CARBON 4 SOIL QUALITY | Interreg Euro-MED | Co-funded by the European Union

January 2026

RECOMMENDATIONS ON AGRICULTURE CARBON CREDIT SCHEMES AND ENVIRONMENTAL CERTIFICATION SYSTEMS

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Deliverable ID

Project acronym	Carbon 4 Soil Quality
Project title	Capturing and Storing Atmospheric CO_2 for Improvement of Soil Quality
Project mission	Natural Heritage
Project priority	Greener MED
Specific objective	RSO2.7
Type of project	Study
Project duration	01/01/24 – 31/03/26 (27 months)

Deliverable title	Recommendations on agriculture carbon credit schemes and environmental certification systems
Deliverable number	1.5.1
Deliverable type	Study
Work package number	1
Work package title	Better understanding of carbon farming benefits for quality of soil and CO_2 reduction
Activity name	Study of carbon credit schemes and environmental certification systems
Activity number	1.5
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Document history

Versions	Date	Document status	Delivered by
Version 1.0	02/12/25	Draft	KIS
Version 2.0	27/01/26	Final before comments	KIS
Version 3.0	03/02/26	final	KIS

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EXECUTIVE SUMMARY

The Euro-Mediterranean region faces a distinctive combination of environmental and agricultural challenges. Drought, soil erosion, declining soil organic matter, and high climatic variability constrain agricultural productivity and increase the vulnerability of rural landscapes. However, Mediterranean soils have considerable potential for improvement and potential for carbon sequestration when managed with practices that enhance soil organic carbon (SOC) stocks, enhance water retention, and support long-term resilience. This deliverable examines how carbon farming can be advanced in the region and outlines a Mediterranean-adapted approach to future carbon certification, with particular attention to monitoring, reporting and verification (MRV) constraints and opportunities under Mediterranean agro-ecological conditions.

Across the European Union, new climate and soil policies are reshaping the role of land-based mitigation. The European Green Deal, the EU Climate Law, the revised LULUCF Regulation, and the 2023–2027 Common Agricultural Policy highlight the importance of soil restoration for achieving climate neutrality. The Carbon Removal Certification Framework (CRCF) is introducing harmonised EU-level quality criteria for carbon removals, including quantification, additionality, permanence, and sustainability. These developments create a strategic opportunity for Mediterranean countries to align carbon farming initiatives with EU standards while adapting them to regional conditions.

A review of existing carbon-credit schemes shows that voluntary market methodologies and national programmes provide useful insights but cannot be directly applied to Mediterranean soils. Most existing systems were developed for temperate regions and do not fully reflect the SOC dynamics of dry, erosion-prone environments. Mediterranean countries therefore require adapted approaches that incorporate region-specific baselines, conservative quantification, hybrid MRV systems, and governance arrangements suited to small and fragmented farms.

This deliverable proposes a conceptual framework for such an approach. It highlights the need for Mediterranean-calibrated methodologies, multi-scale MRV systems combining field data, models, and remote sensing, permanence risks that incorporates drought and erosion risks, and aggregated governance structures capable of supporting farmer participation. These elements are intended as guiding principles for future piloting and CRCF alignment, rather than a ready-made certification scheme.

To advance carbon farming in the Euro-Mediterranean region, policymakers should prioritise investment in soil-monitoring infrastructure, develop region-specific baselines, and support advisory and cooperative structures. Promoting cross-border collaboration on data, modelling, and capacity building is also of great importance. By doing so, Mediterranean countries can create enabling conditions for credible and environmentally robust carbon farming systems that contribute to climate mitigation, soil restoration, and resilient rural development.

1 INTRODUCTION

Carbon farming has become a vital component of recent climate mitigation strategies, particularly in regions where agricultural land represents a major part of the landscape and where soil degradation threatens long-term sustainability. The Euro-Mediterranean (Euro-MED) region illustrates this dual challenge. Mediterranean agriculture has developed in environments characterised by pronounced seasonality, frequent droughts, water shortages, steep terrain, and centuries of intensive land use. These pressures have resulted in soils that are often low in organic matter, structurally fragile, and highly sensitive to climatic extremes. At the same time, these landscapes offer substantial, yet underutilised, opportunities for rebuilding soil organic carbon (SOC), improving soil health, and contributing so to climate objectives.

The Carbon4SoilQuality (C4SQ) project addresses this challenge by developing harmonised tools, models, and governance frameworks to support carbon farming initiatives across diverse Euro-MED contexts. Within C4SQ, Activity 1.5 specifically examines carbon credit schemes and environmental certification systems relevant to Mediterranean agriculture. The associated deliverable is intended as a strategic input for national decision makers and EU bodies considering the future integration of agriculture into carbon-removal frameworks and carbon markets. Its scope builds on earlier project deliverables – such as D1.1.1 (laboratory methods), D1.2.1 (SOC reference values), D1.3.1 (carbon farming practices), and D2.1.1 (PEST analysis)—providing a comprehensive analytical and policy-oriented foundation for carbon farming in the region.

The appeal of carbon farming lies in its capacity to address both climate mitigation and soil health restoration. SOC enrichment enhances water retention, builds aggregate stability, reduces erosion, increases microbial biodiversity, and improves nutrient cycling – functions essential in all regions, not only in the Mediterranean. These improvements strengthen drought resilience and farm stability, illustrating why SOC-rich soils are widely considered “climate-smart” in both scientific and policy discussions. However, the adoption of SOC-enhancing practices remains limited due to financial risks, uncertain returns, and the absence of strong incentives. Carbon credit schemes may offer a solution by monetising climate benefits, creating verification pathways for soil improvements, and enabling private-sector investment. To design a credible scheme for the Euro-MED region, however, it is essential to understand the landscape of existing carbon-credit frameworks, the implications of EU climate legislation, and the scientific principles underpinning SOC dynamics.

This deliverable is structured to guide the development of credible, regionally adapted approaches to carbon farming in the Euro-Mediterranean region. Chapter 1 introduces the scientific, agronomic, and institutional context, together with the methodological approach used in this study. Chapter 2 examines the EU’s policy and legislative landscape, including the Green Deal, the CAP, the LULUCF

Regulation, and the emerging Carbon Removal Certification Framework (CRCF), outlining their relevance for Mediterranean countries. Chapter 3 reviews existing carbon-credit schemes and environmental certification systems in Europe and globally, highlighting key lessons particularly important for dryland and perennial crops dominated agricultural systems. Chapter 4 proposes a conceptual framework for a Mediterranean-adapted carbon certification approach, identifying design elements that could guide future testing and implementation under the CRCF. Chapter 5 translates these insights into policy recommendations and future steps aimed at improving readiness, strengthening MRV capacity, and supporting the mainstreaming of carbon farming across the region. The concluding chapter synthesises the main findings and outlines the broader implications for Mediterranean agricultural systems and forthcoming carbon-governance developments.

1.1 Methodological approach

The methodological design of this deliverable follows a broad analytical framework that integrates evidence from carbon credit schemes, EU policy documents, certification standards, and MRV research, including IPCC-consistent tiered approaches to soil carbon quantification. Its purpose is to establish a credible foundation for assessing existing models and translating those lessons into a region-specific certification proposal consistent with the Certification Framework for Carbon Removals (CRCF – Regulation (EU) 2024/3012) requirements.

The first analytical layer comprises a systematic review of carbon credit schemes active in Europe and globally. This includes compliance markets, voluntary crediting programmes, domestic standards, and emerging science-led frameworks. Each scheme was analysed according to governance structure, baseline design, MRV architecture, permanence mechanism, additionality framework, and overall operational feasibility. Rather than evaluating practice-specific impacts, the review identifies structural and methodological features common to high-integrity systems. This step provides the typological and conceptual basis for comparing current scheme architectures and assessing their relevance for the Mediterranean region.

The second analytical layer focuses on a legal and policy review of EU climate governance as it relates to agriculture and land-based carbon removals. Documents examined include the European Green Deal, the EU Climate Law, the Sustainable Carbon Cycles communication, the LULUCF Regulation, the CAP Strategic Plans Regulation, and the Carbon Removal Certification Framework. Each was analysed to extract regulatory constraints, quality criteria, institutional roles, monitoring obligations, and interactions between EU-level and Member State responsibilities. This legal analysis ensures that the proposed certification scheme complies with EU legislation and contributes effectively to EU climate objectives.

