CREDIBLE
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Earth Observation (EO) for Monitoring, Reporting, and Verification (MRV) of Carbon Farming (CF) - EO across the Carbon Value Chain

Follow up report on the activities of the Focus Group on "Earth Observation for the Monitoring, Reporting, and Verification of Carbon Farming" & "Uncertainty & Benchmarking"

Milestone #3

Project CREDIBLE: "Building momentum and trust to achieve credible soil carbon farming in the EU".

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Carbon farming: Any practice or process, carried out over an activity period of at least five years, related to the management of a terrestrial or coastal environment and resulting in the capture and temporary storage of atmospheric or biogenic carbon in biogenic carbon pools, or in the reduction of soil emissions (Regulation 2024/3012 Article 2).

Title

Earth Observation (EO) for Monitoring, Reporting, and Verification (MRV) of Carbon Farming (CF[1]) - EO across the Carbon Value Chain

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Focus Group Vision

Earth observation contributes significantly to the EU's journey to climate neutrality by 2050. This third draft report is based on ongoing discussions, which should support high-level conversations to shape robust carbon farming markets and policies by sharing stakeholders' knowledge and experiences, upscaling solutions, and enabling the multiplication of climate actions[2] .

Disclaimer: the paper is a collaborative effort and may not necessarily reflect the views of all individual authors and contributors, or the entities they are affiliated with.

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[2] EARSC members participating in the Working Group on Carbon Removals, including: Airbus, Constellr, Disiatek, EarthDaily Agro, e-geos, EOanalytics, Geosat, Geoville, GMV, Latitudo40, OHB, OpenCosmos, Planet, Planetek Italia, Space4Good, TerraNIS and Vortex. Credible Focus Groups (FGs) on Earth Observation (EO) for Monitoring, Reporting, and Verification (MRV) of Carbon Removals, which include: AgroApps, AUTH/MRV4SOC, BeZero, CarbonFarm, CinSoil GmbH, CMCC, Constellr, Copa-Cogeca, CREA, DG CLIMA, EarthDaily, eAgronom, EEA, e-geos, ESA, EURAF, Geosat, Geoville, INRAE, LoamIn, NetCarbon, Planetek Italia, Regen Insight, SAE SL, SouthPole, UCSC/MARVIS, and UFZ. The content is also informed by discussions held during key workshops, such as the ESA–EEA Workshop on EO for Monitoring, Reporting, and Verification of Carbon Removals.

1. Introduction

1.1 Context

Earth Observation (EO) offers powerful capabilities to monitor land use, detect changes, and quantify carbon dynamics at scale. Yet its adoption in carbon farming remains uneven. Fragmented stakeholder landscapes, different methodological protocols, and the absence of clear acceptance thresholds for uncertainty and validation continue to limit EO integration into Monitoring, Reporting, and Verification (MRV) systems. As a result, EO is often used only to map and confirm the location and boundaries of project plots, for crop detection or land use change verification, rather than being embedded as a standard component of robust, scalable carbon farming MRV.

1.2 Policy Background

Under the Paris Agreement (COP21), 195 parties must report annually on their anthropogenic greenhouse gas (GHG) emissions and removals to the United Nations Framework Convention on Climate Change (UNFCCC). Countries committed to the Global Stocktake (GST) collectively contribute to the overarching aim of reducing the global temperature rise to well below 2°C above pre-industrial levels, while pursuing efforts to limit it to 1.5°C. In Europe, the Directorate General for Climate Action (DG-CLIMA) is responsible for implementing climate policies. To reach carbon neutrality by 2050, there are various policies under the umbrella of the Green Deal, such as the Carbon Removal and Carbon Farming Regulation (CRCF), the Nature Restoration Regulation (NRR), the Soil Monitoring Directive, the Effort Sharing Regulation (ESR), and the Land Use, Land-Use Change, and Forestry (LULUCF) Regulation. The successful implementation of these policies relies on advanced monitoring technologies such as Copernicus Data Space Ecosystem (CDSE), and derived information products. This policy ambitiously provides an opportunity to develop EO MRV methodologies. The CRCF, adopted in December 2024[3], explicitly mentions that the monitoring of emissions and removals *"should be based on an appropriate combination of on-site measurements with remote sensing or modelling and make the best use of advanced technologies available under Union programmes, such as in the Copernicus component of the Union Space Programme"* and the use of *"digital technologies, including remote sensing when*

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202403012

establishing standardised baselines and ensuring robust monitoring." The certification scheme will be assessed against the EO MRV methodologies specifically defined for the agriculture, forestry, and peatland carbon pools by the EU Expert Group on carbon removals, as set out in the Carbon Farming Delegated Act expected in 2026. To complement the regulatory framework of the CRCF, the EU Bioeconomy Strategy, announced in December 2025, includes three new initiatives: the creation of an EU Buyers' Club which should pool voluntary demand for carbon farming and permanent carbon removals; an EU Carbon Farming Database of models, emission factors, remote sensing products, and benchmarking datasets; and the planned CRCF methodology for Carbon Storage in Buildings. Alongside these regulatory and demand-side developments, buyers and financial actors are increasingly using independent market transparency tools, such as carbon credit ratings, to compare performance and delivery risk across carbon removal projects. While these tools may not be formally integrated into the CRCF governance framework, they rely on certified MRV outputs and registry data. This makes project-level transparency and data accessibility under the CRCF particularly important for downstream market interpretation and decision-making.

In parallel, the international cooperation framework under Article 6 of the Paris Agreement is becoming increasingly relevant for EU climate policy. Recent EU decisions allow Member States to use internationally transferred mitigation outcomes (ITMOs) for up to 5% of their 2040 target compliance, provided that strong environmental integrity safeguards are in place. This creates a direct link between EU domestic MRV systems and the Article 6 infrastructure being developed globally. Robust EO-based monitoring therefore becomes essential, not only for CRCF and LULUCF reporting, but also for ensuring comparability, transparency, and uncertainty management when EU Member States engage in Article 6 transactions. As cooperation under Articles 6.2 and 6.4 expands, the alignment of EO methodologies, data quality requirements, and reporting formats will be critical to ensure that internationally acquired units meet EU integrity thresholds and can be reliably integrated into national emission balance sheets.

All these policy and market developments make it clear that EO should move beyond isolated pilots and become a more standard input for carbon farming MRV. The practical question now is: who will use EO, for what purpose, and with which tools? This includes identifying the EO technologies that can support key MRV steps, the institutions that will need to accept and rely on EO evidence (authorities, methodology developers, VVBs, registries, project developers, buyers), and what capacity already exists versus what still needs to be built (data access, reference datasets, benchmarking, interoperability, and reporting pipelines). For this reason, the next section maps the carbon-removal value chain to show where EO can add auditable value and where adoption bottlenecks still remain.

1.3 Objective

The objective of this document is to map the carbon-removal value chain: who the actors are and where EO adds measurable, auditable value to some elements of the MRV stages within the stakeholders' workflows (baseline setting, activity detection, soil/biomass sampling design, continuous monitoring, etc.). In parallel, it will diagnose adoption bottlenecks (method misalignment, uneven acceptance of EO evidence, interoperability/metadata gaps, limited validation datasets, capacity constraints and procurement/finance frictions). Finally, it will turn that diagnosis into practical recommendations to accelerate trusted, cost-efficient EO uptake for carbon farming and carbon removals.

