CREDIBLE
EU carbon farming

Funded by the European Union

Earth Observation for the Monitoring, Reporting, and Verification of Carbon Farming

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

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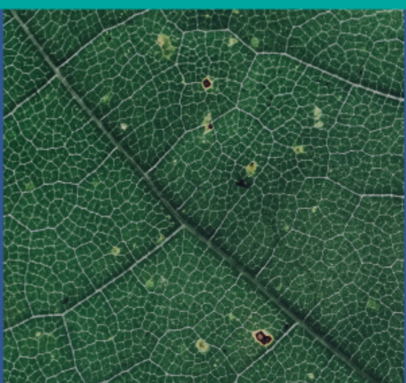

Executive Summary

This document is part of the EU-funded project CREDIBLE, Grant Agreement 101112951, and captures the main outputs of the first round of conversations within the Focus Group on "Earth Observation for the Monitoring, Reporting, and Verification of Carbon Removals".

The main goal is to generate recommendations or opinions that could be used in the development or deployment of relevant policies around carbon farming, and particularly in the definition of the Carbon Removal Certification Framework. These informed opinions have emerged through the active participation of experts (details provided in Tables 1 and 2) in a number of activities (main ones listed in Table 3).

In order to convey the recommendations to the broader possible audience, the following sections have been included in the document: i) an introduction, which helps clarifying the problem and why addressing this topic was considered important by the CREDIBLE consortium; ii) a short process report, which summarises the challenges, knowledge, and opportunities communicated by the Focus Group, highlighting the key points and tensions that emerged and; iii) a summary of key takeaways. This document represents an overview of the ongoing discussions and will serve to inform the way forward for future interaction and exchange on the topic.

Focus Group Vision

"Earth observation contributes significantly to the EU's journey to climate neutrality by 2050"

This draft report is based on ongoing discussions[1] which will support high-level conversations to shape robust carbon farming[2] markets and policies by sharing stakeholders' knowledge and experiences, upscaling solutions, and enabling the multiplication of climate actions.

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[1] This is a draft document accessible for inputs to EARSC members within the WG on Carbon Removals (e-geos, Geoville, Planetek Italia, GMV, Geosat, EarthDaily Agro, Space4Good, Constellr, OpenCosmos, Disiatek, Airbus, Planet, Vortex, OHB, EOanalytics, Latitudo40), and Credible FGs on EO for MRV of Carbon Removals (see table). This statement has been updated with inputs from the 1st Carbon Summit (5-7 March, Valencia) at the Breakout Session 7: Earth Observation Applications for Monitoring Carbon Removals.

[2] Carbon farming is the management of carbon pools, flows and greenhouse gas (GHG) fluxes at the farm level, to mitigate climate change. Examples of effective carbon farming practices include 1) Agroforestry and other forms of mixed farming combining woody vegetation (trees or shrubs) with crop and/or animal production systems on the same land; 2) Use of catch crops, cover crops, conservation tillage and increasing landscape features: protecting soils, reducing soil loss by erosion and enhancing soil organic carbon on degraded arable land; 3) Targeted conversion of cropland to fallow or of set-aside areas to permanent grassland; 4) Restoration of peatlands and wetlands that reduces oxidation of the existing carbon stock and increases the potential for carbon sequestration (DG CLIMA). Carbon farming implies land management, soil and forest activities linked to the LULUCF (e.g., peatland / wetland restoration, agroforestry, reforestation, soil carbon sequestration, etc.), this draft is concentrating almost exclusively on SOC and agriculture but the FG will try to get onboard experts covering these other areas.

1. Focus Group Participation and Activities

Table 1 - Partners of CREDIBLE who participated in the Focus Group

Name of the expert	Affiliation	Role	Country
Monica Miguel-Lago	EARSC	Lead	Belgium
Michelle Hermes	EARSC	Lead	Belgium
Tanya Walker	EARSC	Lead	Belgium
Maria Fantappie	CREA	Member	Italy
Karina Marques	Soluciones Agrícolas Ecoinnovadoras SL	Member	Spain
Andrea Ferrarini	UCSC / MARVIC	Member	Italy
Hannes Mollenhauer	UFZ	Member	Germany
Gerry Lawson	EURAF	Member	Belgium
Manos Lekakis	AgroApps	Member	Greece

