Interreg

Co-funded by the European Union

Italy – Croatia

GECO 2.2





WP1 – COMPARATIVE AND SURVEY STUDIES

D.1.2.1 Research on similar projects

Activity 1.2 Analysis of similar projects developed in the last years in Europe (synergies)

Author:
DNR

antonia.vlasic@dnz.hr

Contents

List of Tables 3

1. List of similar projects developed in the last few years and their identified synergies with GECO 2.2 4

2. Comments on the most significant experiences developed by projects similar to the GECO2.2 project, broken down by areas of interest 26

2.1 Agricultural practices that are able to increase absorption/sequestration of CO2eq 29

2.2 IT tools used for calculating CO2eq and the methodology applied for calculating CO2eq absorption/sequestration 47

2.3 Certification methodologies for achieved CO2eq absorption and sequestration 61

2.4 Developed or utilized voluntary carbon market (VCM) functioning systems and their organization 72

3. Final considerations and possible integration with GECO2.2 contents and activities 83

3.1. Selected projects related to GECO2.2 contents and activities 83

4. Final comments and conclusions 89

Annex A Project sheets collected and filled by the project partners 91

List of Tables

Table 1 A list of similar projects and the major synergies 5
Table 2 Projects and areas of interest elaborated in each project 26
Table 3 Identified agricultural practices able to increase absorption/sequestration of CO2eq in projects 29
Table 4 IT tools for calculating CO2eq and methodology for calculatin CO2eq 47
Table 5 Certification methodologies for achieved CO2eq absorption and sequestration 61
Table 6 Developed or utilized voluntary carbon market, functioning systems and their organization 72

1. List of similar projects developed in the last few years and their identified synergies with GECO 2.2

In the table below is the list of the similar projects developed in the last few years. The presented projects may have synergies with GECO2.2 project. The identified projects have been contributed by the project partners.

Table 1 A list of similar projects and the major synergies

		Four areas of interest			
No.	**Project name**	**Which Agricultural Practices for CO2eq Absorption/Sequestration are applied in the project?**	**Which IT Tools and Methodologies developed or used by the project?**	**Which Certification Methodologies were developed or applied if any?**	**Did the project develop own Voluntary Carbon Market (VCM) Systems or used other Voluntary Carbon Market?**
1	OLIVE4CLIMATE	• Use of innovative cultivation models, such as changing olive varieties or cultural techniques to reduce farming inputs and enhance carbon sequestration. • Practices focus on soil management, reduction of byproduct waste, and sustainable implantation of olive trees optimized for carbon stock and sink capacity.	• A land-use calculator is used to optimize agricultural practices for climate change mitigation by calculating carbon sequestration and emissions in olive groves. • Models are applied to forecast carbon stock and sink capacities under different climate scenarios.	• The project complies with ISO 14067 standards for olive oil carbon footprint evaluation, verified by accredited third-party certification. • Product labeling systems are developed based on Life Cycle Analysis (LCA) and carbon footprint assessments.	• The project proposes carbon credits certification for olive groves, recognizing their role in climate change mitigation. • Provides incentives for preserving low-yield or ancient olive trees through carbon credit sales, aligning with voluntary market mechanisms.
	AGRESTIC	• Efficient Cropping Systems (ECS): o Incorporates legumes (pea, chickpea, lentil) and catch crops (alfalfa, clover) into a four-year rotation with cereals, tomatoes, and sunflowers. o Reduces the need for nitrogen fertilizers by improving organic nitrogen availability, enhancing soil carbon sequestration. • Sustainable Cultivation: o Focuses on optimizing local and rare varieties for agronomic and environmental performance. o Reduces GHG emissions through	• Decision Support System (DSS): o A newly developed DSS integrates GHG emission estimation and provides efficient management tools for multi-year crop rotations. • Real-Time Monitoring Prototype: o Monitors soil GHG emissions continuously to calibrate and validate models for estimating mitigation potential. • Greenhouse Gas Monitoring Tools: o Implements real-time monitoring in	• Product Labeling: o Certifies crops cultivated under ECS systems with quantifiable climate and environmental benefits. • Payment for Ecosystem Services (PES): o Designs schemes incentivizing sustainable practices through measurable GHG reductions.	• Economic Incentives: o The project explores schemes linked to PES but does not explicitly address VCM integration.

2		sustainable soil and crop management.	demonstration sites to validate ECS systems.		
3	"4 per 1000"	• Promotes regenerative agriculture and agroecological practices to increase soil organic carbon (SOC). • Advocates for sustainable soil management practices, including adding organic plant and animal matter to improve soil fertility and carbon storage. • Encourages regional adaptations for land use and soil health management to maximize sequestration under varying agro-pedo- climatic conditions.	• Plans to create a user-friendly MRV (Monitoring, Reporting, and Verification) toolkit for soil health and SOC improvement, integrating remote sensing and decision- support tools. • Develops a real-time dashboard to track the Initiative's progress, providing quantitative data on soil health and SOC at global, regional, and local levels. • Implements a global catalog of MRV systems to enhance data-driven decision- making for stakeholders.	• Supports science-based helpdesks to assist in establishing and applying carbon sequestration compensation schemes. • Plans branding mechanisms, including certification, seals, and labels, to promote and validate soil health practices and carbon stock improvements.	• Identifies and promotes carbon market mechanisms for SOC sequestration, improving accessibility and transparency. • Explores alternative financial instruments, including compensation schemes for carbon storage, to incentivize transitions to agroecological practices.

4	Climate-Smart Agriculture Booster (CSA Booster)	• Focuses on soil resilience, carbon sequestration, and sustainable water and land use practices. • Includes precision and digital agriculture to optimize land use and reduce emissions. • Supports practices like urban agriculture and aquaculture to enhance local food systems and carbon mitigation.	• Hosts the Agrisource Open Innovation Platform (OIP) for CSA solutions, collaboration, and knowledge sharing. • Develops data analytics tools for risk assessment, monitoring, and evaluation (M&E) to support CSA projects. • Offers technical assistance for impact assessment, policy support, and business model optimization.	• Facilitates assessment of CSA impacts via validated methodologies but does not directly certify carbon sequestration efforts.	• Blends public-private financing to de-risk CSA investments. • Provides financing and insurance mechanisms for sustainable agriculture, indirectly enabling carbon market alignment.
5	LIFE Carbon Farming	• Promotes carbon storage in soils and vegetation through low-carbon farming practices. • Builds on strategies from projects like LIFE Carbon Dairy, LIFE Beef Carbon, and LIFE Green Sheep, emphasizing crop-livestock integration and GHG reduction techniques. • Focuses on optimizing fertilization, establishing permanent grasslands, and implementing soil conservation methods.	• Utilizes CAP'2ER, BOVID CO2, and AgNav tools to conduct environmental diagnostics, analyze GHG emissions, and assess carbon sequestration potential. • Develops a harmonized MRV (Monitoring, Reporting, Verification) framework to enable standardized tracking of carbon reductions across diverse farms. • Includes socio-economic impact assessment grids for comprehensive evaluations of farm- level changes.	• Establishes a six-year certification process, beginning with baseline diagnostics, interim monitoring, and a final audit by external verifiers. • Certifications validate the carbon credits generated and ensure compliance with the MRV framework. • Incorporates result-based systems, rewarding farmers based on verified reductions in carbon emissions.	• Creates a European benchmark for the costs of low-carbon farming projects, enabling structured market participation. • Integrates farmers into carbon credit systems by developing a results-based carbon financing mechanism. • Establishes a European network of low- carbon farmers, facilitating knowledge- sharing and scalability of sustainable practices.

6	CARE4C (Carbon Smart Forestry under Climate Change)	• Focuses on carbon-smart forestry to improve forest carbon sinks under climate challenges. • Promotes species diversity (e.g., conifer- broadleaved mixes) for enhanced resilience to droughts and temperature shifts. • Implements thinning practices to optimize tree density and reduce competition for water and nutrients, improving carbon uptake efficiency. • Targets multi-functional landscapes by balancing forest productivity, biodiversity, and carbon storage potential.	• Airborne LiDAR and drone technologies provide high-precision forest inventory and structural data for carbon stock estimation. • Develops land-use models to simulate and optimize carbon sequestration and economic returns across forest types. • Employs data integration tools for scaling up site-specific findings to regional or national levels of carbon management.	• Establishes protocols to monitor and evaluate thinning practices and their impact on carbon emissions and sinks. • Provides frameworks for reporting operational emissions from forestry equipment, aligning with sustainability goals. • Lays the groundwork for including sustainable forest practices in carbon accounting schemes.	• Integrates principles of carbon-smart forestry with potential for inclusion in carbon credit frameworks. • While VCM development is not a direct project goal, the foundational methodologies and practices align with carbon market eligibility.
7	CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)	• Focuses on soil organic carbon (SOC) management in agricultural systems to enhance carbon sequestration. • Targets diverse practices across varying pedo-climatic conditions, such as improving soil structure, biodiversity, and water retention. • Aims to identify effective practices for maintaining a positive carbon budget at farm and landscape levels.	• Develops an Online Collaborative Platform (OCP) to aggregate global knowledge on SOC, including maps, guidelines, and models. • Implements geo-referenced metadata systems to support SOC-related research and policy-making. • Integrates results from meta-analyses, modeling, and experiments into an internationally accessible knowledge base.	• Establishes monitoring, reporting, and verification (MRV) guidelines for SOC improvements. • Provides strategic frameworks to assess and validate SOC sequestration efforts in line with 4 per 1000 initiative objectives.	• Although not a primary focus, the project supports carbon market alignment by standardizing methodologies and promoting scalable SOC practices. • Engages stakeholders to address barriers and solutions to implementing SOC-focused carbon sequestration initiatives.

8	NACAO (Nature-Based Carbon Offsets)	• Forest Carbon Farms: Promotes forest conservation and carbon capturing through underplanting and sustainable forest management (SFM). • CO2 S.Fo.Ma. Marche Project: Involves conservation and carbon sequestration in forestry with voluntary certification and evaluation of sustainability credits. • Restoration and conservation of riparian woods as high-potential carbon sinks. • Implementation of afforestation and forest restoration projects, such as the "Forest Compensation Plan" tied to infrastructure projects. • Use of green roofs and urban vegetation to enhance carbon absorption and reduce urban heat islands.	• Compensative Ecological Evaluation (VEC): A tool to compute ecological values and define compensatory restoration areas. • ITACA Protocol at Urban Scale: A method to assess and score sustainability levels for urban areas, integrating biodiversity, governance, and land use.	• Voluntary certification for sustainable forest management (SFM) through recognized third-party accredited bodies. • Methodology to calculate stored carbon and generate sustainability credits based on agroforestry and forestry sinks.	• The project references developing regional frameworks, such as the "Roadmap for Nature- Based Policies for GHG Reduction," which includes structured plans for implementing green and blue carbon initiatives. • Collaboration on carbon credit generation and trading within nature-based solutions, highlighting partnerships with regional and national authorities.

9	LIFE Regen Farming	• Rotational Grazing: o Livestock grazing is strategically rotated to optimize grass recovery and reduce soil degradation. • Minimum Tillage/Direct Sowing: o Minimizes disturbance to soil, enhancing soil organic carbon (SOC) storage and reducing erosion. • Organic Fertilizers: o Enriches soil with nutrients, supporting biodiversity and contributing to carbon sequestration. • These practices improved soil quality while addressing EU Soil Thematic Strategy goals.	• Agro-ecosystem Health Cards (TSAs): o Provides a diagnostic tool to assess soil health, focusing on factors such as particulate organic matter and carbon fixation. • Chromatograms: o Evaluates soil health visually and quantitatively, enabling cost-effective monitoring of regenerative farming practices. • These tools ensured fast, reliable, and inexpensive monitoring for farmers.	• Monitoring methods assessed environmental and socio-economic impacts of practices. • Improvements in carbon fixation, biodiversity, and soil fertility validated the efficacy of regenerative practices. • Results supported alignment with EU biodiversity conservation and soil health strategies.	• The project focused on quantifiable SOC increases and GHG reductions, enabling potential inclusion in carbon credit systems. • Though not explicitly tied to VCMs, measurable carbon gains (e.g., 10% increase in carbon fixation) could facilitate participation in future markets
10	CARBOMART	• Promotes afforestation projects to enhance carbon storage by increasing forested lands. • Encourages climate-friendly practices linked to low-carbon energy solutions.	• Develops an online carbon-trading platform for buyers and sellers to evaluate and compare carbon emission reduction projects. • Integrates a sustainability comparison tool based on social, environmental, and economic benchmarks to ensure transparency.	• Proposes measurable pricing methodologies for voluntary emission reduction projects. • Facilitates certification of projects by enabling comparisons of sustainability benchmarks directly on the platform.	• Targets the Voluntary Emission Reduction Market by creating a transparent, accessible marketplace for carbon credits. • Aims to increase the investment flow into carbon emission reduction projects, boosting market quality and participation. • Projects a significant impact, including a potential 5% reduction in emissions through increased returns on green energy investments.

11	NoiCompensiAmo	• Promotion of sustainable agricultural practices, such as: o Carbon Farming: Increasing soil organic carbon through improved soil management. o Regenerative Agriculture: Practices that improve soil health, including crop rotation, cover crops, and reduced chemical use. o Soil Regeneration Plans: Collaboration with agronomists to implement measures that enhance soil quality and carbon storage. • Specific practices focus on reducing chemical usage, minimizing soil degradation, and enhancing biodiversity.	• Development of AGRO CFA tools for carbon footprint analysis in agricultural activities and soil chemical analysis. • IT solutions supporting sustainable supply chain management and efficiency improvements in resource usage.	• Use of international standards such as: o ISO 14064:2018 for corporate carbon footprint analysis. o ISO 14067:2018 for product lifecycle carbon footprint certification. • Support for creating and certifying carbon credits based on sustainable agricultural practices.	• Development of a system to generate and trade "Made in Italy" carbon credits based on **agricultural and forestry initiatives**. • Focus on targeted compensation processes to offset emissions using locally certified carbon credits.
12	Block CO2	• Distributes biochar produced from local forest biomass for regenerative agriculture. • Biochar enhances soil carbon sequestration by being integrated into the soil along with compost. • Improves soil water retention, biodiversity, and fertility, supporting long-term carbon storage.	• While no specific IT tools are mentioned, the project focuses on data-driven biochar production and promotes co-composting techniques that reduce methane and nitrous oxide emissions.	• Not explicitly outlined, but the quantifiable carbon removal (150 tons/year of biochar) supports certification frameworks and methodologies for climate mitigation efforts.	• Supports a circular economy by transforming waste into biochar and compost, with potential applicability in carbon credit systems. • Promotes sustainable practices but does not directly involve VCM trading or certifications.

13	βNeutral	• Encourages rotational cropping systems to maintain soil fertility and increase soil organic carbon (SOC). • No-till farming and reduced soil disturbance are highlighted for reducing carbon loss. • Integrates cover cropping and organic amendments to enhance soil carbon sequestration. • Promotes agroecological practices to balance carbon storage and improve biodiversity.	• Implements monitoring and data collection systems for real-time evaluation of carbon sequestration. • Develops GIS-based tools and remote sensing models to track land-use changes and SOC improvements. • Establishes predictive models integrating climate, soil, and vegetation data for accurate carbon flux estimation.	• Defines MRV frameworks (Monitoring, Reporting, Verification) to quantify carbon sequestration impacts. • Standardizes protocols to ensure consistency in carbon credit generation, focusing on transparency and reliability. • Aligns projects with national and international certification bodies for ecosystem service validation.	• Supports market integration of carbon credits generated from validated projects. • Facilitates financing through public-private partnerships to promote sustainable land management. • Establishes mechanisms for credible credit trading, linking projects to global carbon markets.
14	DOLFINS	• Promotes regenerative agricultural practices such as reduced tillage, crop diversification, and organic soil amendments. • Highlights sustainable forest management and agroforestry as effective measures for enhancing carbon storage. • Encourages rotational grazing and the use of perennial crops to improve soil organic carbon levels.	• Utilizes remote sensing technologies and GIS-based models to monitor carbon stock changes in soils and vegetation. • Develops data-driven tools for predictive modeling of carbon flux under different management scenarios. • Applies frameworks for monitoring, reporting, and verifying (MRV) changes in carbon absorption and sequestration.	• Establishes guidelines for quantifying and validating carbon sequestration aligned with international standards. • Integrates frameworks for result-based payments to incentivize sustainable practices. • Provides protocols for third-party verification and compliance with global certification systems.	• Designs mechanisms to connect sustainable land-use projects with voluntary carbon credit markets. • Supports public-private partnerships to facilitate financing for carbon mitigation initiatives. • Encourages transparent trading systems to enhance credibility and traceability of carbon credits.

15	Nucleo Monitoraggio Carbonio (CREA)	• The initiative emphasizes forestry and agroforestry projects to enhance carbon sequestration. • Projects include human-induced activities targeting the creation of ecosystem services, such as reforestation, afforestation, and sustainable forestry management.	• Focuses on the monitoring and evaluation of ecosystem service projects, ensuring accurate tracking of their climate impact. • Proposes a monitoring framework for assessing completed projects and their effectiveness in generating ecosystem services and mitigating climate change.	• Defines minimum criteria for project implementation to ensure consistency and transparency in ecosystem service generation. • Aligns projects with national guidelines and Legislative Decree no. 34/2018, which governs marketable ecosystem services in the agro- forestry sector. • Emphasizes quality analysis to highlight projects with higher efficiency in carbon sequestration and climate mitigation.	• Seeks to improve the transparency and management of voluntary carbon markets at the national level. • Promotes coordination among stakeholders to align forestry projects with market standards, ensuring better integration into voluntary financing mechanisms. • Identifies activities financeable through regional Rural Development Plans (PSR) to ensure a structured approach for ecosystem services in VCMs.
16	Paper: Innovative Approaches in Soil Carbon Sequestration Modelling for Better Prediction with Limited Data	• The document highlights the importance of soil carbon sequestration (SCS) in climate mitigation efforts. • Practices like reduced tillage, incorporation of organic inputs, and improved land-use management are emphasized as effective strategies to enhance soil organic carbon (SOC) levels. • SCS in degraded soils is prioritized, highlighting their potential to restore SOC and improve agricultural productivity.	• Employs Bayesian hierarchical models to predict soil carbon dynamics, even with limited data. • Utilizes RothC-like models for carbon flow estimations, integrating land-use, climatic, and soil data. • Explores probabilistic frameworks for enhanced accuracy in carbon stock and flux modeling under various agro-pedo-climatic conditions.	• While the document does not detail explicit certification processes, it provides frameworks to improve carbon accounting systems. • Suggests standardized modeling to validate SCS benefits, supporting policies aligned with climate mitigation goals.	• The study does not directly discuss VCMs but highlights the application potential of SCS models in establishing carbon credit systems. • Advocates for accurate data and modeling systems to quantify and verify SOC changes, facilitating market-ready solutions.

17	PCCE: Pricing Carbon with a Dedicated Currency to Empower Economic Agents	o The project discusses incentivizing reductions in CO2 emissions from agricultural activities. This includes efforts such as reducing methane emissions from livestock farms, managing livestock effluents, growing legumes, and drying alfalfa in the field. Farmers can receive green-euro credits on their CO2 accounts for these practices. **The project got EU funding and started and ended in 2018. It is about development of a platform platform that will exchange green tokens (money). The project isn't about any particular agricultural practice. It generally accepts carbon emission reductions and tokenize it.**	o The project utilizes a digital platform and mobile application to manage "CO2 Accounts," enabling users to track their carbon reductions and green-euro credits. It also provides tools for calculating carbon footprints and managing green-euro transactions. The app integrates financial services (such as loans) with CO2 reduction incentives, making it easier for individuals and businesses to participate in the carbon reduction economy. The developed system tracks CO2 reductions associated with user/company activities, using web-based calculators for the foot-print.	o The CO2 Account system's methodology for carbon reductions is certified by the French government and the United Nations. It involves verifying reductions in CO2 emissions through documented evidence (e.g., energy bills or mileage records) and providing green-euro credits based on these calculations. This methodology ensures precision and relevance in CO2 reduction metrics. No elaborated or described certification methodology in the project scope.	In a way the project has developed its own quasi voluntary carbon market system. **However, there is no VCM in a sense of an organized market**.The green-euro currency acts as a tool within this system, linking CO2 emission reductions directly to financial incentives. The program supports voluntary carbon offsetting by allowing individuals and businesses to offset emissions locally within Europe, converting verified reductions into CO2 credits.

18	MRV4SOC: Monitoring, Reporting, and Verification of Soil Organic Carbon and Greenhouse Gas Balance	o Carbon farming practices are applied to drive soil organic carbon (SOC) accumulation, including: Reduced tillage (e.g., no-tillage and minimum tillage). Use of cover crops and crop rotation. Smart water management (e.g., underground drip irrigation and controlled drainage systems). Rotational grazing and pasture restoration in grasslands. Agroforestry practices, such as integrating tree plantations (e.g., poplar short rotation coppice) with arable crops for bioenergy and biodiversity preservation. Mitigation practices like erosion reduction and methane reduction from livestock farms.	o The project leverages remote sensing technologies (e.g., satellites and drones) and spectrometry to acquire reliable data on carbon sequestration and greenhouse gas emissions. o It utilizes geostatistical and process-based models for assessing soil carbon and nitrogen cycles. o Data from Earth observation programs like ESA Copernicus and EnMAP are integrated for quality assurance and model validation. o Specific tools are developed to enable Monitoring, Reporting, and Verification (MRV) frameworks for tracking carbon and nitrogen cycles across diverse land use scenarios.	o The project is focused on developing robust, transparent, standardized, and cost- effective MRV systems aligned with EU and international standards for results-based payments. o Certification criteria follow the QU.A.L.ITY framework: Quantification, Additionality and Baselines, Long-term Storage, and Sustainability. o It aims to establish an EU-wide standard for carbon credit certification, with data from demonstration sites contributing to its definition.	o The project recognizes a widespread distrust in Voluntary Carbon Markets and seeks to increase stakeholders' confidence. o Efforts are directed toward establishing a results-based payment mechanism supported by certified carbon credits, which could eventually integrate into VCM systems. o Revenue opportunities are identified for participants, aligning carbon farming with economic incentives in a transparent market.

19	LIFE VitiCaSe	o The project promotes carbon farming in viticulture, using practices such as: Minimum tillage and no-tillage techniques. Use of cover crops and green manures to enhance soil organic carbon. Application of compost and biochar for carbon retention. Precision irrigation and organo-mineral fertilization. Reuse of agricultural residues (green and woody residues). Mulching (natural and green surface mulching). Grassing (e.g., under-row grassing with leguminous plants).	o A digital platform and app is under development for: Estimating soil organic carbon (SOC) potential. Monitoring and validating carbon farming practices. Integrating blockchain technology for carbon credit certification and management. o These tools provide decision support systems (DSS) for selecting effective farming techniques and georeferenced monitoring.• A complete digital platform: protects and facilitates the correct management of agricultural practices and the calculation of carbon credits, based on an app that will integrate the most innovative algorithms based on international standards shared by the scientific community.	o The project includes methodologies for certification of carbon credits based on international standards. o A robust system for carbon stock validation using field data and modeling (e.g., Roth-C model calibration). o **Blockchain** notarization is used to ensure transparency and traceability of carbon credits. • The farms apply standard methodology and protocol, adopting Carbon Standard procedures in order to get the C credits. • Carbon Credits will be result of certification thanks to the support of Carbon Credits Consulting.	o The project is actively involved in developing a business model for carbon credits, including their certification and sale on voluntary carbon markets. o It emphasizes creating additional income streams for farmers through verified carbon credits.