In order to do so, it will highlight actors currently foreseen under the implementation of the EU CRCF, as well as the main actors within the Voluntary Carbon Markets (VCM). This paper does not aim to map in detail to each actor the added value of EO for their workflows (whether CRCF or VCM, or compliance markets). Neither does it aim to address potential overlaps between actor categories in the different frameworks. It rather aims to provide an overview of the main opportunities and bottlenecks of using EO in MRV across the carbon-removal value chain, taking the main actors of the VCM and the CRCF as examples to better visualise/understand these opportunities/bottlenecks.

It is intended as a first step towards starting a conversation on the opportunities and bottlenecks of using EO in MRV in the carbon markets. Subject to stakeholder interest and policy needs, it could be followed by more detailed, market-specific analyses (e.g. VCM, CRCF) to support targeted recommendations and implementation pathways.

This report builds on the findings from the previous two CREDIBLE FG3.3 reports: the 2024 report[4] "EO-based MRV methodologies" which mapped the emerging landscape of EO-supported MRV approaches for carbon farming and identified key technical and

[4] https://www.project-credible.eu/consultations-2024

governance gaps across MRV stages; and the 2025 report,[5] which focused on major sources of uncertainty, the need for transparent benchmarking frameworks and the role of reference datasets and testbeds in comparing methods.

1.4 Scope & Sources

The analysis presented here synthesises insights from the CREDIBLE Focus Group discussions (2024-2026), EARSC working groups, EARSC EXPANDEO (annual event) exchanges[6], and targeted stakeholder consultations (including from the Confederation of European Forest Owners (CEPF)[7] member organisations, summarising forest owners' experiences with EO in forest carbon markets across several EU countries). Together, these inputs capture the perspectives of EO providers, landowners, project developers, validation and verification bodies (VVBs), registries, financiers, and policymakers, offering a representative view of the evolving EO-MRV ecosystem.

1.5 Principle

EO complements field measurements by providing repeat and consistent measurements of the land surface that can be calibrated to field observations, providing a cost-effective data source for filling spatial and temporal gaps. The operating principle for EO should be integration with field data[8]. This can take several forms. EO data can be used to identify and delineate strata with similar environmental and management conditions, enabling robust soil and biomass sampling designs. Through calibration and validation with field measurements, EO data can support the estimation of aboveground biomass at the field plot scale. Change detection alerts can be integrated with field surveys to quantify or validate the uncertainty of detections. EO can also guide where new field measurements are most needed to optimise site planning.

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[5] https://www.project-credible.eu/consultations/FG_33

[6] EXPANDEO 2025: Earth Observation and Carbon Markets: Navigating the Value Chain ; EXPANDEO 2024: THE CARBON REMOVALS CERTIFICATION FRAMEWORK (CRCF)

[7] Confederation of European Forest Owners (CEPF) (https://www.cepf,-eu.org/)

[8] https://newsletter.cecil.earth/p/towards-mutualism-reconciling-differences

2. Value Chain Actors & How They Use EO

Across the carbon farming and carbon-credit value chain, a diverse set of actors play distinct but interconnected roles. This section provides an overview of these different actors, using the VCM and the EU CRCF as examples. The section is organised in three parts: (i) the main actors in the VCM, (ii) the main actors foreseen under the CRCF and (iii) an overview of how EO supports the end-to-end value chain, which is detailed in Table 1, using CRCF stakeholder terminology.

Main actors in the VCM

In the VCM, public authorities and policy makers, through different regulations or (climate) policies, mandate or encourage carbon removals, thus incentivising/driving demand for carbon projects and carbon markets.

Within the project layer[9], landowners/land managers[10] act as project owners/hosts or are aggregated by developers[11]. Project developers design and manage carbon projects that enable the generation of carbon removals or “avoided” emissions. Validation and verification bodies (VVBs) independently confirm that project data meet methodological requirements.

Ratings agencies provide transparency to carbon markets through independent assessments of credit integrity. Carbon rating agencies can play an important role in any transaction within the value chain and allow market actors to compare credits and make risk informed decisions on carbon projects of any type at any stage.

In parallel, the financial/enabling layer supplies capital and resilience: banks and investors fund projects and price risk, and insurers underwrite reversal and catastrophe exposures. Whereas the market layer lists and transfers units via brokers/marketplaces, while (corporate) buyers purchase and retire credits for claims.

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[9] At the project implementation level (i.e., where activities are carried out on the ground)

[10] They may also act as operators under CRCF when they implement the activity directly

[11] Note that input from CEPF members shows that forest owners have differing levels of involvement in carbon markets (VCM or potential CRCF), with some quite established (e.g. Estonia, France), some where there are some activities or interest (e.g. Denmark, Lithuania, Sweden) and others where there are no initiatives (e.g. Belgium).

Finally, across the value chain, EO providers support the different actors through a series of technical functions: collecting spatial inputs, measuring and modelling outcomes, verifying land-use change and practice adoption, validating reported data, and enabling independent third-party checks.

Main actors foreseen under the CRCF

The previous section provides an overview of the different actors in the so-called Voluntary Carbon Markets, however, the CRCF Implementing Regulation (2025/2358) has provided more details on the actors foreseen for the CRCF-related market. Whilst there is some overlap between actors in the VCM and the CRCF, not all "VCM actors" have an explicit role in the CRCF[12].

Figure 1 shows the foreseen structure of the main actors involved in the implementation of the CRCF:

[12] The CRCF also foresees an additional set of stakeholders which are relevant for the CRCF and especially for MRV:

- National CAP Management Agencies - to provide IACS LPIS/GSAA geospatial APIs conforming to the EU High Value Dataset Implementing Regulation (2023/138) for LPIS/GSAA data needed in CRCF Activity Plans;
- National Forest Authorities - to provide parcel data on forest land (where not integrated in the LPIS);
- National Rural Cadastral Services - to provide parcel data for land which is not included in either the LPIS or forest inventories;
- The EU Horizon CAFAMORE and OGRC Projects, which are committed to working with DG CLIMA to develop a CRCF geospatial registry before 2028.