Table 2 - Members of the Focus Group external to CREDIBLE[3]

Name of the expert	Affiliation	Role	Country
Irene deTovar	Copa-Cogeca	Member	Belgium
Saheba Bhatnagar	BeZero	Member	UK
Basanta Gautam	Southpole	Member	Finland
Tatiana Boussange	eAgronom	Co-chair	Czechia
Frank Martin Seifert	ESA	Member	Italy
Eleni Kalopesa	AUTH/MRV4SOC	Member	Greece
Aparna Raturi	CarbonFarm	Member	France
Mariavincenza Chiriacò	CMCC	Member	Italy
Eric Ceschia	INRAE	Member	France
Amiel Sitruk	Regen Insight	Member	France

[3] Inputs to this document have also been provided by EARSC members within the Working Group on Carbon Removals and Credible Focus Group on EO for MRV of Carbon Removals. This statement has been updated with inputs from the 1st Carbon Summit (5-7 March, Valencia) at the Breakout Session 7: Earth Observation Applications for Monitoring Carbon Removals.

Basile Goussard	NetCarbon	Co-chair	France
Antonella Succurro	CinSoil GmbH	Co-chair	Germany
Hugh Sturrock	Loamin	Member	UK
Fabio Volpe	e-geos	Member	Italy
Anne Dubois / Pierre Carrere	Earthdaily	Member	France
Sam Whalley	Constellr	Member	Belgium
Carolina de Castro	Geosat	Member	Spain
Adriano Vulpio	Planetek Italia	Member	Italy
Lucia Perugini	European Environmental Agency	Member	Denmark
Simon Kay	DG CLIMA (Seconded EEA)	Member	Belgium

Table 3 - List of main activities carried out to steer the conversations

General description of the activity	Date of execution
Kick off focus group meeting, discussion of FG and goals, timeline	3 December 2023
Focus group meeting	22 January 2024
Focus group meeting, preparation for Carbon Farming Summit	26 February 2024
Breakout Session 7: EO for MRV at the Carbon Farming Summit	6 March 2024
Focus group meeting, overview of CRCF recommendations to Expert Group	25 March 2024

2. Introduction

As climate change impacts escalate and regulatory and societal pressures are intensifying, carbon markets are experiencing notable growth. This growth underscores the increasing importance of carbon farming initiatives as a key component of sustainable land management practices which ensure responsible and efficient use of land resources while enhancing ecosystem resilience and biodiversity conservation. In the context of the European Green Deal[4] and the Zero Pollution Action Plan for 2050[5], digital solutions are becoming increasingly important to meet the European Union's climate targets. Sustainable land management is promoted across sectors, including agriculture, forestry and land-use planning where Earth Observation[6] (EO) data and added-value services play a fundamental role in supporting the monitoring and evaluation of the effectiveness of sustainable land management strategies. Additionally, EO supports efforts to develop Monitoring, Reporting and Verification (MRV) of carbon capture projects[7] and contributes to efforts to ensure transparent certification processes. Remote Sensing, especially satellite-derived data and services supports the MRV of Carbon Farming (CF) projects. For example, by providing baseline assessments (using historical data on land use), scalability by monitoring large geographic areas, transferability by providing consistent and standardised information using uniform sensors across diverse geographic regions, and streamlining processes.[8] [9] [10] With global coverage and revisit frequency, satellite-derived data provide robust, cost-effective solutions for monitoring natural cycles and establishing uniform measurement systems. However, clarity on the spatial, spectral and temporal resolution needed for calculations, as well as efficient monitoring, data governance, and data accessibility are vital to fully support any kind of certification scheme.