The third analytical layer examines environmental certification systems, encompassing established voluntary standards (such as VCS, Gold Standard, and

Plan Vivo), domestic European schemes (such as Label Bas-Carbone) and emerging EU certification developments. The assessment focuses on methodological architecture, baseline construction, MRV protocols, uncertainty management, permanence models, and sustainability safeguards. Particular attention is paid to the alignment between existing standards and CRCF quality requirements. This review identifies methodological components suitable for adaptation and gaps requiring region-specific solutions.

These three analytical layers were synthesised through a structured comparative assessment based on CRCF quality criteria: quantification accuracy, additionality, permanence, MRV feasibility, governance transparency, and environmental safeguards. This comparative step identifies which elements of existing schemes are transferable to a Euro-MED context, which require adaptation, and which are unsuitable due to scientific or institutional constraints.

Finally, insights from the complete analytical process were consolidated into a conceptual framework for a Mediterranean-adapted carbon certification approach, presented in Chapter 4. Rather than proposing a fixed or operational scheme, this framework outlines potential design elements that could inform future testing, piloting, and policy development. It reflects the scientific, institutional, and socio-economic realities of Mediterranean agriculture and aligns with the emerging requirements of the CRCF, offering an evidence-based foundation upon which Mediterranean countries may build their own regionally appropriate certification pathways.

1.2 Carbon Farming context: Mitigation potential and soil quality benefits

Carbon farming is based on the principle that agricultural soils can serve as dynamic carbon sinks when managed with long-term conservation and regenerative practices. In line with EU climate accounting and carbon-credit methodologies, this deliverable refers primarily to soil organic carbon (SOC) as the measurable climate mitigation indicator; increases in SOC are closely linked to improvements in soil organic matter (SOM), which support soil structure, hydrological regulation and biological functioning.

The climate mitigation potential of enhanced SOC is well established. Soils represent the largest terrestrial carbon reservoir, and modelling studies suggest that improved cropland and grassland management across Europe could sequester significant quantities of CO_2 per year (Smith et al., 2019). Although Mediterranean soils tend to accumulate carbon more slowly than temperate soils due to water and heat constraints, their large geographic extent, low baseline SOC levels and long histories of degradation create considerable opportunities for net sequestration. Moreover, SOC stored deeper in the soil profile, particularly common in perennial crops systems typical of the Euro-MED region, tends to be more stable and less susceptible to short-term climatic variability (Zomer et al., 2022).

Mediterranean biophysical conditions strongly influence SOC dynamics. Hot, dry summers accelerate mineralisation, while intense autumn rainfall events contribute to surface runoff and erosion, removing carbon-rich topsoil. Seasonal gaps in vegetation cover expose soils to wind and to heat stress, compounding SOC losses. These vulnerabilities simultaneously increase the value of SOC gains: even modest improvements can substantially enhance water retention, infiltration and resilience to drought, particularly in landscapes where irregular precipitation is a major limitation to productivity. Enhanced SOC also improves aggregate stability, reduces erosion risk during winter and autumn storms and increases the soil's capacity to buffer climatic extremes.

SOC improvements are closely linked to broader soil quality benefits. Higher organic matter content strengthens aggregation, increases cation-exchange capacity, enhances nutrient retention and supports diverse microbial communities essential for leaf decomposition, nutrient cycling and disease suppression (Lal, 2004; Lehmann & Kleber, 2015). These functions are especially critical in Mediterranean agriculture, where soils must support production under water shortages, heat stress and rapid weather changes.

Despite these advantages, the adoption of SOC-enhancing practices remains limited. Farmers face financial risks, delayed economic returns and unawareness about the long-term benefits. Carbon credit schemes aim to address these barriers by monetising climate benefits and creating verifiable units of SOC increase. When designed in accordance with EU requirements, carbon-credit schemes can operate synergistically with the Common Agricultural Policy (CAP): while CAP eco-schemes support the uptake of regenerative practices, carbon crediting rewards the quantified SOC outcomes (provided additionality is respected and double funding avoided). This complementarity allows farmers to leverage both practice-based support and performance-based incentives.

Together, these scientific, environmental and economic considerations position carbon farming as a promising pathway for climate mitigation and soil restoration in the Euro-MED region. Its effective implementation, however, depends on methodologies, governance structures and MRV approaches tailored to the region's specific ecological dynamics and agricultural realities.

1.3 Euro-MED context

While the previous section outlines the biophysical and agronomic characteristics shaping carbon farming in Mediterranean landscapes, an equally important dimension is the broader socio-economic and institutional context in which carbon farming initiatives must operate.

The Euro-Mediterranean region is shaped not only by its climatic and ecological conditions but also by socio-economic, political, and institutional features that strongly influence the feasibility of carbon farming. Agricultural landscapes are

dominated by fragmented, family-based farms, mixed land-use patterns, and complex land-ownership systems. These characteristics increase the transaction costs of monitoring, reporting, and verification (MRV), reduce economies of scale, and complicate the adoption of new farm management practices. Limited access to technical advice, digital tools, and long-term financing further constrains participation in emerging carbon-credit schemes.

Institutional readiness across the region is highly heterogeneous. Some partner countries maintain relatively robust soil-monitoring networks, digital land registries, and advisory infrastructures, while others rely on partial datasets or fragmented administrative systems. The PEST analysis conducted in Deliverable D2.1.1 highlights gaps in policy alignment, MRV capacity, carbon-market development, and technological level of preparation. In several countries, agricultural soils are not fully integrated into national climate strategies, and dedicated carbon farming regulations are still absent. These gaps make it difficult to harmonise methodologies or establish consistent quality standards across the region.

Despite these challenges, the Euro-MED region also exhibits structural strengths that could support the development of Mediterranean-adapted carbon farming frameworks. Large areas of perennial crops cultivation, particularly olives, vineyards, and fruit orchards, offer natural SOC-sequestration of great potential. Traditional agro-silvo-pastoral systems combine woody biomass with grazing or cropping, creating multi-layered landscapes well suited to long-term carbon storage. The region also has a long history of cooperative farming and producer organisations, which could act as aggregators to reduce MRV costs, improve access to advisory services, and facilitate farmer participation in certification programmes.

Policy developments at the EU level further enhance the potential for a coordinated regional approach. The Carbon Removal Certification Framework provides EU-wide quality criteria for carbon removals, while the LULUCF Regulation establishes long-term accounting obligations. CAP eco-schemes already incentivise many practices aligned with SOC improvement, and the EU Soil Strategy for 2030 calls for restoration of degraded soils and improved soil monitoring. Together, these policies create a favourable environment for developing Mediterranean-adapted certification approaches that translate EU requirements into regionally relevant methodologies and governance structures.

Given these combined biophysical, socio-economic, and policy considerations, the Euro-MED region requires a certification approach scientifically robust, operationally feasible, and institutionally anchored. The conceptual framework developed in Chapter 4 is designed to support such a pathway by outlining potential design elements for a Mediterranean-adapted carbon certification approach that can be further explored, piloted, and refined according to national and regional capacities.

2 EU POLICY AND LEGAL FRAMEWORK FOR CARBON FARMING

Carbon farming has become an important link between agricultural policy, climate legislation, and environmental protection in the EU. Over the past decade, the EU has shifted from fragmented environmental measures to an integrated climate governance framework that combines binding emission targets, land sector monitoring rules, and financial incentives. Agriculture and land use are central to this transformation because they generate emissions but also contain most of Europe's natural carbon sinks, particularly soil and perennial vegetation. In Mediterranean countries, where drought, soil degradation and erosion are worsening, this evolving policy landscape presents both opportunities and responsibilities. Carbon farming and soil carbon restoration are becoming essential components of national climate strategies, and their long-term development is shaped by the legal and policy instruments described in this chapter.

2.1 European green deal and the EU climate law

The European Green Deal, adopted in 2019, sets the strategic direction for Europe's transition to climate neutrality by 2050. It identifies soil degradation, biodiversity loss, and unsustainable land use as major environmental risks, and emphasises the need to strengthen natural carbon sinks in forests and soils. The Green Deal marks a shift towards recognising soil health and carbon sequestration as core components of Europe's climate mitigation pathway. It also calls for new incentives, including future carbon removal certification mechanisms, to reward farmers who deliver climate-beneficial outcomes.