20	ClieNFarms	fertilization, soil management and energy use and energy production. The applied practices are: • Reduced fertilizer application with a localized nitrogen fertilizer injection at seeding for arable crops • Optimization of grassland management • Introducing cover crops in loamy soils • Introducing grain legumes, such as pea crop, in the cropping systems to reduce the net greenhouse gas emissions • Protected urea in the pasture-based system • White clover in the pasture-based system • Strip tillage combined with slurry/digestate fertilization • Feed efficiency and N use efficiency of the herd are important key indicators on dairy farms • Lower footprint farming at the Southern Dairy Hub • Use of improved interrows on olive groves, as a solution to increase carbon sequestration • Double-purpose feeding strategy, by using local oilseeds by-products in order to mitigate GHG small ruminants' diets while gaining side-advantages	o The project utilizes the "Innovative Systemic Solution Space (I3S)" to co-design and test solutions interactively with multi- actor participation. o Digital tools are being deployed to measure, report, and verify (MRV) climate impacts and track progress toward carbon neutrality. o Participatory methodologies like design- thinking are integrated into the project's development and scaling of solutions.	o The project aims to develop methodologies for measuring, reporting, and verifying (MRV) data to support policy applications. o A carbon credit platform with automated certification processes is planned, which will apply to selected supply chains.	o The project is actively developing its own carbon credit platform tailored to support automated certification processes for carbon credits. This will be applied within specific supply chains, including partnerships with Nestlé, Danone, and FrieslandCampina.

21	AgriCaptureCO2	• Regenerative Agriculture: o Keeping the soil surface covered to protect against erosion. o Limiting physical and chemical disturbance of soil. o Integrating a wide diversity of plants to enhance soil biodiversity. o Maintaining living roots in the soil year- round. o Incorporating grazing livestock into the system to improve nutrient cycling. • Adoption of these practices is aimed at improving soil health, transforming soils into carbon sinks, and enhancing ecosystem resilience.	• Digital Solutions for Carbon Quantification: o Use of satellite imagery (Copernicus) combined with AI and soil sampling to map soil carbon. o Soil Carbon Mapper: A digital tool to measure and track soil carbon changes. o Profitability Calculator: Estimates the economic benefits of regenerative practices. o Carbon Farming Potential Calculator: Projects CO2 sequestration potential. • Monitoring, Reporting, and Verification (MRV) Platform: o Facilitates certification of carbon credits with precise and cost-effective methods. • Algorithms for: o Smart soil sampling. o Verification of sustainable practices remotely.	• The project has designed a methodology for carbon credit certification under recognized global frameworks, such as Verified Carbon Standard (VCS), aligned with the Kyoto Protocol. • Certification includes remote monitoring and satellite-based verification of agricultural practices to ensure compliance and streamline documentation. • Aims to submit the AgriCaptureCO2 methodology for EU certification to further enhance credibility.	• The project uses the Verified Carbon Standard (VCS), the world leader in voluntary carbon credits, ensuring alignment with international frameworks like the Kyoto Protocol. • Farmers gain access to global voluntary carbon markets, providing financial incentives for adopting climate-friendly practices. • AgriCaptureCO2 emphasizes scalability and transparency to make participation in carbon markets more accessible for farmers.

22	Digital Solutions to Foster Climate-Smart Agricultural Transition (Digi4CSA)	• Regenerative Agriculture: o Increasing year-round plant cover. o Minimizing soil tillage to enhance carbon retention. o Diversifying crop rotations to improve soil biodiversity. o Applying adaptive grazing to support nutrient cycling. • Practices aim to store carbon in soil, increase yields, and improve soil and aquatic ecosystems. • Regenerative farming focuses on improving soil health and reducing nutrient runoff, which mitigates climate change and protects the Baltic Sea.	• Carbon Action Platform: o A collaborative platform for researchers, farmers, and companies to promote carbon farming and regenerative agriculture. • Monitoring and Research Tools: o Finnish Meteorological Institute coordinates multidisciplinary research projects under the Carbon Action platform. • Knowledge Sharing Systems: o Free online courses for farmers and knowledge-sharing initiatives to enhance adoption of regenerative practices.	• The project explores methods to quantify soil carbon storage and certify practices under regenerative and carbon farming frameworks. • Efforts focus on linking carbon farming with measurable and certifiable outcomes to support policy integration and financial incentives.	• While the document does not explicitly detail the development of its own Voluntary Carbon Market system, it highlights the Carbon Action Platform as a framework to integrate carbon farming into larger voluntary carbon markets. • The platform aims to enable farmers to benefit financially from carbon sequestration efforts through market mechanisms and partnerships.
	LIFECO2PES&PEF	• Sustainable and "climate-smart" forestry management to maintain high rates of carbon absorption. • Selection of suitable tree species for rapid CO2 absorption. • Forest thinning, regeneration cutting, and prevention of fire and windthrow risks to enhance forest resilience and CO2 sequestration. • Maintenance of forest ecosystems to prevent hydrogeological risks and	• Development of a Carbon Tool for calculating carbon stocks in sawn wood, customized for different wood species typical in Italian and European forests. • Creation of an interactive web platform for stakeholders (companies, public authorities, universities, environmental organizations) to access tools for monitoring and managing ecosystem services and carbon stocks. • Application of the Product Environmental Footprint (PEF) methodology for lifecycle analysis of	• Establishment of a certification standard for ecosystem services to attribute monetary value and integrate them into voluntary markets. • Development of the PEFCR (Product Environmental Footprint Category Rules) for the wood sector, which includes lifecycle analysis to assess and improve the environmental performance of forest-based products. • Proposed validation protocol for ecosystem services to transform them	• Creation of an ecosystem credit system aimed at financing ecosystem services through voluntary carbon markets. • The platform includes a software system for registry management, marketing, and cancellation of ecosystem credits, facilitating exchange in voluntary markets. • Support for European policy frameworks, including the EU Green

23		improve minor hydrographic networks.	wood products, ensuring compliance with European standards (Recommendation 2013/179/EU).	into marketable "products" with certified monetary value.	Deal, to integrate ecosystem credits into broader Land Use, Land Use Change, and Forestry (LULUCF) initiatives.
24	CARBON FARMING MED	• Regenerative Agricultural Practices: o Implementation of conservation tillage and minimal soil disturbance to enhance carbon sequestration. o Use of cover crops, crop rotation, and organic amendments to improve soil organic matter and carbon retention. o Adoption of agroforestry systems combining woody vegetation with crops and/or animals, which sequesters carbon in biomass and soil. o Reforestation and afforestation efforts to enhance terrestrial carbon storage. • Peatland Management: o Restoration and conservation to maintain high levels of soil organic	• Carbon Measurement Framework: o Development of Monitoring, Reporting, and Verification (MRV) systems tailored for Mediterranean conditions to measure and verify carbon sequestration. o Use of decision-making trees and scalable MRV components for soil carbon assessment. o Integration of modelling and direct measurement approaches to assess soil organic carbon (SOC) and emissions. • Knowledge-Sharing Platforms: o Dissemination of best practices via digital platforms to encourage adoption	• The project incorporates frameworks under the Carbon Removals and Carbon Farming Certification Regulation (CRCF). • Development of standards for monitoring SOC and certifying carbon sequestration practices at the farm level. • Alignment with the EU's Product Environmental Footprint (PEF) methodologies to ensure transparent and standardized assessment	• The project is actively developing a Mediterranean-focused voluntary carbon market that facilitates trading of carbon credits generated from regenerative agricultural practices. • Emphasis on creating hybrid and result- based payment systems to support farmers and integrate credits into broader markets. • Encourages collaboration between public and private stakeholders to scale up market adoption and create sustainable funding mechanisms.

		carbon.	among stakeholders and farmers.	processes.	
25	Carbon 4 Soil Quality	• Regenerative and Sustainable Farming Practices: o Guidelines for carbon farming techniques tailored for Mediterranean climates. o Emphasis on practices that increase soil organic carbon content and improve soil health. o Development of a catalog of soil organic reference values to guide implementation.	• Toolbox for Carbon Farming: o A comprehensive set of tools includes methodologies for organic carbon analysis, soil quality monitoring, and business models for carbon farming. o The toolbox also includes recommendations for agricultural carbon credit schemes and environmental certification systems. • Collaborative Tools: o Tools to harmonize methodologies and foster knowledge-sharing across borders.	• The project develops and tests carbon credit schemes linked to agricultural practices. • Incorporates environmental certification systems to ensure the scalability and credibility of carbon farming practices in Mediterranean regions.	• Recommendations and frameworks for agricultural carbon credit schemes to integrate into voluntary carbon markets. • The project does not mention developing its own VCM system but provides tools and guidelines for stakeholders to access existing carbon markets effectively.

26	Paper: Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content (China authors)Modelling and Remote Sensing of Soil Carbon	• The document does not directly comment on specific agricultural practices for CO2eq absorption or sequestration. However, it highlights the importance of monitoring soil organic carbon (SOC), which is a key component of carbon sequestration efforts in agricultural systems.	• Remote Sensing: Landsat 5 TM images were used for spectral analysis to estimate soil organic carbon content. • Data Processing and Analysis Tools: ENVI software for image preprocessing, and ArcGIS for mapping spatial distribution and resampling. • Machine Learning Models: o Random Forest (RF). o Support Vector Machines (SVM). o Multiple Linear Regression (MLR). o Partial Least Squares Regression (PLSR). • A combination of original spectral reflectance (OSR) and environmental variables (climate, terrain, soil, and vegetation cover) were used to improve SOC estimation accuracy.	• The paper does not directly discuss any certification methodologies. It focuses on methodological improvements for estimating SOC content and does not link these findings to carbon credit certification systems or similar frameworks.	• The document does not comment on the development of a Voluntary Carbon Market system or the use of an existing one. Its focus is on advancing the scientific methodologies for SOC monitoring, which could indirectly support carbon market mechanisms.
27	Towards Climate-Smart Sustainable Management of Agricultural Soils https://ejpsoil.eu/	• The project focuses on climate-smart and sustainable management of agricultural soils to enhance carbon sequestration. • Practices include monitoring and improving soil organic carbon (SOC) concentrations over time. • Use of soil quality indicators to evaluate soil organic matter, nutrient status, and physical soil properties, which are linked to practices enhancing carbon storage.	• Development of ICT-based decision support tools to evaluate soil quality indicators and provide actionable insights. • Tools include geodatabases and soil information geoportals for mapping and monitoring soil parameters. • Integration of soil sampling, monitoring campaigns, and digital terrain modeling for improved data collection and analysis.	• The document discusses efforts to harmonize soil quality indicators across European countries to ensure consistency in monitoring and policy applications. • Emphasis on aligning practices with EU standards, such as the Common Agricultural Policy (CAP) and the UNFCCC climate change emission indicators.	• While the document does not explicitly state the development of a standalone VCM system, it highlights the use of soil carbon data in policy and decision-making frameworks that could support carbon market initiatives. • Focus on providing foundational data for carbon flux calculations, essential for integrating agricultural soils into broader carbon market mechanisms.

28	Innovative Carbon Farming Initiatives	• Practices include: o Peatland rewetting and restoration, mitigating CO2 and N2O emissions with a potential annual savings of 3.5-24 t CO2/ha. o Agroforestry systems that integrate trees into crop and livestock systems, offering 7.7–234.8 MtCO2/yr mitigation potential. o Crop rotation, reduced tillage, and organic amendments to enhance soil organic carbon (SOC). o Livestock feed and manure management, reducing CH4 and N2O emissions by up to 30%.	• Decision Support Tools (DSTs): o 26 projects developed DSTs, integrating remote sensing, AI, and soil databases. o Features include precision agriculture solutions and tailored recommendations for crop, soil, and land use. • MRV Systems: o Projects utilized Earth Observation (EO) data from Copernicus satellites and sensors for continuous SOC monitoring. o Blockchain technologies enhance traceability in carbon accounting.	• Emphasizes result-based payments tied to accurate SOC measurement. • Certification aligns with emerging EU frameworks, focusing on additionality and permanence of carbon removals. • Advanced MRV solutions provide robust data for certification.	• Development of ecosystem credits linked to agroforestry and peatland rewetting. • Integration of carbon credits into VCMs enables farmers to earn based on verified carbon sequestration. • Projects include pilot models for private- public financing partnerships.
29	CARBONCAPS	• Project is about Biochar Production via Flash Carbonisation-not abut particular practice: o Each ton of biochar produced sequesters 3.2 tons of CO2eq, providing a long-term carbon storage solution. o Biochar improves soil fertility and SOC levels, reducing the need for synthetic fertilizers. • Waste Utilization: o Agricultural residues are pyrolyzed, reducing methane emissions from organic matter decomposition.	• Carbon Monitoring Tools: o Flash Carbonisation systems track carbon content and quantify CO2eq removal during production.	• Verified Carbon Standards not applicable in GECO2.2 snse. o However carbon credits may be created after certification using rigorous international standards like ISO 14064. • Third-Party Verification: o Audits ensure that each project meets the standard of 3.2 tons CO2eq removal per ton of biochar as promised in the project	It wasn't within a scope of the project that was focused on new technology development.

30	SOVCM	• Soil Carbon Storage: Encouraging the use of regenerative farming practices like no-till agriculture, cover cropping, and agroforestry to enhance soil organic carbon (SOC). • Biochar Application: Using biochar as a soil amendment to sequester carbon long-term while improving soil fertility and water retention. • Rotational Grazing: Implementing rotational grazing strategies to optimize pasture carbon capture and reduce methane emissions from livestock.	• Digital Monitoring Platforms: Tools like CAP'2ER, BOVID CO2, and AgNav are used to calculate and monitor carbon footprints, assess emission reductions, and manage carbon stock effectively. • Carbon Modeling Frameworks: Advanced simulation tools and databases analyze crop growth, carbon emissions, and SOC dynamics to provide precise assessments. • Data Integration Systems: Utilizing GIS mapping, remote sensing, and big data analytics to model and monitor CO2eq sequestration at regional and field levels.	• ISO-Driven Standards: Certification based on ISO 14067 ensures the credibility of carbon footprint assessments. • MRV Systems: Monitoring, Reporting, and Verification (MRV) frameworks ensure that carbon sequestration practices meet rigorous environmental and socio-economic standards. • Lifecycle Analysis (LCA): Detailed assessments of the entire agricultural value chain to certify carbon credits.	• Trading Platforms: Platforms like CARBOMART allow for transparent comparison and trade of carbon credits between buyers and sellers based on environmental, social, and economic criteria. • Standards and Benchmarks: Defining sustainability metrics to ensure carbon credits reflect genuine and measurable emission reductions. • Stakeholder Engagement: Engaging farmers, investors, and policymakers to streamline the adoption and integration of carbon credits into agricultural practices.
31	Carbon farming CE	• The project emphasizes regenerative practices, such as minimum tillage, perennial cropping, and rotational grazing, to enhance soil organic carbon (SOC) levels. • Techniques tested include direct seeding, use of organic fertilizers, and cover cropping to improve soil quality and biodiversity. • Six promising carbon farming techniques are identified for implementation and transnational testing to optimize carbon	• Visual Soil Assessments (VSA): A farmer- friendly method for basic soil quality monitoring. • Carbon Stock Quantification and Soil Enzyme Analysis: Used for professional audits to measure SOC changes. • Development of a Carbon Farming Monitoring Strategy Roadmap, offering methodologies for soil functionality, carbon storage, and nitrogen cycle evaluations. • Pilot Testing and Feedback Loops: Techniques are peer-reviewed transnationally, ensuring robust	• Establishes sustainability verification models that include CO2 sequestration assessments and socio-economic impact analyses. • Transnational guidelines provide step-by- step instructions to scale certification efforts nationally and internationally. • Outputs include compliance-ready tools for monitoring carbon stock	• Focuses on creating transnational business models for carbon farming, connecting farmers and stakeholders. • Promotes sustainability verification models to facilitate integration into voluntary carbon markets. • Strategy and action plans emphasize financial aspects, monitoring frameworks, and policy recommendations to mainstream carbon farming and align it with VCMs.

		sequestration under varying climate conditions.	methodologies for diverse regions.	improvements and validating carbon farming efforts.	

Some of the projects are out of EU member states like Turkey, Australia and USA. In the table are also papers that are of importance for the project GECO2.2 according to the project partners.

2. Comments on the most significant experiences developed by projects similar to the GECO2.2 project, broken down by areas of interest

The projects identified by the project partners are analysed for the areas of interest. The most important areas of interest for the project GECO2.2 are presented in the following subchapters.

In the table that follows are projects and areas of interest that are elaborated in those projects (according to the forms provided by the project partners)

Table 2 Projects and areas of interest elaborated in each project

		Thematic areas		
No.	Project name/acronym	Local carbon offset trade systems modelling of applied to agriculture (voluntary carbon market)	Sustainable soil carbon farming	Software development or agricultural practices for GHG sequestration and emissions and carbon trading platform
1	OLIVE4CLIMATE	X	X	X
2	AGRESTIC		X	X
3	4 per 1000 Initiative	X	X	
4	CSA booster		X	X
5	CARE4C (Carbon Smart Forestry under Climate Change)		X	X
6	LIFE Carbon Farming	X	X	X
7	CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)		X	
8	LIFE REGEN FARMING		X	

9	Paper: Innovative approaches in soil carbon sequestration modelling	X		
10	NoiCompensiAmo	X	X	
11	Nucleo Monitoraggio Carbonio (CREA)			X
12	βNeutral	X		
13	BlockCO2	X	X	
14	CARBOMART	X		
15	DOLFINS			X
16	PPCE Pricing carbon with a dedicated currency to empower economic agents			
17	MRV4SOC Monitoring, Reporting and Verification of Soil Organic Carbon and Greenhouse Gas Balance			X
18	CARBONCAPS – Efficient and verifiable carbon removal with ecosystem co-benefits		X	
19	LIFE VitiCaSe	X	X	X
20	ClieNFarms		X	X
21	NACAO – Nature-based Carbon Offsets		X	
22	AgriCaptureCO2	X		X
23	Digital solutions to foster climate-smart agricultural Transition (Digi4CSA)		X	X
24	LIFECO2PES&PEF	X	X	
25	CARBON FARMING MED	X	X	X
26	Carbon 4 Soil Quality	X	X	X

27	**Paper: Modelling and remote sensing of soil carbon**			**X**
28	**CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)**		**X**	
29	**Carbon Farming**		**X**	
30	**Towards climate-smart sustainable management of agricultural soils**	**X**		
31	**Carbon farming initiatives**		**X**	

Note: Some project partners identified the same projects. The doubled projects are included in the table only once.

2.1 Agricultural practices that are able to increase absorption/sequestration of CO2eq

After reviewing the provided projects and papers the contribution of the particular project is summarized in the table that follows.

Table 3 Identified agricultural practices able to increase absorption/sequestration of CO2eq in projects

No.	Project name	Which AgriculturalPractices for CO2eq Absorption/Sequestration are applied in the project?
1	OLIVE4CLIMATE	• Use of innovative cultivation models, such as changing olive varieties or cultural techniques to reduce farming inputs and enhance carbon sequestration. • Practices focus on soil management, reduction of byproduct waste, and sustainable implantation of olive trees optimized for carbon stock and sink capacity.

2	AGRESTIC	• Efficient Cropping Systems (ECS): o Incorporates legumes (pea, chickpea, lentil) and catch crops (alfalfa, clover) into a four-year rotation with cereals, tomatoes, and sunflowers. o Reduces the need for nitrogen fertilizers by improving organic nitrogen availability, enhancing soil carbon sequestration. • Sustainable Cultivation: o Focuses on optimizing local and rare varieties for agronomic and environmental performance. o Reduces GHG emissions through sustainable soil and crop management.
3	"4 per 1000"	• Promotes regenerative agriculture and agroecological practices to increase soil organic carbon (SOC). • Advocates for sustainable soil management practices, including adding organic plant and animal matter to improve soil fertility and carbon storage. • Encourages regional adaptations for land use and soil health management to maximize sequestration under varying agro-pedo- climatic conditions.

4	Climate-Smart Agriculture Booster (CSA Booster)	• Focuses on soil resilience, carbon sequestration, and sustainable water and land use practices. • Includes precision and digital agriculture to optimize land use and reduce emissions. • Supports practices like urban agriculture and aquaculture to enhance local food systems and carbon mitigation.
5	LIFE Carbon Farming	• Promotes carbon storage in soils and vegetation through low-carbon farming practices. • Builds on strategies from projects like LIFE Carbon Dairy, LIFE Beef Carbon, and LIFE Green Sheep, emphasizing crop-livestock integration and GHG reduction techniques. • Focuses on optimizing fertilization, establishing permanent grasslands, and implementing soil conservation methods.
	CARE4C (Carbon Smart Forestry under Climate Change)	• Focuses on carbon-smart forestry to improve forest carbon sinks under climate challenges. • Promotes species diversity (e.g., conifer- broadleaved mixes) for enhanced resilience to droughts and temperature shifts. • Implements thinning practices to optimize tree density and reduce competition for water and nutrients, improving carbon uptake efficiency. • Targets multi-functional landscapes by balancing forest productivity,

6		biodiversity, and carbon storage potential.
7	CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)	• Focuses on soil organic carbon (SOC) management in agricultural systems to enhance carbon sequestration. • Targets diverse practices across varying pedo-climatic conditions, such as improving soil structure, biodiversity, and water retention. • Aims to identify effective practices for maintaining a positive carbon budget at farm and landscape levels.
	NACAO (Nature-Based Carbon Offsets)	• Forest Carbon Farms: Promotes forest conservation and carbon capturing through underplanting and sustainable forest management (SFM). • CO2 S.Fo.Ma. Marche Project: Involves conservation and carbon sequestration in forestry with voluntary certification and evaluation of sustainability credits. • Restoration and conservation of riparian woods as high-potential carbon sinks. • Implementation of afforestation and forest restoration projects, such as the "Forest Compensation Plan" tied to infrastructure projects. • Use of green roofs and urban

8		vegetation to enhance carbon absorption and reduce urban heat islands.
9	LIFE Regen Farming	• Rotational Grazing: o Livestock grazing is strategically rotated to optimize grass recovery and reduce soil degradation. • Minimum Tillage/Direct Sowing: o Minimizes disturbance to soil, enhancing soil organic carbon (SOC) storage and reducing erosion. • Organic Fertilizers: o Enriches soil with nutrients, supporting biodiversity and contributing to carbon sequestration. • These practices improved soil quality while addressing EU Soil Thematic Strategy goals.

10	CARBOMART	• Promotes afforestation projects to enhance carbon storage by increasing forested lands. • Encourages climate-friendly practices linked to low-carbon energy solutions.
11	NoiCompensiAmo	• Promotion of sustainable agricultural practices, such as: o Carbon Farming: Increasing soil organic carbon through improved soil management. o Regenerative Agriculture: Practices that improve soil health, including crop rotation, cover crops, and reduced chemical use. o Soil Regeneration Plans: Collaboration with agronomists to implement measures that enhance soil quality and carbon storage. • Specific practices focus on reducing chemical usage, minimizing soil degradation, and enhancing biodiversity.

12	Block CO2	• Distributes biochar produced from local forest biomass for regenerative agriculture. • Biochar enhances soil carbon sequestration by being integrated into the soil along with compost. • Improves soil water retention, biodiversity, and fertility, supporting long-term carbon storage.
13	βNeutral	• Encourages rotational cropping systems to maintain soil fertility and increase soil organic carbon (SOC). • No-till farming and reduced soil disturbance are highlighted for reducing carbon loss. • Integrates cover cropping and organic amendments to enhance soil carbon sequestration. • Promotes agroecological practices to balance carbon storage and improve biodiversity.
14	DOLFINS	• Promotes regenerative agricultural practices such as reduced tillage, crop diversification, and organic soil amendments. • Highlights sustainable forest management and agroforestry as effective measures for enhancing carbon storage. • Encourages rotational grazing and the use of perennial crops to improve soil organic carbon levels.