Identifying opportunities and challenges in leveraging EO data for carbon removal certification methodologies underscores the critical need for collaborative efforts in addressing these issues. While EO data offer immense potential in advancing climate action by providing valuable insights into carbon removal processes, challenges such as data integration, harmonisation and interpretation complexity must be overcome. Collaborative initiatives involving scientists, policymakers, technology experts and land

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[4] Set of policy initiatives by the European Commission with the overarching aim of making the European Union climate neutral in 2050 (European Green Deal)

[5] The vision for 2050 aims to eliminate air, water, and soil pollution to levels deemed safe for human health and natural ecosystems (Zero Pollution Action Plan for 2050)

[6] Earth Observation (EO) refers to the use of remote sensing technologies to monitor land, marine (seas, rivers, lakes) and atmosphere. Satellite-based EO relies on the use of satellite-mounted payloads to gather imaging data about the Earth's characteristics. The images are then processed and analysed to extract different types of information that can serve a very wide range of applications and industries (Ref. EUSPA Market Report 2024)

[7] World Bank, 2021, Assessment of Innovative Technologies and Their Readiness for Remote Sensing- Based Estimation of Forest Carbon Stocks and Dynamics

[8] Batjes, et al. 2023. International review of current MRV initiatives for soil carbon stock change assessment and associated methodologies

[9] Paustian, et al.2019. Quantifying carbon for agricultural soil management: from the current status toward a global soil information system

[10] Smith, et al. 2019. How to measure, report and verify soil carbon change to realize the potential of soil carbon sequestration for atmospheric greenhouse gas removal

owners are essential to develop robust methodologies that harness the full potential of EO applications for carbon removal certification. Through shared expertise and coordinated efforts, stakeholders can maximise the effectiveness of EO data in supporting climate mitigation strategies, ultimately contributing to global efforts to combat climate change.

3. Short Process Report

Knowledge and Opportunities

The Focus Group (FG) activity is designed as a multifaceted approach to facilitate comprehensive discussion and development of expert insights surrounding the crucial role of satellite-derived data in carbon farming. This initiative begins with the formation of a dedicated focus group, engaging in monthly meetings that serve as dynamic platforms for collaboration and knowledge exchange. These meetings, enhanced by co-creation workshops, provide fertile ground for stakeholder members to share ideas, exchange insights, and collectively develop a working document. Within this document, attention is directed towards delineating the key elements, challenges, and opportunities inherent in leveraging satellite-derived data for carbon farming initiatives.

Further extending the reach of the Focus Group, roundtable discussions are planned at the European Carbon Farming Summits, fostering an environment for dialogue, feedback collection, and the identification of additional perspectives. The insights garnered from these roundtables will feed the FG which then will be disseminated widely within the expert and stakeholder community, facilitating broader engagement and feedback solicitation. External stakeholder consultations under CREDIBLE project are conducted to ensure inclusivity and the integration of diverse viewpoints, enriching the discourse surrounding satellite data utilisation in carbon farming.

The process doesn't end here. Parallel activities such in-depth analysis of stakeholder comments will be undertaken to distil common themes, concerns, and valuable insights, thereby informing iterative document revisions and updates. Throughout this iterative process, transparency is maintained to uphold the integrity of the revision process. Yearly cycles are embraced, aligning with Carbon Summits to incorporate evolving technology, scientific understanding, and shifting stakeholder priorities into the focus group's endeavours.

Ultimately, the culmination of these efforts results in the production of a final report encapsulating key findings, actionable recommendations, and a strategic roadmap for future initiatives. This report will be shared openly with the broader community, ensuring that the insights and recommendations derived from the focus group activities are accessible and actionable on a wider scale.

3a. Knowledge and Opportunities

Earth observation, including remote sensing through satellite images, offers valuable data for identifying and analysing bare soil areas across large geographical regions[11]. This aids in estimating topsoil organic carbon content[12] and other soil attributes, especially in areas with temporal or partial vegetation cover.[13] However, while the collection of spectral reflectance associated with soil properties improves our understanding of the surface, it does not provide direct information on soil organic carbon (SOC)[14] stocks or stock changes.[15] Most methodologies addressing topsoil organic carbon content still result in spatially fragmented information on bare soil with a single image, underscoring the necessity for further enhancements to ensure continuous surface information.

