify deforestation-free status
6. If verification passes, the DDS is submitted with the geolocation data and cédula cafetera-based supply chain record

This pathway is viable for the ~70% of Colombian coffee that flows through FNC-affiliated cooperatives. For the ~30% that moves through private channels (comercializadores privados), parallel traceability systems must be established.

Simplified Due Diligence for Low-Risk Countries

If the European Commission classifies Colombia (or specific sub-regions) as low risk, operators sourcing from those areas would benefit from simplified due diligence: reduced information requirements, lower verification intensity, and faster DDS processing. This creates a strong incentive for Colombia to invest in national-level deforestation monitoring and EUDR compliance infrastructure — as a low-risk classification would reduce the compliance burden on all 540,000 coffee families and maintain market competitiveness relative to other origins.

Third-Party Verification and Audit Frameworks

Several third-party verification frameworks are emerging or adapting to serve EUDR compliance needs:

- **Rainforest Alliance (RA):** Updated its 2020 standard to include geolocation data collection and deforestation monitoring. RA's farm data can partially satisfy EUDR Article 9 requirements, but operators must independently verify the data and cannot rely solely on RA certification as EUDR compliance.
- **4C (Common Code for the Coffee Community):** Provides a baseline sustainability standard with some traceability elements. Less granular than RA for EUDR purposes but covers a larger share of the global coffee trade.
- **Proforest/3PRCL:** Emerging EUDR-specific verification services offering satellite-based deforestation risk assessment integrated with supply chain data.
- **SGS, Control Union, Bureau Veritas:** Traditional auditing firms developing EUDR compliance verification products, including field audits and documentary review.


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EUDR Coffee — Technology & MRV Solutions

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Satellite Monitoring for Deforestation Detection

Satellite-based monitoring is the backbone of EUDR deforestation-free verification. The technology stack for coffee compliance combines multiple sensor types:

- **Sentinel-2 (Copernicus):** EU-operated optical satellite constellation with 10-metre spatial resolution and 5-day revisit time. Freely available. Band combinations (B8-NIR, B4-Red, B3-Green) enable NDVI (Normalized Difference Vegetation Index) time series analysis for detecting forest-to-agriculture conversion. Cloud cover is the main limitation in tropical Andean coffee zones — wet-season imagery may have 60–80% cloud cover in departments like Nariño and Cauca.
- **Sentinel-1 (SAR — Synthetic Aperture Radar):** All-weather, day/night imaging. C-band SAR penetrates cloud cover, making it essential for tropical monitoring. IDEAM's SMBYC uses Sentinel-1 as its primary data source for quarterly deforestation bulletins. Radar backscatter changes indicate forest loss regardless of cloud conditions. 12-day revisit cycle at 10-metre resolution.
- **Planet Labs (PlanetScope):** Commercial constellation of 200+ CubeSats providing daily 3-metre optical imagery globally. High temporal frequency enables detection of rapid land use change between Sentinel-2 passes. Planet's Forest Carbon Diligence product packages time-series analysis specifically for EUDR-type verification. NICFI agreement provides free access to Planet basemaps (4.77 m monthly mosaics) for tropical countries.
- **Maxar (WorldView):** Very high-resolution (30–50 cm) optical imagery for targeted verification of specific plots. Too expensive for blanket monitoring but valuable for investigating flagged alerts or disputed cases. Can distinguish individual coffee plants from forest trees.
- **Landsat (NASA/USGS):** 30-metre resolution, 16-day revisit. The source data for GFW's annual tree cover loss product. Long archive (1984–present) provides historical context for land use change analysis. Lower resolution limits utility for smallholder-scale verification.

AI and Machine Learning for Deforestation Detection

Raw satellite imagery requires processing to detect deforestation events. Machine learning models are increasingly central to this processing:

- **Random Forest / Gradient Boosting classifiers:** Traditional ML approaches for land cover classification using multi-spectral band features. Widely used in national monitoring systems including IDEAM/SMBYC. Require hand-crafted features but are computationally efficient and well-understood.
- **Convolutional Neural Networks (CNNs):** Deep learning models (U-Net, DeepLabV3+) trained on labelled satellite imagery for pixel-level land cover segmentation. Can distinguish coffee plantations from primary forest, secondary growth, and other crops. Require substantial labelled training data — the JRC and WRI are building labelled datasets for tropical land use.
- **Change Detection Algorithms:** Bi-temporal or time-series algorithms that compare satellite imagery across dates to identify forest loss events. BFAST (Breaks For Additive Season and Trend) and LandTrendr are established approaches. Applied to EUDR: compare a baseline image from before the 31 December 2020 cutoff with current imagery to detect changes.
- **SAR-optical fusion:** Combining Sentinel-1 SAR (cloud-penetrating) with Sentinel-2 optical data for robust all-weather deforestation detection. Research from IDEAM and international partners has demonstrated improved accuracy in cloud-prone regions like the Colombian Pacific and western Andes.