The European Climate Law (Regulation (EU) 2021/1119) translates these ambitions into binding legislation. It establishes a legal obligation for the EU to reduce greenhouse gas emissions by at least 55% by 2030 and to achieve climate neutrality by 2050. The law emphasises that land-based removals are essential for meeting these goals and requires all subsequent climate legislation – including the revised LULUCF Regulation, CAP Strategic Plans, and the Carbon Removal Certification Framework (CRCF)—to align with the neutrality objective. Together, the Green Deal and the Climate Law anchor carbon farming within a long-term climate policy direction.

2.2 Sustainable carbon cycles and the carbon farming initiative

The Communication "Sustainable Carbon Cycles" (COM (2021) 800) outlines how the EU plans to increase carbon removals through both engineered and nature-based approaches. While reducing emissions remains the priority, the document highlights that carbon removals will be necessary to balance residual emissions from sectors such as agriculture, transport, and industry. Carbon farming is identified as a key instrument for achieving these removals.

The strategy describes carbon farming as a combination of practices aimed at

increasing soil organic carbon (SOC), enhancing biomass carbon in agroforestry and grasslands, and reducing emissions from soils. It sets a target to generate at least 5 Mt of additional annual removals from carbon farming by 2030. However, achieving this target requires clear financial incentives, advisory systems, and robust monitoring, reporting, and verification (MRV) procedures.

To support Member States, the Commission published the Technical Guidance Handbook for Result-Based Carbon Farming (2021), which outlines how carbon farming can be implemented through action-based, result-based, or hybrid schemes. The handbook highlights the importance of reliable baselines, conservative quantification methods, and sustainability safeguards. It also emphasises that carbon farming must consider all carbon pools on the farm, not only SOC. This guidance forms a conceptual bridge between Sustainable Carbon Cycles and the CRCF.

2.3 Effort Sharing Regulation (ESR)

The Effort Sharing Regulation (ESR) governs greenhouse gas emissions from sectors not included in the EU Emissions Trading System, such as agriculture, buildings and transport. For agriculture, the ESR is relevant because it sets binding national targets for reducing non-CO_2 emissions, mainly methane from livestock and nitrous oxide from fertiliser use. Soil carbon sequestration is accounted for under LULUCF, not the ESR, but ESR obligations influence the broader mitigation context in which carbon farming develops.

The 2023 Fit-for-55 revision increased the collective ESR target to a 40% reduction by 2030 compared to 2005 and restricted the use of flexibilities, including the limited use of LULUCF removals to compensate for agricultural emissions. For many Mediterranean member states, reducing agricultural non-CO_2 emissions is difficult due to climate constraints, farm structure and production systems. This reinforces the need for complementary mitigation pathways, including soil carbon enhancement under LULUCF. While the ESR does not directly regulate carbon farming, it contributes to policy pressure for stronger agricultural climate action and increases the relevance of land-based removals.

2.4 LULUCF Regulation

The Land Use, Land Use Change and Forestry (LULUCF) Regulation forms the EU's accounting system for carbon fluxes in soils, forests and other land categories. Its revised version (Regulation (EU) 2023/839) has strengthened the role of the land sector by establishing a binding EU-wide target of 310 Mt CO_2-eq net removals by 2030. This target is part of the "land-sector pillar" of the Fit-for-55 package and requires Member States to increase the carbon sink of their managed land.

LULUCF is directly connected to carbon farming because many carbon farming practices, such as increasing SOC, restoring degraded land or improving grassland management, contribute to a Member State's LULUCF balance. For Mediterranean countries, LULUCF obligations are particularly challenging. Climate impacts such

as drought, wildfires and erosion reduce the natural capacity of soils and forests to store carbon, and many southern member states have already experienced a decline in their land-based carbon sink. This implicitly increases the pressure on agricultural soils to deliver additional removals.

Carbon farming schemes must be designed to align with LULUCF accounting rules to avoid double counting, especially when credits are issued for voluntary markets. Any credit-issuing system must clearly separate removals counted towards national inventories from those traded privately or ensure that both uses are transparently recorded. Despite its complexities, LULUCF provides a strong legal foundation for Member States to promote soil restoration measures as part of their climate obligations.

2.5 Common Agricultural Policy (CAP) 2023–2027

The Common Agricultural Policy remains the EU's main instrument for influencing farming practices and rural development. The 2023–2027 reform introduced a greener framework based on enhanced conditionality, eco-schemes under Pillar I, and agri-environment-climate measures (AECMs) under Pillar II.

Stricter conditionality rules include standards for maintaining soil cover, reducing erosion, protecting permanent grasslands, and promoting crop rotation. These requirements support many carbon farming objectives by preventing soil carbon loss. Eco-schemes provide additional incentives for the voluntary adoption of practices such as organic farming, agroforestry, reduced tillage, and the use of cover crops, many of which overlap with carbon farming methodologies. AECMs under Pillar II often offer longer commitments and can target complex interventions that support soil health and climate resilience.

However, the CAP remains action-based, paying farmers for implementing practices rather than for measured outcomes. This makes CAP support useful for promoting adoption but not suitable for generating certified carbon credits. Coordination between CAP interventions and CRCF certification will therefore be essential to avoid double funding or conflicts with additionality rules. Mediterranean CAP Strategic Plans increasingly focus on erosion control, drought resilience, and soil organic matter maintenance, showing growing alignment with carbon farming objectives.

2.6 Carbon Removal Certification Framework (CRCF)

The Carbon Removal Certification Framework (CRCF), established under Regulation (EU) 2024/3012, is the EU's first unified system for certifying carbon removals, including agricultural soil carbon sequestration. It sets harmonised EU-wide rules for defining, measuring, verifying and certifying removals, and will eventually be supported by an EU-level registry expected to be operational by 2028.

The CRCF recognises three categories of removals: permanent carbon storage, carbon farming, and carbon storage in products. For agriculture, carbon farming

includes practices that increase soil organic carbon, reduce emissions from mineral and organic soils, or increase biomass carbon in agroforestry systems. The framework relies on EU-approved methodologies, baseline comparisons, and independent verification.

At its core are the QU.A.L.ITY criteria, which ensure that certified removals meet minimum standards:

- **Quantification** requires conservative, IPCC-aligned methodologies that measure net carbon benefits relative to a baseline.
- **Additionality** refers to carbon removals or emission reductions that would not have occurred in the absence of the specific incentive provided by the scheme, consistent with IPCC and CRCF principles.
- **Long-term storage** requires risk assessment, monitoring of reversals, and mechanisms such as buffer pools.
- **Sustainability** ensures no significant harm to biodiversity, soil health, or water resources.

Independent assessments highlight challenges, especially for soil-based removals. Concerns include uncertainty in measurement, high sensitivity to management decisions, permanence risks, and the difficulty of distinguishing removals from avoided emissions. These concerns are more pronounced in Mediterranean conditions, where climate variability and erosion increase uncertainty. For this reason, many experts suggest that soil carbon credits are more suitable for contribution claims than for offsetting hard-to-abate emissions.

Despite these limitations, the CRCF represents a major milestone. It provides the legal foundation for high-quality removal certification and will shape all future carbon farming schemes in Europe. For Mediterranean countries, CRCF implementation must consider local soil conditions, climatic risks, and institutional capacities to ensure that regionally adapted approaches meet EU quality standards.

2.7 National and regional frameworks in C4SQ partner countries

C4SQ partner countries exhibit diverse institutional and agronomic conditions. Although CAP Strategic Plans differ significantly, most Mediterranean Member States encounter similar challenges: fragmented farm structures, limited advisory capacity, severe soil erosion risks, and low baseline SOC levels. These factors complicate the implementation of uniform carbon farming approaches but also underscore significant potential for SOC restoration.

Several partners countries have integrated soil health, carbon sequestration, and sustainable land management into climate strategies and rural development plans. However, capacities for MRV, modelling, and advisory support vary considerably across the region. Transnational cooperation, as seen in the C4SQ and other regional projects, remains essential for harmonising methodologies,

improving data availability, and developing shared baselines for Euro-MED carbon farming schemes.

2.8 Policy context in non-EU Mediterranean and Western Balkan countries

Non-EU C4SQ partners, particularly those in the Western Balkans, are not bound by EU legislation but are gradually aligning with existing EU standards as part of their accession processes. Candidate and potential candidate countries, such as Montenegro and North Macedonia, have increasing obligations under various chapters of the accession negotiation process. This steers countries towards EU-style climate governance, including soil monitoring systems and MRV structures.

