EUDR Coffee — Technology & MRV Solutions

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
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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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