Traceability Platforms and Digital Solutions

Several technology platforms are positioning themselves for EUDR coffee traceability:

- **Farmer Connect:** Swiss-based platform using blockchain (Hyperledger Fabric) to create transparent supply chains from farm to cup. Already deployed with major roasters. The platform's "Thank My Farmer" consumer-facing app enables end-to-end traceability. EUDR adaptation involves adding geolocation fields and deforestation verification to existing supply chain records.
- **IBM Food Trust:** Enterprise-grade blockchain platform for food supply chain transparency. Coffee was an early use case, with pilot deployments in Colombia and Brazil. IBM Food Trust can store and share EUDR Article 9 data across supply chain participants with permissioned access.
- **iFinca:** Colombian-developed platform specifically designed for Colombian coffee traceability. Integrates with FNC cooperative systems. Mobile app for farm-level data capture including GPS coordinates, quality assessments, and transaction records. Strong alignment with EUDR requirements due to Colombia-specific design.
- **Yara Digital (FarmGo):** Agricultural input company Yara's digital farming platform includes GPS-enabled farm mapping and input tracking. While primarily designed for precision agriculture, the geolocation and farm data infrastructure is adaptable for EUDR compliance.
- **Sourcemap:** Supply chain mapping platform that visualizes multi-tier supply chains and integrates satellite deforestation data. Used by several large consumer goods companies for commodity traceability.
- **Meridia (Cadasta Foundation):** Land documentation platform that helps smallholder farmers establish GPS-verified land boundaries and digital land records. Relevant for the EUDR legality requirement, particularly in Colombian departments where land tenure is informal or disputed.

Blockchain for Tamper-Evident Compliance Records

Blockchain technology offers specific advantages for EUDR compliance data management:

- **Immutability:** Once geolocation data and deforestation verification results are recorded on-chain, they cannot be retroactively altered — important for the 5-year documentation retention requirement.
- **Interoperability:** Multi-party supply chains (farmer, cooperative, exporter, importer, roaster) can share a common, trusted record without relying on a single centralized database.

- **Auditability:** EU competent authorities can verify compliance records without depending on any single actor's data systems.

However, blockchain alone does not solve the "garbage in, garbage out" problem — if the initial GPS coordinate or deforestation assessment is incorrect, the immutable record simply preserves incorrect data. Ground-truth verification and satellite cross-referencing remain essential inputs.

IoT Sensors and Precision Agriculture

Internet of Things (IoT) devices are emerging as supplementary tools in the EUDR compliance ecosystem:

- **GPS-enabled soil/weather sensors:** Devices deployed on coffee farms that continuously record location (confirming the farm is where it claims to be) along with agronomic data (soil moisture, temperature, rainfall). Can serve as supplementary geolocation evidence.
- **Smart weighing scales at purchase points:** Connected scales that record the weight of parchment coffee purchased, linked to the seller's cédula cafetera and GPS timestamp. Automating the purchase-point data capture reduces manual data entry errors — a critical vulnerability in traceability chains.
- **Cold-chain and logistics sensors:** Temperature and humidity loggers in export containers that create a continuous record from warehouse to port to EU destination, supporting chain-of-custody documentation.

CLP Startup Ecosystem for EUDR Traceability

The CleanTech Hub's Climate Launchpad (CLP) program has identified and supported startups developing EUDR-relevant technologies in LATAM. This ecosystem includes ventures working on satellite-based monitoring tools adapted for smallholder contexts, mobile-first traceability apps designed for low-connectivity rural areas, AI models trained on Colombian landscape data for coffee-specific land cover classification, and digital cooperative management platforms that integrate EUDR data collection into existing workflows. These startups represent a local innovation layer that complements the large-platform solutions and can address Colombia-specific challenges like SICA integration, cédula cafetera linkage, and the unique characteristics of Andean shade-grown coffee landscapes.