Earth observation (EO) could play a crucial role in monitoring and estimating biomass stock over time in various forest contexts, including mature forests as well as afforestation and reforestation projects. Forests often cover vast areas, which can be challenging to access or accurately delineate. Several studies have shown that satellite data, such as hyperspectral, multispectral, and synthetic aperture radar (SAR) imagery,

11 Zepp, et al. 2023. Optimised bare soil compositing for soil organic carbon prediction of topsoil croplands in Bavaria using Landsat

12 Urbina-Salazar, et al. 2021. Using Sentinel-2 Images for Soil Organic Carbon Content Mapping in Croplands of Southwestern France

13 Demattê, et al. 2018. Geospatial Soil Sensing System (GEOS3): A powerful data mining procedure to retrieve soil spectral reflectance from satellite images

14 What is Soil Organic Carbon (SOC)

15 Measuring and modelling soil carbon stocks and stock changes in livestock production systems - Guidelines for assessment. Version 1

can effectively monitor forest health, extent, and changes over time.[16] [17] [18] [19] EO applications in forestry offer a rapid and accurate means of collecting data and information about biomass stock and potential risks in specific areas worldwide.

Furthermore, the implementation of CF practices (e.g., no-till, cover crops) will result in "quasi-permanent" soil cover jeopardising the possibility of observing soil surface using remote sensing. Yet EO-based service providers could support seasonal insights on crop development and forest standing biomass. This includes assessing the effects of soil biomass restitution on SOC stock changes and disturbances like forest fires and edge effect, which can enhance the accuracy of carbon ratings for voluntary carbon projects.[20] Additionally, EO data assimilation in vegetation (crops and forest) or ecosystem models (plant and soil) offers useful information on the water cycle, biomass, and yield estimations.

Recent advancements in EO missions[21] have significantly enhanced our ability to monitor and understand specific farming practices crucial for SOC management, such as crop rotations, cover cropping, no-till farming, and agroforestry. With this integration we gain deeper insights into the interactions between vegetation dynamics, soil health, and agricultural practices, thus enabling more informed decisions for sustainable land management and carbon sequestration efforts. While EO alone faces limitations in monitoring certain activities like irrigation for on-crop water stress estimation and quantifying organic amendments, nitrogen fertilisers, or pesticides, the integration with on-the-ground measurements offers a promising avenue to achieve more comprehensive and accurate assessments of carbon farming processes.

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[16] Wang, Junming, et al. 2018. Review of satellite remote sensing use in forest health studies

[17] Bayr, Caroline, et al. 2016. Satellite-based forest monitoring: Spatial and temporal forecast of growing index and short-wave infrared band

[18] Engelhart, et al. 2011. Aboveground biomass retrieval in tropical forests — The potential of combined X- and L-band SAR data use

[19] Berninger, et al. 2018. SAR-Based Estimation of Above-Ground Biomass and Its Changes in Tropical Forests of Kalimantan Using L- and C-Band

[20] EARSC 2022, EO can provide a cost-effective solution by strongly reducing ground surveys and measures, Statement: Proposal for a Regulation on a certification framework for carbon removals

[21] EO missions, from public and private providers, allow measuring reflectance with higher frequency (weekly), greater accuracy (in metres), and in multiple wavelengths (red, blue, green, near-infrared, etc.) (ref. Ustin et al.2021.Current and near-term advances in Earth observation for ecological applications)

Optical or radar EO images, including high-resolution hyperspectral images[22] combined with ground truth data and meteorological data for carbon flux monitoring,[23] aid forest analysis, detection of land use/land cover changes, and agricultural land management. Despite challenges in data processing and cost, there is a need to continue to explore and integrate these types of datasets. EO optical data can assist in the operational monitoring of carbon stock changes using carbon budget approaches[24] assimilating EO data in models, further refinement and enhancement of this integration are still necessary. In addition, Synthetic Aperture Radar (SAR) data could prove useful 1) to gap-fill leaf area index (LAI) time series that can be assimilated in crop models or 2) to be assimilated in models as biomass proxy.[25] The EAGLE action group[26] of the CORINE Land Cover (CLC+) under LULUCF[27] Instance, particularly at 10m resolution, offers Member States an opportunity to provide land use assumptions. This supports comparisons with other methodologies for calculating farm-scale Carbon Removal Certification Framework (CRCF)[28] emissions, highlighting the importance of satellite-derived data for carbon farming and standardising measurements of land use changes and carbon emissions at the farm level.