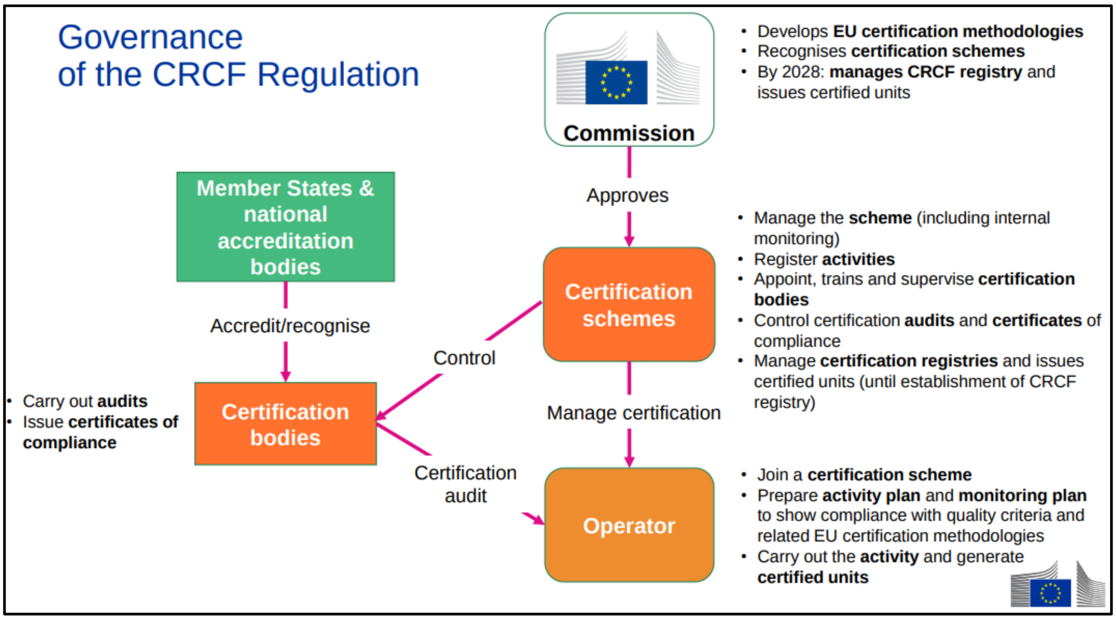

Figure 1 - Future Governance of the CRCF Regulation - from presentation by Valeria Forlin (DG CLIMA) to the Carbon Removals Expert Group, 9th November 2025[13]. This figure uses the EU CRCF terminology, which is mapped to VCM terminology in Table 1 below.

How EO supports the full chain (VCM+CRCF)

More specifically, public authorities use EO to anchor governance functions such as supply-shed mapping, policy monitoring and compliance oversight. EO providers generate the foundational datasets used by project developers (operators or groups of operators under the CRCF) and landowners to delineate spatial boundaries, verify or establish baselines, refine sampling designs, and monitor activity footprints. For example, inputs from CEPF members confirm that forest owners use EO-based tools in day-to-day forest and land management (for example Estonia, Finland and Denmark).[14]

VVBs (certification bodies under the CRCF) and accreditation bodies (Member States and accreditation bodies under the CRCF) rely on EO to cross-check land-use change, detect crops or practices, validate the consistency of field data, guide sampling designs, and provide model inputs. Standard setting bodies and their registries (certification schemes and certification registries under the CRCF) use EO to confirm spatial boundary integrity, prevent reallocation or double claims, and verify that projects

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[13] https://climate.ec.europa.eu/document/download/26ec807d-6e88-418e-a84c-4943bc145b51_en?filename=EG9_November_2025_Presentation_final.pdf

[14] Internal consultation conducted at CEPF

meet methodological requirements. Ratings agencies apply EO as independent evidence to assess additionality, carbon performance, and permanence risk across projects and geographies.

Downstream, financiers, insurers, brokers, and (corporate) buyers depend on EO-derived indicators as audit-ready, traceable evidence of activity implementation, disturbance events, and uncertainty ranges.

Together, these interactions show how EO operationalises data collection, measurement, verification, and reporting across all actors while maintaining transparent, reproducible, scalability, and globally comparable evidence - highlighting the importance of EO for credible MRV systems and high-integrity carbon credits.

Explanatory note (Table 1 structure and colour coding):

Table 1 presents a more detailed map of the main stakeholders within the carbon value chain and how they are using/could use EO as part of a MRV system. It reflects CRCF terminology and specifies if/where there is a difference between the CRCF ecosystem and the broader VCM ecosystem, and any foreseen roles and use of EO under the CRCF. Building on this stakeholder mapping, the following paragraph clarifies how EO providers fit across the chain and how to interpret their placement in the table.

EO providers can support across all segments, from regulators and accreditation bodies to project developers, registries, rating agencies, investors, buyers and insurers, by turning raw satellite, airborne and modelled data into operational geospatial products. However, for simplicity in this document, they are presented within the "supply (from land to project and credits)" segment, as their data and services first enter the chain through land owners and project developers and then cascade downstream to enable verification, certification, risk assessment and market transactions. The three colours in the table distinguish where each stakeholder sits in the value chain, especially focusing on how they relate to EO-based MRV.

- *[Blue colour] The "drivers/governance (regulatory)" groups the public authorities and supervisory bodies that set the rules (CRCF, CAP, EUDR, etc.), define MRV methodologies, maintain geospatial reference systems, and supervise certification bodies and schemes.*

- *[Grey colour] The "supply actors (from land to project and credit)" covers the operational chain that actually generates certified carbon units: land owners and farmers, project developers/operators, VVBs, certification schemes and registries, rating agencies, and national accreditation bodies. Together they design, implement, verify and certify projects, increasingly using EO-derived indicators and datasets as core evidence.*

- *[Green colour] The "(financial) enablers" section highlights the actors that provide capital and demand: banks, investors, corporate buyers, intermediaries/marketplaces and insurers. They rely on EO-backed MRV outputs, ratings and registries to price risk, perform due diligence, structure products and ensure the environmental integrity of the credits they finance, trade or insure.*

Table 1. An overview of the different actors in the carbon value chain, what they do, and how they are using/could use Earth Observation (EO).

Stakeholder type	What do they do? / What will they do under the CRCF?	How are they using EO? / How could they use EO?
Public authorities and policy makers[15] (European Commission, Member State competent authorities, national agricultural/cadastral agencies)	Set the rules (creating demand) through different regulations and policies (e.g., EU Green Deal, LULUCF, CRCF, CAP IACS, CAP Area Monitoring System, EUDR, etc.) and oversee/define MRV methodologies. *CRCF-focus[16]:* Member States & the Commission supervise certification bodies.	They use EO to anchor governance functions such as supply-shed mapping, policy monitoring, and compliance oversight. They use EO-based monitoring products (e.g., land use/cover maps, disturbance alerts) to supervise schemes, support policy evaluation, and, where relevant, cross-check information in certification registries and in the CRCF-related the Union registry.
Land owners[17]	Owners of the land where carbon projects are implemented. They provide their consent for the project to take place, can provide data on the land (e.g., in-situ measurements, farm activity, etc.), implement practices, provide consent/data, and benefit from credit revenues (can be farmers, forest owners, etc.).	Land owners, farmers, and private forest holders are increasingly involved in EO-enabled carbon farming schemes, primarily as beneficiaries and contributors rather than direct operators of EO technologies. EO supports the assessment of land use, management practices, and environmental outcomes, and EO-derived information contributes to demonstrating compliance with carbon farming and sustainability requirements. In some contexts, particularly under the EU CAP, landowners and farmers are increasingly required to participate directly in results verification by uploading farm activity data and evidence, often supported by EO-based monitoring, in order to unlock subsidies or payments. Looking ahead, EO can further empower landowners by providing decision-support tools, benchmarking performance, and enabling access to carbon credit revenues, allowing them to be rewarded with carbon credits for sustainable farming practices.

[15] Member States, national competent authorities, Commission, and national accreditation bodies supervising certification schemes and certification bodies and operating the Union registry

[16] They maintain geospatial reference systems such as rural cadastral maps (activity plans must include georeferenced boundaries and may reference IACS/LPIS parcel codes) and CAP IACS/LPIS parcel registers, which CRCF activity plans must use to define georeferenced boundaries.