15	Nucleo Monitoraggio Carbonio (CREA)	• The initiative emphasizes forestry and agroforestry projects to enhance carbon sequestration. • Projects include human-induced activities targeting the creation of ecosystem services, such as reforestation, afforestation, and sustainable forestry management.
16	Paper: Innovative Approaches in Soil Carbon Sequestration Modelling for Better Prediction with Limited Data	• The document highlights the importance of soil carbon sequestration (SCS) in climate mitigation efforts. • Practices like reduced tillage, incorporation of organic inputs, and improved land-use management are emphasized as effective strategies to enhance soil organic carbon (SOC) levels. • SCS in degraded soils is prioritized, highlighting their potential to restore SOC and improve agricultural productivity.
		o The project discusses incentivizing reductions in CO2 emissions from agricultural activities. This includes efforts such as

17	PCCE: Pricing Carbon with a Dedicated Currency to Empower Economic Agents	reducing methane emissions from livestock farms, managing livestock effluents, growing legumes, and drying alfalfa in the field. Farmers can receive green-euro credits on their CO2 accounts for these practices. **The project got EU funding and started and ended in 2018. It is about development of a platform platform that will exchange green tokens (money). The project isn't about any particular agricultural practice. It generally accepts carbon emission reductions and tokenize it.**
18	MRV4SOC: Monitoring, Reporting, and Verification of Soil Organic Carbon and Greenhouse Gas Balance	o Carbon farming practices are applied to drive soil organic carbon (SOC) accumulation, including: - Reduced tillage (e.g., no-tillage and minimum tillage). - Use of cover crops and crop rotation. - Smart water management (e.g., underground drip irrigation and controlled drainage systems). - Rotational grazing and pasture restoration in grasslands. - Agroforestry practices, such as integrating tree plantations (e.g., poplar short rotation coppice) with arable crops for bioenergy and biodiversity preservation. - Mitigation practices like erosion reduction and methane reduction from

		livestock farms.
	LIFE VitiCaSe	o The project promotes carbon farming in viticulture, using practices such as: - Minimum tillage and no-tillage techniques. - Use of cover crops and green manures to enhance soil organic carbon. - Application of compost and biochar for carbon retention. - Precision irrigation and organo-mineral fertilization. - Reuse of agricultural residues (green and woody residues).

19		- Mulching (natural and green surface mulching). - Grassing (e.g., under-row grassing with leguminous plants).

20	ClieNFarms	fertilization, soil management and energy use and energy production. The applied practices are: • Reduced fertilizer application with a localized nitrogen fertilizer injection at seeding for arable crops • Optimization of grassland management • Introducing cover crops in loamy soils • Introducing grain legumes, such as pea crop, in the cropping systems to reduce the net greenhouse gas emissions • Protected urea in the pasture-based system • White clover in the pasture-based system • Strip tillage combined with slurry/digestate fertilization • Feed efficiency and N use efficiency of the herd are important key indicators on dairy farms • Lower footprint farming at the Southern Dairy Hub • Use of improved interrows on olive groves, as a solution to increase carbon sequestration • Double-purpose feeding strategy, by using local oilseeds by-products in order to mitigate GHG small ruminants' diets while gaining side-advantages

21	AgriCaptureCO2	• Regenerative Agriculture: o Keeping the soil surface covered to protect against erosion. o Limiting physical and chemical disturbance of soil. o Integrating a wide diversity of plants to enhance soil biodiversity. o Maintaining living roots in the soil year- round. o Incorporating grazing livestock into the system to improve nutrient cycling. • Adoption of these practices is aimed at improving soil health, transforming soils into carbon sinks, and enhancing ecosystem resilience.
	Digital Solutions to Foster Climate-Smart Agricultural Transition (Digi4CSA)	• Regenerative Agriculture: o Increasing year-round plant cover. o Minimizing soil tillage to enhance carbon retention. o Diversifying crop rotations to improve soil biodiversity. o Applying adaptive grazing to support nutrient cycling. • Practices aim to store carbon in soil, increase yields, and improve soil and aquatic ecosystems. • Regenerative farming focuses on improving soil health and reducing nutrient runoff, which mitigates climate

22		change and protects the Baltic Sea.
23	LIFECO2PES&PEF	• Sustainable and "climate-smart" forestry management to maintain high rates of carbon absorption. • Selection of suitable tree species for rapid CO2 absorption. • Forest thinning, regeneration cutting, and prevention of fire and windthrow risks to enhance forest resilience and CO2 sequestration. • Maintenance of forest ecosystems to prevent hydrogeological risks and improve minor hydrographic networks.

24	CARBON FARMING MED	• Regenerative Agricultural Practices: o Implementation of conservation tillage and minimal soil disturbance to enhance carbon sequestration. o Use of cover crops, crop rotation, and organic amendments to improve soil organic matter and carbon retention. o Adoption of agroforestry systems combining woody vegetation with crops and/or animals, which sequesters carbon in biomass and soil. o Reforestation and afforestation efforts to enhance terrestrial carbon storage. • Peatland Management: o Restoration and conservation to maintain high levels of soil organic carbon.
25	Carbon 4 Soil Quality	• Regenerative and Sustainable Farming Practices: o Guidelines for carbon farming techniques tailored for Mediterranean climates. o Emphasis on practices that increase soil organic carbon content and improve soil health. o Development of a catalog of soil organic reference values to guide implementation.

26	Paper: Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content (China authors)Modelling and Remote Sensing of Soil Carbon	• The document does not directly comment on specific agricultural practices for CO2eq absorption or sequestration. However, it highlights the importance of monitoring soil organic carbon (SOC), which is a key component of carbon sequestration efforts in agricultural systems.
	Towards Climate-Smart Sustainable Management of Agricultural Soils https://ejpsoil.eu/	• The project focuses on climate-smart and sustainable management of agricultural soils to enhance carbon sequestration. • Practices include monitoring and improving soil organic carbon (SOC) concentrations over time. • Use of soil quality indicators to evaluate soil organic matter, nutrient status, and physical soil properties, which are linked to practices enhancing carbon storage.

27		
28	Innovative Carbon Farming Initiatives	• Practices include: o Peatland rewetting and restoration, mitigating CO2 and N2O emissions with a potential annual savings of 3.5-24 t CO2/ha. o Agroforestry systems that integrate trees into crop and livestock systems, offering 7.7–234.8 MtCO2/yr mitigation potential. o Crop rotation, reduced tillage, and organic amendments to enhance soil organic carbon (SOC). o Livestock feed and manure management, reducing CH4 and N2O emissions by up to 30%.
29	CARBONCAPS	• Project is about Biochar Production via Flash Carbonisation- not abut particular practice: o Each ton of biochar produced sequesters 3.2 tons of CO2eq, providing a long-term carbon storage solution. o Biochar improves soil fertility and SOC levels, reducing the need for synthetic fertilizers. • Waste Utilization: o Agricultural residues are pyrolyzed, reducing methane emissions from organic matter decomposition.

30	SOVCM	• Soil Carbon Storage: Encouraging the use of regenerative farming practices like no-till agriculture, cover cropping, and agroforestry to enhance soil organic carbon (SOC). • Biochar Application: Using biochar as a soil amendment to sequester carbon long-term while improving soil fertility and water retention. • Rotational Grazing: Implementing rotational grazing strategies to optimize pasture carbon capture and reduce methane emissions from livestock.
31	Carbon farming CE	• The project emphasizes regenerative practices, such as minimum tillage, perennial cropping, and rotational grazing, to enhance soil organic carbon (SOC) levels. • Techniques tested include direct seeding, use of organic fertilizers, and cover cropping to improve soil quality and biodiversity. • Six promising carbon farming techniques are identified for implementation and transnational testing to optimize carbon sequestration under varying climate conditions.

2.2 IT tools used for calculating CO2eq and the methodology applied for calculating CO2eq absorption/sequestration

After reviewing all the provided projects and papers there are several IT tools and digital platforms identified. Those IT tools and digital platforms utilized by various projects for calculating or monitoring CO2 equivalents (CO2eq) in agricultural practices are in the following table.

Table 4 IT tools for calculating CO2eq and methodology for calculatin CO2eq

No.	Project name	Which IT Tools and Methodologies developed or used by the project?
1	OLIVE4CLIMATE	• A land-use calculator is used to optimize agricultural practices for climate change mitigation by calculating carbon sequestration and emissions in olive groves. • Models are applied to forecast carbon stock and sink capacities under different climate scenarios.

2	AGRESTIC	• Decision Support System (DSS): o A newly developed DSS integrates GHG emission estimation and provides efficient management tools for multi-year crop rotations. • Real-Time Monitoring Prototype: o Monitors soil GHG emissions continuously to calibrate and validate models for estimating mitigation potential. • Greenhouse Gas Monitoring Tools: o Implements real-time monitoring in demonstration sites to validate ECS systems.
3	"4 per 1000"	• Plans to create a user-friendly MRV (Monitoring, Reporting, and Verification) toolkit for soil health and SOC improvement, integrating remote sensing and decision- support tools. • Develops a real-time dashboard to track the Initiative's progress, providing quantitative data on soil health and SOC at global, regional, and local levels. • Implements a global catalog of MRV systems to enhance data-driven decision-making for stakeholders.

4	Climate-Smart Agriculture Booster (CSA Booster)	• Hosts the Agrisource Open Innovation Platform (OIP) for CSA solutions, collaboration, and knowledge sharing. • Develops data analytics tools for risk assessment, monitoring, and evaluation (M&E) to support CSA projects. • Offers technical assistance for impact assessment, policy support, and business model optimization.
5	LIFE Carbon Farming	• Utilizes CAP'2ER, BOVID CO2, and AgNav tools to conduct environmental diagnostics, analyze GHG emissions, and assess carbon sequestration potential. • Develops a harmonized MRV (Monitoring, Reporting, Verification) framework to enable standardized tracking of carbon reductions across diverse farms. • Includes socio-economic impact assessment grids for comprehensive evaluations of farm- level changes.
6	CARE4C (Carbon Smart Forestry under Climate Change)	• Airborne LiDAR and drone technologies provide high-precision forest inventory and structural data for carbon stock estimation. • Develops land-use models to simulate and optimize carbon sequestration and economic returns across forest types. • Employs data integration tools for scaling up site-specific findings to regional or national levels of carbon management.

7	CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)	• Develops an Online Collaborative Platform (OCP) to aggregate global knowledge on SOC, including maps, guidelines, and models. • Implements geo-referenced metadata systems to support SOC-related research and policy-making. • Integrates results from meta-analyses, modeling, and experiments into an internationally accessible knowledge base.
8	NACAO (Nature-Based Carbon Offsets)	• Compensative Ecological Evaluation (VEC): A tool to compute ecological values and define compensatory restoration areas. • ITACA Protocol at Urban Scale: A method to assess and score sustainability levels for urban areas, integrating biodiversity, governance, and land use.
9	LIFE Regen Farming	• Agro-ecosystem Health Cards (TSAs): o Provides a diagnostic tool to assess soil health, focusing on factors such as particulate organic matter and carbon fixation. • Chromatograms: o Evaluates soil health visually and quantitatively, enabling cost-effective monitoring of regenerative farming practices. • These tools ensured fast, reliable, and inexpensive monitoring for farmers.

10	CARBOMART	• Develops an online carbon-trading platform for buyers and sellers to evaluate and compare carbon emission reduction projects. • Integrates a sustainability comparison tool based on social, environmental, and economic benchmarks to ensure transparency.
11	NoiCompensiAmo	• Development of AGRO CFA tools for carbon footprint analysis in agricultural activities and soil chemical analysis. • IT solutions supporting sustainable supply chain management and efficiency improvements in resource usage.
12	Block CO2	• While no specific IT tools are mentioned, the project focuses on data-driven biochar production and promotes co-composting techniques that reduce methane and nitrous oxide emissions.
13	βNeutral	• Implements monitoring and data collection systems for real-time evaluation of carbon sequestration. • Develops GIS-based tools and remote sensing models to track land-use changes and SOC improvements. • Establishes predictive models integrating climate, soil, and vegetation data for accurate carbon flux estimation.

14	DOLFINS	• Utilizes remote sensing technologies and GIS-based models to monitor carbon stock changes in soils and vegetation. • Develops data-driven tools for predictive modeling of carbon flux under different management scenarios. • Applies frameworks for monitoring, reporting, and verifying (MRV) changes in carbon absorption and sequestration.
15	Nucleo Monitoraggio Carbonio (CREA)	• Focuses on the monitoring and evaluation of ecosystem service projects, ensuring accurate tracking of their climate impact. • Proposes a monitoring framework for assessing completed projects and their effectiveness in generating ecosystem services and mitigating climate change.
16	Paper: Innovative Approaches in Soil Carbon Sequestration Modelling for Better Prediction with Limited Data	• Employs Bayesian hierarchical models to predict soil carbon dynamics, even with limited data. • Utilizes RothC-like models for carbon flow estimations, integrating land-use, climatic, and soil data. • Explores probabilistic frameworks for enhanced accuracy in carbon stock and flux modeling under various agro-pedo-climatic conditions.
		o The project utilizes a digital platform and mobile application to manage "CO2 Accounts," enabling users to track their

17	PCCE: Pricing Carbon with a Dedicated Currency to Empower Economic Agents	carbon reductions and green-euro credits. It also provides tools for calculating carbon footprints and managing green-euro transactions. The app integrates financial services (such as loans) with CO2 reduction incentives, making it easier for individuals and businesses to participate in the carbon reduction economy. The developed system tracks CO2 reductions associated with user/company activities, using web-based calculators for the foot-print.
	MRV4SOC: Monitoring, Reporting, and Verification of Soil Organic Carbon and Greenhouse Gas Balance	o The project leverages remote sensing technologies (e.g., satellites and drones) and spectrometry to acquire reliable data on carbon sequestration and greenhouse gas emissions. o It utilizes geostatistical and process-based models for assessing soil carbon and nitrogen cycles. o Data from Earth observation programs like ESA Copernicus and EnMAP are integrated for quality assurance and model validation. o Specific tools are developed to enable Monitoring, Reporting, and Verification (MRV) frameworks for tracking carbon and nitrogen cycles across diverse land

18		use scenarios.
19	LIFE VitiCaSe	o A digital platform and app is under development for: - Estimating soil organic carbon (SOC) potential. - Monitoring and validating carbon farming practices. - Integrating blockchain technology for carbon credit certification and management. o These tools provide decision support systems (DSS) for selecting effective farming techniques and georeferenced monitoring.• A complete digital platform: protects and facilitates the correct management of agricultural practices and the calculation of carbon credits, based on an app that will integrate the most innovative algorithms based on international standards shared by the scientific community.
	ClieNFarms	o The project utilizes the "Innovative Systemic Solution Space (I3S)" to co-design and test solutions interactively with multi- actor participation. o Digital tools are being deployed to measure, report, and verify (MRV) climate impacts and track progress toward carbon neutrality. o Participatory methodologies like design- thinking are integrated into the

20		project's development and scaling of solutions.
21	AgriCaptureCO2	• Digital Solutions for Carbon Quantification: o Use of satellite imagery (Copernicus) combined with AI and soil sampling to map soil carbon. o Soil Carbon Mapper: A digital tool to measure and track soil carbon changes. o Profitability Calculator: Estimates the economic benefits of regenerative practices. o Carbon Farming Potential Calculator: Projects CO2 sequestration potential. • Monitoring, Reporting, and Verification (MRV) Platform: o Facilitates certification of carbon credits with precise and cost-effective methods. • Algorithms for: o Smart soil sampling. o Verification of sustainable

		practices remotely.
22	Digital Solutions to Foster Climate-Smart Agricultural Transition (Digi4CSA)	• Carbon Action Platform: o A collaborative platform for researchers, farmers, and companies to promote carbon farming and regenerative agriculture. • Monitoring and Research Tools: o Finnish Meteorological Institute coordinates multidisciplinary research projects under the Carbon Action platform. • Knowledge Sharing Systems: o Free online courses for farmers and knowledge-sharing initiatives to enhance adoption of regenerative practices.

23	LIFECO2PES&PEF	• Development of a Carbon Tool for calculating carbon stocks in sawn wood, customized for different wood species typical in Italian and European forests. • Creation of an interactive web platform for stakeholders (companies, public authorities, universities, environmental organizations) to access tools for monitoring and managing ecosystem services and carbon stocks. • Application of the Product Environmental Footprint (PEF) methodology for lifecycle analysis of wood products, ensuring compliance with European standards (Recommendation 2013/179/EU).
24	CARBON FARMING MED	• Carbon Measurement Framework: o Development of Monitoring, Reporting, and Verification (MRV) systems tailored for Mediterranean conditions to measure and verify carbon sequestration. o Use of decision-making trees and scalable MRV components for soil carbon assessment. o Integration of modelling and direct measurement approaches to assess soil organic carbon (SOC) and emissions. • Knowledge-Sharing Platforms: o Dissemination of best practices via digital platforms to encourage adoption among stakeholders and farmers.

25	Carbon 4 Soil Quality	• Toolbox for Carbon Farming: o A comprehensive set of tools includes methodologies for organic carbon analysis, soil quality monitoring, and business models for carbon farming. o The toolbox also includes recommendations for agricultural carbon credit schemes and environmental certification systems. • Collaborative Tools: o Tools to harmonize methodologies and foster knowledge-sharing across borders.
26	Paper: Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content (China authors)Modelling and Remote Sensing of Soil Carbon	• Remote Sensing: Landsat 5 TM images were used for spectral analysis to estimate soil organic carbon content. • Data Processing and Analysis Tools: ENVI software for image preprocessing, and ArcGIS for mapping spatial distribution and resampling. • Machine Learning Models: o Random Forest (RF). o Support Vector Machines (SVM). o Multiple Linear Regression (MLR). o Partial Least Squares Regression (PLSR). • A combination of original spectral reflectance (OSR) and environmental variables (climate, terrain, soil, and vegetation cover) were used to improve SOC estimation accuracy.

27	Towards Climate-Smart Sustainable Management of Agricultural Soils https://ejpsoil.eu/	• Development of ICT-based decision support tools to evaluate soil quality indicators and provide actionable insights. • Tools include geodatabases and soil information geoportals for mapping and monitoring soil parameters. • Integration of soil sampling, monitoring campaigns, and digital terrain modeling for improved data collection and analysis.
28	Innovative Carbon Farming Initiatives	• Decision Support Tools (DSTs): o 26 projects developed DSTs, integrating remote sensing, AI, and soil databases. o Features include precision agriculture solutions and tailored recommendations for crop, soil, and land use. • MRV Systems: o Projects utilized Earth Observation (EO) data from Copernicus satellites and sensors for continuous SOC monitoring. o Blockchain technologies enhance traceability in carbon accounting.
29	CARBONCAPS	• Carbon Monitoring Tools: o Flash Carbonisation systems track carbon content and quantify CO2eq removal during production.

30	SOVCM	• Digital Monitoring Platforms: Tools like CAP'2ER, BOVID CO2, and AgNav are used to calculate and monitor carbon footprints, assess emission reductions, and manage carbon stock effectively. • Carbon Modeling Frameworks: Advanced simulation tools and databases analyze crop growth, carbon emissions, and SOC dynamics to provide precise assessments. • Data Integration Systems: Utilizing GIS mapping, remote sensing, and big data analytics to model and monitor CO2eq sequestration at regional and field levels.
31	Carbon farming CE	• Visual Soil Assessments (VSA): A farmer- friendly method for basic soil quality monitoring. • Carbon Stock Quantification and Soil Enzyme Analysis: Used for professional audits to measure SOC changes. • Development of a Carbon Farming Monitoring Strategy Roadmap, offering methodologies for soil functionality, carbon storage, and nitrogen cycle evaluations. • Pilot Testing and Feedback Loops: Techniques are peer-reviewed transnationally, ensuring robust methodologies for diverse regions.

2.3 Certification methodologies for achieved CO2eq absorption and sequestration

After thoroughly reviewing the provided projects, the identified certification methodologies for CO2 equivalent (CO2eq) absorption and sequestration are presented in the following table.

Table 5 Certification methodologies for achieved CO2eq absorption and sequestration

No.	Project name	Which Certification Methodologies were developed or applied if any?
1	OLIVE4CLIMATE	• The project complies with ISO 14067 standards for olive oil carbon footprint evaluation, verified by accredited third-party certification. • Product labeling systems are developed based on Life Cycle Analysis (LCA) and carbon footprint assessments.
2	AGRESTIC	• Product Labeling: o Certifies crops cultivated under ECS systems with quantifiable climate and environmental benefits. • Payment for Ecosystem Services (PES): o Designs schemes incentivizing sustainable practices through measurable GHG reductions.
3	"4 per 1000"	• Supports science-based helpdesks to assist in establishing and applying carbon sequestration compensation schemes. • Plans branding mechanisms, including certification, seals, and labels, to promote and validate soil health practices and carbon stock improvements.

4	Climate-Smart Agriculture Booster (CSA Booster)	• Facilitates assessment of CSA impacts via validated methodologies but does not directly certify carbon sequestration efforts.
5	LIFE Carbon Farming	• Establishes a six-year certification process, beginning with baseline diagnostics, interim monitoring, and a final audit by external verifiers. • Certifications validate the carbon credits generated and ensure compliance with the MRV framework. • Incorporates result-based systems, rewarding farmers based on verified reductions in carbon emissions.
6	CARE4C (Carbon Smart Forestry under Climate Change)	• Establishes protocols to monitor and evaluate thinning practices and their impact on carbon emissions and sinks. • Provides frameworks for reporting operational emissions from forestry equipment, aligning with sustainability goals. • Lays the groundwork for including sustainable forest practices in carbon accounting schemes.
7	CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)	• Establishes monitoring, reporting, and verification (MRV) guidelines for SOC improvements. • Provides strategic frameworks to assess and validate SOC sequestration efforts in line with 4 per 1000 initiative objectives.

8	NACAO (Nature-Based Carbon Offsets)	• Voluntary certification for sustainable forest management (SFM) through recognized third-party accredited bodies. • Methodology to calculate stored carbon and generate sustainability credits based on agroforestry and forestry sinks.
9	LIFE Regen Farming	• Monitoring methods assessed environmental and socio-economic impacts of practices. • Improvements in carbon fixation, biodiversity, and soil fertility validated the efficacy of regenerative practices. • Results supported alignment with EU biodiversity conservation and soil health strategies.
10	CARBOMART	• Proposes measurable pricing methodologies for voluntary emission reduction projects. • Facilitates certification of projects by enabling comparisons of sustainability benchmarks directly on the platform.
11	NoiCompensiAmo	• Use of international standards such as: o ISO 14064:2018 for corporate carbon footprint analysis. o ISO 14067:2018 for product lifecycle carbon footprint certification. • Support for creating and certifying carbon credits based on sustainable agricultural practices.

12	Block CO2	• Not explicitly outlined, but the quantifiable carbon removal (150 tons/year of biochar) supports certification frameworks and methodologies for climate mitigation efforts.
13	βNeutral	• Defines MRV frameworks (Monitoring, Reporting, Verification) to quantify carbon sequestration impacts. • Standardizes protocols to ensure consistency in carbon credit generation, focusing on transparency and reliability. • Aligns projects with national and international certification bodies for ecosystem service validation.
14	DOLFINS	• Establishes guidelines for quantifying and validating carbon sequestration aligned with international standards. • Integrates frameworks for result-based payments to incentivize sustainable practices. • Provides protocols for third-party verification and compliance with global certification systems.