Policy adjustments in line with the CRCF are necessary for MRV in certification schemes and for the Common Agricultural Policy (CAP)[29], alongside with raising market awareness about the benefits of using Earth Observation for nature-based solutions (NBS)[30] [31]. Implementing rigorous certification, conducting awareness campaigns for land managers, and putting in place supportive public policies are essential for promoting

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22 Francos, et al. 2024. Mapping Soil Organic Carbon Stock Using Hyperspectral Remote Sensing

23 e.g., AgriCarbon-EO – Carbon Farming & Monitoring

24 Wijmer, et al. 2024. GMD - AgriCarbon-EO v1.0.1: large-scale and high-resolution simulation of carbon fluxes by assimilation of Sentinel-2 and Landsat-8 reflectances using a Bayesian approach

25 Revill, et al. 2013 (Carbon cycling of European croplands: A framework for the assimilation of optical and microwave Earth observation data

26 Action Group on Land monitoring in Europe of the European environment information and observation network (Eionet). Copernicus Land Monitoring Service, EAGLE

27 European Commission, Land Use Sector

28 The CRCF aims to scale up carbon removal activities and fight greenwashing by empowering businesses to show their action in this field (https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification_en).

29 Common Agricultural Policy (https://agriculture.ec.europa.eu/common-agricultural-policy_en)

30 e.g., Farm Sustainability Tool for nutrients (FaST) Platform

31 EU Space Data for Sustainable Farming. (All MS are due to make versions of this available by the end of 2024)

cost-effective carbon removal practices, particularly given the diversity of certification frameworks and requirements that exist under different instruments[32].

3b. Challenges

Various factors may contribute to the perceived lack of advancement in fully harnessing EO for carbon markets, despite the many benefits. These could be due to a lack of understanding among carbon experts regarding EO, gaps in EO experts' understanding of carbon market mechanics, insufficient clarity on the EO verification process, scalability issues with processing chains, weather-related limitations such as the presence of clouds and cloud shadow,[33] and other potential obstacles. Such challenges make it hard to reach wide-scale adoption by end-users and customers, whether it be from a voluntary market or a regulatory market perspective.

Moreover, difficulties arise in accessing both FAIR[34] and freely available ground truth data to establish connections between satellite imagery and carbon farming practices, including changes in carbon stocks or various components of the carbon budget, like biomass, yield, and CO_2 fluxes. Additionally, it is necessary to develop models capable of deducing carbon-related information from acquired imagery, whether for the estimation of biomass, identification of carbon farming practices[35] (such as mapping cover crops or tillage), the quantification of soil properties like texture, depth, and SOC content in the topsoil and also an adequate soil database to train/validate these models for different regions in the EU. These challenges collectively contribute to the need for more advancement in this field. A crucial link needs to be made with the minimum soil monitoring standard, as stipulated by the Soil Monitoring Directive, provides a foundation, the limitation of LUCAS[36] data lies in its lack of information on land management practices, rendering it less useful for accurately explaining changes in SOC stocks. With comprehensive data on management practices such as cover crop, tillage, crop rotation, and fertiliser application, it becomes easier to attribute variations in SOC

[32] e.g., "gold-plated" for the CRCF or standard compliance for an agri-ETS scheme incentivising greenhouse gases (GHG) removals/reductions

[33] Li, et al. 2022. Cloud and cloud shadow detection for optical satellite imagery: Features, algorithms, validation, and prospects

[34] FAIR (findability, accessibility, interoperability, reusability) principle is a first step BUT not yet guaranteed

[35] Remote sensing imagery with ground truth data could be used to train Machine Learning models.

[36] Land Use and Coverage Area frame Survey (LUCAS) data points, https://esdac.jrc.ec.europa.eu/projects/lucas.

levels solely to natural processes or specific agricultural activities. As a result, while LUCAS data provide valuable baseline information, they are insufficient for elucidating the drivers behind SOC stock changes over time.

In contrast, extensive ground truth data have been collected by private campaigns or dedicated studies[37], particularly concerning forest ecosystems, and correlated with Earth observation (EO) data. For instance, carbon flux has been measured in the field using techniques such as eddy covariance towers.[38] Additionally, data pertaining to forest structure, height, and biomass are available for forests worldwide, gathered for diverse purposes ranging from commercial to conservation objectives. Numerous studies have conducted in-situ data collection to validate models aimed at estimating biomass and tree height, with some tailored to specific ecozones.