[17] In CRCF language, many land owners will be the 'operators' applying for certification of carbon farming activities

Operators/groups of operators (project developers under VCM)[18]	They design and implement carbon farming projects, from defining baselines and additionality to setting activity boundaries, sampling strategies, and MRV plans. *CRCF-focus:* They are responsible for preparing the CRCF activity plan and monitoring plan, ensuring consistency with the relevant certification methodology, providing data for audits, and implementing corrective actions if non-conformities are found	They may use EO time series to characterise historical land use, stratify fields for soil sampling, and detect practice adoption (e.g., cover crops, residue retention). Satellite data are then combined with in-situ measurements to calibrate and validate models used to estimate biomass and SOC stock changes, ultimately producing verifiable monitoring reports. *CRCF-focus:* In CRCF, these EO-derived indicators should appear as data sources and parameters in the activity and monitoring plans, alongside in situ data and models. EO time series are central data sources in the monitoring plan (implementation act[19], e.g., to define parameters, monitoring frequency, and methods for detecting practice adoption and SOC stock and biomass changes.
Certification schemes (governance & rules) and their certification registries (tracking certificates & units)[20]	They set standards for certifying carbon credits, issue and manage carbon credits, maintain registries and design the rules for updating, transferring, and retiring units. *CRCF-focus:* Certification schemes set rules; approve/implement certification methodologies; track operators, certificates, and certified units; appoint certification bodies; do internal monitoring; handle complaints, and apply remediation measures & sanctions.	They define which EO datasets, methods, and QA/QC procedures are acceptable under each methodology and how EO-derived evidence (including uncertainty and metadata) must be documented in activity/monitoring plans and audit reports. They increasingly require EO-supported evidence bundles, data, methods, metadata, and quantified uncertainty to check that projects follow approved methodologies, remain within declared spatial boundaries, and continue to deliver the claimed removals over time, while ensuring full traceability across vintages.

[18] The ones submitting activity and monitoring plans and being audited.

[19] Implementing Act. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202502358

[20] Article 4–12 of the Implementing Regulation lay out the role for the certification schemes.

Certification bodies[21] (Validation and Verification Bodies - VVBs)	They conduct third-party audits to confirm that project measurements and models meet methodological and standards requirements. *CRCF-focus:* Certification bodies audit activities, including certification audits (validation) and re-certification and monitoring audits (verification).	EO provides an independent evidence layer for cross-checking reported results and detecting inconsistencies in activity boundaries or baseline assumptions[22]. *CRCF-focus:* They must provide at least 'reasonable assurance' that activity and monitoring plans and monitoring reports are free from material errors or omissions and comply with methodologies. Where EO is used to verify land use, SOC stock, or biomass, certification bodies need sufficient technical capacity in EO and soil/land science, as required by the scheme's competence rules. They also verify that EO-derived information is correctly reflected in the certification registry.
National accreditation bodies[23]	National bodies that set the competency requirements for Validation and Verification Bodies (VVBs) and formally accredit them to operate under specific standards. *CRCF-focus:* Member States may delegate supervision of certification bodies to national accreditation bodies.	In an EO-enabled MRV system, they ensure that certification bodies applying EO-based methods meet the competence requirements and that their QA/QC systems align with the rules and protocols defined by certification schemes (including EO data and reference datasets).

[21] Article 10–15 of the Implementing Regulation, where all audits (certification, recertification, monitoring) are done by certification bodies under EN ISO/IEC 17065 or recognition by a national authority.

[22] In the EU context, this aligns with the CRCF regulation's expectation that certification and verification draw on IACS/LPIS parcel codes and boundaries. Ongoing work under DG CLIMA to develop a geospatial register of carbon-farming parcels will further support VVBs by improving boundary traceability and reducing ambiguity in project area definition.

[23] They accredit certification bodies for the CRCF scope under EU standards or national rules.

Rating agencies	They independently assess the integrity of carbon credits and provide an opinion on how likely they are to deliver on their climate claims. *CRCF-focus:* Not explicitly covered or mentioned under the CRCF Implementing Regulation. However, independent ratings can act as a complementary market transparency layer by using CRCF-certified MRV outputs and registry data to support buyer due diligence, financial risk assessment, and comparison across projects.	They use EO data as independent indicators to help assess the additionality, carbon accounting and permanence of carbon credits. EO supports them in assessing project baselines and regional practices, monitoring project implementation, effectiveness and leakage and identifying natural risks that may affect credit permanence. *CRCF-focus:* Where projects are CRCF-certified, EO helps ratings agencies test whether credit performance, as reported in registry data, is consistent with observable land-use and disturbance dynamics.
Banks & investors	They provide upfront finance to project developers and invest in platforms of carbon credits, relying on MRV outputs, ratings, and risk analyses to inform their decisions. In some instances, they can also act as brokers (selling credits to large banking clients on behalf of project proponents). *CRCF-focus:* Not explicitly covered or mentioned under the CRCF Implementing Regulation, but their risk and due diligence decisions will benefit from CRCF MRV and certification outputs.	They increasingly request EO-backed MRV outputs and registry data as audit-ready, traceable evidence of implementation, disturbance events, and uncertainty.

(Corporate) Buyers	They purchase carbon credits to offset their activities (private companies, governments, individuals, etc), they incentivise the development of carbon projects, or can directly "sponsor" them. *CRCF-focus:* CRCF "Buyers Club" is an intermediary between Governments and Corporate Buyers.	They depend on EO data indirectly, through project ratings, MRV outputs, or registries, to validate the environmental integrity of purchased credits. Some large buyers are starting to request direct access to EO-derived monitoring dashboards as part of their due diligence.
Intermediaries/brokers/ marketplaces	They connect supply and demand by aggregating, marketing, and transacting credits. *CRCF-focus:* Not explicitly covered or mentioned under the CRCF Implementing Regulation.	They use EO-derived indicators and MRV outputs to curate project portfolios, flag high-risk areas (e.g. deforestation, fires, reversal risk), and provide transparency dashboards to clients.
Insurers/Re-insurers	They provide insurance to cover risks that could disrupt carbon projects or cause reversals (e.g., fire, drought, storms), with re-insurers spreading this risk across larger portfolios. EO can help by detecting disturbances over time, supporting risk pricing and, where relevant, faster claims checks using consistent, time-stamped evidence. *CRCF-focus:*	They use EO-based monitoring to price and manage risk related to natural events or carbon-reversal triggers. EO supports parametric insurance design by offering measurable, time-stamped indicators of disturbance. *CRCF-focus:* In a CRCF context, EO-based indicators can feed parametric insurance products that are aligned with the same disturbance metrics and monitoring periods used in certification methodologies and registries.

	Not explicitly covered or mentioned under the CRCF Implementing Regulation.	