15	Nucleo Monitoraggio Carbonio (CREA)	• Defines minimum criteria for project implementation to ensure consistency and transparency in ecosystem service generation. • Aligns projects with national guidelines and Legislative Decree no. 34/2018, which governs marketable ecosystem services in the agro- forestry sector. • Emphasizes quality analysis to highlight projects with higher efficiency in carbon sequestration and climate mitigation.
16	Paper: Innovative Approaches in Soil Carbon Sequestration Modelling for Better Prediction with Limited Data	• While the document does not detail explicit certification processes, it provides frameworks to improve carbon accounting systems. • Suggests standardized modeling to validate SCS benefits, supporting policies aligned with climate mitigation goals.
	PCCE: Pricing Carbon with a Dedicated Currency to Empower Economic Agents	o The CO2 Account system's methodology for carbon reductions is certified by the French government and the United Nations. It involves verifying reductions in CO2 emissions through documented evidence (e.g., energy bills or mileage records) and providing green-euro credits based on these calculations. This methodology ensures precision and relevance in CO2 reduction

17		metrics. No elaborated or described certification methodology in the project scope.
18	MRV4SOC: Monitoring, Reporting, and Verification of Soil Organic Carbon and Greenhouse Gas Balance	o The project is focused on developing robust, transparent, standardized, and cost-effective MRV systems aligned with EU and international standards for results-based payments. o Certification criteria follow the QU.A.L.ITY framework: Quantification, Additionality and Baselines, Long-term Storage, and Sustainability. o It aims to establish an EU-wide standard for carbon credit certification, with data from demonstration sites contributing to its definition.

19	LIFE VitiCaSe	o The project includes methodologies for certification of carbon credits based on international standards. o A robust system for carbon stock validation using field data and modeling (e.g., Roth-C model calibration). o **Blockchain** notarization is used to ensure transparency and traceability of carbon credits. • The farms apply standard methodology and protocol, adopting Carbon Standard procedures in order to get the C credits. • Carbon Credits will be result of certification thanks to the support of Carbon Credits Consulting.
20	ClieNFarms	o The project aims to develop methodologies for measuring, reporting, and verifying (MRV) data to support policy applications. o A carbon credit platform with automated certification processes is planned, which will apply to selected supply chains.

21	AgriCaptureCO2	• The project has designed a methodology for carbon credit certification under recognized global frameworks, such as Verified Carbon Standard (VCS), aligned with the Kyoto Protocol. • Certification includes remote monitoring and satellite-based verification of agricultural practices to ensure compliance and streamline documentation. • Aims to submit the AgriCaptureCO2 methodology for EU certification to further enhance credibility.
22	Digital Solutions to Foster Climate-Smart Agricultural Transition (Digi4CSA)	• The project explores methods to quantify soil carbon storage and certify practices under regenerative and carbon farming frameworks. • Efforts focus on linking carbon farming with measurable and certifiable outcomes to support policy integration and financial incentives.

23	LIFECO2PES&PEF	• Establishment of a certification standard for ecosystem services to attribute monetary value and integrate them into voluntary markets. • Development of the PEFCR (Product Environmental Footprint Category Rules) for the wood sector, which includes lifecycle analysis to assess and improve the environmental performance of forest-based products. • Proposed validation protocol for ecosystem services to transform them into marketable "products" with certified monetary value.
24	CARBON FARMING MED	• The project incorporates frameworks under the Carbon Removals and Carbon Farming Certification Regulation (CRCF). • Development of standards for monitoring SOC and certifying carbon sequestration practices at the farm level. • Alignment with the EU's Product Environmental Footprint (PEF) methodologies to ensure transparent and standardized assessment processes.
25	Carbon 4 Soil Quality	• The project develops and tests carbon credit schemes linked to agricultural practices. • Incorporates environmental certification systems to ensure the scalability and credibility of carbon farming practices in Mediterranean regions.

26	Paper: Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content (China authors)Modelling and Remote Sensing of Soil Carbon	• The paper does not directly discuss any certification methodologies. It focuses on methodological improvements for estimating SOC content and does not link these findings to carbon credit certification systems or similar frameworks.
27	Towards Climate-Smart Sustainable Management of Agricultural Soils https://ejpsoil.eu/	• The document discusses efforts to harmonize soil quality indicators across European countries to ensure consistency in monitoring and policy applications. • Emphasis on aligning practices with EU standards, such as the Common Agricultural Policy (CAP) and the UNFCCC climate change emission indicators.
28	Innovative Carbon Farming Initiatives	• Emphasizes result-based payments tied to accurate SOC measurement. • Certification aligns with emerging EU frameworks, focusing on additionality and permanence of carbon removals. • Advanced MRV solutions provide robust data for certification.

29	CARBONCAPS	• Verified Carbon Standards not applicable in GECO2.2 snse. o However carbon credits may be created after certification using rigorous international standards like ISO 14064. • Third-Party Verification: o Audits ensure that each project meets the standard of 3.2 tons CO2eq removal per ton of biochar as promised in the project
30	SOVCM	• ISO-Driven Standards: Certification based on ISO 14067 ensures the credibility of carbon footprint assessments. • MRV Systems: Monitoring, Reporting, and Verification (MRV) frameworks ensure that carbon sequestration practices meet rigorous environmental and socio-economic standards. • Lifecycle Analysis (LCA): Detailed assessments of the entire agricultural value chain to certify carbon credits.
31	Carbon farming CE	• Establishes sustainability verification models that include CO2 sequestration assessments and socio-economic impact analyses. • Transnational guidelines provide step-by- step instructions to scale certification efforts nationally and internationally. • Outputs include compliance-ready tools for monitoring carbon stock improvements and validating carbon farming efforts.

2.4 Developed or utilized voluntary carbon market (VCM) functioning systems and their organization

Some of the projects took certain steps in direction of organisation of own VCM. The others intended to result with carbon credits that will be tradable in VCMs. One project tried to develop an own "green currency" as a mean of trading results of the project related to reduction of emissions from agriculture.
The efforts of particular project in direction of monetization of project results and eventual VCM are summarized in the following table.

Table 6 Developed or utilized voluntary carbon market, functioning systems and their organization

No.	Project name	Did the project develop own Voluntary Carbon Market (VCM) Systems or used other Voluntary Carbon Market?
1	OLIVE4CLIMATE	• The project proposes carbon credits certification for olive groves, recognizing their role in climate change mitigation. • Provides incentives for preserving low-yield or ancient olive trees through carbon credit sales, aligning with voluntary market mechanisms.
2	AGRESTIC	• Economic Incentives: o The project explores schemes linked to PES but does not explicitly address VCM integration.

3	"4 per 1000"	• Identifies and promotes carbon market mechanisms for SOC sequestration, improving accessibility and transparency. • Explores alternative financial instruments, including compensation schemes for carbon storage, to incentivize transitions to agroecological practices.
4	Climate-Smart Agriculture Booster (CSA Booster)	• Blends public-private financing to de-risk CSA investments. • Provides financing and insurance mechanisms for sustainable agriculture, indirectly enabling carbon market alignment.
5	LIFE Carbon Farming	• Creates a European benchmark for the costs of low-carbon farming projects, enabling structured market participation. • Integrates farmers into carbon credit systems by developing a results-based carbon financing mechanism. • Establishes a European network of low-carbon farmers, facilitating knowledge-sharing and scalability of sustainable practices.
6	CARE4C (Carbon Smart Forestry under Climate Change)	• Integrates principles of carbon-smart forestry with potential for inclusion in carbon credit frameworks. • While VCM development is not a direct project goal, the foundational methodologies and practices align with carbon market eligibility.

7	CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)	• Although not a primary focus, the project supports carbon market alignment by standardizing methodologies and promoting scalable SOC practices. • Engages stakeholders to address barriers and solutions to implementing SOC-focused carbon sequestration initiatives.
8	NACAO (Nature-Based Carbon Offsets)	• The project references developing regional frameworks, such as the "Roadmap for Nature- Based Policies for GHG Reduction," which includes structured plans for implementing green and blue carbon initiatives. • Collaboration on carbon credit generation and trading within nature-based solutions, highlighting partnerships with regional and national authorities.
9	LIFE Regen Farming	• The project focused on quantifiable SOC increases and GHG reductions, enabling potential inclusion in carbon credit systems. • Though not explicitly tied to VCMs, measurable carbon gains (e.g., 10% increase in carbon fixation) could facilitate participation in future markets

10	CARBOMART	• Targets the Voluntary Emission Reduction Market by creating a transparent, accessible marketplace for carbon credits. • Aims to increase the investment flow into carbon emission reduction projects, boosting market quality and participation. • Projects a significant impact, including a potential 5% reduction in emissions through increased returns on green energy investments.
11	NoiCompensiAmo	• Development of a system to generate and trade "Made in Italy" carbon credits based on **agricultural and forestry initiatives**. • Focus on targeted compensation processes to offset emissions using locally certified carbon credits.
12	Block CO2	• Supports a circular economy by transforming waste into biochar and compost, with potential applicability in carbon credit systems. • Promotes sustainable practices but does not directly involve VCM trading or certifications.
13	βNeutral	• Supports market integration of carbon credits generated from validated projects. • Facilitates financing through public-private partnerships to promote sustainable land management. • Establishes mechanisms for credible credit trading, linking projects to global carbon markets.

14	DOLFINS	• Designs mechanisms to connect sustainable land-use projects with voluntary carbon credit markets. • Supports public-private partnerships to facilitate financing for carbon mitigation initiatives. • Encourages transparent trading systems to enhance credibility and traceability of carbon credits.
15	Nucleo Monitoraggio Carbonio (CREA)	• Seeks to improve the transparency and management of voluntary carbon markets at the national level. • Promotes coordination among stakeholders to align forestry projects with market standards, ensuring better integration into voluntary financing mechanisms. • Identifies activities financeable through regional Rural Development Plans (PSR) to ensure a structured approach for ecosystem services in VCMs.
16	Paper: Innovative Approaches in Soil Carbon Sequestration Modelling for Better Prediction with Limited Data	• The study does not directly discuss VCMs but highlights the application potential of SCS models in establishing carbon credit systems. • Advocates for accurate data and modeling systems to quantify and verify SOC changes, facilitating market-ready solutions.

17	PCCE: Pricing Carbon with a Dedicated Currency to Empower Economic Agents	In a way the project has developed its own quasi voluntary carbon market system. **However, there is no VCM in a sense of an organized market**.The green-euro currency acts as a tool within this system, linking CO2 emission reductions directly to financial incentives. The program supports voluntary carbon offsetting by allowing individuals and businesses to offset emissions locally within Europe, converting verified reductions into CO2 credits.
18	MRV4SOC: Monitoring, Reporting, and Verification of Soil Organic Carbon and Greenhouse Gas Balance	o The project recognizes a widespread distrust in Voluntary Carbon Markets and seeks to increase stakeholders' confidence. o Efforts are directed toward establishing a results-based payment mechanism supported by certified carbon credits, which could eventually integrate into VCM systems. o Revenue opportunities are identified for participants, aligning carbon farming with economic incentives in a transparent market.

19	LIFE VitiCaSe	o The project is actively involved in developing a business model for carbon credits, including their certification and sale on voluntary carbon markets. o It emphasizes creating additional income streams for farmers through verified carbon credits.
20	ClieNFarms	o The project is actively developing its own carbon credit platform tailored to support automated certification processes for carbon credits. This will be applied within specific supply chains, including partnerships with Nestlé, Danone, and FrieslandCampina.
21	AgriCaptureCO2	• The project uses the Verified Carbon Standard (VCS), the world leader in voluntary carbon credits, ensuring alignment with international frameworks like the Kyoto Protocol. • Farmers gain access to global voluntary carbon markets, providing financial incentives for adopting climate-friendly practices. • AgriCaptureCO2 emphasizes scalability and transparency to make participation in carbon markets more accessible for farmers.

22	Digital Solutions to Foster Climate-Smart Agricultural Transition (Digi4CSA)	• While the document does not explicitly detail the development of its own Voluntary Carbon Market system, it highlights the Carbon Action Platform as a framework to integrate carbon farming into larger voluntary carbon markets. • The platform aims to enable farmers to benefit financially from carbon sequestration efforts through market mechanisms and partnerships.
23	LIFECO2PES&PEF	• Creation of an ecosystem credit system aimed at financing ecosystem services through voluntary carbon markets. • The platform includes a software system for registry management, marketing, and cancellation of ecosystem credits, facilitating exchange in voluntary markets. • Support for European policy frameworks, including the EU Green Deal, to integrate ecosystem credits into broader Land Use, Land Use Change, and Forestry (LULUCF) initiatives.

24	CARBON FARMING MED	• The project is actively developing a Mediterranean-focused voluntary carbon market that facilitates trading of carbon credits generated from regenerative agricultural practices. • Emphasis on creating hybrid and result-based payment systems to support farmers and integrate credits into broader markets. • Encourages collaboration between public and private stakeholders to scale up market adoption and create sustainable funding mechanisms.
25	Carbon 4 Soil Quality	• Recommendations and frameworks for agricultural carbon credit schemes to integrate into voluntary carbon markets. • The project does not mention developing its own VCM system but provides tools and guidelines for stakeholders to access existing carbon markets effectively.
26	Paper: Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content (China authors)Modelling and Remote Sensing of Soil Carbon	• The document does not comment on the development of a Voluntary Carbon Market system or the use of an existing one. Its focus is on advancing the scientific methodologies for SOC monitoring, which could indirectly support carbon market mechanisms.

27	Towards Climate-Smart Sustainable Management of Agricultural Soils https://ejpsoil.eu/	• While the document does not explicitly state the development of a standalone VCM system, it highlights the use of soil carbon data in policy and decision-making frameworks that could support carbon market initiatives. • Focus on providing foundational data for carbon flux calculations, essential for integrating agricultural soils into broader carbon market mechanisms.
28	Innovative Carbon Farming Initiatives	• Development of ecosystem credits linked to agroforestry and peatland rewetting. • Integration of carbon credits into VCMs enables farmers to earn based on verified carbon sequestration. • Projects include pilot models for private- public financing partnerships.
29	CARBONCAPS	It wasn't within a scope of the project that was focused on new technology development.
	SOVCM	• Trading Platforms: Platforms like CARBOMART allow for transparent comparison and trade of carbon credits between buyers and sellers based on environmental, social, and economic criteria. • Standards and Benchmarks: Defining sustainability metrics to ensure carbon credits reflect genuine and measurable emission reductions. • Stakeholder Engagement: Engaging

30		farmers, investors, and policymakers to streamline the adoption and integration of carbon credits into agricultural practices.
31	Carbon farming CE	• Focuses on creating transnational business models for carbon farming, connecting farmers and stakeholders. • Promotes sustainability verification models to facilitate integration into voluntary carbon markets. • Strategy and action plans emphasize financial aspects, monitoring frameworks, and policy recommendations to mainstream carbon farming and align it with VCMs.

Note: If it isn't explicitly stated that a VCM is organized and functional it means that the project just made described efforts/activities related to trade of carbon credits and trading.

3. Final considerations and possible integration with GECO2.2 contents and activities

3.1. Selected projects related to GECO2.2 contents and activities

All in all, project partners identified 31 projects or papers (not only in EU) that have some innovative issues on themes interesting for GECO2.2.
Among them, the most valuables in terms of innovative practices and approach, are the followings:
LIFE VitiCaseProject: The project deals with various practices that not only helps the environment by reducing the climate impact, but can also improve soil quality and the long-term sustainability of the wine sector. GECO2.2 including vineyards as a part of the pilot project, this project is perfectly in line with it.
The selected key issues of the project can be summarized as follows:

1. **Agricultural Practices for CO2eq Absorption/Sequestration**:
   The project promotes **carbon farming in viticulture** practices such as: Minimum tillage and no-tillage techniques. Use of cover crops and green manures to enhance soil organic carbon. Application of compost and biochar for carbon retention. Precision irrigation and organo-mineral fertilization. Reuse of agricultural residues (green and woody residues). Mulching (natural and green surface mulching). Grassing (e.g., under-row grassing with leguminous plants).
   These practices are all included in the GECO2 protocols and software tools.

2. **IT Tools and Certification Methodologies Developed or Used by the Project:**

   A **digital platform and app** have been created for: Estimating soil organic carbon (SOC) potential; Monitoring and validating carbon farming practices; Integrating blockchain technology for carbon credit certification and management.
   Informatic tools provide decision support systems (DSS) for selecting effective farming techniques and georeferenced monitoring. The project includes methodologies for certification of carbon credits based on international standards. A robust system for carbon stock validation using field data and modelling (e.g., Roth-C model calibration). Blockchain notarization is used to ensure transparency and traceability of carbon credits.

3. **Development or Use of Voluntary Carbon Market (VCM) Systems**: The project is actively involved in developing a business model for carbon credits, including their certification and sale on

voluntary carbon markets. It emphasizes creating additional income streams for farmers through verified carbon credits.

ClieNFarms Project: The project applied 17 agricultural practices that are worth considering. In the WP4 of the project, it is mentioned a "Carbon credit platform". More specifically, in the Task 4.3, the project declared that it will "develop a carbon credit platform with automated certification processes, which will be applied in at least two of the supply chains of food production companies". There are no other details available. However, there is an incipient business model for voluntary carbon credits that is related to providing carbon credits and data to the big food companies that have to decarbonize its supply chain and keep a record about the whole carbon footprint from agriculture to the final products (due to EU directive). Projects like GECO2.2 or in this case ClienNFarms may provide information that is the most valuable for big food companies like involved: Nestlé, Danone, and Friesland Campina. The information can be monetized besides VCM and it may be a way to achieve economic sustainability and provide sufficient incentives to farmers/operators.

The selected key issues of the project can be summarized as follows:

1. **Agricultural Practices for CO2eq Absorption/Sequestration:** Diversifying crop rotations. o Incorporating crop residues into the soil; Cultivating cover crops and legume crops; Establishing or maintaining hedgerows, individual trees, and agroforestry; Reducing soil tillage and applying biochar. o Adapting fertilization practices, including using organic and low-emission fertilizers. o Improving drainage of mineral soils and managing water tables in peat soils; Using renewable energy sources like biofuels, biogas, and low-carbon heat.

2. **IT Tools and Methodologies:** The project utilizes the "Innovative Systemic Solution Space (I3S)" to co-design and test solutions interactively with multi-actor participation. o Digital tools are being deployed to measure, report, and verify (MRV) climate impacts and track progress toward carbon neutrality. o Participatory methodologies like design-thinking are integrated into the project's development and scaling of solutions.

3. **Certification Methodologies:** The project aims to develop methodologies for measuring, reporting, and verifying (MRV) data to support policy applications. o A carbon credit platform with automated certification processes is planned, which will apply to selected supply chains.

4. **Voluntary Carbon Market (VCM) Systems:** The project is actively developing its own carbon credit platform tailored to support automated certification processes for carbon credits. This will

be applied within specific supply chains, including partnerships with Nestlé, Danone, and Friesland Campina.

These above-mentioned projects are both worth contacting.

ClieNFarms Project: https://clienfarms.eu/contact/: Jacques-Eric Bergez, INRAE; clienfarms@gmail.com LIFE VitiCaseProject: Coordinatrice: Simona Palermo c/o Image Line srl Unipersonale – Via Giovanni Nicotera 29, 00195 Roma (Italy) - Mail: info@life-viticase.eu • Tel. +39 0546 060098

The remaining projects are interesting mostly for some specific operative aspects:

1) **MRV4SOC Project: Measure long-term soil organic carbon** accumulation in 9 EU representative land use/land cover classes, assess how carbon farming practices drive carbon flux dynamics in the 9 classes, evaluate the impact of climate change on soil organic carbon accumulation, develop a robust, transparent, standard, and cost-effective monitoring, reporting, and verification system to facilitate results-based payments for farming practices, identify revenue opportunities to unlock results-based payments and increase stakeholders' confidence in Voluntary Carbon Markets. According to the available information, here are the four aspects that are of particular interest for GECO2.2:

Agricultural Practices for CO2eq Absorption/Sequestration: Carbon farming practices are applied to drive soil organic carbon (SOC) accumulation, including: Reduced tillage (e.g., no-tillage and minimum tillage). Use of cover crops and crop rotation. Smart water management (e.g., underground drip irrigation and controlled drainage systems). Rotational grazing and

pasture restoration in grasslands. Agroforestry practices, such as integrating tree plantations (e.g., poplar short rotation coppice) with arable crops for bioenergy and biodiversity preservation. Mitigation practices like erosion reduction and methane reduction from livestock farms.

IT Tools and Methodologies Developed or Used by the Project: o The project leverages remote sensing technologies (e.g., satellites and drones) and spectrometry to acquire reliable data on carbon sequestration and greenhouse gas emissions. o It utilizes geostatistical and process-based models for assessing soil carbon and nitrogen cycles. o Data from Earth observation programs like ESA Copernicus and EnMAP are integrated for quality assurance and model validation. o Specific tools are developed to enable Monitoring, Reporting, and Verification (MRV) frameworks for tracking carbon and nitrogen cycles across diverse land use scenarios.

Certification Methodologies Developed or Applied: o The project is focused on developing robust, transparent, standardized, and cost-effective MRV systems aligned with EU and international standards for results-based payments. o Certification criteria follow the QU.A.L.ITY framework: Quantification,

Additionality and Baselines, Long-term Storage, and Sustainability. It aims to establish an EU-wide standard for carbon credit certification, with data from demonstration sites contributing to its definition.

Development or Use of Voluntary Carbon Market (VCM) Systems: The project recognizes a widespread distrust in Voluntary Carbon Markets and seeks to increase stakeholders' confidence. Efforts are directed toward establishing a results-based payment mechanism supported by certified carbon credits, which could eventually integrate into VCM systems. o Revenue opportunities are identified for participants, aligning carbon farming with economic incentives in a transparent market

2) **Towards Climate-Smart Sustainable Management of Agricultural Soils Project**

This project is part of a wide EJP SOIL Joint European Initiative. The project comes up with plenitude of information. The project (initiative) results could be summarized regarding the four aspects that are of particular interest for GECO2.2 this way:

Agricultural Practices for CO2eq Absorption/Sequestration: The project focuses on climate-smart and sustainable management of agricultural soils to enhance carbon sequestration. Practices include monitoring and improving soil organic carbon (SOC) concentrations over time. Use of soil quality indicators to evaluate soil organic matter, nutrient status, and physical soil properties, which are linked to practices enhancing carbon storage.

IT Tools and Methodologies Developed or Used: Development of ICT-based decision support tools to evaluate soil quality indicators and provide actionable insights. Tools include geodatabases and soil information geoportals for mapping and monitoring soil parameters. Integration of soil sampling, monitoring campaigns, and digital terrain modelling for improved data collection and analysis.
Certification Methodologies: The document discusses efforts to harmonize soil quality indicators across European countries to ensure consistency in monitoring and policy applications. Emphasis on aligning practices with EU standards, such as the Common Agricultural Policy (CAP) and the UNFCCC climate change emission indicators.
Voluntary Carbon Market (VCM) Systems: While the document does not explicitly state the development of a standalone VCM system, it highlights the use of soil carbon data in policy and decision-making frameworks that could support carbon market initiatives. Focus on providing foundational data for carbon flux calculations, essential for integrating agricultural soils into broader carbon market mechanisms.

3) Nucleo Monitoraggio Carbonio Project

In this project is involved CREA, an in-house structure of the Italian Ministry of Agriculture. The project objectives could be wrapped up regarding the four aspects that are of particular interest for GECO2.2: **Agricultural Practices for CO2eq Absorption/Sequestration:** The initiative emphasizes forestry and agroforestry projects to enhance carbon sequestration; Projects include human-induced activities targeting the creation of ecosystem services, such as reforestation, afforestation, and sustainable forestry management.
IT Tools and Methodologies: Focuses on the monitoring and evaluation of ecosystem service projects, ensuring accurate tracking of their climate impact. Proposes a monitoring framework for assessing

completed projects and their effectiveness in generating ecosystem services and mitigating climate change. **Certification Methodologies:** Defines minimum criteria for project implementation to ensure consistency and transparency in ecosystem service generation.; Aligns projects with national guidelines and Legislative Decree no. 34/2018, which governs marketable ecosystem services in the agro-forestry sector; Emphasizes quality analysis to highlight projects with higher efficiency in carbon sequestration and climate mitigation. **Voluntary Carbon Market (VCM) Systems:** Seeks to improve the transparency and management of voluntary carbon markets at the national level; Promotes coordination among stakeholders to align forestry projects with market standards, ensuring better integration into voluntary financing mechanisms; identifies activities financeable through regional Rural

Development Plans (PSR) to ensure a structured approach for ecosystem services in VCMs.