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EUDR Coffee — LATAM Country Exposure

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LATAM Coffee Producers and EUDR Exposure

Latin America dominates global coffee production and is disproportionately affected by the EUDR. The region accounts for approximately 55–60% of global coffee output and an even higher share of EU imports. Four LATAM countries illustrate the range of EUDR exposure levels, compliance readiness, and deforestation risk profiles.

Colombia — Medium Risk, High Readiness

Colombia's EUDR exposure profile is characterized by a large, fragmented smallholder base combined with relatively strong institutional infrastructure for compliance.

- **Farm count:** ~540,000 coffee families across 853,000 hectares in 22 departments
- **Average farm size:** 1.5–2.0 hectares (virtually all below the 4-hectare polygon threshold)
- **EU export share:** 35–40% of annual production (~12–14 million 60-kg bags total)
- **Deforestation risk:** Medium overall. Core coffee zones (Eje Cafetero, Huila highlands) are long-established with low recent deforestation. Frontier zones (Caquetá border, Putumayo, Norte de Santander) present elevated risk. IDEAM reports approximately 171,000 hectares of national deforestation annually (all causes, all commodities), with coffee directly responsible for a small fraction.
- **Compliance readiness:** High relative to peers. SICA provides geolocated farm data for most registered farms. FNC cooperative network covers ~70% of production with existing traceability systems. Cédula cafetera provides supplier identification. IDEAM/SMBYC offers authoritative national deforestation monitoring. Key gaps: SICA GPS precision upgrades needed, polygon mapping incomplete, private-channel traceability (~30% of production) underdeveloped.
- **Expected benchmarking classification:** Standard risk (initial). Potential for sub-national differentiation if the Commission allows regional benchmarking.

Peru — Higher Risk, Lower Readiness

Peru is Latin America's second-largest coffee exporter and faces more acute EUDR compliance challenges than Colombia.

- **Farm count:** ~223,000 coffee families across approximately 425,000 hectares, primarily in the selva alta (high jungle) and ceja de selva (jungle brow) ecological zones
- **Key regions:** Junín (Satipo, Chanchamayo — Peru's largest coffee zone), San Martín (Moyobamba, Lamas, Tarapoto), Cajamarca (Jaén, San Ignacio), Amazonas (Rodríguez de Mendoza, Bagua), Cusco (La Convención/Quillabamba)
- **Average farm size:** 2–5 hectares, larger than Colombia's average, with more farms potentially requiring polygon mapping
- **Deforestation risk:** HIGH. Peru's Amazon deforestation is the highest in the Andean region. The Junín and San Martín departments — Peru's top coffee zones — are also among the country's highest deforestation areas. Coffee expansion into primary forest is documented in Junín (Ene-Apurímac-Mantaro valley), where farmers clear forest for new coffee plantings at lower altitudes. SERFOR (Peru's forest authority) and MINAM (environment ministry) monitoring systems exist but are less mature than Colombia's IDEAM.
- **Compliance readiness:** LOWER than Colombia. Peru lacks an equivalent to SICA — there is no comprehensive national coffee farm registry with GPS coordinates. Cooperatives (e.g., Cooperativa Agraria Cafetalera Pangoa, CAC La Florida) maintain some farm data, but coverage is fragmented. SENASA (national agricultural health service) has some farm registration data, but it was not designed for EUDR-grade traceability. JNC (Junta Nacional del Café) is coordinating national response but lacks the institutional density of FNC.
- **Expected benchmarking classification:** Standard to high risk, depending on the sub-national assessment. San Martín, with its REDD+ program experience, may score better than Junín.

Guatemala — Mixed Risk by Region

Guatemala is Central America's largest coffee producer and a significant EU supplier, particularly to Germany and Belgium.