The Green Agenda for the Western Balkans (2020) reinforces this direction by promoting sustainable agriculture, soil protection, climate adaptation, and gradual alignment with the European Green Deal. Additionally, pre-accession programmes such as IPARD III prioritise soil protection, climate-smart agriculture, and sustainable land management. While none of the non-EU partners currently have carbon farming legislation or certification systems, several acknowledge soil carbon and climate mitigation in national strategies. This creates an opportunity to integrate CRCF-compatible approaches from the outset as institutional capacity develops.

2.9 Synthesis and implications for emerging carbon-credit schemes

Across the EU policy framework, carbon farming lies at the intersection of climate mitigation, soil protection and agricultural resilience. The Green Deal and Climate Law set the strategic direction; Sustainable Carbon Cycles identifies carbon farming as a central instrument; LULUCF provides the accounting framework; the CAP offers financial and agronomic support; and the CRCF establishes the certification rules required for credible carbon-removal units.

However, implementation challenges persist. Soil-carbon measurement is technically complex and costly, particularly in heterogeneous Mediterranean landscapes. Additionality must be carefully managed to avoid overlap with CAP funding. Permanence risks are heightened by drought, wildfire and erosion. Institutional readiness varies widely and is particularly uneven in non-EU partner countries, where convergence with EU climate governance is still in progress.

These dynamics shape the conditions under which future carbon-credit schemes must operate. While the EU is building a strong regulatory foundation for high-quality carbon removals, the operationalisation of carbon markets – whether voluntary, public or hybrid – will depend on governance models capable of addressing Mediterranean climatic constraints, ensuring environmental integrity and accommodating diverse national capacities. These issues are examined in greater detail in Chapter 3, which reviews existing carbon-credit schemes and their relevance for the Euro-MED region.

3 REVIEW OF EXISTING CARBON CREDIT SCHEMES

Carbon credit schemes have developed into a diverse and sometimes confusing array of standards, programmes and methodologies. For the agriculture sector, now increasingly recognised as an important component of climate mitigation strategies, this complexity can make it difficult for farmers, advisers and policymakers to understand how carbon credits are generated, which systems are credible, and how different frameworks interact. In the Euro-Mediterranean region, this issue is particularly relevant. The region faces persistent environmental pressures already listed in this document; however, it also holds considerable potential for carbon sequestration in perennial fruit crops systems, agroforestry, grasslands and improved cropland management. Therefore, understanding the different types of carbon credit schemes is essential for evaluating which elements could be integrated into a future Mediterranean-adapted approach and for grounding the policy recommendations presented in later chapters of this deliverable.

A carbon credit scheme can be broadly defined as a system that applies methodologies to quantify, verify and issue credits for emission reductions or carbon removals. These schemes differ in purpose and governance, ranging from voluntary market standards to domestic national initiatives and compliance systems used in regulated carbon markets. Many schemes do not focus specifically on soil carbon, but those that do have varying levels of scientific robustness and monitoring requirements. The aim of this chapter is not to provide a technical review of every global system, but to synthesise the main categories of carbon credit schemes relevant to soil carbon and to highlight how their experiences can guide the development of a Euro-MED carbon farming framework that is compatible with emerging EU regulations, especially the CRCF.

3.1 Structure and typology of carbon credit schemes

To understand how carbon credits are generated, it is useful to distinguish between several components that often coexist within a scheme. These include the certification standard, which defines the rules and methodologies used to quantify carbon; the scheme itself, which provides governance, participation rules, and project oversight; the registry, which records issued credits and prevents double counting; and the market or platform where credits may be exchanged. Different schemes combine these functions in various ways. For example, some national programmes include their own registries, while voluntary standards rely on independent registries. Environmental labelling systems may recognise sustainable practices without creating tradable credits.

In addition to these structural components, schemes fall into several functional categories. Compliance or regulatory systems issue credits that can be used to meet legally binding emission reduction obligations. Voluntary carbon markets operate independently of regulation and are driven by corporate commitments,

supply chain goals, and climate strategies. Domestic agricultural schemes developed by EU Member States are usually linked to national climate plans and may issue nationally recognised units. Methodological and MRV (monitoring, reporting, and verification) frameworks provide scientific guidance that underpins credible quantification across different schemes.

3.2 Compliance Frameworks: ETS and Related systems

Compliance carbon markets are regulatory systems in which participating entities must hold emission allowances or certified units to meet legally binding climate targets. These systems generally require very high environmental integrity and long-term permanence, which is why agricultural soil carbon rarely fits easily within them. Nevertheless, understanding how regulatory systems work is important, as they shape expectations around credibility, monitoring standards and financial flows that influence voluntary markets and, indirectly, agricultural carbon schemes.

The most important compliance system in Europe is the EU Emissions Trading System (EU ETS). It is the cornerstone of the EU's climate policy and the world's largest carbon market. The ETS operates on a cap-and-trade principle: a fixed quantity of emission allowances is issued each year, forming a declining cap, and companies in energy, industry and aviation must surrender as many allowances as the emissions they produce. Firms that reduce emissions can sell surplus allowances, while those that exceed their limit must purchase more. This creates a financial signal that rewards low-carbon behaviour and innovation. As the cap declines each year, the market progressively tightens, reinforcing the price incentive.

Although agriculture is not included and soil carbon credits cannot be used for ETS compliance, the logic of the ETS remains relevant for understanding carbon trading in general. The ETS demonstrates how pricing emissions creates an economic rationale for decarbonisation, stimulates demand for high-quality carbon units and influences corporate behaviour. Companies operating within the ETS often also participate in voluntary carbon markets, bringing with them expectations regarding integrity, transparency and verification. In other words, even if agricultural removals are outside the ETS, the ETS indirectly shapes the landscape in which voluntary agricultural credits are perceived and valued.

A key feature of the ETS is its use of revenues generated through the auctioning of emission allowances. Member States are required to spend most of these revenues on climate action, energy transition and environmental projects. ETS revenues finance initiatives such as renewable energy deployment, building renovation, energy-efficiency improvements, industrial decarbonisation and adaptation measures. Two major EU instruments – the Innovation Fund and the Modernisation Fund – are funded through ETS revenues and support breakthrough technologies, clean industrial processes and transition efforts in lower-income Member States. This financing logic illustrates how carbon pricing can mobilise substantial resources for broader sustainability goals.

This principle has important parallels in agriculture. Although soil carbon is not included in the ETS, a similar financing mechanism could support carbon farming in the Euro-MED region. Revenue from carbon pricing – whether from future domestic schemes, voluntary markets, or the allocation of public climate funds – could be directed towards MRV systems, soil-monitoring networks, advisory services, digitalisation, and cooperative structures. Such reinvestment would help address the high up-front costs of implementing and verifying carbon farming practices, especially in Mediterranean countries where limited water supply, land degradation, and low farm profitability pose significant barriers, but could also serve as incentives if addressed properly.

The ETS also demonstrates the importance of robust tracking systems. Allowances are recorded in a central Union Registry, which prevents double counting and ensures complete transparency in ownership and transactions. This same principle is now being applied to the Carbon Removal Certification Framework (CRCF), which will establish an EU-wide registry for certified carbon-removal units. For Mediterranean countries designing carbon farming schemes, this signals that any future certification system must be interoperable with EU-level registries to ensure traceability, consistency and high integrity.

Other compliance systems worldwide, such as those in New Zealand, California and Australia, offer additional insights. They often include forestry and land-use credits but still largely exclude soil carbon due to uncertainty and permanence concerns. These systems demonstrate that, at the regulatory level, carbon markets accept only credit types backed by strong evidence, rigorous monitoring and clear long-term durability.

In summary, although agricultural soil carbon will not enter compliance markets like the EU ETS in the foreseeable future, the logic and structure of the ETS remain highly relevant for understanding why carbon trading matters. Compliance markets show how pricing mechanisms can mobilise climate finance, create incentives and set expectations for integrity, elements that will influence the future development of carbon farming schemes and certification systems in the Euro-MED region.

3.3 Voluntary carbon markets

Voluntary carbon markets (VCM) are currently the main environment in which soil carbon projects operate. Participation in these markets is driven primarily by corporate climate goals, supply chain strategies and broader sustainability commitments, and they function independently of regulatory obligations. To understand how agriculture fits within this context, it is useful to recognise that VCM are part of a broader family of offset markets, in which carbon credits compensate for emissions elsewhere. Offset markets can be divided into compliance offsets, which serve regulatory systems such as the EU ETS, and voluntary offsets, which rely on independent standards. As already mentioned, agriculture is not permitted as an offset source in compliance markets, meaning all

agricultural soil carbon projects fall within the voluntary sphere.