3. Cross-cutting Opportunities, Challenges, and Barriers

3.1 Opportunities

Methods, Quality Assurance, and Audit-Ready Evidence

High-quality EO use across the carbon market requires all actors, including EO providers, project developers, VVBs, registries, financiers, and policymakers, to work with data whose uncertainty is transparently quantified, whose models and sampling designs are independently validated, and whose pipelines are versioned, documented, and reproducible. In practice, uncertainty propagation, calibration differences across sensors, inconsistent regional performance, and limited benchmark datasets challenge every stage of MRV and oversight. Verifiers depend on EO products that clearly separate signal from noise, developers rely on consistent baselines and disturbance detection, and registries need auditable, repeatable evidence trails. These systemic issues shape the reliability of EO for everyone who uses it.

For example, ratings agencies help market participants to overcome these shared challenges through independent risk assessment, benchmarking, and evaluation of EO methodologies, reinforcing EO's role as a critical input to risk-assessment frameworks.

In addition, the increasing use of EO across carbon markets highlights the need for audit-ready, transparent data lineage so that every actor, from developers to regulators, can verify results using the same independent evidence base. EO technologies, including satellite imagery and remote sensing products, provide precise measurements of land use, vegetation cover, and SOC changes, and support the TACCC principles of Transparency, Accuracy, Completeness, Comparability, and Consistency, thereby enhancing the credibility of carbon credit schemes.

For example, accurate MRV data supports verification by regulatory bodies and carbon markets, allowing farmers to be rewarded with carbon credits and reducing disputes over carbon sequestration claims.

Harmonisation, Standardisation, and Scalability Across Schemes and Jurisdictions

EO-based MRV methodologies provide consistent, replicable approaches that enable harmonised reporting and standardised procedures across projects, regions, and countries. This increases comparability and facilitates integration across carbon accounting frameworks. Ideally, further harmonisation would enable cross-scheme comparability, supporting buyers, investors, and policymakers who increasingly require consistent evidence across jurisdictions rather than project-by-project assessments. EO MRV can be applied across regions or countries, making it feasible for national or corporate carbon accounting. This scalability is also critical for emerging Article 6 cooperation and jurisdictional reporting, where national-level consistency cannot rely solely on field-based datasets.

Baseline Establishment and Change Detection

EO MRV can estimate carbon stocks, establish land-use change baselines, track seasonal dynamics, and monitor long-term transitions, detecting improvements or degradation over time. EO-derived baselines further enhance transparency by providing publicly accessible reference data and reproducible verification pathways that can be independently checked across time, without necessarily requiring disclosure of proprietary processing methods. Satellite time-series support transparent baseline construction by documenting historical land use, vegetation conditions, and management trends over long periods of practice (at least 5 years). EO helps identify trends, disturbances, and prior land use, reducing uncertainty in defining “business-as-usual” scenarios and enabling reproducible comparisons across different projects and time periods. However, while EO data can provide core information, translating EO into usable MRV products (e.g. biomass model-based baselines, land use/land cover, crop type) often requires substantial investment in finance, expertise and in some cases proprietary knowledge and workflows. Given the highly competitive nature of the market, the approach moving forward should safeguard intellectual property and avoid undermining developers’ value propositions, while still ensuring transparency through standardized outputs, documentation, and independent verification. EO enables systematic, automated detection of land-use transitions (e.g., cropland to grassland, forest to shrubland), providing spatially explicit evidence for MRV. This supports additionality assessments by verifying that the proposed practices are not common in the area, while compliance checks ensure eligibility conditions are met, such as the absence of recent land conversion and the identification of activities that could cause or have a high-risk of causing potential leakage at the landscape level.

Crop Detection and Simplified Multi-Purpose Reporting

EO provides indicators for detecting cover crops, residue retention, tillage practices, rotations, and other management actions required under CRCF methodologies. These signals support both developer self-reporting and VVB verification, allowing practices to be monitored at scale and with consistent criteria. EO provides an opportunity to simplify activity reporting for multiple purposes and more broadly, is a key enabler of simplified digital MRV.

For example, farmers and farm managers may need to report for carbon markets/CRCF, for value chain footprints, and for CAP subsidies. Accurate MRV data supports verification by regulatory bodies and carbon markets, enabling farmers to receive carbon credits and reducing disputes over carbon sequestration claims.

Sampling Optimisation, Stratification, and Modelling

EO-derived spatial layers enable stratified and optimised sampling designs that better capture field/strata variability, reduce sampling bias, and guide the number and location of soil or biomass sampling positions, typically at plot scales. This integration is crucial not only to improve sample efficiency and reduce costs, but also to generate representative data that can initiate and support soil or ecosystem modelling.

For ecosystem and GHG modelling, MRV suppliers can leverage EO datasets to improve GHG emissions quantification and generate insights at scale, while maintaining or reducing MRV costs. EO-derived datasets provide essential inputs for process-based models (e.g., soil-based and coupled soil-plant models, CO_2 sequestration rates for vegetation), including climatic variables, land cover, and vegetation indices. This integration enables spatially explicit predictions of SOC stock changes, supports scalable monitoring, and strengthens the transparency and reproducibility of MRV assessments.

EO-derived datasets also enable spatially explicit estimation of aboveground biomass and associated carbon stocks through vegetation indices, LiDAR, SAR, and multispectral imagery. This supports quantification of crop and non-crop biomass (trees, shrubs, and cover crops) and scalable removals accounting. By combining EO with optimised field sampling, MRV systems can scale assessments across large areas, reduce reliance on labour-intensive field surveys, and ensure consistency and comparability across projects and reporting cycles[24].

EO for Integrity Assurance: Boundaries, Permanence, and Market Risk Indicators

EO can provide consistent, high-resolution[25] delineation of field and parcel boundaries, ensuring that activity areas are accurately defined and remain stable across monitoring cycles. This is essential for CRCF activity plans, leakage assessments, and ensuring that sampling and modelling are correctly anchored to the actual managed area.

EO enables ongoing monitoring of SOC stock and biomass permanence post-credit issuance by detecting reversals, leakage, or degradation in near-real time to ensure long-term integrity of credited carbon stocks. By providing spatially explicit and time-stamped information, EO strengthens confidence among financial actors and buyers who depend on transparent, independently verifiable claims before committing capital. EO provides continuous, independent surveillance of reversal risks, including fire, drought stress, canopy loss, flooding, or land-use conversion, underpinning remediation actions, buffer decisions, and insurance triggers.

EO-derived indicators can be translated into comparable risk signals for ratings, investment due diligence, and insurance triggers, reducing information asymmetry and unlocking more standardised financial products. This independent risk signalling is becoming increasingly important as financial institutions and insurers incorporate EO metrics into due diligence, portfolio monitoring, and risk-pricing models.

Compliance with Voluntary and Mandatory Co-Benefits

EO MRV allows assessment of biodiversity, water retention, and overall ecosystem health, highlighting additional environmental and socio-economic benefits of

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[24] Example: https://doi.org/10.32942/X2KW7H

[25] The CRCF Draft Carbon Farming Delegated Act indicates that "*the minimum resolution of land cover and volume of above-ground biomass shall be 10m*". However, the geolocation of landscape features like isolated trees and hedges, buildings or water bodies, as well as smaller parcel boundary delineation require higher resolution to assess, and thus comply with requirements from certification bodies/VVBs . It also remains an open question whether the 10 m threshold reflects a science-driven performance requirement or, more pragmatically, the current availability of widely used Copernicus data at that scale. As higher-resolution Copernicus capabilities come online in the future, this requirement may warrant revisiting to better match operational needs for finer-scale features.

sustainable land management. For example, farmers and land managers can use EO data to optimise land management practices for both productivity and carbon storage, supporting adaptive management by identifying areas requiring intervention. In addition, EO-derived co-benefit and statutory constraint indicators help align carbon farming with broader EU priorities such as biodiversity restoration, water regulation, and climate adaptation.