4. Final comments and conclusions

The abovementioned issues, outlined in Chapter 3, will be the subject of further investigation with the aim to collect more detailed data from the selected projects. The identified project links will be used for increasing quantity and quality of needed information.
In particular, the following topics will be analysed in depth:

- **Agricultural Practices for CO2eq Absorption/Sequestration** for a potential upgrading of the practices panel of Geco2.2

- **Measuring system** to be used in defining the baseline and in the voluntary carbon market monitoring activities (for example exploiting EU sustained research centres) to collect and compare methods and data

- **IT Tools (calculators and platform)** for comparing informatic structures and security issues**.**

  In particular have to be reviewed the algorithms of calculator and the data base structure and organization. Furthermore, Artificial Intelligence use has to be considered.

- **Certification Methodologies** for setting up a certification scheme, in line with EU regulation and ISO 14064 standard. The certification scheme intends to validate the whole GECO2.2 market system (baseline definition; CO2eq calculation; matchmaking market platform; certification process; market rules; controlling mechanisms; credits registry; etc.)

- **Voluntary Carbon Market (VCM)** for upgrading contents and operational solutions of Geco2.2 Pilot market implementation.

- **Soil and biomass Carbon Modelling** for improving the reliability of CO2eq calculation system

- **Open Life cycle analysis for buyers** can be evaluated as a tool for easing

participation of buyers to the market.

Annex A Project sheets collected and filled by the project partners

WP1.2 Analysis of similar projects developed in the last years in Europe (synergies with GECO 2.2)

A collection of the filled–in templates about the projects that have similarities/relevance for GECO 2.2. that are contributed by the project partners

OLIVE4CLIMATE (Climate Change Mitigation Through a Sustainable Supply Chain for the Olive Oil Sector)	olive4 climate
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Co-financed by the European Union's LIFE Programme under the Climate Change Mitigation sub-programme.
Period	July 1, 2016, to December 31, 2019.
Country/Region	Italy, Greece, and Israel
Key words	Olive cultivation, carbon sequestration, sustainable agriculture, life cycle assessment, carbon footprint, climate change mitigation
Objectives	• Develop a sustainable olive oil supply chain with a reduced carbon footprint. • Quantify the CO_2 fixation capacity of olive groves. • Promote sustainable management practices in olive cultivation. • Create protocols for carbon credits certification in the voluntary market.
Partners	• Università degli Studi di Perugia (Coordinator) • CNR - Institute of Biosciences and BioResources • SGS Italia S.p.A. • Università degli Studi della Tuscia

GECO 2.2

Description	OLIVE4CLIMATE proposed a holistic approach to extra virgin olive oil production by assessing the carbon footprint of all processes involved. The project tested innovative cultivation practices in Italy, Greece, and Israel to enhance carbon sequestration and promote sustainable olive farming.
Results/expected impact	• Development of guidelines for sustainable olive oil production techniques. • Implementation of best practices leading to reduced carbon footprints in olive cultivation. • Establishment of standards for sustainability credits certification. • Market sale of the first sustainability credits obtained from olive farms adopting sustainable practices.
Relevance for the project GECO 2.2	OLIVE4CLIMATE's experience in quantifying carbon sequestration in agriculture and creating protocols for carbon credits certification provides valuable insights for GECO2.2. The project's methodologies can inform GECO2.2's efforts in developing a regional voluntary carbon market and promoting sustainable farming practices.
Website or other relevant links	https://olive4climate.eu/en/
Project reference contacts	Università degli Studi di Perugia • Address: Piazza Università 1, 06123 Perugia, Italy • Contact Person: Primo Proietti • Email: primo.proietti@unipg.it
Note	
Who is filling this fact sheet?	*Saša-Ivan Vrdoljak*

AGRESTIC (Reduction of Agricultural GReenhouse gases EmiSsions Through Innovative Cropping systems)	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Co-financed by the European Union's LIFE Programme under the Climate Change Mitigation sub-programme.
Period	January 1, 2019, to December 31, 2023.
Country/Region	Italy (Emilia-Romagna, Tuscany, and Puglia)
Key words	Greenhouse gas reduction, innovative cropping systems, legumes, catch crops, carbon sequestration, decision support systems
Objectives	• Promote the adoption of innovative and efficient cropping systems (ECS) incorporating legumes and catch crops to mitigate climate change. • Reduce greenhouse gas (GHG) emissions and increase soil carbon sequestration. • Develop a Decision Support System (DSS) for efficient management of multi-year crop rotations. • Design a prototype for real-time monitoring of soil GHG emissions. • Create product labels and schemes for the payment of ecosystem services.

Partners	• Horta Srl (Coordinator) • ART-ER S.Cons.p.a. • Isea Srl • New Business Media Srl • Scuola Superiore di Studi Universitari e di Perfezionamento Sant'Anna • Università Cattolica del Sacro Cuore di Piacenza
Description	AGRESTIC aims to foster the adoption of innovative cropping systems that integrate legumes and catch crops into traditional rotations of cereals and industrial crops. The project focuses on reducing GHG emissions, enhancing carbon sequestration, and optimizing agronomic management through the development of a DSS and real-time soil GHG emission monitoring.
Results/expected impact	• Implementation of ECS in three demonstration sites, leading to reduced GHG emissions and increased soil carbon storage. • Development of a web-based DSS to assist farmers in resource- efficient crop management. • Creation of a prototype for automated soil GHG flux monitoring. • Establishment of product labels certifying the adoption of ECS and schemes for ecosystem service payments.
Relevance for the project GECO 2.2	GRESTIC's approach to integrating legumes and catch crops into cropping systems, along with its development of decision support tools and real-time monitoring prototypes, offers valuable insights for GECO2.2. The project's methodologies for reducing GHG emissions and enhancing carbon sequestration can inform GECO2.2's efforts in creating a regional voluntary carbon market in agriculture.
Website or other relevant	https://www.agrestic.eu/en/the-project/

links	
Project reference contacts	Horta Srl • Address: Via Egidio Gorra 55, 29122 Piacenza, Italy • Contact Person: Pierluigi Meriggi • Email: info@agrestic.eu
Note	
Who is filling this fact sheet?	*Saša-Ivan Vrdoljak*

Priject name: 4 per 1000	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	France, Germany, Spain, Italy, Netherlands, Switzerland, Canada, Australia, United States.
Period	Launched on December 1, 2015, during COP 21 in Paris; ongoing initiative.
Country/Region	France, Germany, Spain, Italy, Netherlands, Switzerland, Canada, Australia, United States.
Key words	Soil carbon sequestration, sustainable agriculture, climate change mitigation, food security, international collaboration.
Objectives	• Demonstrate that agricultural soils can play a crucial role in food security and climate change mitigation. • Encourage stakeholders to transition towards regenerative, productive, and resilient agriculture. • Promote practices that increase soil organic carbon stocks by 0.4% per year.
Partners	• Includes governments, international organizations, research institutions, NGOs, and private sector entities. • Notable partners: Food and Agriculture Organization (FAO), International Union for Conservation of Nature (IUCN), and various national agricultural ministries.

GECO 2.2

Description	The "4 per 1000" Initiative aims to demonstrate that increasing soil organic carbon stocks can improve soil health, enhance agricultural productivity, and contribute to climate change mitigation. By promoting sustainable land management practices, the initiative seeks to achieve a 0.4% annual growth rate in soil carbon stocks, aligning with broader climate and food security goals.
Results/expected impact	• Development of a strategic plan guiding actions until 2050, with specific targets for 2030 and 2050. • Establishment of regional networks and a collaborative platform to facilitate stakeholder interaction. • Promotion of Monitoring, Reporting, and Verification (MRV) systems to assess progress.
Relevance for the project GECO 2.2	The "4 per 1000" Initiative's emphasis on soil carbon sequestration and sustainable agricultural practices aligns closely with GECO2.2's objectives. The initiative's frameworks for MRV systems and stakeholder engagement can inform GECO2.2's development of a regional voluntary carbon market.
Website or other relevant links	https://4p1000.org/?lang=en
Project reference contacts	**INRAE** • **Address: 1000 Avenue Agropolis, 34394 Montpellier Cedex 5, France**
Note	
Who is filling this fact sheet?	*Saša-Ivan Vrdoljak*

Project name: Climate-Smart Agriculture Booster (CSA Booster)	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Sponsored by the European Institute of Innovation and Technology (EIT), a body of the European Union, through EIT Climate-KIC.
Period	Launched in January 2015; ongoing initiative.
Country/Region	Operates across Europe with regional hubs in the Netherlands, France, Italy, and Switzerland.
Key words	Climate-smart agriculture, sustainable farming, greenhouse gas reduction, innovation hub, capacity building.
Objectives	• Accelerate the adoption of climate-smart agricultural (CSA) technologies and practices across Europe. • Enhance agricultural productivity while reducing greenhouse gas emissions and increasing resilience to climate change. • Facilitate collaboration among stakeholders in the agri-food value chain, including farmers, researchers, businesses, and policymakers. • Develop and promote CSA solutions that are scalable and sustainable.

Partners	Coordinated by EIT Climate-KIC. Core partners include: • Wageningen University & Research (Netherlands) • French National Institute for Agricultural Research (INRA) • South Pole Group (Switzerland) • Consiglio Nazionale delle Ricerche Istituto di Biometeorologia (CNR- IBIMET) (Italy) • University of Reading (UK) A wider network of over 50 organizations, including major agri-food industry players, regional farmer cooperatives, government bodies, technology providers, and start-ups.
Description	CSA Booster serves as Europe's leading innovation hub and community platform dedicated to promoting climate-smart agriculture. It brings together a diverse ecosystem of stakeholders to incubate, catalyze, and scale innovative CSA solutions. The initiative focuses on enhancing productivity, building climate resilience, and mitigating greenhouse gas emissions in the agricultural sector. Activities include capacity building, knowledge management, project facilitation, and the development of tools such as the Agrisource open innovation platform.
Results/expected impact	• Development of a portfolio of 50 CSA solutions, with 25 ready for market deployment. • Launch of Europe's first open innovation platform for climate-smart agriculture, Agrisource, facilitating collaboration and knowledge exchange. • Establishment of regional CSA hubs to support localized innovation and adoption of CSA practices. • Delivery of Massive Open Online Courses (MOOCs) to educate stakeholders on CSA concepts and practices.
Relevance for the project GECO 2.2	CSA Booster's experience in fostering collaboration among diverse stakeholders and developing scalable CSA solutions offers valuable insights for GECO2.2. The initiative's tools, such as the Agrisource platform, and its methodologies for capacity building and knowledge management can inform GECO2.2's efforts to create a

	regional voluntary carbon market in agriculture.
Website or other relevant links	https://csabooster.climate-kic.org/
Project reference contacts	**Project Reference Contacts**: • **Coordinating Organization**: EIT Climate-KIC ○ Address: Limmatstrasse 264, 8005 Zurich, Switzerland ○ Contact Person: Pan Pan, Flagship Manager ○ Email: pan.pan@climate-kic.org
Note	
Who is filling this fact sheet?	*Saša-Ivan Vrdoljak*

Project name: CARE4C (Carbon Smart Forestry under Climate Change)	*No logo*
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Funded by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 778322.
Period	January 1, 2018, to December 31, 2021.
Country/Region	Austria, Germany, Italy, Poland, and South Africa.
Key words	Carbon smart forestry, climate change mitigation, sustainable forest management, carbon sequestration, forestry practices.
Objectives	• Develop and promote carbon smart forestry practices to enhance carbon sequestration. • Mitigate climate change through sustainable forest management. • Provide training and knowledge exchange on carbon smart forestry. • Implement international case studies to apply and assess the developed practices.
Partners	• Coordinated by the University of Natural Resources and Life Sciences, Vienna (Austria). • Partners include universities and research institutions from the participating countries.

Description	CARE4C focuses on developing forestry practices that optimize carbon sequestration while maintaining sustainable forest management. The project emphasizes training and international collaboration to implement carbon smart forestry practices that contribute to climate change mitigation.
Results/expected impact	• Development of carbon smart forestry concepts and practices. • Implementation of training programs and knowledge exchange initiatives. • Application of developed practices in international case studies. • Contribution to climate change mitigation through enhanced carbon sequestration in forests
Relevance for the project GECO 2.2	CARE4C's emphasis on carbon smart forestry provides insights into sustainable forest management practices that enhance carbon sequestration. The project's outcomes can inform GECO2.2's strategies in promoting sustainable land use and contributing to regional carbon markets.
Website or other relevant links	http://www.care4c.eu/
Project reference contacts	**University of Natural Resources and Life Sciences, Vienna** • **Address: Gregor-Mendel-Straße 33, 1180 Vienna, Austria** • **Contact Person: Paul Luu** • **Email: Contact via Website**
Note	
Who is filling this fact sheet?	*Saša-Ivan Vrdoljak*

Project name: LIFE Carbon Farming Project	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Co-financed by the European Commission's LIFE Programme under the "Climate Change Mitigation" sub-programme.
Period	October 1, 2021, to October 1, 2027.
Country/Region	France, Belgium, Germany, Ireland, Italy, and Spain.
Key words	Carbon footprint reduction, mixed crop-livestock systems, result-based funding, carbon sequestration, sustainable agriculture.
Objectives	• Achieve a 15% reduction in the carbon footprint of agricultural products within six years through result-based funding mechanisms. • Develop harmonized tools and a common Monitoring, Reporting, and Verification (MRV) framework for low-carbon initiatives. • Implement low-carbon projects on 700 mixed crop-livestock farms across the participating countries. • Establish a results-based carbon mitigation financing mechanism. • Create a European network of low-carbon farmers to share knowledge and facilitate replication of successful practices.

Partners	• Coordinating Beneficiary: Institut de l'Élevage (France). • Participants include: • Université de Liège (Belgium) • Leibniz-Institut für Agrartechnik und Bioökonomie e.V. (Germany) • Teagasc - Agriculture and Food Development Authority (Ireland) • Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria (Italy) • Asociación Española de Productores de Vacuno de Carne (ASOPROVAC) (Spain) • Additional regional agricultural chambers and research institutes across the participating countries.
Description	The LIFE Carbon Farming project aims to reduce greenhouse gas emissions from agriculture by promoting sustainable practices in mixed crop-livestock systems. It focuses on developing harmonized assessment methodologies and MRV processes to facilitate the implementation of low-carbon strategies on farms. By engaging 700 farms, the project seeks to create a robust framework for carbon finance, enabling farmers to benefit economically from their contributions to climate mitigation.
Results/expected impact	• 15% reduction in the carbon footprint of participating farms, equating to approximately 633,841 tonnes of CO_2 equivalent emissions avoided. • Generation of €6.34 million in revenue for farmers through carbon offset credits. • Implementation of 18 Carbon Farming Projects across the six countries. • Training of 78 advisors in sustainability assessments and mitigation action planning.

Relevance for the project GECO 2.2	The LIFE Carbon Farming project offers valuable insights into establishing a regional voluntary carbon market in agriculture, a core objective of GECO2.2. Its experience in developing harmonized MRV frameworks and result-based funding mechanisms can inform GECO2.2's efforts to create a sustainable and scalable carbon market model. Additionally, the project's approach to engaging multiple stakeholders and training advisors can serve as a model for capacity-building initiatives within GECO2.2.
Website or other relevant links	https://life-carbon-farming.eu/
Project reference contacts	Coordinating Beneficiary: Institut de l'Élevage Address: 149 Rue de Bercy, 75012 Paris, France Contact Person: Jean Baptiste DOLLE Email: Contact via Website
Note	
Who is filling this fact sheet?	*Saša-Ivan Vrdoljak*

CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture)	RÉPUBLIQUE FRANÇAISE Liberté Égalité Fraternité INRAE
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☒ Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 774378.
Period	November 1, 2017, to February 28, 2021.
Country/Region	Involved 22 partners from 17 countries across Europe, Asia, Africa, and the Americas.
Key words	Soil carbon sequestration, international research cooperation, climate change mitigation, sustainable agriculture, knowledge exchange.
Objectives	• Strengthen the international research community focused on soil carbon sequestration in agriculture. • Enhance understanding of agricultural soil carbon sequestration's potential for climate change mitigation and food security. • Co-design a Strategic Research Agenda with stakeholders on soil carbon sequestration in agriculture. • Structure international research cooperation in this field more effectively.

Partners	• Coordinated by INRAE (France). • Partners included institutions such as ISRIC – World Soil Information (Netherlands), University of Aberdeen (UK), and the Chinese Academy of Agricultural Sciences (China).
Description	CIRCASA aimed to develop international synergies in research and knowledge exchange regarding carbon sequestration in agricultural soils. By engaging a diverse range of stakeholders, the project sought to align research efforts globally to enhance soil carbon storage, thereby contributing to climate change mitigation and sustainable agriculture.
Results/expected impact	• Established a global network of researchers and stakeholders focused on soil carbon sequestration. • Developed a Strategic Research Agenda outlining priorities for future research. • Facilitated the creation of an International Research Consortium to continue collaborative efforts.
Relevance for the project GECO 2.2	CIRCASA's work in coordinating international research and developing strategic agendas provides a framework that GECO2.2 can utilize to align its regional efforts with global initiatives, ensuring that methodologies and practices are consistent with international standards.
Website or other relevant links	https://www.circasa-project.eu/
Project reference contacts	INRAE • Address: 147 Rue de l'Université, 75338 Paris Cedex 07, France • Contact Person: Jean-François Soussana • Email: Contact via Website
Note	
Who is filling	*Saša-Ivan Vrdoljak*

this fact sheet?	

LIFE Regen Farming - Regenerative agricultural practices: demonstration of an alternative sustainable management of agrarian soils	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market). ☑Sustainable agricultural practices for soil carbon farming. ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	LIFE16 ENV/ES/000276
Period	From 01/07/2013 to 30/12/2016
Country/Region	Spain
Key words	Soil regeneration, Soil degradation, Pasture management, Sustainable agricultural practices.
Objectives	Demonstrate successful regenerative agricultural practices for preventing soil degradation and improving soil quality. The project would test potential good practices in pasture management under different climatic and agricultural conditions.
Partners	NEIKER - Instituto Vasco de Investigacion y Desarrollo Agrario Urduñederra-Urduna Ederra S.L., Spain Instituto Navarro de Tecnologías e Infraestructuras Agroalimentarias S.A. (INTIA), Spain
Description	The LIFE REGEN FARMING project demonstrated the environmental, economic and social benefits of an animal farming scheme based on regenerative practices. The following regenerative techniques were implemented in three areas under different agroclimatic and livestock system conditions: rotational grazing plans; direct sowing/minimum tillage; and use of organic fertilizers.

Results/expected impact	As a result, a significant improvement was observed in soil quality and biodiversity conservation, namely: • 10% increase in carbon fixation in the grass; • 10% decrease in the carbon footprint; • 7% increase in soil fertility (more specifically, particulate organic matter); • 3% increase in plant diversity; • 10-15% improvement of biomass production (pasture biomass); • 9% reduction in costs of forage; • 5% increase in economic viability (lower production costs).
Relevance for the project GECO 2.2	Regenerative projects are relevant for GECO 2.2, in order to assess the capability of carbon sinking/capture in agro-eco-systems.
Website or other relevant links	https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE12-ENV-ES- 000232/regenerative-agricultural-practices-demonstration-of-an- alternative-sustainable-management-of-agrarian-soils
Project reference contacts	E-mail: info@neiker.eus NEIKER - Instituto Vasco de Investigacion y Desarrollo Agrario Address: C/ Berreaga 1, 48160, Derio
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

A paper: Innovative approaches in soil carbon sequestration modeling for better prediction with limited data. Modeling of GHG sequestration	
Thematic area	□ Local carbon offset trade systems applied to agriculture (voluntary carbon market). □ Sustainable agricultural practices for soil carbon farming. ☑Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Australian Research Council Discovery Project (DP200102101)
Period	08/02/2024
Country/Region	Australia
Key words	Carbon sequestration, modeling.
Objectives	Land managers selling carbon credits, in the spirit of the Paris and Kyoto protocol agreements. Land managers typically rely on computationally complex models fit using sparse datasets to make these accounts and predictions. The model complexity and sparsity of the data can lead to over- fitting, leading to inaccurate results when making predictions with new data. Modelers address over-fitting by simplifying their models and reducing the number of parameters, and in the current context this could involve neglecting some soil organic carbon (SOC) components. In this study, the paper introduces two novel SOC models and a new RothC-like model and investigate how the SOC components and complexity of the SOC models affect the SOC prediction in the presence of small and sparse time series data.
Partners	Not pertinent

Description	The mode considers: (i) a single pool model considering soil carbon as a homogeneous pool that can decay and release carbon into the atmosphere; (ii) a two-pool model in which we consider a single homogeneous pool of decomposable SOC and an IOM pool that does not decompose; (iii) a three- pool model which considers two pools of decomposable SOC (one of them represents the biological pool) and the IOM pool; and (iv) a five-pool model considering all pools mentioned above that are present in RothC. The two and three-pool models are novel soil carbon models that we introduce in this study. Also, the five-pool model used herein is somewhat novel in terms of the statistical modelling framework it is embedded in and its simplification in terms of time-step and reduced set of parameters compared to RothC.
Results/expected impact	Modelling framework predicts changes in soil carbon stocks and accounts for epistemic uncertainty, uncertainty in the bio-geochemical process dynamics, in a statistically defensible manner.
Relevance for the project GECO 2.2	The project is relevant for GECO 2.2, in order to model carbon sinking soil.
Website or other relevant links	https://www.nature.com/articles/s41598-024-53516-z#Ack1
Project reference contacts	Mohammad Javad Davoudabadi School of Mathematical Sciences, Queensland University of Technology, Brisbane, Australia Australian Research Council Centre of Excellence for Mathematical & Statistical Frontiers (ACEMS), Victoria, Australia QUT Centre for Data Science, Queensland University of Technology, Brisbane, Australia CSIRO Data61, GPO Box 2583, Brisbane, QLD, 4001, Australia
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

Project name: NoiCompensiAmo	NoiCompensiAmo
Thematic area	☑Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☑Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	No type of funding, private enterprise.
Period	From 2017 to today
Country/Region	Italy
Key words	Carbon Credit, Regeneration of agricultural soils, ISO 14064-2.
Objectives	To produce carbon credits using the ISO 14064-2 standard, certified by a third party, generated by farms committed to applying regenerative soil agriculture techniques, to be sold on the voluntary carbon credit market.
Partners	Agatheia s.r.l., I.C.I.M. s.r.l..
Description	By applying the ISO 14064-2 standard, a carbon balance is prepared for agricultural activities, with the system boundary defined as the field(s) cultivated by the organization aiming to generate carbon credits through the application of regenerative soil agricultural practices. Soil samples taken from the various cultivated plots are analyzed to determine the organic matter content in the soil. These data are compared over subsequent years to quantify the increase in carbon storage in the soil.