For the incorporation of satellite-derived data and open-access datasets for MRV applications, data harmonisation and estimation methods are crucial components. Data harmonisation involves standardising datasets from various sources to ensure consistency and comparability. This ensures that the data utilised in MRV efforts are coherent and reliable. Concurrently, uncertainty estimation methods assess the reliability and precision of the model and the collected data, providing insights into the level of confidence in the reported carbon removals. Carbon projects have faced challenges in terms of their reputation, mainly due to issues surrounding additionality, transparency and reliability of their actual performance, established baselines, and achieved benefits.[39] In recent years, there has been a noticeable decline in reliability, impacting the credibility of these projects, often leading to accusations of greenwashing by some entities leveraging carbon offsetting.

Despite challenges, EO remains essential for enhancing the monitoring and validating of carbon projects, ensuring credibility and transparency. It is important that certifiers adopt EO in the standard methodologies, which sometimes are updated very sparsely without keeping up with technical developments, as with the monitoring of carbon estimates or baselines, which are often carried out every 3-5 years, nowadays with satellites with daily

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[37] Harris, et al., 2021. Global maps of twenty-first century forest carbon fluxes.

[38] Mo, et al. 2023.Integrated global assessment of the natural forest carbon potential.

[39] Haya, et al. 2023. Quality Assessment of REDD+ Carbon Credit Projects.

temporal resolution, it is important that these methodologies follow technological advances that allow for an increase in the accuracy of the various carbon estimates. Establishing centralised data repositories with standardised formats, alongside investing in capacity building in under-resourced areas, are essential steps. Additionally, increasing efforts to gather and share in situ data, particularly from inaccessible or under-studied regions, is crucial for improving the accuracy and reliability of environmental datasets.

4. Key Takeaways

Earth Observation facilitates data supply and comparison of methodologies. Satellite-derived data and services show promise in mapping and evaluating carbon farming but require further research and development, testing, and validation along with in-situ and ground truth data, in line with user needs. While the growth of carbon markets faces uncertainties, the demand for EO technology for carbon monitoring will continue, especially with the need for transparency and integrity in Voluntary Carbon Markets. Despite the existence of numerous methodologies, the lack of comprehensive operational standards that clearly define workflow and data needs in each process makes it difficult for EO service providers to enter the MRV market. Harmonising and standardising MRV methodologies for carbon farming is crucial for providing coherent solutions across different contexts, supported by real case scenarios and ongoing EU-level projects.

Combining soil sampling[40] [41] with EO data in digital soil mapping models offers a promising approach for accurately measuring soil organic carbon content in the top layer of agricultural lands.[42] Additionally, integrating EO data into ecosystem[43] and biomass models[44] enables the assessment of changes in soil organic carbon stocks through a

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[40] Wijmer, et al. 2024. GMD - Metrics - AgriCarbon-EO v1.0.1: large-scale and high-resolution simulation of carbon fluxes by assimilation of Sentinel-2 and Landsat-8 reflectances using a Bayesian approach

[41] Regrow, Agreena and Netcarbon have EO-based models that use hundreds of thousands of ground truth data points to identify/verify things like no tillage and cover cropping

[42] Samarinas, et al, 2023. Soil Data Cube and Artificial Intelligence Techniques for Generating National-Scale Topsoil Thematic Maps: A Case Study in Lithuanian Croplands

[43] AgriCarbon-EO processing chain, Netcarbon, Loamin, and the Regen Network have a methodology for grasslands that outlines an approach - while there are still issues with the statistical approach to the uncertainty they use, it is a step in the right direction. Verra is working on something similar

[44] Estimate feeding soil in Carbon models - Perennial biomass cropping and use: Shaping the policy ecosystem in European countries

carbon budget approach. These hybrid methodologies allow for highly precise estimates at the field or farm level, offering a more efficient alternative to traditional, expensive, and time-consuming methods. Satellites are also indispensable for quickly assessing forested areas, and recent studies demonstrate that the accuracy of available models for estimating key parameters is continually improving. Earth observation (EO) could serve as a valuable tool for monitoring forests worldwide.