Cost and Time Efficiency

Continuous remote monitoring reduces the need for extensive field surveys, saving labour and operational costs, and enabling large-scale assessments that would be impractical using only ground-based methods.

CEPF member feedback illustrates these gains, where EO is already integrated into national forest inventories and management systems in countries such as Denmark, Finland, and Estonia, while also underlining that true cost-efficiency is typically achieved only for larger or pooled projects rather than for small, isolated forest holdings.

These efficiency gains are essential for scaling carbon farming in Europe, particularly in regions dominated by smallholders, where only EO-enabled group or pooled approaches can achieve viable MRV costs.

3.2 Challenges

EO Acceptance and Technical Requirements Across Standards

Across the ecosystem, EO uptake is constrained by methodological fragmentation: standards prescribe different acceptance criteria, QA/QC thresholds, spatial and temporal minimums, and validation requirements. Project developers must navigate multiple technical specifications, VVBs must interpret inconsistent EO tolerances, and registries face difficulties aligning EO-based evidence with methodology-specific rules. Interoperability between EO data formats, APIs, and metadata conventions is uneven, complicating integration into MRV systems and limiting smooth cross-project comparisons. This lack of harmonisation also creates uncertainty for EO and MRV solution providers, who cannot easily align their methods or long-term investments with evolving CRCF and Article 6 expectations without clearer, system-wide acceptance criteria.

A key barrier remains the limited interoperability between project-level MRV systems and the EO datasets that feed into independent ratings, constraining the seamless integration of evidence across the wider carbon market. It also reinforces the perception that EO remains an optional or secondary layer, instead of being recognised as part of an integrated measurement framework where EO, field data, and models complement each other to reduce uncertainty and support auditability.

Comparable issues arise for financial and risk actors: banks and investors struggle to use EO consistently in due diligence, covenant monitoring, or portfolio risk pricing when project evidence follows non-comparable EO rules, as well while insurers and reinsurers face similar friction in defining standardised EO-based triggers and service-level expectations for reversal or catastrophe cover, given uneven acceptance thresholds and variable data specifications across methodologies. For financial institutions and insurers, this fragmentation limits the ability to incorporate EO-derived indicators into risk models, due diligence workflows, and parametric triggers, undermining the potential of EO to act as shared infrastructure for market integrity and climate-finance mobilisation.

In addition, EO-based evidence comes with uncertainty and uptake is slowed because it is often unclear who is responsible if EO outputs are wrong (i.e. who assumes the residual error and liability). Banks, in particular, operate in a highly regulated, low-risk environment and therefore adopt new technologies cautiously. As a result, EO is unlikely to scale in finance unless uncertainty is clearly quantified and backed by credible assurance and clear accountability or risk-sharing arrangements.

Data & Coverage

Actors rely on EO products whose usefulness is shaped by data availability, spatial and temporal coverage, sensor performance, and suitability for operational decision-making. This means that even scientifically robust EO datasets often remain underutilised because they cannot be directly integrated into operational MRV workflows without substantial pre-processing effort or additional methodological clarification from standards and regulators. Many EO products remain difficult to use because they require expert post-processing, have inconsistent documentation, or require costly licences, thereby limiting adoption across both project-level and oversight functions. In addition, their effective use often depends on basic infrastructure for data storage, processing, and management, which can be a barrier for smaller projects or MRV teams without adequate computational resources. Applying FAIR data principles, ensuring that EO datasets are Findable, Accessible, Interoperable, and Reusable, can significantly alleviate these challenges. By promoting consistent metadata, open formats, and standardized processing workflows, FAIR data facilitate integration into MRV systems, enhance transparency, and increase trust among stakeholders. However, FAIR compliance should be understood as standardising metadata, interfaces, formats, and quality reporting—rather than requiring disclosure of proprietary models or workflows. Addressing both infrastructure and FAIR-compliance needs is therefore essential to unlock the full potential of EO for scalable and reliable MRV while safeguarding intellectual property and preserving incentives for commercial developers to invest in high-quality EO-derived products.

CEPF member organisations stress that these limitations are particularly visible in afforestation projects and young forest stands, where current EO signals are too weak to provide robust estimates of biomass or SOC content, making extensive ground plots and, in some cases, drone-based LiDAR indispensable. They also note that in many forest contexts, EO-based inventories only become technically and economically viable once project areas reach several thousand hectares and, at that scale, comprehensive field-based approaches can become impractical, meaning EO is not only cost-effective but often the only feasible option for full-area monitoring. Pooling and group schemes can therefore be a precondition for deploying EO effectively at scale. At the same time, certifier requirements in some contexts still place strong emphasis on field data even as project size increases, which can weaken the business case and slow adoption of EO-enabled MRV. This highlights the need for proportional MRV approaches, where field measurements are scaled to project risk and used for model calibration/validation, while EO provides the primary, consistent wall-to-wall monitoring, ensuring that uncertainty is managed transparently even in contexts where EO signals are weak or resolution is insufficient.

In practice, project developers and MRV providers are constrained by cloud gaps, mixed pixels, and heterogeneous smallholder or agroforestry landscapes, which make baseline consistency and practice detection harder to scale. Financial and risk actors face parallel issues: banks and investors need globally comparable, analysis-ready EO indicators for due diligence and portfolio risk pricing, while insurers and reinsurers depend on reliable coverage and detection latency to define credible reversal or catastrophe triggers.

The lack of consistent, analysis-ready EO layers also limits the ability of financial actors to align risk models with MRV evidence, making it difficult to incorporate EO-derived indicators into sustainability-linked finance, insurance pricing, or independent transaction safeguards.

Balancing cost and scalability is also critical. This underscores the need for scalable, interoperable EO solutions that deliver reliable, analysis-ready data at a global scale. Without such scalable solutions, EO cannot fulfil its potential role as a shared digital infrastructure for carbon markets, where comparability, reproducibility, and transparent uncertainty reporting are essential for long-term market confidence.

Nonetheless, a supportive policy direction is emerging in Europe: the European Commission's 2025 Bioeconomy Strategy commits to establishing an EU carbon farming database of models, emission factors, remote-sensing products, and benchmarking datasets to reduce monitoring and administrative costs, directly addressing these data and usability constraints[26].

Perception & Trust

EO-based MRV offers clear advantages in terms of data accessibility, automation, and spatial and temporal coverage. However, its convenience can create perceptions of lower accuracy for certain components of the MRV system. Consider, for example, SOC stock and biomass estimation. While EO provides consistent and repeatable observations, it cannot on its own fully capture underlying soil processes or long-term changes in business-as-usual conditions. Both process-based models and measure–remeasure approaches with control plots are able to represent declining baselines driven by soil degradation, which remain a relevant issue across many European landscapes. This highlights the opportunity for hybrid MRV systems, where EO contributes spatially explicit and scalable monitoring, while targeted field measurements and process-based or empirical change-estimation methods provide the depth of information needed to characterise soil processes, detect gradual degradation, and validate long-term trends. Such complementarity strengthens both the scientific robustness and the perceived trustworthiness of EO-enabled MRV.