In voluntary offset markets, credits are generated by projects that avoid, reduce or remove greenhouse gas emissions and are then independently verified. These markets have developed rapidly in recent years and now include a wide range of programmes and mechanisms working with farmers. Internationally, initiatives such as Indigo Carbon and Truterra's TruCarbon programme illustrate how private actors engage farmers, offering technical support, digital tools or even access to machinery to facilitate the adoption of carbon-sequestering practices. Buyer demand includes high-profile companies such as Cargill, Shopify and Microsoft, alongside many smaller firms seeking credible climate contributions. Global projections estimate that the voluntary carbon market could reach a value of around USD 100 billion by 2050, indicating its growing relevance for agricultural sectors worldwide.

Inset markets represent a parallel but distinct model within the broader carbon market landscape. Rather than purchasing external credits, companies with agricultural supply chains partner directly with farmers to reduce emissions or enhance removals within their value chains. Inset arrangements focus on internal decarbonisation rather than compensation, and often involve education, advisory support and financial incentives for farmers. Companies such as Nestlé and Bayer, together with multi-stakeholder initiatives like the Field to Market Alliance, exemplify this approach. For Mediterranean agriculture – characterised by fragmented farm structures, high-value perennial crops and strong cooperative traditions – inset models may offer particularly promising pathways, especially where sustainability standards and product traceability already influence market value, such as in olive oil and wine production.

Alongside these market structures, VCM rely on independent certification standards that provide methodologies, governance frameworks and verification rules. The Verified Carbon Standard (VCS), managed by Verra, is the most widely used and includes several methodologies relevant to soil carbon and improved land management. These methodologies typically combine modelling, soil sampling and land use verification, and although influential, some have faced criticism for inconsistent calibration and uncertainty levels that can lead to over- or underestimation of carbon sequestration benefits. Such concerns are especially relevant in Mediterranean systems, where drought, low biomass production and soil erosion introduce additional variability.

Gold Standard emphasises sustainable development co-benefits and uses conservative quantification approaches, offering strong environmental safeguards, even though fewer methodologies are available for soil carbon. Plan Vivo focuses on community-based projects and small-scale farming systems, which can resemble certain Mediterranean landscapes, but may be less applicable to larger commercial farms. The Climate Action Reserve (CAR) provides high-rigour methodologies with robust permanence rules, although these are tailored mainly to North American high-productivity systems.

Voluntary markets have played an important role in driving methodological innovation and motivating early farmer participation in soil carbon projects. They are also likely to remain influential as the EU operationalises the Carbon Removal Certification Framework (CRCF), which is setting new standards for integrity, additionality and MRV. For Euro-MED policymakers, voluntary markets should be understood as a transitional space where important lessons can be learned, but where careful selection of standards and methodologies is essential to avoid adopting practices that are poorly suited to regional conditions or incompatible with EU climate accounting rules.

Table 1: Key differences between compliance and voluntary carbon markets

Dimension	COMPLIANCE MARKETS	VOLUNTARY MARKETS
Purpose	Meet legally binding climate targets.	Support corporate climate or supply-chain goals.
Legal status	Mandatory under regulation (e.g., EU ETS).	Fully voluntary participation.
Governance	Managed by public authorities and EU institutions.	Managed by private or NGO-led certification standards.
Role of agriculture	Agriculture and soil carbon excluded.	Agriculture included (soil carbon, agroforestry, grasslands).
Unit type	Emission allowances (EUAs).	Verified carbon credits (tCO_2e).
MRV requirements	Very strict, high permanence, continuous monitoring.	More flexible; hybrid MRV approaches increasingly common.
Revenue use	Auction revenues reinvested in climate and energy transition.	Credit revenues go directly to farmers or project developers.

3.4 Mediterranean carbon farming initiatives and emerging crediting approaches

Across the Mediterranean region, carbon farming activity is emerging through a combination of private programmes, public–private pilots and research-driven initiatives. While most countries do not yet operate formal, government-approved carbon-crediting schemes, several initiatives provide practical experience with SOC monitoring, regenerative practices and early-stage credit generation under voluntary standards.

In Spain, BALAM Agriculture's "Cultiva Carbono" program is one such active private carbon farming initiative. The programme supports farmers, particularly in perennial crops such as olives and almonds, in adopting regenerative practices aimed at increasing soil organic carbon and improving soil water retention. Although operating within voluntary-market frameworks, it has gained recognition as a Mediterranean example of applied SOC regeneration.

Another private-sector programme with a strong Mediterranean presence is AgreenaCarbon, which operates across Spain, Italy, Portugal and Greece. Designed as a pan-European results-based programme, it incentivises farmers to adopt practices such as reduced tillage and cover cropping. While not tailored specifically to Mediterranean soils, participation from southern European farmers highlights the growing interest in soil-carbon crediting in dryland arable systems.

Southern France provides a publicly governed example through the application of Label Bas-Carbone methodologies in Mediterranean regions such as Occitanie and Provence. Although originally designed for broader French agricultural conditions, several of its methodologies, particularly for agroforestry, vineyards and hedgerows, have been implemented in climates and cropping systems like those found across the Euro-MED region. This demonstrates the feasibility of structured, government-led carbon certification in Mediterranean settings, even if methodological adaptation is still needed.

In addition to these market-oriented schemes, the Mediterranean hosts several science-led projects that contribute data and methodological insights rather than issuing carbon credits. A particularly interesting research-driven initiative is the LIFE CLIMAMED project, which focuses on climate adaptation in Mediterranean dry-farming systems. The project tests soil-management practices – such as reduced tillage, cover cropping and diversification – that directly influence soil organic matter and water retention. While not a carbon-credit scheme, LIFE CLIMAMED generates high-quality field data on Mediterranean soil responses and

contributes to the development of monitoring frameworks that can support future CRCF-aligned methodologies.

These Mediterranean initiatives show that while carbon farming is still at an early stage in the region, there is growing practical experience with regenerative agriculture, SOC monitoring and pilot MRV approaches. They also illustrate that methodologies and governance structures must be adapted to Mediterranean pedoclimatic constraints, particularly drought, erosion and high SOC variability. None of the existing initiatives can be directly adopted as a region-wide scheme, but they offer valuable learning for the design of future CRCF-aligned models.

3.5 Research and science-led MRV frameworks

Monitoring, reporting and verification (MRV) is the backbone of any carbon-credit system, determining both the credibility and the cost of certification. For soil carbon, MRV must capture relatively small annual changes in a highly variable medium while ensuring that claimed removals are real, measurable and verifiable. Core MRV components typically include baseline soil sampling, biogeochemical modelling, management reporting, remote-sensing verification, uncertainty assessment and third-party auditing.

Soil carbon presents unique MRV challenges. Spatial heterogeneity, shallow or stony soil profiles, mixed land-use patterns and climate-driven fluctuations all affect measurement accuracy. These constraints are particularly relevant in Mediterranean landscapes, where drought, erosion, perennial–annual crop mosaics and strong interannual variability increase uncertainty in the measurements. For small and fragmented farms, which are common across the region, MRV costs can be too expensive, unless aggregation or digital tools are used to reduce complexity.

Internationally, MRV quality is often described using the IPCC Tier framework, which outlines three levels of methodological sophistication for quantifying agricultural and land-use emissions:

- Tier 1, based on default emission factors and generic equations, provides broad estimates with minimal data requirements but low accuracy.
- Tier 2 uses national or regional emission factors and locally relevant parameters, offering improved precision.
- Tier 3 relies on detailed in situ measurements or process-based biogeochemical models capable of capturing local pedoclimatic dynamics.

Although originally designed for national greenhouse gas inventories, this Tier system is directly relevant for soil-carbon crediting. Most credible soil-carbon methodologies operate between Tier 2 and Tier 3, using regionally calibrated models supported by measurement data. Under the CRCF, higher-tier approaches are expected to become standard for soil carbon, as they better reflect true carbon

dynamics and allow for transparent uncertainty reporting.