It is important to note that while combining EO data with soil surveys may represent a significant advancement in soil mapping techniques, there is a need for further refinement in the statistical methodologies employed. Supplementing LUCAS data with more detailed soil sampling that includes information on management practices is essential for gaining a comprehensive understanding of SOC dynamics and effectively addressing climate change mitigation strategies. This supplementation is necessary to enhance the accuracy and reliability of soil carbon measurements, particularly at larger scales such as the pan-EU scale.

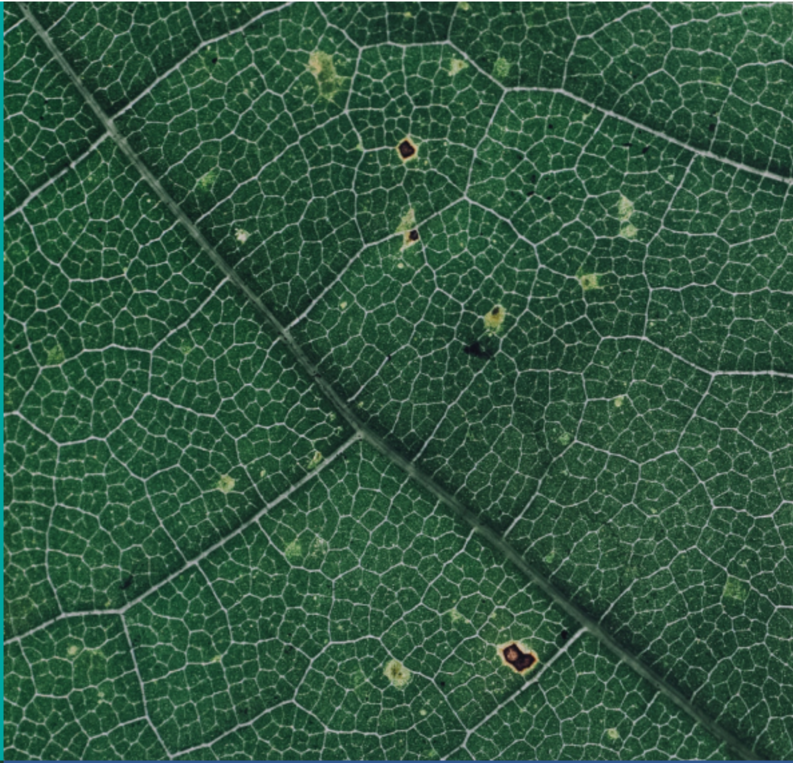
Definitions of terminology such as baseline, carbon removal, carbon sequestration, carbon farming, carbon storage in products, the durability of removal, and permanent carbon storage should be clearly defined to better understand and implement the regulation. Embracing a multi-actor approach involving a wide range of stakeholders and establishing a platform for sharing input data and testing environments for future EU-wide MRV tools is essential for the implementation of the CRCF. Dedicated funding and resources should be considered to create such a platform for data harmonisation and exchange. Collaboration and communication among stakeholders, both private and public, that are involved in carbon farming activities, and more importantly farmers, producers and growers, are crucial for realising the full potential of these initiatives and ensuring successful implementation.

Engaging with policy and legal experts to address data governance and ownership, while establishing clear regulations and standards, is essential for ensuring the success of integrating EO for MRV of CF. Similarly, the private sector's potential to accelerate the carbon market is underestimated, hindered by the absence of a harmonised standardisation framework. Without recognized "Carbon standards" and adequate incentives for stakeholders, progress remains slow despite social and political pressure for change.

This preliminary report marks the outset of discussions, serving as an initial document in collaboration with experts within the context of the CREDIBLE project.[45] It serves as a starting point, aiming to facilitate discussions rather than representing a final stance. As we continue our engagements with stakeholders, we anticipate refining the content over the coming months and years. The timing of sharing this information aligns with the DG CLIMA expert group meetings, providing an opportunity for its consideration in ongoing discussions.

The Focus Group will continue discussing the sections mentioned above, delving deeper into the role of EO in specific aspects of carbon farming practices, whether voluntary or mandated by law, pinpoint how EO facilitates accurate reporting at various levels, and analyse EO's involvement in verification methodologies by National Reporting Centers or certification bodies.

[45] Credible is an EU-funded coordination and support action. Its main goal is to build consensus on the methodologies that could maximise the capacity of soils to act as carbon sinks. To know more, explore the consensus-building process



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