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[26] https://climate.ec.europa.eu/news-other-reads/news/commission-adopts-rules-and-launches-initiatives-boost-carbon-removals-and-carbon-farming-eu-2025-12-01_en?

CEPF inputs, particularly from Estonia and Finland, underline that forest owners tend to place greater trust in national forest inventories and locally developed EO systems than in centralised EU-level 'black box' repositories. They call for data sovereignty, clear rules on data ownership and use, and careful attention to regional differences in mineral soils, peatlands, and forest types when designing EO-based benchmarks and central data infrastructures.

Interoperability

A key challenge in using EO for MRV across the carbon value chain is harmonising measurement definitions and reporting conventions across different data sources. For example, variables such as canopy height or above-ground biomass can be quantified in multiple ways that are not directly comparable[27].

In parallel, inconsistent or incomplete metadata—such as units of analysis, measurement protocol, or coordinate precision—limits the ability of MRV providers and verifiers to reproduce results, track updates across EO product versions, or integrate outputs into CRCF-aligned monitoring plans, where traceability and version control are increasingly required[28].

Interoperability should be prioritised by providing clear metadata descriptions and standards to ensure that different data products can be fairly evaluated, instead of asking users to reconcile incomparable measurements. Achieving this level of interoperability requires not only technical alignment but also governance clarity, so that public authorities, certification schemes, and private MRV providers apply the same conventions for metadata, uncertainty reporting, sensor provenance, and temporal validity.

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[27] In forests, for example, canopy height could be measured as Lorey's Height in the field, as Mean Canopy Height from airborne LiDAR, or as RH98 from Spaceborne LiDAR. They cannot be easily translated between units, so harmonisation is not straightforward. To simplify interpretation, data providers should describe measurement units so that users don't try to validate RH98 estimates with Lorey's height measurements in the field and expect perfect relationships.

[28] In another forest example, metadata for aboveground biomass should disclose the units of analysis (e.g. aboveground live biomass in Mg or biomass density in Mg/ha), the measurement type (e.g. basal area recorded at 2 meters DBH vs. 1.37 meters DBH), the coordinate precision (e.g. exact coordinates, 2km uncertainty, randomized coordinate swapping).

Benchmarks[29]

Shared benchmark datasets and challenge tasks, such as canopy-change detection or SOC stock mapping, present an opportunity to improve the transparency and comparability of EO-based assessments. The challenge is that few open, validated datasets exist at the spatial and temporal scales required for project-level evaluations. Without such benchmarks, it remains difficult for certification bodies and verifiers to assess whether EO-derived metrics meet acceptable accuracy levels or fall within methodological uncertainty thresholds, which further limits consistent EO uptake across schemes. Given the high cost of building and maintaining validated benchmarks, public (or public–private) funding is often needed so benefits can be shared across schemes and duplicated private efforts are avoided.

Initiatives that develop shared benchmark datasets and harmonised, well-documented, interoperable data catalogues (e.g. soil, climate, EO, crop and management information) can improve data accessibility and enable more consistent use of available information across Europe. This, in turn, can strengthen methodological comparability and support broader acceptance of EO-derived evidence by reducing duplicated validation efforts, lowering verification costs, and aligning performance expectations across EU and voluntary frameworks[30]. A pragmatic approach is therefore to standardise "what is reported" (metadata, formats, interfaces, and performance/uncertainty metrics) while allowing providers to retain flexibility over "how it is done" (their models and workflows).

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[29] Benchmarking can be public, private, or public–private. Public benchmarking is often preferred because it can fund costly reference datasets and provide open access, common protocols and long-term maintenance for comparability across schemes. Private benchmarking can move faster, but should meet minimum conditions to avoid fragmentation: independent oversight, shared evaluation protocols and clear output/uncertainty reporting. Public–private models are a strong compromise because public funding can build and maintain shared "reference infrastructure" that everyone can use, while private companies compete on performance and service quality (better models, faster processing, support, tailored products).

[30] One recent Horizon Europe initiative, CAFAMORE, aims to develop an EU-wide parcel-level monitoring approach for carbon farming, including harmonised/automated data collection, a spatially explicit registry, and the creation of harmonised data catalogues, with MRV solutions tested across multiple pilot countries. https://www.cafamore.eu/

4. Recommendations

To optimise the use of EO for MRV by stakeholders in the carbon value chain:

- Stakeholders should prioritise interoperability, transparency, and scalability. Developing open, analysis-ready EO products and harmonised metadata standards would reduce technical barriers and improve comparability across projects and regions. In parallel, long-term alignment between EO providers, national agencies, and certification bodies will be essential to ensure that datasets used in CRCF, Article 6, and voluntary carbon market MRV converge toward interoperable standards rather than diverging into isolated, scheme-specific tools.
- Promote consistent EO-based MRV protocols, reporting standards, and key performance indicators (KPIs) to ensure comparability, reliability, and credibility across carbon farming projects. Such alignment is particularly important for hybrid MRV approaches that combine field measurements, EO signals, and process-based models, ensuring that uncertainty is handled consistently and that evidence can be audited across jurisdictions and market instruments.
- Establishing shared benchmark datasets and uncertainty frameworks can enhance confidence in EO-derived evidence. At the same time, closer alignment between EO workflows and MRV requirements can make independent verification more efficient, consistent, and less costly. To be operational, these benchmarks must also include clear documentation, governance rules, and version control so that all actors, developers, verifiers, registries, and financial institutions can reference the same validated baseline for performance assessments. In this context, a practical principle could be that data collected under publicly funded projects should be made available (subject to legal, privacy and security constraints), so that benchmark assets can be reused, independently scrutinised and maintained over time rather than duplicated across initiatives.
- Policymakers should provide clear guidelines, frameworks, and incentives to encourage EO adoption, align methodologies, and integrate EO MRV into national and international carbon accounting systems. For example, define clearly what role EO is to play in the CRCF methodology long term in order to avoid developing MRV solutions that will end up not complying with the

evolution of the methodology. Clear policy direction is equally critical for national MRV systems that are now integrating EO into LULUCF reporting, CAP monitoring, and Article 6 readiness activities, ensuring that public and private MRV systems evolve coherently rather than in parallel, and that complementary market transparency tools, such as independent ratings, can consistently interpret and rely on CRCF-aligned evidence without duplicating monitoring systems.