- **Farm count:** ~125,000 coffee producers across approximately 305,000 hectares
- **Key regions:** Huehuetenango (Highland specialty, 1,500–2,000 masl — very low deforestation risk in established coffee zones), Antigua Guatemala (volcanic soils, historic coffee landscape, minimal deforestation), Cobán/Alta Verapaz (lower altitude, significant deforestation driven by cattle and palm oil — coffee is secondary), Fraijanes, San Marcos, Atitlán
- **Deforestation risk:** Mixed. Highland zones (Huehuetenango, Antigua, Atitlán) are established coffee landscapes with low deforestation. Lowland zones (Petén border, Alta Verapaz, Izabal) have high deforestation driven primarily by cattle ranching and palm oil, with coffee sometimes present as an adjacent crop. Guatemala lost approximately 61,000 hectares of tree cover annually in recent years (GFW data).
- **Compliance readiness:** Moderate. Anacafé (Asociación Nacional del Café) maintains some farm registry data, but coverage and GPS precision are uneven. Guatemala's specialty coffee sector (Huehuetenango, Antigua) has relatively mature traceability through direct-trade relationships. The commodity segment moving through larger fincas and intermediaries has weaker traceability infrastructure. INAB (Instituto Nacional de Bosques) provides forest monitoring, but with less granularity than IDEAM.
- **FPIC considerations:** Significant indigenous population (Maya) in coffee-producing highlands. EUDR legality requirement includes compliance with indigenous peoples' rights and land tenure. Guatemala's complex land tenure history (post-conflict) adds compliance layers.

El Salvador — Low Risk, Specialty Focus

El Salvador is a small but notable coffee producer with one of the lowest deforestation risk profiles in the LATAM coffee sector.

- **Farm count:** ~20,000 coffee producers across approximately 140,000 hectares
- **Key regions:** Apaneca-Ilamatepec (highest-quality zone, volcanic soils), El Bálsamo-Quetzaltepec, Chinchontepec, Tecapa-Chinameca, Cacahuatique. All are long-established shade-grown coffee systems.
- **Deforestation risk:** LOW. El Salvador is one of the most deforested countries historically (only ~12% forest cover remaining), but current deforestation rates are among the lowest in Central America. Coffee in El Salvador is almost entirely shade-grown under existing forest canopy — meaning coffee production actually conserves rather than threatens forests. The Bourbon, Pacamara, and Pacas varieties grown under traditional shade systems make El Salvador's coffee inherently aligned with EUDR deforestation-free requirements.
- **Compliance readiness:** Moderate to high for the specialty segment. CSC (Consejo Salvadoreño del Café) provides institutional coordination. Farm sizes are larger on average (many traditional estates — beneficios), simplifying geolocation data collection. The specialty/direct-trade segment (a large share of El Salvador's small export volume) already has strong traceability. EU export volume is relatively small, reducing the total compliance infrastructure needed.
- **Market access implication:** El Salvador could be an early beneficiary of the low-risk country benchmarking classification, which would confer simplified due diligence and make Salvadoran coffee particularly attractive to EU operators seeking lower compliance costs.

Comparative Risk Matrix

Country	Coffee Farms	EU Export Exposure	Deforestation Risk	Compliance Readiness	Expected Benchmarking
Colombia	~540,000	High (35–40% of production)	Medium (frontier zones elevated)	High (SICA, FNC, IDEAM)	Standard
Peru	~223,000	High (EU major destination)	High (Amazon frontier expansion)	Lower (no unified farm registry)	Standard to High
Guatemala	~125,000	Moderate to High	Mixed (low in highlands, high in lowlands)	Moderate (Anacafé partial coverage)	Standard
El Salvador	~20,000	Low (small volume, specialty)	Low (shade-grown, minimal deforestation)	Moderate to High (specialty traceability)	Low (potential)

Market Access Implications

The EUDR creates asymmetric market access conditions based on compliance readiness. Countries and supply chains that achieve compliance early gain competitive advantage — EU roasters and importers will preferentially source from "EUDR-ready" origins to minimize regulatory risk and compliance costs. This dynamic could reshape coffee trade flows:

- **Premium for compliance:** EUDR-compliant coffee may command a quality-neutral premium as EU operators pay for regulatory certainty. Early estimates suggest a 2–5 cent/lb compliance premium could emerge, especially in the transition period.
- **Supply chain consolidation:** Larger cooperatives and exporters with existing traceability infrastructure will absorb market share from smaller actors unable to meet EUDR requirements. This could accelerate consolidation in Colombian coffee exports.
- **Trade diversion risk:** Non-compliant coffee may be diverted from the EU market to non-EUDR destinations (USA, Japan, South Korea), creating a two-tier market. However, since the EU represents 35–40% of Colombian coffee demand, market diversion is not a viable long-term strategy for major origins.
- **National compliance investment:** Countries that invest in national-level compliance infrastructure (farm registries, satellite monitoring integration, DDS facilitation platforms) will reduce per-farm

compliance costs and maintain market access. Colombia's existing SICA/FNC/IDEAM infrastructure positions it well for this investment.


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