In practice, three broad MRV strategies exist. The first is measurement-based MRV, involving repeated soil sampling. This approach can be accurate but becomes costly and statistically demanding in heterogeneous Mediterranean soils. The second is model-based MRV, which uses biogeochemical models such as RothC or CENTURY. This approach is cost-effective but heavily dependent on calibration; without Mediterranean-specific parameters, model outputs may not reliably represent dryland SOC behaviour. The third and increasingly preferred strategy is hybrid MRV, which integrates sampling, modelling and remote-sensing data. Hybrid systems provide a balanced combination of accuracy, scalability and cost-efficiency, and align closely with CRCF principles.

Several scientific initiatives contribute directly to improving MRV capability across Europe. Projects such as MARVIC advance digital and remote-sensing tools for agricultural MRV, including Mediterranean-type perennial systems. VERIFY supports improved greenhouse gas flux estimation and model validation. EJP Soil provides empirical datasets, modelling tools and guidance essential for calibrating MRV frameworks to regional soil and climate conditions. ISO standards (e.g. ISO 14068-1:2023) and IPCC guidelines form the global methodological foundation on which these systems are built.

Mediterranean MRV faces distinct technical constraints: steep slopes, shallow horizons, stoniness, mixed perennial–annual crops systems, high soil erosion risk and long summer dry periods that weaken remote-sensing signals. These factors complicate both soil sampling and satellite-based verification. As a result, regionally adapted MRV strategies are essential to ensure that soil-carbon certification remains both scientifically credible and economically feasible.

3.6 Comparative assessment and key insights

A comparative review of existing carbon-credit schemes shows that each category offers valuable elements, yet none can be directly applied to Mediterranean agriculture without adaptation. Compliance markets provide robust integrity benchmarks but are not suitable for soil carbon under current scientific and regulatory conditions. Voluntary markets demonstrate methodological innovation and farmer engagement, though their quality varies and many approaches require strengthening before they can meet EU-level expectations. Domestic European schemes highlight the value of public governance and structured methodologies, while science-led MRV initiatives offer essential tools for quantification, calibration, and verification. Collectively, these systems indicate that effective Mediterranean carbon farming will require combining the strongest components of existing frameworks while addressing region-specific constraints such as drought, erosion, low SOC baselines, and highly fragmented farm structures.

All above shows that Mediterranean countries need regionally adapted methodologies, calibrated modelling approaches, hybrid MRV systems, and

governance structures that reduce participation costs while maintaining environmental integrity. Voluntary and domestic schemes offer important lessons, but their transfer to the Mediterranean requires careful adjustment and alignment with CRCF quality criteria. This chapter therefore prepares the ground for Chapter 4, which presents a conceptual framework for a Mediterranean-adapted carbon certification approach capable of reflecting local soil processes, supporting credible quantification, and harmonising with emerging European policy expectations.

4 CONCEPT FOR A MEDITERRANEAN-ADAPTED CARBON CERTIFICATION APPROACH

Despite the diversity of carbon-credit schemes and certification systems reviewed in the previous chapter, a clear conclusion emerges - existing approaches provide valuable insights but cannot be directly transferred to the Mediterranean context without adaptation. International standards offer methodological experience but struggle with Mediterranean-specific uncertainties such as drought-driven variability, low baseline soil organic carbon and erosion risks. Domestic European schemes demonstrate the importance of strong governance and public oversight, yet most were developed for temperate climates and different farm structures. Similarly, emerging MRV innovations provide powerful tools, but still require calibration to regional soils and land-use patterns. Taken together, these findings highlight a gap between what current schemes can deliver and what Mediterranean agriculture requires. This gap provides the rationale for developing a regionally adapted conceptual framework, presented in the next chapter, to guide future testing, policy alignment, and the gradual development of credible carbon farming mechanisms in the Euro-MED region.

Carbon farming in the Euro-Mediterranean region presents a unique combination of challenges and opportunities. The region is characterised by agricultural systems that have evolved through centuries of adaptation to drought, irregular rainfall, steep topography and fragile soils. Despite these constraints, Mediterranean landscapes hold considerable potential for carbon sequestration through practices such as agroforestry, improved grassland management, perennial crop systems, organic amendments, and erosion-control measures. Scientific research consistently shows that even modest increases in soil organic carbon can significantly improve soil stability, water retention, and resilience, producing benefits that are particularly valuable under Mediterranean climatic pressures. However, the region's potential can only be realised if monitoring, governance, and incentive structures are adapted to its specific conditions.

For these reasons, the purpose of this chapter is not to prescribe a detailed certification scheme, but to outline a conceptual, Mediterranean-adapted approach that can guide future piloting, testing, and policy development. The approach is grounded in the scientific and policy analysis presented earlier and is designed to help Euro-MED countries build the necessary methodological and institutional foundations while aligning with the CRCF. The text that follows describes four key areas of design consideration that could form the backbone of a future Mediterranean carbon farming certification effort: methodological adaptation to Mediterranean soils, regionally appropriate MRV systems, permanence and risk-management logic suited to the region's climatic pressures, and governance structures capable of supporting fragmented agricultural landscapes. These elements are presented not as fixed components but as flexible recommendations that Mediterranean countries may choose to test or incorporate in their own national frameworks.

4.1 Implications of existing schemes for a Mediterranean approach

The review of carbon markets in Chapter 3 makes it clear that Mediterranean countries cannot rely on any single existing scheme as a ready-made model. Regulatory compliance markets, such as the EU ETS, offer an important reference point for credibility and tracking systems, but they do not include agricultural soil carbon and are unlikely to do so soon. Voluntary markets, although more open and dynamic, vary greatly in integrity and depend on methodologies that are often poorly suited to water-limited and erosion-prone environments. Domestic schemes in Europe demonstrate the value of public oversight and transparent methodologies, but their focus has largely been on temperate regions and often specific national contexts. Science-led MRV initiatives offer promising tools, yet these remain technical and require operational translation.

What emerges from this landscape is the need for a regionally grounded, stepwise approach. Mediterranean conditions require careful baseline setting, conservative quantification, flexible yet rigorous MRV, and aggregation mechanisms that enable small farmers to participate. The approach must reflect the realities of Mediterranean agriculture, including fragmented holdings, perennial cropping systems, strong cooperative traditions, and a high dependence on advisory support. These observations form the basis for the design areas discussed below.

4.2 Mediterranean-appropriate soil carbon methodological approach

Mediterranean soils differ significantly from those of northern Europe. They are often shallow, stony, and low in organic matter, with long histories of degradation and a strong susceptibility to drought-driven mineralisation. Due to these characteristics, baselines for carbon certification cannot be derived from continent-wide averages or generalised national datasets. Instead, baselines must reflect local pedoclimatic conditions and historical land use. A Mediterranean-appropriate methodological approach would therefore rely on stratification by soil texture, rainfall patterns, slope, land-use category, and erosion susceptibility. This would improve comparability between regions and reduce uncertainty.

Eligible practices must also reflect Mediterranean realities. The scientific literature highlights the strong potential of agroforestry systems, perennial crops such as olives, almonds and vines, organic amendments in nutrient-depleted soils, controlled grazing in permanent grasslands, and erosion-control measures that stabilise topsoil. Some practices common in voluntary markets, such as certain forms of reduced tillage or cover cropping, may not consistently deliver carbon benefits in dry climates. For this reason, any Mediterranean-adapted methodology should focus on practices supported by robust, region-specific evidence.

Quantification of SOC changes in Mediterranean landscapes benefits from a hybrid approach that combines soil sampling, calibrated models, and remote-sensing

indicators. Sampling alone cannot capture the significant spatial heterogeneity typical of these landscapes, while modelling alone is insufficient without field-level calibration. Mediterranean-specific calibration datasets, such as those developed by EJP Soil, MARVIC, and national soil-monitoring networks, will therefore be essential. Modelling approaches should incorporate drought modifiers and, where possible, erosion-loss dynamics, as both strongly influence SOC trends.

4.3 Mediterranean-adapted MRV architecture

Monitoring, reporting and verification (MRV) is a central component of any carbon certification framework, as it determines both the credibility of certified removals and the practical feasibility of implementation. For soil carbon, MRV must detect relatively small changes in soil organic carbon (SOC) stocks against a background of high spatial variability and strong climatic influences. These challenges are particularly pronounced in Mediterranean environments, where drought, erosion, shallow soils and mixed land-use patterns increase uncertainty and complicate standardised measurement approaches.

Scientific literature consistently shows that direct measurement of SOC change through repeated soil sampling, while essential for calibration and validation, is often insufficient as a stand-alone MRV strategy. Annual or short-term SOC changes are frequently smaller than sampling uncertainty, especially in heterogeneous agricultural landscapes, making exclusive reliance on measurement costly and statistically demanding (Smith et al., 2019). As a result, credible MRV systems increasingly rely on hybrid approaches that integrate measurements with modelling and auxiliary data sources.