- Clarify the role of private MRV solutions as compared to publicly funded projects such as Project CAFAMORE[31], in order to provide perspectives beyond 3 years related to methodology and MRV capabilities requirements to build and ensure complementarity rather than potential cannibalisation.
- Strengthen technical expertise and facilitate the exchange of best practices among farmers, project developers, verifiers, data providers, and investors to support effective adoption and use of EO-based MRV tools.
    - *Specific recommendations emerging from CEPF[32] forest-owner inputs include:*
        - *Support pooled and group-based project structures so that EO-based inventories become technically and economically viable for small and fragmented forest holdings. Such structures also create the economies of scale needed for high-resolution monitoring and reduce per-hectare MRV costs, making EO adoption feasible for fragmented forest landscapes typical across much of Europe.*
        - *Clarify, in CRCF and voluntary carbon market standards, how EO and drone/LiDAR data can be combined with ground plots for young afforestation stands and for soil carbon estimation, where current EO signals are weak, but project demand is high. Developing clear guidance on how these data streams should be integrated, and how uncertainty should be combined across*

[31] https://www.cafamore.eu/

[32] *Written inputs from CEPF member organisations provide additional evidence on how forest owners currently use EO in relation to carbon markets. The responses highlight large differences in market maturity and EO uptake – from Belgium, where there are currently no forest carbon market actors, to contexts such as Estonia, Finland and Denmark, where EO-based tools are already embedded in forest management and national forest inventories, but are not yet fully connected to voluntary carbon markets. Across countries, CEPF members point to common themes: EO is most useful today for confirming land eligibility and detecting deforestation or management changes, while it remains challenging to use EO alone to estimate carbon in young afforestation stands and in soils without extensive ground data. Forest owners emphasise the importance of pooling and group schemes to make EO-based inventories viable at small parcel scale, robust data-protection and clear rules on data ownership, and an EO-MRV architecture that respects national data systems and regional specificities of forest and peat soils.*

them, will be essential for both project developers and verifiers as EO-based approaches expand into soil carbon and early-stage forest restoration.

- *Ensure that EU-level data infrastructures build on, rather than replace, national forest inventories and registries, with transparent rules on data ownership, access, and liability, and with explicit consideration of boreal forest and peat soil conditions*

5. Annexe

This annexe includes reference to some use cases to show where EO already adds value, turning stakeholder needs into actionable EO specs and helping prioritise method development and procurement.

Use Cases

Non exhaustive examples of EU-funded initiatives around soil, carbon farming and land-based climate action, with a strong focus on soil organic carbon, MRV, and/or agroforestry.

- CAFAMORE[33]
- DigitAF[34]
- EO4SD[35]
- Evo-Land[36]
- LILAS4SOIL[37]
- MRV4SOC[38]
- MARVIC[39]
- OGCR[40]
- ORCASA[41]
- RapidAI4EO[42]

These projects form a coherent family of EU-funded initiatives that aim to operationalise land-based climate action in Europe. They focus on improving our ability to understand, monitor and enhance SOC and carbon removals (MRV4SOC, MARVIC, ORCASA, and also Evo-Land), while also advancing robust, cost-effective MRV approaches and the

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33 https://www.cafamore.eu/

34 https://digitaf.eu/

35 https://www.eo4sd-forest.info/

36 https://www.evo-land.eu/

37 https://www.lilas4soils.eu/

38 https://mrv4soc.eu/

39 https://www.project-marvic.eu/

40 https://www.ogcr.eu/

41 https://irc-orcasa.eu/

42 https://rapidai4eo.eu/

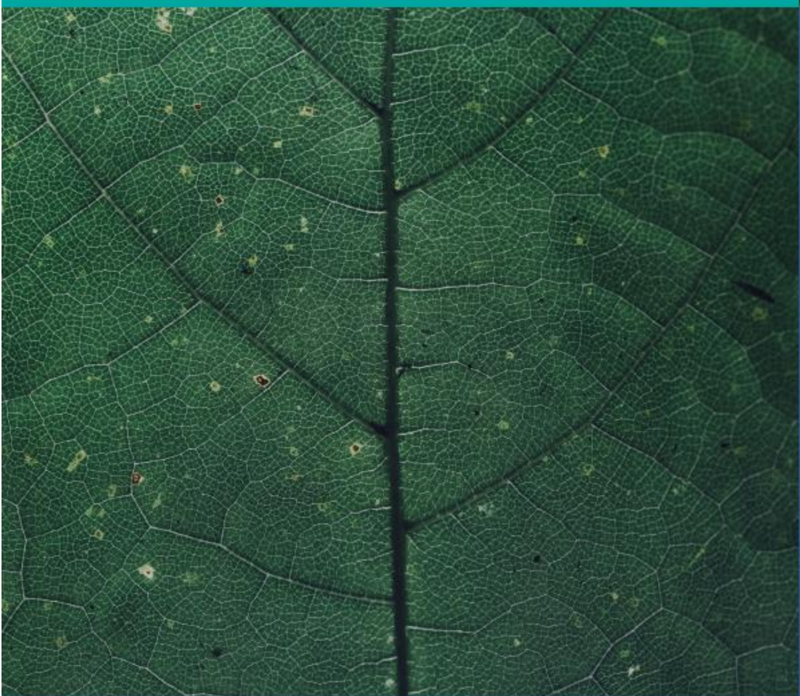
digital infrastructure needed for carbon farming and certification (CAFAMORE, OGCR, and RapidAI4EO for AI-enabled processing and scaling). In parallel, they work on testing and deploying carbon-farming and agroforestry solutions in real conditions, using living labs, digital tools and decision-support to support farmers, advisors and policymakers (LILAS4SOIL, DigitAF, and CAFAMORE). Finally, complementary initiatives such as EO4SD help connect Earth Observation capabilities with operational sustainability reporting and uptake pathways, reinforcing interoperability and user adoption across the broader ecosystem. Collectively, this portfolio helps establish the technical, institutional and practical foundations needed for credible carbon farming markets that support the EU Green Deal, the Soil Mission and the emerging Carbon Removal Certification Framework.

6. Glossary

Acronym	Meaning
CAP	Common Agricultural Policy
CAP AMS	CAP Area Monitoring System
CEPF	Confederation of European Forest Owners
CF	Carbon Farming
CREDIBLE	Building momentum and trust to achieve credible soil carbon farming in the EU
CRCF	Carbon Removal Certification Framework (EU)
DigitAF	Digital tools for agroforestry and carbon farming (EU project)
DG CLIMA	Directorate-General for Climate Action (European Commission)
EC	European Commission
EO	Earth Observation
EU	European Union

EUDR	EU Deforestation-free Regulation
EXPANDEO	EARSC annual conference on EO services and applications
FG3.3	Focus Group 3.3 “EO for MRV of Carbon Farming / Carbon Removals”
GHG	Greenhouse Gas
GSAA	Geospatial Aid Application (part of IACS)
GST	Global Stocktake (under the Paris Agreement)
IACS	Integrated Administration and Control System (under the CAP)
ITMO	Internationally Transferred Mitigation Outcome (Article 6.2, Paris Agreement)
LILAS4Soils	Living labs / landscape approaches for soils & carbon (EU project)
LPIS	Land Parcel Identification System (part of IACS)
LULUCF	Land Use, Land-Use Change and Forestry
MARVIC	EU project on context-specific MRV systems for carbon removals
MRV	Monitoring, Reporting and Verification
MRV4SOC	Monitoring, Reporting and Verification for Soil Organic Carbon (EU project)
NRR	Nature Restoration Regulation (EU)
OGRC	EU project on CRCF geospatial registry & MRV infrastructure
ORCaSa	Operationalising International Research on Soil Carbon (EU project)
SOC	Soil Organic Carbon
TACCC	Transparency, Accuracy, Completeness, Comparability and Consistency
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market

VVB	Validation and Verification Body



CREDIBLE
EU carbon farming

Funded by
the European Union