Results/expected impact	Through this method, it is possible to measure the actual increase in carbon stored in soils and convert this value into CO_2 removed from the atmosphere. In subsequent years, the increase in carbon storage and its permanence in the soil can be monitored. This approach allows for quantifying the value of the enhanced ecosystem services provided by the examined soils. These credits will be sold to organizations (preferably local) seeking to offset their residual CO_2 emissions, thereby also benefiting from the increased ecosystem services rendered by these areas.
Relevance for the project GECO 2.2	This project focuses on measuring carbon fluxes in agricultural soils, creating a balance between emissions and removals, using analytical data on the increase in soil carbon concentration over the years. Additionally, it applies an ISO standard that allows for certification by a third-party organization.
Website or other relevant links	https://noicompensiamo.it/
Project reference contacts	d.raffaeta@noicompensiamo.it Dott. Davide Raffaetà
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

Project name: Nucleo Monitoraggio Carbonio (CREA)	Nucleo Monitoraggio Carbonio
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☑Software development or modeling of GHG sequestration and emissions and carbon trading platform
Funding	Public funds as a technical body of the Italian Ministry of Agriculture, Food Sovereignty, and Forests
Period	From 2011 to today
Country/Region	Italy
Key words	Carbon Credit, Forest Market, Questionnaire.
Objectives	The establishment, at CREA, an Italian research institution in the agri-food sector, of the Public Registry of carbon credits voluntarily generated by the national agroforestry sector. Preparation of quantification schemes in line with the guidelines of the European Union.
Partners	The CREA (CREA - National Council for Agricultural Research and Economic Analysis); the Euro-Mediterranean Center on Climate Change (CMCC); and the TeSAF Department of the University of Padua.
Description	Following the publication of EU Regulation 2024/3012 of the European Parliament and the Council on November 27, 2024, "establishing a Union certification framework for permanent carbon removals, carbon farming, and carbon storage in products," CREA will develop calculation schemes that will enable Italian agricultural enterprises to quantify their contribution in terms of additional CO_2 absorption. This data can be included in the new Italian registry, allowing them to commercialize these contributions.

GECO 2.2

Results/expected impact	Monitoring of all projects carried out in Italy or by Italian organizations abroad, aimed at generating carbon credits. Subsequent inclusion of the results of these projects in a national registry to track the quantities produced and traded.
Relevance for the project GECO 2.2	The development of a calculation framework and the creation of a platform for trading carbon credits generated using this framework.
Website or other relevant links	https://www.nucleomonitoraggiocarbonio.it/it/
Project reference contacts	saverio.maluccio@crea.gov.it Dott. Saverio Maluccio ilaria.falconi@crea.gov.it Dott.ssa Ilaria Falconi
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

Name of the project: BetaNeutral	
Thematic area	☑Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modeling of GHG sequestration and emissions and carbon trading platform
Funding	No type of funding, private enterprise.
Period	From 2021 to today
Country/Region	Italy
Key words	Certificazione, crediti di carbonio, Norma UNI/PDR 99:2021
Objectives	The purpose of this project is to promote the "Reference Practice" UNI/PDR 99:2021 as a tool to engage stakeholders and encourage them to take action in implementing climate projects based on standardized rules. In this context, UNI/PdR 99:2021 plays a key role, as production chains will be required to rethink the economic principles of supply and demand, taking the CO2 parameter into account and contributing to the dissemination of a new market value index based on carbon.
Partners	Verification body BIOS S.R.L., UNI (Italian Standards Body).

Description	βneutral proposes two Certification Programs: Program 1 – Offset Emissions The offset emissions certification can be conducted at an organizational and/or product level and involves the following fundamental and integral steps: - Obtaining a third-party Verification Statement in accordance with UNI EN ISO 14064-1 or UNI EN ISO 14067. - Annually reducing a percentage of the calculated emissions related to the organization and/or product. - Completely offsetting the residual emissions of the organization and/or product. The process of calculating, reducing, and offsetting residual emissions, as provided for by the βneutral Program, aligns with the concept of carbon neutrality. Program 2 – Carbon Sequestration The carbon sequestration certification enables organizations to enhance and validate virtuous projects that increase carbon sequestration capacity. Unless explicitly stated in the methodology, the certification is issued ex- ante, at the beginning of the project, by the certifying body. This sequestration capacity can be integrated into an offsetting project for participants of Program 1 of the βneutral protocol. Program 2 is structured around methodologies that are already defined and approved by the verification body. Each methodology focuses on a specific calculation method for carbon sequestration capacity and describes the associated process. The methodologies currently recognized by the Program include: - Organic Agriculture - Biochar - Ecological Corridors - Urban Reforestation

Results/expected impact	Achieving the transformation from PdR/UNI to a UNI Technical Standard is linked to the possibility of certifying carbon credits generated by methodologies currently recognized by the Program. Proposers have the opportunity to present new methodologies, which will be thoroughly reviewed by the βneutral Technical Committee.
Relevance for the project GECO 2.2	Reference Practices are documents published by UNI that define technical requirements and provide a voluntary initial reference on emerging topics not yet consolidated by technical standards. Developed based on the specific needs and experiences of economic and social stakeholders, these documents are characterized by a rapid sharing process among the authors alone, under UNI's coordination. Compared to standards, reference practices are documents whose content reflects the needs of market players and whose development is governed by UNI rules. They are not UNI technical standards, UNI/TS technical specifications, or UNI/TR technical reports (from which they differ in terms of the level of consensus, the drafting process, and their graphic format). However, they may become technical standards if they are endorsed by the entire market.
Website or other relevant links	http://www.bneutral.it/il-programma/
Project reference contacts	info@certbios.it Agr. Daniele Dal Molin
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

Block CO_2	BLOCKCO2
Thematic area	☑Local carbon offset trade systems applied to agriculture (voluntary carbon market). ☑Sustainable agricultural practices for soil carbon farming. ☐ Software development or modeling of GHG sequestration and emissions and carbon trading platform
Funding	No type of funding, private enterprise.
Period	From 2020 to today
Country/Region	Italy
Key words	Biochar, Carbon Credits, Sustainable agricultural practices.
Objectives	Encourage the production of Biochar and its use in agricultural soils as a practice of regenerative agriculture. Additionally, the production of energy from biomass reduces the GHG emissions of the companies themselves.
Partners	Aichi Obiettivo 20 srl
Description	Credi-Cs offer companies the opportunity to invest in highly effective actions to reduce climate impact . Their reliability is guaranteed through rigorous internal protocols and the use of blockchain technology , which makes the entire process transparent and fully traceable . Credi-C by Bi-Biochar Biochar production and use chain Biochar is a type of plant charcoal that is used in agriculture to improve soil quality. Among its numerous benefits, the increase in water retention capacity stands out, which helps plants maintain moisture, and the enhancement of soil fertility, contributing to creating a more favorable environment for crop growth. It is truly an excellent ally for sustainable agricultural practices.

Results/expected impact	The purpose of this initiative is to use agro-forestry residues to produce biochar as well as heat and/or electricity through the pyrolysis process. This technology allows for the production of an amendment for agriculture, in addition to energy. The biochar product is characterized by a high carbon content, which, when mixed with the soil, helps to restructure agricultural lands by returning stable carbon to cultivated fields. This results in the dual benefit of sequestering carbon and increasing the percentage of organic matter in agricultural soils that are particularly depleted of this fraction.
Relevance for the project GECO 2.2	This approach allows for the reduction of CO2 emissions generated by the self-production of energy (electricity and heat) necessary for the organization. Additionally, it enables the production of Biochar, which is needed as an amendment to restore agricultural soils depleted by industrial farming practices.
Website or other relevant links	https://www.blockco2.it/portfolio/credi-c-di-local-carbon-italia/
Project reference contacts	E-mail: info@aichio20.it Silvia Scozzafava
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

Name of the project: CARBOMART Trading Platform for Sustainable Carbon Credits	Project logo (if any)
Thematic area	☐ X Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ Software development or modeling of GHG sequestration and emissions and carbon trading platform
Funding	SOCIETAL CHALLENGES - Secure, clean and efficient energy
Period	From 1 February 2018 to 31 July 2018
Country/Region	Turkey
Key words	Natural sciences, environmental engineering, carbon markets
Objectives	The EU-funded CARBOMART project has the objective to develop an online carbon-trading platform that brings together carbon credit buyers and carbon credit sellers.
Partners	**GREEN DANISMANLIK FINANS ENERJI CEVRE MUHENDISLIK TARIM MUSAVIRLIK INSAAT SANAYI VE DIS TICARET LIMITED SIRKETI**

Description	Trading platform facilitates transparency in the voluntary carbon market The EU-funded CARBOMART project plans to develop an online carbon- trading platform that brings together carbon credit buyers and carbon credit sellers. The platform will allow buyers to evaluate the carbon emission reduction projects by performing line-by-line project comparisons according to social, environmental and economic sustainability criteria. Moreover, they will be able to directly access the emission reduction projects with their sales prices directly set by the sellers. This will enable both buyers and sellers to get reference carbon credit prices and reference sustainability benchmarks for those projects.

Results/expected impact	Therefore the outcome of this project will facilitate; - Low-cost, low-carbon electricity supply - Reducing Greenhouse Gas emissions due to energy consumption - Increase in the forested lands (carbon storage) in a sustainable wayby increasing the income of the renewable energy, energy efficiency and afforestation projects. General objectives Green Consult and Finance (GCF) targets through CARBOMART are; • Developing a reliable sustainability comparison tool for the voluntary emission reduction projects, • Developing a measurable pricing methodology for the Voluntary Carbon Market • Creating an accessible platform for both buyers and sellers In line with these objectives the expected impacts are; • Facilitating the transparency voluntary carbon market. • Increase in the quality of voluntary emission reduction projects in terms of sustainability, • Increase the investment made in carbon emission reduction projects so that decrease the emission reductions up to 5%, since the effects of the carbon credit income to the IRR of an green energy investment is around 5%. The market volume is expected to be 4.1 billion USD by 2020. It is planned that the CARBOMART would be fully commercialized by 2019 and reach a sales income of 20 million Euros by 2023.
Relevance for the project GECO 2.2	In line with Geco2 2, the CARBOMART proposes solutions for the Voluntary Emission Reduction Market, which is an incentive mechanism for disseminating the investments on climate friendly low carbon energy projects.
Website or other relevant	DOI 10.3030/808145

links	
Project reference contacts	
Note	
Who is filling this fact sheet?	*Simona Giordano – CIHEAM Bari*

Name of the project: DOLFINS Distributed Global Financial Systems for Society	**Project logo (if any)**
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ X Software development or modeling of GHG sequestration and emissions and carbon trading platform
Funding	EXCELLENT SCIENCE - Future and Emerging Technologies (FET)
Period	From March 2015 to 31 May 2018
Country/Region	Switzerland
Key words	Natural sciences, big data, semantic web, civil society
Objectives	DOLFINS will focus on two crucial and interconnected policy areas that will shape the public debate in the coming 5 years: How to achieve financial stability and how to facilitate the long-term investments required by the transition to a more sustainable, more innovative, less unequal and greener EU economy.
Partners	UNIVERSITAT ZURICH Switzerland

Description	The DOLFINS project addresses the global challenge of making the financial system better serve society by placing scientific evidence and citizens participation at the centre of the policy process in finance. The project strives to give scientific evidence and citizens participation central roles in the policy process concerning finance.
Results/expected impact	The expected impact is to achieve crucial advances in reshaping the policy process to overcome the financial and political crisis faced by the EU. The project will deliver quantitative tools to evaluate policies aiming to tame systemic risk and to foster sustainable investing. The tools will be based on fundamental research combining network models and algorithmic game theory with broader economic insights. This approach can provide a more satisfactory understanding of credit, risk and sustainable investments in an interconnected world.
Relevance for the project GECO 2.2	As to the relevance for Geco2 2, the project will investigate how to engage citizens in the early stage of the policy making process and will develop evidence-based narratives in order to better shape policies in the public interest. To this end, the project will take advantage of semantic web technologies, big data and ICT in general. Given the highly technical nature of key issues in finance, it will explore how ICT and art can facilitate citizens' engagement through innovative narratives, leading to better coordinated actions of stakeholders.

Website or other relevant links	DOI 10.3030/640772
Project reference contacts	
Note	
Who is filling this fact sheet?	*Simona Giordano – Ciheam Bari*

Name of the project: PCCE Pricing carbon with a dedicated currency to empower economic agents	**Project logo (if any)**
Thematic area	X Local carbon offset trade systems applied to agriculture (voluntary carbon market) Sustainable agricultural practices for soil carbon farming Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	INDUSTRIAL LEADERSHIP – Innovation In SMEs
Period	From 1 May 2018 to 31 October 2018
Country/Region	France
Key words	Business models, commerce, climate change, energy and fuels
Objectives	450 is the SME operating and promoting a digital platform for the management of the CO2 digital currency (CO2s) based on the CO2 reductions achieved by a CO2Account owner. A CO2Account is held in the platform to register the CO2 consumption, to calculate the yearly reduction, and to provide the relevant credit, expressed in units of CO2. CO2 is the alternative digital currency which rewards the account owner by the verified reduction of 1 kg of CO2 emissions through the reduced use of fossil fuel in heating and/or transport. CO2s can be credited to, and debited from (notably with CO2Cards - payment card, or with a mobile App) the account. The CO2/€ exchange rate prices carbon.

Partners	450 France
Description	Carbon has become a commodity – or 'hot potato' – with exchanges set up to help homeowners, landowners and business owners sell carbon offsets or credits or buy them to offset their own use to achieve carbon neutrality. For example, a homeowner planting trees could sell carbon credits to companies wanting to reduce emissions.
Results/expected impact	The French SME 450 has developed a 'carbon central bank' concept to motivate households and businesses to reduce their CO2 emissions. Users create an account and start accumulating or spending euro-greens, the carbon-free currency. The CO2 emission coin will also be registered on blockchain platforms. The EU-funded PCCE project is helping the team finalise the application and prepare a path to market.
Relevance for the project GECO 2.2	As can be noticed from the above description, the two projects are strongly connected as they both deal with economic tools related to carbon emissions and savings.
Website or other relevant links	DOI 10.3030/817104
Project reference contacts	
Note	
Who is filling this fact sheet?	*Simona Giordano – Ciheam Bari*

Name of the project: MRV4SOC Monitoring, Reporting and Verification of Soil Organic Carbon and Greenhouse Gas Balance	Project logo (if any)
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ Sustainable agricultural practices for soil carbon farming ☐ X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Food, Bioeconomy Natural Resources, Agriculture and Environment
Period	From 1 June 2023 to 31 May 2026
Country/Region	Spain
Key words	Sustainable agriculture, software development, landscape ecology
Objectives	With regard to the challenges associated with the project, to overcome these challenges, MRV4SOC will develop 6 specific objectives, which will be measurable, verifiable, and monitored through KPIs pointing at specific targets. MRV4SOC proposes a comprehensive 3-year work plan that ranges from the assessment of C pools in 9 land use/ land cover classes located in 14 Demonstration Sites (DS); to the potential integration of the approacMRV4SOC aims at designing a comprehensive and robust Tier 3 approach accounting for changes in as many C pools as possible (above- ground biomass, below ground-biomass, litter, dead wood, soil organic carbon, and harvested wood products) fully aligned with national GHG reporting. MRV4SOC seeks to develop solutions applicable for different space-temporal scales and climate change scenarios and validated for a wide variety of ecosystems in arid, temperate, and continental climate zones in collaboration with local stakeholders. The proposed approach will

	help establish reliable and transparent C farming credits within a cost- effective monitoring, reporting, and verification (MRV) methodological framework.
Partners	GMV AEROSPACE AND DEFENCE SA

Description	MRV4SOC aims at designing a comprehensive, robust, and cost-effective Tier 3 approach, accounting for changes in as many C pools as possible, to estimate GHG and full C budgets, coupling C and N cycles, quantify Soil Organic Carbon (SOC) accumulation, and assess the results of traditional management practices and C farming. The main challenges addressed in MRV4SOC are: i) monitoring changes in SOC accumulation due to climate change and socio-economic pressures; ii) accounting for C and N cycles in full C budgets; iii) development of scientifically-sound, standard, and transparent Tier 3 methodology at different scales, iv) implementation of high-quality in-situ and RS data for testing methods and scale-up purposes; iv) standardisation of Monitoring, Reporting, and Verification schemes to ensure transparency, robustness, and cost-effectiveness; and v) a lack of trust in Voluntary Carbon Markets.
Results/expected impact	Soil organic carbon (SOC) plays a crucial role in regulating ecosystem services, particularly in terms of managing greenhouse gas (GHG) emissions to mitigate climate change. The EU-funded MRV4SOC project aims to develop an inclusive, robust, transparent, and cost-effective approach to assess GHG emissions, estimate full carbon budgets, measure the accumulation of SOC, and evaluate the outcomes of conventional management practices and carbon farming.

Relevance for the project GECO 2.2	The relevance is connected with the project's primary objective is to monitor changes in SOC accumulation within the context of both climate change and socio-economic pressures. Additionally, it seeks to standardise monitoring, reporting, and verification (MRV) schemes for the EU land sector. Ultimately, the project aims to establish a methodological MRV framework that increases the faith of stakeholders in voluntary carbon markets.
Website or other relevant links	**DOI**10.3030/101112754
Project reference contacts	
Note	
Who is filling this fact sheet?	*Simona Giordano – Ciheam Bari*

Name of the project: CARBONCAPS – Efficient and verifiable carbon removal with ecosystem co-benefits		Project logo (if any)
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) ☐ X Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform	
Funding	The European Innovation Council (EIC)	
Period	From 1 October 2022 to 30 September 2024	
Country/Region	Finland	
Key words	Sustainable agriculture, software development, landscape ecology	
Objectives	The project has developed a patent protected, innovative, 'Flash Carbonisation' pyrolysis technology for the production of biochar, a stable form of carbon that can be used as a carbon sink. This high temperature, high pressure method can be used to produce reproducible high surface area, fixed carbon content and electroconductive biochar. The biochar is verified to sequester 3.2t of CO2 per tonne of biochar, making it one of the most efficient ways to sequester carbon today. In addition, for every ton of biochar produced, 9.5MWh of carbon-neutral heat is generated in the form of syngas that can be used for municipal/industrial energy needs, displacing fossil based heat. Key technical benefits of technology include: Wide feedstock range inc. high moisture content 5 – 35%. High stable, solid carbon yield – 50-60%. High surface area biochar – 200 – 400 m2/g. Low toxins - volatiles (<10%), low ash	

	(<5%). Modular/scalable systems with planned use of by-product syngas heat safely.
Partners	CARBO CULTURE OY
Description	One of the most powerful carbon removal methods today is a process involving biochar. Biochar is a carbon substance used by farmers for centuries to improve soil. It is also an efficient carbon sink. This climate change mitigator is produced by burning agricultural and forestry residues in a controlled process called pyrolysis.

Results/expected impact	The EU-funded CARBONCAPS project has developed an innovative and patent protected "carbolysis" technology to produce biochar. This high- temperature method produces high-quality, electroconductive biochar. The biochar produced through this technology is verified to sequester 3.2t of CO2 per tonne of biochar, making it one of the most efficient ways to sequester carbon. In addition, the process generates clean energy, making it a net-energy generating carbon removal process.
Relevance for the project GECO 2.2	As to the above description, the connection is related to practices such as the use of one the most powerful carbon removal methods today, i.e a process involving biochar.
Website or other relevant links	DOI 10.3030/190108904
Project reference contacts	
Note	
Who is filling this fact sheet?	*Simona Giordano – Ciheam Bari*

Name of the project: LIFE VitiCaSe	
Thematic area	X Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	LIFE-2022-SAP-CLIMA
Period	09/01/2023 – 08/31/2027
Country/Region	Italy - Region Veneto and Region Toscana
Keywords	Monitoring. Agriculture. Soil Degradation. Common Agreement. Greenhouse Gas. Certification. Carbon Sequestration. Climate Adaptation Strategy. Climate Change Adaptation. Market-Based Instruments. Resource Conservation. Agri-Environmental Measures.

Objectives	VitiCaSe LIFE project aims to develop an incentive-based carbon farming mechanism that allows farmers and land managers to generate carbon credits by storing organic carbon or by reducing greenhouse gas (GHG) emissions. In particular, the project will pursue the following objectives: • Define agronomic practices and cultivation techniques to increase the storage of organic carbon in vineyard soils • Estimate the carbon credits generated in the vineyards (compared to business-as-usual) through ad-hoc IT technologies. • Develop specific monitoring and verifying procedures to allow third-party certification of the carbon credits generated in the vineyards. • Test the sale of carbon credits in voluntary markets. Farmers will sell credits and acquire them from companies wanting to offset their CO2 emissions.
Partners	• EZ LAB FRANCE. • AGREL SOCIETA AGRICOLA SPA. • PODERI DUCALI RUFFINO SRL SOCIETA' AGRICOLA. • CARBON CREDITS CONSULTING S.R.L. • UNIONE PROVINCIALE AGRICOLTORI DI SIENA. • CASTELLO DI ALBOLA. • CONSIGLIO PER LA RICERCA IN AGRICOLTURA E L'ANALISI DELL'ECONOMIA AGRARIA. • AGRONOTIZIE SRL. • IMAGE LINE SRL.

Description	The LIFE VitiCaSe project (LIFE22-CCA-IT-LIFE-VitiCaSe/101113620) promotes viticulture practices that enhance soil organic carbon (SOC) sequestration. The project aims to mitigate climate change by adopting sustainable vineyard management techniques by reducing atmospheric CO_2 levels while improving soil health and resilience. The initiative is aligned with EU climate adaptation strategies, encouraging agricultural stakeholders to adopt practices that contribute to carbon storage and sustainable production systems. On this basis, the VitiCaSe LIFE project will set up a pilot business model for promoting the removal of land-based CO2 in vineyards. The business model will push winegrowers to integrate carbon stocking into their soil management practices and cultivation techniques. The structure of the project includes: WP1: Project management and coordination (Image-Line) WP2: C FARMING data collection (CREA) WP3: C Farming IT tool (Image-Line) WP4: Pilot action and tool validation (CREA) WP5: C stocking certification and development of a business model (Carbon Credits Consulting) WP6: Monitoring (CREA) WP7: Sustainability, replication, and exploitation of project results (Image-Line)

Results/expected impact	The expected results of the VitiCaSe project are as follows: • A database and manual containing details of sustainable soil management (SSM) practices to be used by farmers to improve carbon stock and carbon sequestration (SSM4SOC) in vineyards. • Set up a reliable IT tool for estimating carbon stocks in vineyards using the RothC estimation model. In particular, quantification of the baseline and estimation of the potential SOC accumulation for each selected field of intervention and SSM practice. • The VitiCaSe system's creation in four pilot vineyards will cover at least 350 ha. • Certification of carbon credits generated in the vineyards and their placement on exchange platforms. • The monitoring of technical results (C stock) will collect and analyze data based on soil samples (three to five for each area at the beginning and end of the project). • Evaluation of the economic results and the business model for farmers using selected indicators and the "*Quaderno di campagna*" management information system developed by the project and used by the farmers. • Preparation of an exploitation plan for replicating project results. • During the four years of the project, the carbon stored in the vineyards will increase by around 3 t/ CO2 eq.