A Mediterranean-adapted MRV architecture would therefore operate across multiple spatial and temporal scales. At farm level, MRV would focus on land-use documentation, management records and targeted soil sampling at representative locations and depths. These data provide the empirical basis for model calibration and help verify that claimed management changes have occurred. At landscape and regional level, process-based or empirically calibrated biogeochemical models can be used to estimate SOC dynamics, supported by climate data, soil maps and remote-sensing indicators such as vegetation cover or erosion proxies. This approach allows SOC changes to be assessed consistently across fragmented farm structures while keeping monitoring costs proportionate.

Verification under such a system would emphasise methodological robustness rather than exhaustive field measurement. Independent verification bodies would assess compliance with approved methodologies, consistency of data inputs, transparency of assumptions and appropriate treatment of uncertainty. Conservative crediting rules, uncertainty discounts and buffer mechanisms can be applied to account for residual risks and variability, in line with CRCF quality requirements.

Importantly, MRV systems must remain operationally feasible for Mediterranean agriculture. Small farm sizes, limited administrative capacity and uneven access to advisory services necessitate aggregation mechanisms, such as cooperatives or regional intermediaries, to coordinate data collection, sampling and reporting. Digital tools and shared data infrastructures can further reduce transaction costs and support scalability. By combining scientific rigour with pragmatic design, Mediterranean-adapted MRV architectures can deliver credible carbon accounting while remaining accessible to farmers and aligned with emerging EU certification frameworks.

4.4 Permanence and risk management under Mediterranean conditions

Permanence is a difficult issue for land-based carbon projects everywhere, but it is particularly challenging in Mediterranean environments. Risks increase the likelihood of carbon reversals and complicate long-term carbon accounting. A Mediterranean-adapted certification approach must therefore incorporate permanence logic that reflects these risks without imposing unrealistic burdens on farmers.

A risk-adjusted permanence framework would incorporate longer monitoring periods and encourage conservative crediting, recognising that SOC gains may fluctuate under extreme climatic conditions. It would include mechanisms to address unavoidable reversals, such as pooled buffers or insurance-based solutions, but apply these in a way that is proportionate to project scale and risk. Erosion indicators should be integrated into permanence assessments, since erosion can remove significant amounts of carbon from topsoil in a single event. For perennial crops systems, where carbon may be stored deeper and more stably, permanence rules may need to differentiate between shallow and deeper carbon pools.

Importantly, such a framework should emphasise transparency and documentation rather than punitive measures. The CRCF provides high-level requirements for permanence, but Mediterranean countries will need to develop implementation rules that acknowledge regional vulnerabilities while maintaining environmental integrity.

4.5 Governance and institutional arrangements for Mediterranean carbon farming

Governance structures determine whether farmers can effectively participate in certification systems. Mediterranean agriculture is characterised by small, scattered plots, diverse farming systems and, in some regions, complex land tenure arrangements. These features make individual farm-level certification costly and administratively burdensome. Therefore, governance models should build on collective arrangements, using cooperatives, producer organisations, extension services or regional agencies as intermediaries.

Such intermediaries could provide technical support, manage MRV workflows, centralise data, coordinate verification and interact with national and EU registries. This would not only reduce individual costs but also ensure a level of technical consistency that farmers cannot achieve alone. Institutional arrangements must also ensure compatibility with national climate inventories, CAP Strategic Plans and emerging CRCF implementation rules. Harmonisation with EU-level requirements will be essential, as certification systems will need to avoid double counting and ensure that credit-issuing mechanisms complement, rather than conflict with, public funding schemes.

Cross-border coordination could be particularly valuable in the Euro-MED region, where countries share similar soils and climatic conditions. Shared data infrastructures or calibration datasets, common training programmes and joint pilot projects could greatly accelerate capacity building and reduce costs. Over time, such regional cooperation could contribute to the development of a coherent Mediterranean approach within the broader CRCF framework.

4.6 Integrating the Mediterranean approach with EU policy frameworks

Any Mediterranean-adapted approach to soil carbon certification must operate within the broader framework of European climate and agricultural policies. The CRCF sets out the core integrity requirements – quantification, additionality, permanence and sustainability – that all future carbon removal activities must satisfy. The LULUCF Regulation establishes the accounting structure through which national contributions to the EU's climate targets are assessed, meaning that any certified soil carbon enhancement must comply with national inventory rules and avoid double counting. The CAP, in turn, provides the main financial and advisory support that shapes management practices on farms. It already incentivises soil-friendly actions through eco-schemes and agri-environmental measures, although these remain action-based rather than outcome-certified.

A Mediterranean approach therefore requires careful alignment of its methodological recommendations with the forthcoming CRCF certification methodologies, ensuring compatibility with the EU registry, baseline rules, and permanence requirements. At the same time, such an approach must complement – not duplicate – existing CAP incentives. Achieving this balance will require transparency on how publicly funded practices are accounted for under additionality rules, and attention to how farmers can participate in certification without facing administrative burdens that exceed their capacity. By linking Mediterranean-appropriate science with the structures of EU legislation, the proposed approach aims to support a coherent and practical pathway for future certification efforts.

4.7 Summary and path forward

The Euro-Mediterranean region requires a carbon certification approach that recognises its distinct biophysical constraints, socio-economic structures and institutional capacities. The conceptual recommendations developed in this chapter – regarding soil carbon baseline design, hybrid MRV architectures, risk-responsive permanence logic, and governance structures suited to fragmented farm landscapes – do not constitute a finalised scheme. Rather, they provide a foundation on which countries or regional authorities may build as they explore pilot initiatives or prepare for CRCF-aligned methodologies.

Mediterranean soils are highly variable, drought-sensitive, and prone to erosion. These conditions increase uncertainty and affect both the measurability and durability of soil carbon gains. A credible approach must therefore combine scientific rigour with operational pragmatism. Hybrid MRV systems, calibrated models, targeted sampling strategies, and cooperative governance can significantly reduce uncertainty and improve feasibility. Incorporating these elements into future pilot schemes would enable Mediterranean authorities to test methodological options and gain experience before deploying more formal certification systems.

Looking ahead, the path for the Euro-Mediterranean region involves iterative development rather than immediate standardisation. Pilot projects, shared scientific resources, regional knowledge exchange, and gradual alignment with CRCF frameworks will be key to developing robust and regionally credible systems for soil carbon certification. The conceptual approach outlined here is intended to support that evolution – providing guidance, structure, and scientific rationale, while allowing for adaptation, practical testing, and democratic decision-making at national and regional levels.

5 POLICY RECOMMENDATIONS AND FUTURE DIRECTIONS FOR ADVANCING CARBON FARMING IN THE EURO-MEDITERRANEAN REGION

Carbon farming has the potential to support multiple strategic objectives in the Euro-Mediterranean region, including climate mitigation, soil restoration, rural resilience and long-term agricultural sustainability. However, the region faces a unique combination of environmental pressures, institutional constraints and socio-economic realities that require policies tailored to its conditions. The preceding chapters have shown that Mediterranean soils, shaped by heat, drought and erosion, are particularly vulnerable to carbon loss but also highly responsive to carefully designed management interventions. They have also demonstrated that existing carbon-credit schemes, whether voluntary or regulated, were largely designed for temperate or high-productivity contexts and therefore require careful reinterpretation before being applied in Mediterranean landscapes. At the same time, the EU's emerging Carbon Removal Certification Framework is redefining what constitutes credible, high-integrity carbon removals and will set the standards for all future carbon certification in Europe.

Within this evolving landscape, Mediterranean countries face both an opportunity and a challenge. They can align with EU frameworks early, developing regionally adapted approaches that anticipate CRCF implementation. However, they must also recognise that successful carbon farming requires more than methodologies or markets; it depends on robust institutions, scientific capacity, effective MRV infrastructures and the ability to involve farmers in ways that are feasible and fair. This chapter presents policy recommendations and future directions based on the analytical foundations of this deliverable, offering a roadmap for Mediterranean states and regional actors seeking to create enabling conditions for credible and realistic carbon farming systems.