Relevance for the project GECO 2.2	The project supports the development of good practices for the voluntary carbon market in the agricultural sector by providing measurable, verifiable, and replicable methodologies for carbon dioxide equivalent (CO_2e) emissions reductions. These practices ensure that agricultural stakeholders, such as vineyard owners, can quantify their contributions to carbon sequestration and potentially monetize these efforts in voluntary carbon markets. The project will be implemented in a small geographic area, but it is relevant for the wine sector. It is particularly developed in the Marche Region and the areas of the Geco 2.2 project. The LIFE VitiCaSe project is particularly relevant to GECO 2.2 as both initiatives aim to enhance carbon sequestration in agricultural contexts. LIFE VitiCaSe provides practical models and validated techniques that can be integrated into broader frameworks like GECO 2.2. This synergy strengthens the capacity of GECO 2.2 to scale up climate-smart practices, foster market opportunities for agricultural emissions reductions, and contribute to climate change mitigation goals. Also, the LIFE VitiCaSe project will implement an app. It will be open source and available to farmers. This innovative tool will make credit exchange operations easier and more intuitive.
Website or other relevant links	www.life-viticase.eu/it
Project reference contacts	Simona Palermo IMAGE LINE SRL VIA GIOVANNI NICOTERA 29, 00195, ROMA 0546 680688
Note	
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Name of the project: ClieNFarms	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	H2020-EU.3.2. - SOCIETAL CHALLENGES - Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy
Period	01/01/2022 – 12/31/2025
Country/Region	France, Ireland, Sweden, Netherlands, and Serbia (with other case studies in multiple locations in Europe (East, West, North, and South) and includes a case study in New Zealand.
Keywords	Carbon farming. GHG reduction. Carbon sequestration. Sustainable agriculture. Biogeophysical effects. Multi-actor collaboration. Holistic Approach. Stakeholder Involvement. Participatory arena. Livestock systems. Crop systems. Multicriteria

	assessment. Scaling-up.
Objectives	The general objective of ClieNFarms is to co-develop and upscale systemic locally relevant solutions (financial, technical, …) to reach climate-neutral and climate-resilient sustainable farms across Europe, interactively integrating and improving existing solutions to achieve economically viable business models in farming systems by involving farmers, extension services, agri-food business, policymakers, finance, and citizens. Specific Objectives are: 1. Enhance carbon sequestration and storage in agricultural systems. 2. Develop and validate financial incentives for farmers transitioning to sustainable practices. 3. Create robust Monitoring, Reporting, and Verification (MRV) frameworks using advanced tools like remote sensing. 4. Foster multi-actor collaboration among farmers, researchers, and supply chain stakeholders.

Partners	The project includes 33 partners from 14 countries. The main partners are: • Institut National De Recherche Pour L'agriculture, L'alimentation Et L'environnement Inrae (Coordinator). • Teagasc - Agriculture and Food Development Authority of Ireland. • University of Wageningen - Research Center; • AgResearch (New Zealand) • BioSense Institute of Serbia; • International Federation of Organic Agriculture Movements (IFOAM) (Sweden); • Nestlé; • Other universities and research institutions across Europe.

Description	ClieNFarms focuses on co-developing innovative, locally relevant solutions by integrating biogeochemical and biogeophysical effects to reduce greenhouse gas emissions, increase carbon sequestration, and improve sustainability. The project employs a living-lab approach with 20 demonstration farms across Europe and New Zealand, testing and scaling solutions in diverse agricultural systems. The core concept of the project is a demonstration approach called the Innovative Systemic Solution Space (I3S). I3S consists of different components and actors who will test and disseminate tailored multi-actor, co- designed innovative solutions to achieve climate-neutral farms within the supply chain and local geographical extent. ClieNFarms is based on 20 demonstration case studies (I3S) where systemic innovative solutions will be tested and evaluated using up-to-date modeling approaches and multicriteria assessment tools. These case studies will pave the diversity of the production systems (crops, cattle, dairy, special crop productions, etc) and the diversity of geographical situations (from East to West and North to South of Europe, plus one in New Zealand). The solutions will be co-designed with farmers and the surrounding ecosystem (R&D, finance, supply chain, etc) through a creative arena in a living-lab structure. Involving finance and supply chain will help create an enabling environment for farmers to transition to climate-neutral farms. I3S structure aims to allow for 1 demonstration farm to reach 10 lead commercial farms and then 100 outreach farms. With the help of the supply, a much larger number of farmers will be reached. All the solutions will be recorded in the ClieNFarms data hub which will be an open catalog for everyone interested in climate mitigation in the agricultural sector. Different guidelines and tools will be part of the outputs of the projects. A large dissemination of the results project will be made through professional newspapers, scientific articles, social networks, etc. ClieNFarms will also develop bricks for capacity building allowing to show in a short sequence the pros and cons of the different solutions and tools. ClieNFarms will create a dialog with other ongoing projects and with the EC. Also, the project will develop a carbon credit platform with automated certification processes, which will be applied in at least two of the supply chains. This system

	will explore the potential for climate-neutral farming in the EU using scenario analyses to assess different pathways for upscaling I3S.

Results/expect e d impact	Supporting the Farm to Fork (F2F) strategy, and contributing to the achievement of its objectives, the ClieNFarms project will aim to demonstrate, evaluate, and improve technical, organizational, and financial solutions at the farm level that will contribute to achieving climate-neutrality of European agriculture by 2050. This will be done by a multi-actor approach, interactively integrating and improving existing solutions to achieve economically viable business models in farming systems by involving farmers, extension services, agri-food businesses, policymakers, finance, and citizens. These solutions will be disseminated, and young farmers will be targeted through capacity building. Specifically, the results and expected impact can be summarized in: • A real reduced greenhouse gas emissions and improved carbon sequestration; • A better Scalable, cost-effective MRV systems. • Enhanced farmer capacity and stakeholder engagement for systemic solutions. • Demonstration of sustainable practices through 20 pilot farms. • Integration of biogeophysical effects to maximize climate benefits without compromising yields. • Development of financial mechanisms to incentivize sustainable transitions.

Relevance for the project GECO 2.2	ClieNFarms is significant for its holistic approach to climate mitigation in agriculture, leveraging advanced technology, systemic integration, and stakeholder collaboration. By adopting similar frameworks and solutions, Geco 2.2 can enhance its impact on carbon farming, improve MRV systems, and create stronger support mechanisms for farmers transitioning to sustainable practices. In addition, ClieNFarms integrates biogeochemical (e.g., GHG reductions and carbon storage) and biogeophysical effects (e.g., surface albedo changes) to mitigate climate impacts. This dual focus ensures that climate solutions are more comprehensive and avoid unintended consequences like reduced yields or soil degradation. These factors are enhanced by the adoption of a living-lab model to co-design solutions with farmers, researchers, and other stakeholders. This inclusive approach ensures that solutions are practical, locally relevant, and widely accepted. Geco 2.2 could adopt similar holistic frameworks to ensure balanced environmental and productivity outcomes. Also, it could improve farmer engagement and the real-world applicability of its strategies. The last factor of relevance is related to the technologies. ClieNFarms employs innovative modeling and remote sensing tools for Monitoring, Reporting, and Verification (MRV). These tools ensure accurate measurement of GHG reductions and carbon sequestration. Also, the project's 20 case studies in diverse farming systems showcase scalable solutions. Geco 2.2 could benefit from integrating similar technologies and could replicate this structure by testing and refining practices across different regions and farm types, ensuring adaptability and effectiveness.
Website or other relevant links	www. clienfarms.eu
Project reference contacts	Jacques-Eric Bergez, INRAE Project Coordinator jacques-eric.bergez@inrae.fr

	+33 05.61.28.50.37
Note	
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Name of the project: NACAO – Nature-based Carbon Offsets	Interreg Europe Co-funded by the European Union NACAO
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Interreg Europe 2021-2027
Period	03/01/2023 – 05/31/2027
Country/Region	Spain, Italy, France, Germany, Poland and Finland
Keywords	Carbon sequestration. GHG reduction. Carbon offsetting. Regional policies. Sustainability. Capacity building.
Objectives	The general objective is to reduce greenhouse gas emissions through sustainable practices and to promote nature-based carbon sequestration solutions. The specific objectives are: • Enhance regional capacity for implementing low-carbon policies. • Support the development of local and regional carbon offset standards. • Strengthen public-private collaboration for environmental sustainability. • Encourage institutional learning and stakeholder involvement in climate policies. • Foster innovation in carbon capture and sustainable land management techniques.

Partners	• Auvergne-Rhône-Alpes Energy Environment Agency. • Department Andaluza de Cambio Climático - Junta de Andalucia. • Senator For Environment, Climate, And Science Of Bremen. • Regional Council of Central Finland. • Regione Marche. • Świętokrzyskie Region.
Description	NACAO – Nature-based Carbon Offsets is a project under the Interreg Europe 2021-2027 program, co-funded by the European Regional Development Fund (ERDF). It supports regions in creating policies for GHG emission reduction and environmental protection. NACAO project will aim at being an accelerator for regional governments with competencies on climate change approaching the offsetting of carbon emissions, in this case by developing nature-based solutions and policies contributing to the offsetting of emissions through them. The project emphasizes inter-regional and regional learning, involving structured activities and stakeholder collaboration. It aims to mainstream nature-based carbon offset practices, such as afforestation and soil carbon sequestration, into local development policies. During the NACAO project, regional governments with competencies in environment and climate change from Spain, Italy, France, Germany, Poland, and Finland will share green and blue carbon solutions in force aiming at: • preservation • restoration • improvement of natural sites; • dissemination of knowledge relative to carbon sinks and compensating greenhouse gas emissions. Partner regions will also share their experiences on carbon credits and emissions markets related to nature-based solutions, as well as policies supporting the project aims. The ultimate aim is to increase the partners' knowledge and capacity to implement green and blue carbon initiatives and policies learned during the cooperation.

Results/expected impact	The project will identify good practices on successful approaches to carbon offsetting in the regions involved in the project activities. The collected knowledge will also be used by a regional stakeholder group, which will play an important role in putting the results into practice and ultimately contribute to the improvement of the regional policy instrument. The expected results include: • Enhanced capacity of regional authorities to integrate carbon offset mechanisms into policies. • Development and adoption of innovative solutions for GHG reduction. • Strengthened stakeholder networks for collaborative environmental action. • Increased use of sustainable practices in forestry and agriculture for carbon capture.
Relevance for the project GECO 2.2	NACAO's implementation involves knowledge-sharing sessions and capacity- building initiatives to integrate sustainable practices into regional frameworks. In this context, NACAO's structured approach to carbon offsets and stakeholder engagement could offer some specific benefits to GECO 2.2: • Enhanced Stakeholder Engagement because NACAO's inclusive learning mechanisms can strengthen GECO 2.2's community involvement. • Sustainable Practices and strategies for reduced agricultural inputs, afforestation, and agroecology align with GECO 2.2's objectives of soil carbon farming. Also, NACAO can influence regional policies and support GECO 2.2 in integrating similar frameworks or regional protocols. By integrating NACAO's strategies, GECO 2.2 could enhance its focus on sustainable agricultural practices and expand its impact through improved carbon trading systems.
Website or other relevant links	www.interregeurope.eu/nacao

Project reference contacts	Liliana Krężołek – project coordinator, Economic Cooperation and European Projects Unit, Department of Investment and Development, Marshal`s Office of Świętokrzyskie Voivodeship, phone: +48 41 395 14 52, e-mail: liliana.krezolek@sejmik.kielce.pl
Note	The project supports several micro-projects and good practices based on carbon credits.
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Name of the project: AgriCaptureCO2	AgriCaptureCO2
Thematic area	X Local carbon offset trade systems applied to agriculture (voluntary carbon market) □ Sustainable agricultural practices for soil carbon farming X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Program Horizon 2020 - H2020-SPACE-2018-2020
Period	01/01/2021 – 12/31/2023
Country/Region	Greece, Serbia, United Kingdom, Poland, Germany, Netherlands, Belgium
Keywords	Carbon farming. Carbon credits. Satellite monitoring. Copernicus. Farmer training. GHG reduction. Carbon offset.

Objectives	The general objective of AgriCapture is to combat climate change by enhancing soil carbon sequestration. The project will provide a series of value-added services that make regenerative agriculture easier and more affordable, and it will contribute to accelerating the digital and green transformation of the agricultural sector. The specific objectives are: • Develop innovative soil carbon measurement tools combining satellite and on-ground data. • Facilitate farmers' adoption of regenerative practices via training and community-building. • Establish a verified carbon credit trading platform for farmers and industries. • Empowering regenerative agriculture and measuring and monitoring resulting soil carbon sequestration via remote sensing (satellite observation) backed up by robust ground-truthing (soil sampling).
Partners	• GILab. • One Carbon World • Hellenic Agricultural Organization "DIMITRA" (ELGO). • European Environmental Bureau (EEB). • Linking Environment And Farming (LEAF). • SatAgro. • Game and Wildlife Conservation Trust (GWCT). • Agricultural University of Athens. • Planet Labs GmbH (Planet). • Envirometrix. • Farrington Oils. • Lancashire County Council. • Association of farmers UPOR. • Arthur's Legal.

Description	The EU-funded AgriCapture project is addressing a strong market need for efficient and simplified carbon capture solutions that could be used in land use, land use change, and forestry. To this end, the project will develop a systematic, robust, and flexible platform to quantify, verify, and promote soil carbon capture. The results will benefit farmers and food businesses, as well as enable the certification of organizations to scale up and automate their processes. This will be achieved through a co-creation approach with target users (agricooperatives, an agro-processing company, a Reg Agri certifier, and an emission balance certification organization) in 5 different use cases located across Europe. To support the uptake of the project results, the project will establish a European Reg Agri community, which will be used to raise awareness of Reg Agri as a high-potential approach to meet climate commitments, to coordinate and empower farmers as climate mitigation agents, and to inform the launch of the AgriCapture product through first- hand market information and a direct channel to potential customers. Finally, the project will also undertake dedicated activities to proactively assess, identify, and pursue market opportunities, which will lead to several contracts for post-project service provision by the end of the project. The platform will use satellite data and farmer participation to ensure accuracy, cost-effectiveness, and value for end-users. The results will benefit farmers and food companies, as well as enable the certification of organizations to scale up and automate their processes. In this way, the AgriCapture project will develop and commercialize highly scalable services that: -provide a simple, cost-effective, and accurate estimate of soil carbon changes over time. -simplify farmer certification by remotely verifying farming practices -support farmers in evaluating the costs and benefits of adopting specific regenerative practices in their fields -provide timely and personalized advisory services to regenerative farmers

Results/expected impact	AgriCapture will develop a systematic, robust, and flexible platform for quantifying, verifying, and promoting soil C capture, allowing (i) farmers and other landowners to become "carbon farmers", (ii) food companies to offset their carbon footprint and offer "zero carbon" products, and (iii) certifying organizations to scale up and automatize their processes. The main results so far include: -Organised three webinars, including the launch of the European Regenerative Agriculture Community. -We have published a policy brief on the topics of regenerative agriculture and carbon credits. -Completed the first version of the AgriCapture platform. -Started use case activities based on detailed plans covering >10.000 ha, implementing: new regenerative practices on farms, installation of field sensors, training and support to farmers, collecting soil samples, etc. -Measured the emissions footprint of 26 agri-food organizations and farms. -Contributed to the review process for a VCS-certified methodology for assessing soil carbon capture and issuing carbon credits. -Laid the foundation for a carbon credit reward program to be launched soon in the UK. -Launched the project website and promoted the project to a wide international audience, including at a dedicated AgriCapture side-event at COP26 in Glasgow. -We have launched business planning activities and have published the first market analysis and business report. AgriCapture will co-develop the platform together with key stakeholders (farmers, cooperatives, agri-processors, agri-food companies, public bodies, certification agencies, ...) in five use cases from across Europe. We will also engage the larger farming ecosystem to facilitate knowledge exchange and to promote our results. Dedicated business planning activities will result in the launch of operational services by the end of the project.

Relevance for the project GECO 2.2	AgriCaptureCO2 is a project that focuses on integrating carbon sequestration practices in agriculture with voluntary carbon markets. It enables farmers to adopt practices that reduce carbon emissions and increase carbon storage in soils, directly supporting GECO2's local carbon offset trade systems in agriculture. The first factor of interest is the platform implementation approach. This platform provides us with a farmer-centric approach to address several barriers to adopting regenerative practices at scale and thereby empower cooperatives, companies, and other organizations that promote their adoption. The AgriCaptureCO2 project seeks to make it easier and more profitable for farmers to adopt regenerative farming practices. Accounting for a climate footprint is an established practice. However, accounting for C capture is largely based on manual methodologies that cannot be easily scaled. The consortium has found a strong market need for a streamlined solution that can be scaled to meet the growing needs of C capture from Land Use, Land Use Change, and Forestry (LULUCF). The AgriCaptureCO_2 project offers tools and methodologies directly applicable to GECO 2.2. Its focus on creating an accessible carbon trading platform and fostering regenerative agriculture aligns with GECO 2.2's goals. Leveraging AgriCaptureCO_2's tools, particularly its soil carbon quantification systems and training modules, could enhance GECO 2.2's effectiveness in building local carbon offset systems and fostering sustainable farming practices. Also, AgriCapture seizes upon Earth Observation – free and open Copernicus data in particular – to deliver a highly innovative, flexible, and scalable solution for soil C capture projects/initiatives, targeting 1 of the 2 only potential mass C sinks through proven and increasingly popular practices (i.e. Reg Agri). By combining satellite images with farmers' data and soil samples, we aim to make soil carbon measurement more accurate and cheaper than ever before. This will allow farmers to easily track how their efforts in the field are translating into increased carbon in their soils – and will help farmers get paid for their results.

GECO 2.2

Website or other relevant links	www. agricaptureco2.eu
Project reference contacts	Bojana Obrenovic Dragoslava Srejovića 94, Belgrade, Serbia team@gilab.rs
Note	The project started in 2021 (one year after the request for identification of good practices from 2022 onwards), but it was included for the added value (in technical terms) for the Geco 2.2 project.
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Name of the project: Digital solutions to foster climate-smart agricultural transition (Digi4CSA)	Project logo not available
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	NextGenerationEU - RRF funding for research on key areas of green and digital transition 2022
Period	01/01/2023 – 12/31/2025
Country/Region	Finland
Keywords	Climate-smart agriculture. GHG monitoring. Trading platform. Stakeholder Engagement. AI for Predictive Modeling. Decision-making.

Objectives	The main objectives are: • Develop a methodology for i) collecting necessary data from farms and supply chains, ii) integrating these data with the IT system of climate- smart agricultural impacts, and iii) informing decision-making about these impacts. • Improve stakeholders' (farmers, companies, decision-makers, and consumers) current decision support systems with the developed digital solution to help the stakeholder's decisions in the complex decision- making landscape. • Create prototypes of the digital solution and the APIs that quantify climate-smart agricultural impacts for different stakeholders' needs by combining data collection, modeling, artificial intelligence, and IT knowledge. • Couple the prototypes created in 3) with social, economic, cultural, and policy factors (drivers and reforms) pertinent to value creation with stakeholders in the agriculture value chain and thus lay the foundation for climate-smart agricultural expansion in society.
Partners	• Finnish Meteorological Institute. • University of Helsinki. • Aalto University. • Häme University of Applied Sciences.

Description	The Digi4CSA project is proposed by the Academy of Finland as an evolution of previous project experiences. The project aims to build a digital solution to estimate and monitor climate-smart agricultural environmental and economic impacts relevant to the different stakeholders" decision-making and following climate-smart agricultural outcomes. By pursuing these goals, the project aims to create a digital platform that integrates relevant data streams on climate-smart agricultural farms to facilitate agricultural stakeholders' decision-making and enable novel business models and market exchanges to foster scaling up climate-smart agricultural initiatives. In this context, it employs advanced data collection, integration, and processing technologies to build a robust IT infrastructure. The system aggregates farm-level and supply-chain data, applies machine learning models, and generates actionable insights through tailored APIs (Application Programming Interfaces). Also, the project incorporates the following components: 1. Data Sources: Environmental and economic indicators are collected using on-farm sensors, remote sensing, and stakeholder inputs. 2. Modeling and Integration: Data is processed through algorithms that combine models for greenhouse gas (GHG) emissions, soil carbon sequestration, and farm productivity. 3. Decision-Support System: Outputs are customized for stakeholders, including farmers, policymakers, businesses, and consumers. 4. Prototype Systems: Prototypes like the Field Observatory system provide an initial platform for monitoring and validating climate-smart agricultural impacts. 5. Innovative Accounting Methods: Holistic metrics for assessing climate- smart agricultural impacts, integrating environmental, economic, and social dimensions. In this way, Digi4CSA will build novel ways of accounting that will holistically capture the climate and other impacts of climate-smart agriculture as it grows in scale.

Results/expected impact	Digi4CSA will support the digital solution for assessing and monitoring the environmental and economic impacts of climate-smart agriculture and aims to build a digital solution for assessing and monitoring. Also, it will provide to the decision-making of various stakeholders and in tracking climate-smart agriculture results. The main results expected are: • Create a digital platform to quantify and track climate-smart agricultural impacts. • Improved decision-making tools for stakeholders; • Creation of new business models and markets for climate-smart agriculture; • Enhanced resilience and sustainability of agriculture against climate change.

Relevance for the project GECO 2.2	The project aligns well with the goals of the Geco 2.2 project, suggesting potential synergies. It aligns with the goals of sustainable agricultural practices, data-driven decision-making, and greenhouse gas (GHG) management, which are consistent with Geco 2.2's objectives. Digi4CSA is relevant for the project GECO 2.2 about some technical elements as: • Advanced GHG Accounting Systems: Digi4CSA's field-specific GHG accounting models provide detailed and accurate emissions data, enabling Geco 2.2 to improve, if necessary, its carbon offset calculations. • Digital Platform Development: The modular IT infrastructure of Digi4CSA can directly contribute to Geco 2.2's goal of building a GHG monitoring and trading platform. By leveraging Digi4CSA's expertise in API design, Geco 2.2 could offer user-friendly tools for stakeholders to monitor, trade, and verify carbon credits. • Stakeholder Engagement: Digi4CSA's system incorporates tools for tailoring information to farmers, policymakers, and businesses, addressing their specific needs. Geco 2.2 could adopt similar stakeholder-centric designs, ensuring widespread adoption and compliance within carbon markets. • Scalability and Integration: By using Digi4CSA's integration framework, Geco 2.2 can upscale its system to cover more regions or crops. This adaptability ensures the broader applicability of carbon farming practices and aligns with global standards for CSA. • AI and Predictive Modeling: Digi4CSA utilizes artificial intelligence and machine learning to optimize decision-making. Geco 2.2 can incorporate these methods to refine its models for carbon sequestration and predict the long-term impacts of sustainable farming practices.
Website or other relevant links	www.bsag.fi/en/projects/digi4csa/ www. gi.copernicus.org/articles/11/93/2022/

Project reference contacts	Jari Liski Finnish Meteorological Institute jari.liski@fmi.fi
Note	Digi4CSA has an extensive partner network, including Carbon Action, ACCC Flagship, worldwide PEcAn project Ecological Forecast Initiative, and science collaborators.
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Name of the project: LIFECO2PES&PEF	
Thematic area	X Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	LIFE Program
Period	06/03/2020 – 12/31/2023
Country/Region	Italy / Region Friuli Venezia Giulia, Region Toscana and Region Emilia- Romagna
Keywords	Carbon sequestration. Product Environmental Footprint (PEF). Sustainable agricultural practices. Forest-based industries. Fire prevention. Windthrow risk management. Carbon capture and storage. Carbon sequestration. Ecosystem-based approach. Market-based instruments. Payment scheme. Forestry management.

Objectives	The LIFECO2PES&PEF Project was set up to promote and support the forestry ecosystems in CO2 storage and prevent fire and windthrow risks through 3 specific and measurable objectives: • To identify a set of ecosystem services and assess their benefits in the three above-mentioned forestry areas. • To improve the forestry and forest-based industry system. • To create an ecosystem credit system to finance the same ecosystem services.
Partners	• LEGAMBIENTE NAZIONALE • Regione Autonoma Friuli Venezia Giulia - Servizio Foreste e Corpo Forestale); • Università degli Studi di Milano (UMIL); • Consorzio Comunali Parmensi (CCP); • Unione Montana dei Comuni della Romagna Forlivese • Regione Emilia Romagna - Dipartimento Servizio Aree Protette, Foreste e Sviluppo della Montagna; • FederlegnoArredo (FLA).