A first recommendation concerns the development of region-specific methodological guidance. Carbon farming methodologies currently used in voluntary markets rely on assumptions that do not consistently reflect Mediterranean pedoclimatic conditions. Policymakers should therefore prioritise the creation of Mediterranean-calibrated baselines, incorporating soil texture, rainfall patterns, slope and land-use categories into their stratification. Such baselines would reduce uncertainty and ensure that quantification reflects the realities of local landscapes. Developing these baselines requires cooperation among soil research institutions, agricultural agencies and regional governments. Coordinated sampling campaigns and harmonised classification systems would enable countries to build compatible evidence bases, allowing methodological convergence across the region.

Closely linked to methodology is the need for an MRV architecture adapted to Mediterranean farming structures. Small and fragmented farms dominate many

parts of the region, increasing the cost and complexity of soil sampling and on-farm monitoring. Future policy should therefore encourage hybrid MRV systems that integrate soil measurements with modelling and remote sensing, ensuring that quantification remains robust while accessible to farmers. Investments in national soil-monitoring networks, digital reporting tools and remote-sensing infrastructures would substantially reduce long-term MRV costs. Cooperation through cooperatives, producer organisations and advisory services can ensure that farmers receive the technical support needed to participate. Over time, Mediterranean countries may consider building shared regional calibration datasets or jointly validating models, allowing them to meet CRCF expectations more efficiently.

A third recommendation concerns permanence and risk management. Mediterranean countries must accept that soil-carbon projects in the region face higher risks of reversals due to drought, wildfire and erosion. Rather than viewing these constraints as prohibitive, policymakers should design permanence arrangements that acknowledge regional realities. Longer monitoring periods, transparent documentation of climate-related impacts and risk-adjusted buffer contributions can all help maintain environmental integrity. Importantly, permanence rules must be proportionate to project scale and should not impose unrealistic liabilities on farmers. Recognition of deep-rooted carbon in perennial crops systems and the integration of erosion indicators into permanence assessments would further strengthen credibility.

Governance will play a crucial role in determining whether Mediterranean carbon farming becomes operational. Individual, project-by-project certification is unlikely to be possible in regions characterised by small holdings, diverse cropping systems, and limited administrative capacity. Policymakers should therefore explore aggregated governance structures, using cooperatives, extension services, public–private partnerships, or regional agencies to coordinate participation. These intermediaries could manage MRV data, coordinate with verifiers, organise soil sampling, and ensure compliance with CRCF rules. Strong governance frameworks would also help prevent double counting and ensure that carbon-crediting activities complement, rather than conflict with, CAP eco-schemes and national climate obligations.

Future development will require alignment with EU policies. The CRCF is gradually becoming the reference point for all carbon-removal certification within Europe. Mediterranean countries should therefore position their emerging systems so that they are easily interoperable with CRCF methodologies and registries once these are fully operational. Similarly, carbon farming policies must be integrated into CAP Strategic Plans, ensuring that farmers can benefit from both action-based CAP payments and outcome-based carbon-crediting mechanisms without putting at risk additionality. Regional authorities should also evaluate how LULUCF accounting interacts with private credit issuance, ensuring transparency and avoiding potential conflicts between national inventory needs and voluntary

transactions.

A related policy consideration concerns the treatment of early adopters in carbon farming schemes. Farmers who have already implemented soil-improving or regenerative practices prior to the introduction of carbon-credit mechanisms may face limited eligibility due to additionality requirements, despite having delivered long-term environmental benefits. If not carefully addressed, this dynamic may reduce social acceptance of carbon farming initiatives and discourage proactive land stewardship. Policymakers may therefore consider additionality approaches that recognise early action while maintaining environmental integrity, for example through differentiated baselines, transitional arrangements, or complementary support mechanisms outside pure credit issuance. Such approaches can help balance fairness, climate ambition and farmer engagement, particularly in Mediterranean regions where conservation practices have often been adopted in response to long-standing environmental constraints rather than market incentives.

Although policy frameworks are essential, capacity building will be equally important. Many Mediterranean countries lack the advisory services, technical skills and digital tools required for auditing credible carbon farming. Future work should therefore include investment in farmers training, extension programmes, demonstration farms and pilot projects. Capacity-building initiatives should also target public administrations, which will need to develop the expertise required to interpret MRV data, engage with EU registries and ensure alignment with CRCF implementation acts. Cross-border initiatives, knowledge-exchange networks, and collaborative research programmes could significantly accelerate learning and reduce costs.

Looking ahead, Mediterranean carbon farming would benefit from a phased approach. Early efforts should focus on pilot projects using regionally adapted methodologies, allowing countries to test MRV systems, farmer engagement approaches, and governance arrangements. Pilot results can then be used to refine methodological assumptions, improve risk-management designs and adjust monitoring procedures. As CRCF methodologies become available, Mediterranean countries can gradually align their systems with EU-wide standards, ensuring compatibility and long-term viability. Over time, this phased approach would allow the region to develop a credible, efficient, and fair carbon farming framework that reflects its specific environmental and socio-economic context.

Finally, strong policy leadership will be needed to integrate carbon farming into broader sustainability agendas. Carbon farming should not be treated as a stand-alone mechanism but as part of a wider strategy that includes soil health protection, water management, biodiversity restoration and climate adaptation planning. The Euro-Mediterranean region is particularly vulnerable to climate change, and carbon farming offers an opportunity not only to remove atmospheric carbon but also to support agricultural resilience. Policymakers should therefore consider carbon farming within long-term land-use strategies, linking it to soil-

health legislation, drought-management plans, and rural development programmes.

In summary, advancing carbon farming in the Euro-Mediterranean region requires a combination of careful scientific work, institutional innovation and regional cooperation. By adopting Mediterranean-adapted methodologies, strengthening MRV systems, designing realistic permanence rules and building governance structures that reflect regional realities, countries can create enabling conditions for credible carbon farming systems. Future work should focus on piloting, capacity building and alignment with EU regulatory frameworks, laying the foundation for a resilient and regionally coherent approach to soil-carbon certification.

6 CONCLUSIONS

The Euro-Mediterranean region is at an important moment in its approach to agricultural soils, climate mitigation, and environmental resilience. Mediterranean landscapes face a distinctive combination of pressures – drought, erosion, declining soil organic matter, and high interannual variability – that shape both the vulnerability and potential of agricultural soils. These biophysical realities, together with fragmented farm structures and uneven institutional capacities, complicate the implementation of robust carbon farming approaches. At the same time, emerging EU policies, including the Carbon Removal Certification Framework (CRCF) and the evolving Common Agricultural Policy (CAP), are creating new opportunities for land-based climate action to be recognised, verified, and supported.

The analysis presented in this deliverable demonstrates that Mediterranean can meaningfully contribute to the EU's climate objectives, especially if carbon-certification approaches are adapted to regional conditions. Many existing methodologies developed for temperate climates do not fully reflect Mediterranean SOC dynamics, where drought, heat, and erosion strongly influence the accumulation and stability of soil carbon. In response to these limitations, this study has outlined a conceptual framework for a Mediterranean-adapted certification approach, encompassing region-specific methodological foundations, multi-scale MRV architectures, climate-aware permanence considerations, and governance structures suited to smallholder-dominated landscapes. These elements should not be interpreted as a finalised scheme but as building blocks for future testing and refinement.

The policy directions outlined in Chapter 5 highlight a pathway towards tailored schemes. Strengthening soil-monitoring infrastructures, aligning CAP instruments with long-term soil stewardship, investing in SOC modelling and field experimentation, supporting advisory and cooperative structures, and promoting cross-border collaboration will all be essential steps towards a credible Mediterranean carbon farming landscape. These actions can reduce uncertainty, enhance institutional coherence and build the environment needed for high-quality certification.

Ultimately, mainstreaming carbon farming in the Mediterranean will require sustained political commitment, gradual implementation and an openness to learning by doing. Pilot projects, demonstration sites, shared datasets and coordinated governance platforms will be critical for translating conceptual recommendations into practice. The aim is not to impose a single model across countries but to enable Mediterranean administrations to develop carbon farming approaches that reflect their specific environmental conditions, agricultural traditions, and institutional capacities.

Work in the Carbon4SoilQuality project has laid some groundwork for this process. By synthesising scientific evidence, reviewing existing schemes, mapping policy

frameworks and proposing region-adapted concepts, this deliverable provides a foundation on which subsequent work can build. Continued cooperation among farmers, researchers, policymakers, and verification bodies will be essential as the region prepares for the implementation of CRCF methodologies and the expansion of soil-health governance.

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