Description	The LIFE CO2PES&PEF project promotes sustainable forest management and ecosystem services in three forestry areas across Italy (Alpine and Tosco- Emiliano Apennines). It aims to enhance CO2 storage capacity, reduce the environmental footprint of the wood industry using the Product Environmental Footprint (PEF) methodology, and create a market for ecosystem credits. Key actions include lifecycle assessment of forest products, fire risk prevention, and policy guidance to integrate sustainable practices into regional development plans. Pursuing these purposes, the project was developed along three main lines: 1. Measuring the carbon stock and carbon sink of the three representative areas and assessing the additional activities that enable the increase in ecosystem services over at least 100 years; 2. Supporting the control of resources and environmental impacts along wood supply chains, to improve input flows and negative output impacts from the wood production system as much as possible. 3. Create a financing mechanism from the production system in general, which uses forests as an indirect productive resource, to be able to create the financial means to implement additional forest management activities. Through these macro actions, the project offered useful tools to companies, forestry sector technicians, and policymakers, whether local, national, or European, through the creation and definition of different tools such as action plans, toolkits for companies, and guidelines for the policies or for verification of regulations and organizational and management procedures.

Results/expected impact	LIFE CO2PES&PEF will contribute to the improvement of the forest management scenario, (increasing the absorption of CO2), the mitigation of hydrogeological risk, and the prevention of fire and crash risks, which would lead to additional CO2 emissions. The project will also offer useful tools for companies, forestry specialists, and policy-makers, whether they be local, national, or international, through drawing up and establishing: • A Toolkit for forest-based industry companies to be able to assess their ecological footprint and identify areas of intervention; • A certification standard of the ecosystem services produced from the forests to attribute a monetary value and place them on the environmental compensation market; • A negotiation box for the ecosystem credits; • The guidelines for the policies of the relevant regions; • An increase in the monitoring of forestry activities, forestry certification, ecosystem credit certification, and management, as well as the financial activities related to green bonds and eco-sustainable tourism.
Relevance for the project GECO 2.2	This project was selected for the theme of forestry, which is a representative sub-economy in the regions of the Geco 2.2 project. The LIFE CO2PES&PEF project demonstrates how forest-based carbon sequestration and ecosystem services can be effectively monetized and integrated into markets. Its structured methodologies in certification, lifecycle assessment, and credit systems could directly enhance GECO 2.2 by providing replicable tools and frameworks for voluntary carbon trading and sustainable practices in agriculture. Additionally, the project's focus on stakeholder involvement and regional policy alignment complements GECO 2.2's mission of fostering collaborative environmental solutions.
Website or other relevant links	www.lifeco2pefandpes.eu/en/
Project reference	Francesco Testa Scuola Superiore di Studi Universitari e di Perfezionamento

contacts	Sant'Anna francesco.testa@santannapisa.it
Note	
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Name of the project: CARBON FARMING MED	CARBON FARMING MED | Interreg Euro-MED
Thematic area	X Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Interreg Euro-MED (Priority: Promote the transition towards a circular and resource-efficient economy)
Period	01/01/2024 – 09/01/2024
Country/Region	Spain, France, Italy, Greece, Slovenia and Bosnia and Herzegovina
Keywords	Carbon farming. Regenerative agriculture. Soil carbon sequestration. Carbon credits. Mediterranean agriculture. MRV system. Carbon market. EU climate goals. Geen business model. CO_2 capture. Sustainable farming. Carbon offset trade.

Objectives	The main objective of the project is to help farmers develop a sustainable and resilient Mediterranean agricultural system and, at the same time, encourage their entry into the carbon market to obtain another source of income. This objective will be achieved by optimizing regenerative agricultural practices in a Mediterranean context and providing the necessary tools to facilitate the adoption of carbon credits in the market (from the perspective of the seller and the buyer). The specific objectives of the project are: • Develop a framework for regenerative agricultural and agroforestry practices. • Implement a robust Monitoring, Reporting, and Verification (MRV) system for carbon credits. • Establish a Mediterranean carbon credit market platform. • Encourage farmer participation in carbon trading to enhance revenues and sustainability. • Support the EU's 2050 climate neutrality goals through CO_2 capture and storage.
Partners	• Universitat de Vic. • Universitat Central de Catalunya. • Beta Technology Centre. • Azolla Projects, Spain. • CREA (Council for Agricultural Research and Economics). • Technical University of Crete. • CRITT Agroalimentaire Sud (Agrofood Innovation and Technology Transfer Center). • Euroregion Pyrenees Mediterranean (EPM). • EURAF (European Agroforestry Federation). • Institute for Health and Environment (IHE). • CENER 21 (Center for Energy, Environment and Resources).

Description	The Carbon Farming MED project, funded by the Interreg Euro-MED program, aims to integrate Mediterranean agriculture into the carbon credit market while supporting the EU's 2035 climate neutrality goals. The overall objective of the CFM project is to develop a resilient Mediterranean agricultural system and to help farmers implement carbon farming as a new green business model to obtain additional revenues (e.g. voluntary carbon credit market, CAP funding, ...), by optimizing regenerative agricultural and agroforestry practices and by providing the necessary tools to facilitate the carbon credit market adoption (from both the seller's and the buyer's perspective). The project, under the coordination of the UVic-UCC's BETA Technology Centre, will focus on adapting methodologies for measuring, reporting, and verifying the amount of CO2 that can be captured and stored in agricultural soils thanks to the application of certain agricultural and agroforestry practices. The project structure includes: • Establish the theoretical framework of carbon agriculture in the Mediterranean, through the selection of indicators and predictive models, monitoring parameters, and the implementation of a sustainability assessment of regenerative agriculture (WP1). • Quantify carbon capture in the soil and GHG emissions avoided, by evaluating, monitoring, and forecasting the effects of the implementation of regenerative agricultural techniques in the Mediterranean region (WP2). • Promotion of a Mediterranean market for carbon credits generated by regenerative agriculture, through (i) the development of a computer platform that helps farmers in the verification process to obtain carbon credits and (ii) the development of a virtual meeting point to promote and bring together buyers and sellers of carbon credits (WP3). • Transfer and integration of project results and lessons learned by capitalizing on project developments and results (WP4).

Results/expected impact	The primary output of the Carbon Farming MED project is the creation of the first cross-border platform in the Mediterranean to support the buying and selling of carbon credits. This platform is essential for promoting carbon farming as a viable green business model, facilitating the adoption of sustainable agricultural practices, and supporting the EU's climate neutrality goals by enhancing carbon removals. The specific results/impact expected are: • Enhanced adoption of regenerative agricultural and agroforestry practices. • Development of an MRV system to ensure reliable carbon credit transactions. • Increased soil carbon sequestration and reduced greenhouse gas emissions. • Economic benefits for farmers through carbon credit sales. • Strengthened resilience of Mediterranean agricultural systems to climate change.
Relevance for the project GECO 2.2	The CARBON FARMING MED project is strongly synergistic with the Geco 2.2 project. It aligns well with best practices for sustainable development and environmental impact in agriculture, particularly in its focus on carbon sequestration and creating a carbon credit market. Its structured approach to regenerative farming, monitoring methodologies, and cross-border cooperation makes it a suitable model for adoption and adaptation in other projects. Its relevance is underscored by its potential to integrate climate change mitigation into practical agricultural systems while offering economic benefits to Mediterranean farmers. Also, the CARBON FARMING MED project provides valuable insights and methodologies that could enhance the GECO 2.2 project as a business model, MRV System, and Technological Advancements.
Website or other relevant links	www.carbonfarmingmed.interreg-euro-med.eu

Project reference contacts	BETA	Technological Center info.beta@uvic.cat
Note		
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*	

Name of the project: Carbon 4 Soil Quality	Interreg Euro-MED Co-funded by the European Union CARBON 4 SOIL QUALITY
Thematic area	X Local carbon offset trade systems applied to agriculture (voluntary carbon market) X Sustainable agricultural practices for soil carbon farming X Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Euro-MED program
Period	01/01/2024 – 03/31/2026
Country/Region	Slovenia, Spain, Greece, Italy, North Macedonia and Montenegro
Keywords	Carbon farming. Soil quality. Carbon sequestration. Mediterranean cultures. Carbon credits. GHG mitigation. Soil monitoring Carbon credit certification. Mediterranean protocols. Credit schemes. Cross-border collaboration. Environmental certification systems.

Objectives	The CARBON 4 SOIL QUALITY project's objective is to develop sustainable soil management strategies through carbon farming. It focuses on capturing atmospheric CO_2 and storing it in soil to mitigate climate change and improve soil health. Specific objectives are: • Develop a catalog of soil organic carbon reference values. • Create methodologies for organic carbon analysis and monitoring soil quality. • Provide guidelines for carbon farming techniques. • Establish business models for carbon farming. • Recommend carbon credit schemes and environmental certification systems.
Partners	• Agricultural Institute of Slovenia. • Institute for Sustainable Development. • Aristotle University of Thessaloniki. • University of Almeria. • Ri.nova Cooperative Society. • University of Padova. • University of Montenegro, Biotechical Faculty. • University "SS Cyril and Methodius" - Institute of Agriculture.

Description	Carbon 4 Soil Quality is a project seeking to foster soil management techniques that favor carbon storage on soil, thus tackling climate change and improving soil health. It will aim to develop sustainable soil management strategies through carbon farming. It focuses on capturing atmospheric CO_2 and storing it in soil to mitigate climate change and improve soil health. The project will establish a "Toolbox for Carbon Farming," including reference values, methodologies, and business models. The initiative spans Mediterranean countries, enabling cross-border collaboration to adapt carbon farming techniques to diverse climatic and soil conditions. To achieve these goals, the project will develop a toolbox for carbon farming. This will include a catalog of organic soil reference values, methodology for organic carbon analysis and soil quality monitoring, guidelines for carbon farming techniques, business models, and recommendations on credit schemes and environmental certification systems. The end users of this box will be the farmers, but also the agricultural advisors and the policymakers. The project also includes the future testing of carbon farming in the Euro-Mediterranean area, with the preparation of transferable training materials. Moreover, Carbon 4 Soil Quality wishes to contribute to the EU carbon farming initiative. The project considers the pedo-climatic specificities of the Mediterranean region including local variations (for example, in terms of aridity levels).

Results/expected impact	The project will contribute to fostering soil management techniques that will favor carbon storage on soil, thus tackling climate change and improving soil health. Main results/expected impact are: • Establishment of a Toolbox for Carbon Farming (methodologies, guidelines, business models). • Analysis and development of methods for organic carbon farming and soil quality monitoring specific to these regions will lead to more efficient guidelines and recommendations for farmers applying the new farming techniques. • Improved soil health and fertility through increased organic carbon content. • Mitigation of atmospheric CO_2 levels via enhanced sequestration. • Adaptation of agricultural practices to diverse Mediterranean conditions. • Strengthened cross-border collaboration for sustainable farming.
Relevance for the project GECO 2.2	The Carbon 4 Soil Quality project is a Euro-MED initiative that focuses on carbon farming and that started at the same time that Geco 2.2. It aligns with the goals of promoting sustainable agriculture and carbon sequestration while addressing climate change. The project's focus on developing standardized tools for carbon farming and its alignment with European Green Deal goals make it a relevant model for enhancing soil quality and managing greenhouse gas (GHG) emissions. In this way, the project is relevant because it has a particular focus on the development of a toolbox in particularly about carbon farming techniques and credit schemes.
Website or other relevant links	www.carbon4soilquality.interreg-euro-med.eu
Project reference contacts	Borut Vrščaj Kmetijski inštitut Slovenije
Note	
Who is filling this fact sheet?	*Legacoop Marche – Filled by Cristian Ciarrocchi - Good practice selected and analyzed by the internal working team and external experts in agriculture and carbon markets*

Paper: Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content

Project name: i.e. Paper topic Modelling and remote sensing of soil carbon	
Thematic area	☐ Local carbon offset trade systems applied to agriculture (voluntary carbon market). ☐ Sustainable agricultural practices for soil carbon farming. ☑ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	National Natural Science Foundation of China (No. 42141007).
Period	2020 - 2025
Country/Region	China
Key words	Soil organic carbon, Remote Sensing: Landsat 5 ™, Environmental variables, Model comparison
Objectives	Modeling methodologies and environmental variables in order to accurately and quickly estimate soil organic carbon (SOC) content
Partners	College of Resources and Environmental Sciences, China Agricultural University, Beijing, 100193, China - Collaborative Innovation Center on Forecast and Evaluation of Meteorological Disasters (CIC-FEMD), Nanjing University of Information Science and Technology, Nanjing, 210044, China

Description	The study focuses on modeling methodologies and environmental variables, which significantly influence the Soil organic carbon (SOC) content estimation model. The modeling methods used in this research comprise multiple linear regression (MLR), partial least squares regression (PLSR), random forest, and support vector machines (SVM). The analyzed environmental variables include terrain, climate, soil, and vegetation cover factors. The original spectral reflectance (OSR) of Landsat 5 TM images and the spectral reflectivity after the derivative processing were combined with the above environmental variables to estimate SOC content
Results/expected impact	The study generated soil organic carbon content maps for the surface layer of the Northeast Transect at a spatial resolution of 30 m. Results demonstrate that adding environmental variables enhances the accuracy of SOC content estimation across various models.
Relevance for the project GECO 2.2	The study provides theoretical reference for the rapid estimation of large- area soil organic carbon content using remote sensing images combined with environmental factors.
Website or other relevant links	Xiao, X., He, Q., Ma, S. et al. Environmental variables improve the accuracy of remote sensing estimation of soil organic carbon content. Sci Rep 14, 18964 (2024). https://doi.org/10.1038/s41598-024-68424-5
Project reference contacts	Qijin He, heqijin@cau.edu.cnCollege of Resources and Environmental Sciences, China Agricultural University, Beijing, 100193, China heqijin@cau.edu.cn
Note	
Who is filling this fact sheet?	*Antonio Cinti, Leonardo Marotta, Legacoop Romagna*

Project name: Towards climate-smart sustainable management of agricultural soils	
Thematic area	☑ Local carbon offset trade systems applied to agriculture (voluntary carbon market). ☐ Sustainable agricultural practices for soil carbon farming. ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Ecosystem Marketplace and its EM Global Carbon Hub are fueled by a growing global network of hundreds of EM Global Carbon Survey Respondents and is made possible with the diverse mix of support that we receive from Visionary Partners, Strategic Supporters, collaborators, and donors.
Period	2024
Country/Region	World
Key words	Carbon market, voluntary carbon credits.
Objectives	Provide a comprehensive overview of global supply and demand of voluntary carbon credits.
Partners	Ecosystem Marketplace, initiative of the non-profit organization Forest Trends, Washington, DC
Description	State of the Voluntary Carbon Market (SOVCM) annual report collects annual disclosures from market participants representing the majority of project developers and credit resellers, and combine this with registry data from the largest carbon credit standards and certifications.

Results/expected impact	Report captures the previous full year of market activity and takes a forward-looking lens to understand the most important developments shaping the future of the voluntary carbon market (VCM).
Relevance for the project GECO 2.2	Report–a series now approaching the two-decade mark–to provide a comprehensive overview of the global supply and demand of voluntary carbon credits.
Website or other relevant links	https://www.ecosystemmarketplace.com/publications/2024-state-of-the- voluntary-carbon-markets-sovcm/
Project reference contacts	Charlotte Barber, Associate Director of Ecosystem Marketplace, Forest Trends | cbarber@forest-trends.org Kate Brandaw Ellis, Senior Budget and Project Manager of Ecosystem Marketplace, Forest Trends | kellis@forest-trends.org Alex Procton, Manager of Data Solutions & Insights of Ecosystem Marketplace, Forest Trends | aprocton@forest-trends.org Ciro Calderon, Strategic Engagement Manager & Latin America Lead of Ecosystem Marketplace, Forest Trends | ccalderon@ecosystemmarketplace.com Laura Weatherer, Senior Associate of Ecosystem Marketplace, Forest Trends | lweatherer@forest-trends.org
Note	Editor & General Information: info@ecosystemmarketplace.com
Who is filling this fact sheet?	*Antonio Cinti, Leonardo Marotta, Legacoop Romagna*

Report: State of the Voluntary Carbon Market (SOVCM)

Development of Carbon Farming in the Central Europe

Project name: Carbon Farming	
Thematic area	☑ Local carbon offset trade systems applied to agriculture (voluntary carbon market). ☑ Sustainable agricultural practices for soil carbon farming. ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Interreg CENTRAL EUROPE (EU funding programme for cohesive regional development)
Period	2023 - 2026
Country/Region	Slovenia (SI), Hungary (HU), Italy (IT), Poland (PL), Austria (AT), Slovakia (SK), Croatia (HR), Germany (DE), Czechia (CZ)
Key words	Carbon farming
Objectives	Development of Carbon Farming in the Central Europe The Carbon Farming – CE project wants to make regions more familiar with t Carbon Farming concept. The partnership adapts and tests various techniques and business models and develops a monitoring tool for transnational, standardised carbon sequestration.
Partners	Lead partner: Agricultural Institute of Slovenia and 10 more partners in 9 countries

GECO 2.2

Description	Pilot actions: A.1 Use of organic fertilization A.2 Relocation harvest residues B.1 Additional cultivation of cover/catch crops instead of fallow B.2 Diversification of field crop rotation, including undersowing, intercropping and mulching practices C.1 Reducing tillage to different extents Test Carbon Sequestration Monitoring Methodology Define Transnational Carbon Farming Material For Farmers
Results/expected impact	Modelling framework predicts changes in soil carbon stocks and accounts for epistemic uncertainty, uncertainty in the bio-geochemical process dynamics, in a statistically defensible manner.
Relevance for the project GECO 2.2	The project is relevant for GECO 2.2, they are linked with common outputs as: Transnational Carbon Farming Material For Farmers; Carbon Sequestration Monitoring Methodology; Carbon Farming Business Model Approach Guide; Strategy for Mainstreaming Carbon Farming in CE
Website or other relevant links	https://www.interreg-central.eu/projects/carbon-farming-ce
Project reference contacts	Project Manager Antoaneta Golemanova Kuhar Email: antoaneta.kuhar@kis.si Phone: +386 (0)1 280 51 03
Note	
Who is filling this fact sheet?	*Coldiretti Molise, Agr. Dott. Gianmario Deandrea*

Project name: Towards climate-smart sustainable management of agricultural soils	
Thematic area	☑ Local carbon offset trade systems applied to agriculture (voluntary carbon market). Sustainable agricultural practices for soil carbon ☑ farming. ☑ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	European Union's Horizon 2020 research and innovation programme under grant agreement N° 862695
Period	2020 - 2025
Country/Region	France The Nederlands Austria Belgium Czech Republic Denmark Estonia Finland Germany Hungary Ireland Italy
Key words	Climate smart sustainable soil management, Soil education and capacity building, Soil data & Monitoring, mapping and modelling
Objectives	EJP SOIL is a European Joint Programme on Agricultural Soil Management addressing key societal challenges including climate change and future food supply. One of the objectives is accounting and monitoring soil quality and soil carbon stocks.
Partners	lead contractor: INRAE, others: https://ejpsoil.eu/about-ejp-soil/consortium EJP SOIL unites a unique group of 26 partners from 24 European countries and 400 scientists.

Description	The overall goal of the EJP SOIL programme is to build a sustainable European integrated research system and develop and deploy a reference framework on climate-smart, sustainable agricultural soil management. The EJP SOIL workflow starts with the development of a roadmap for research on agricultural soil management in the EU. This includes the identification of aspirational targets at regional, national and European level, overview of the current situation of knowledge, identification of barriers and opportunities, synthesis of key soil related issues, and building and updating the roadmap and drafting calls scope.
Results/expected impact	EJP SOIL goal is to improve the understanding of agricultural soil management by finding synergies in research, strengthening research communities and raising public awareness. EJP SOIL considers the need for effective policy solutions and strategic multi- actor approach allowing to initiate inter-society dialogue and implementation of best practices. Key definitions: https://ejpsoil.eu/fileadmin/projects/ejpsoil/WP8/Policy_briefs/EJPSOIL_Policy_Brief_C_sequestration_terminology_FINAL_08012024.pdf
Relevance for the project GECO 2.2	The project is relevant for GECO 2.2, they are linked with common issues

Website or other relevant links	https://ejpsoil.eu/ Carbon farming: CarboSeq (https://ejpsoil.eu/soil-research/carboseq, Project manager: Axel Don: axel.don@thuenen.de), AGROECOSeqC (https://ejpsoil.eu/soil-research/agroecoseqc, Project coordinator: Alessandra Trinchera: alessandra.trinchera@crea.gov.it), EOM4SOIL (https://ejpsoil.eu/soil-research/eom4soil, Project coordinator: Sabine Houot, INRAE: sabine.houot@inrae.fr), TRUESOIL (https://ejpsoil.eu/soil- research/first-external-call-projects-selected/truesoil). Soil carbon measure and models: ProbeField (https://ejpsoil.eu/soil-research/probefield, Project Coordinator: Bo Stenberg, bo.stenberg@slu.se), https://ejpsoil.eu/soil-research/soil-data-monitoring-mapping-and-modelling Carbon farming schemes: http://reports.crea.gov.it/powerbi/CarbonSchemesInventory.html
Project reference contacts	EJP SOIL Coordinator Claire CHENU INRAE, France e-mail: ejpsoilcoord@inrae.fr
Note	
Who is filling this fact sheet?	*Antonio Cinti, Leonardo Marotta, Legacoop Romagna*

EJP SOIL: Towards climate-smart sustainable management of agricultural soils

Report: Innovative carbon farming initiatives

Project name: Carbon farming initiatives	
Thematic area	☑ Local carbon offset trade systems applied to agriculture (voluntary carbon market). ☑ Sustainable agricultural practices for soil carbon farming. ☐ Software development or modelling of GHG sequestration and emissions and carbon trading platform
Funding	Horizon Europe and others
Period	2019-2023
Country/Region	Europe
Key words	Carbon farming, Innovation in agriculture
Objectives	The report presents an overview of ongoing and recently completed EU projects that promote innovation in carbon farming, focusing on initiatives funded by Horizon Europe and a smaller selection of programs financed through other sources of public funding and private sector initiatives. These projects have been compiled into an accompanying project inventory, available at https://carbonfarminginventory.ieep.eu/
Partners	Institute for European Environmental Policy (IEEP)

Description	Innovative monitoring, reporting, and verification (MRV) solutions enable more accurate data collection, facilitate decision-making, and support result-based payments for ecosystem services and compliance verification. The analysed projects show advancements in the use of monitoring technologies, such as remote sensing, satellite imagery, and sensor networks, as well as citizen participation and improved carbon accounting methods. Technological innovation is a central theme in many of the projects, with a focus on developing and commercialising novel technologies to enhance resource efficiency, reduce environmental impact, and lower greenhouse gas emissions. These innovations cover various aspects, including crop production equipment, methane abatement technologies, or the use of microalgae in agriculture. Innovative contractual solutions are explored in several projects, both in the public and private sectors. These initiatives aim to incentivise sustainable practices within the agricultural sector while maintaining economic viability. They include programmes developed by large private sector entities to promote sustainable practices among their suppliers, including the co- design of financial products to support the transition to regenerative agriculture.
Results/expected impact	Analysed projects represent a significant effort to promote sustainable agriculture and carbon farming in the EU. They address various aspects of the agricultural sector, from technology and innovation to policy development and contract design. However, ongoing challenges related to access, regional disparities, farmer behaviour and adequate incentives need to be addressed to ensure the widespread adoption of sustainable practices in European agriculture.
Relevance for the project GECO 2.2	The project is relevant for GECO 2.2, in order to improve carbon farming projects.
Website or other relevant links	https://ieep.eu/wp-content/uploads/2023/09/Carbon-farming-project- inventory-IEEP-2023.pdf

Project reference contacts	Krystyna Springer (kspringer@ieep.eu)
Note	
Who is filling this fact sheet?	*Antonio Cinti, Leonardo Marotta, Legacoop Romagna*

An overview of recent and ongoing projects across the EU