2nd meeting of the Carbon Removals Expert Group

Carbon Farming: mapping of certification methodologies

21-22 June, Brussels

Carbon Farming

Certification methodologies

Christian HOLZLEITNER, Head of Unit,
European Commission, DG CLIMA, Unit C3

Carbon Removals Expert Group – 21 June 2023

Housekeeping Rules

1. IN-PERSON PARTICIPANTS: KEEP YOUR BADGE
Keep your badge (V-Pass) to access the conference building tomorrow.

2. ONLINE PARTICIPANTS: TURN ON YOUR VIDEO & MUTE YOURSELF
We encourage you to turn on your video. Please leave your microphone on mute, unless you take the floor.

3. ASK QUESTIONS & INTERACT (in the room + Webex & Slido)
We want to hear from you! Pls ask questions & share your comments! We endeavour to take at least one online question from each Webex and Slido respectively in Q&A.

4. CONSENT FOR THE WEBSTREAM RECORDING & PICTURES
Be informed that the meeting will be web-streamed, recorded and pictures will be taken.

5. SOCIAL MEDIA: #EUCarbonRemovals
Your posts and comments can help others learn more about the topic and connect with like-minded professionals in the industry.

European Commission

Agenda for today – 21 June

10:30 to 11:00	11:00 to 12:10	12:10 to 13:15	13:15 to 17:00	From 17:30
• **Opening remarks by DG CLIMA** • **Approval of the minutes from 1st EG**	• **Supporting the Expert Group:** ongoing Commission activities	• Lunch	• Thematic Session I: **Agriculture on mineral soils**	• Drinks at Grand Central

European Commission

Agenda for tomorrow – 22 June

9:00 to 9:15	09:15 to 12:00	12:00 to 13:30	13:30 to 15:30	15:45 to 16:30
• Arrival	• Thematic Session II: **Forestry**	• Lunch	• Thematic Session III: **Peatland**	• **Takeaways** from the workshop & **next steps**

European Commission

Principles of working together: response to letter by CMW, Bellona, EEB, ECOS, Fern

Transparency	Open debate	Diversity	Inclusiveness
• **Agendas** and **meeting documents** made public • **Webstreaming**	• Ample time and space for **open discussion** • **Tools** to enable expert exchanges between the meetings (“Basecamp”)	• **Gender balance** of speakers and panelists	• Invitation of **ad-hoc experts** • Possibility to **enlarge membership** (‘sub-groups’) in 2024

European Commission

Legislative state of play

Council of the European Union

- **Last meeting under Swedish presidency on 16 June**
- **Spanish presidency takes over on 1 July**

European Parliament

- **The proposal is being discussed in ENVI and AGRI Committees**
  - COMENVI report tabled on 2 May
  - COMAGRI report tabled on 4 May
- **Plenary vote scheduled for 16-19 October**

European Commission

Framework for the voluntary certification of carbon removals in the EU

Principles in the framework

QU.A.L.ITY criteria

- **QU**antification
- **A**dditionality
- **L**ong-term storage
- Sustainabil**-ITY**

Credible certification

- **Third-party** verification
- **Certification** schemes
- **Interoperable** registries

Tailored certification methodologies

(to be developed in consultation with Expert Group)

PERMANENT STORAGE

CARBON FARMING

CARBON STORAGE IN LONG-LASTING PRODUCTS

European Commission

A single certification methodology for all financing options

Voluntary financing of carbon removals

- **Green Claims**
  - Commission proposal from March 2023 on climate-neutrality claims
- **Corporate Sustainability Reporting**
  - Draft Sustainable Reporting Standards on Climate
  - *Delegated act published for public consultation*
- **EU financing and State aid**
  - Innovation Fund
  - State aid for carbon farming

Milestones for post-2030 EU policy on carbon removals

- **2040 target - review of the Climate Law**
  - Public consultation
- **Industrial Carbon Management**
  - Public consultation
- **Article 30 new EU ETS Directive**
  - Commission to report in 2026 to assess the inclusion of permanent removals in EU ETS
- **LULUCF review – new Article 17**
  - Carbon farming and carbon storage products

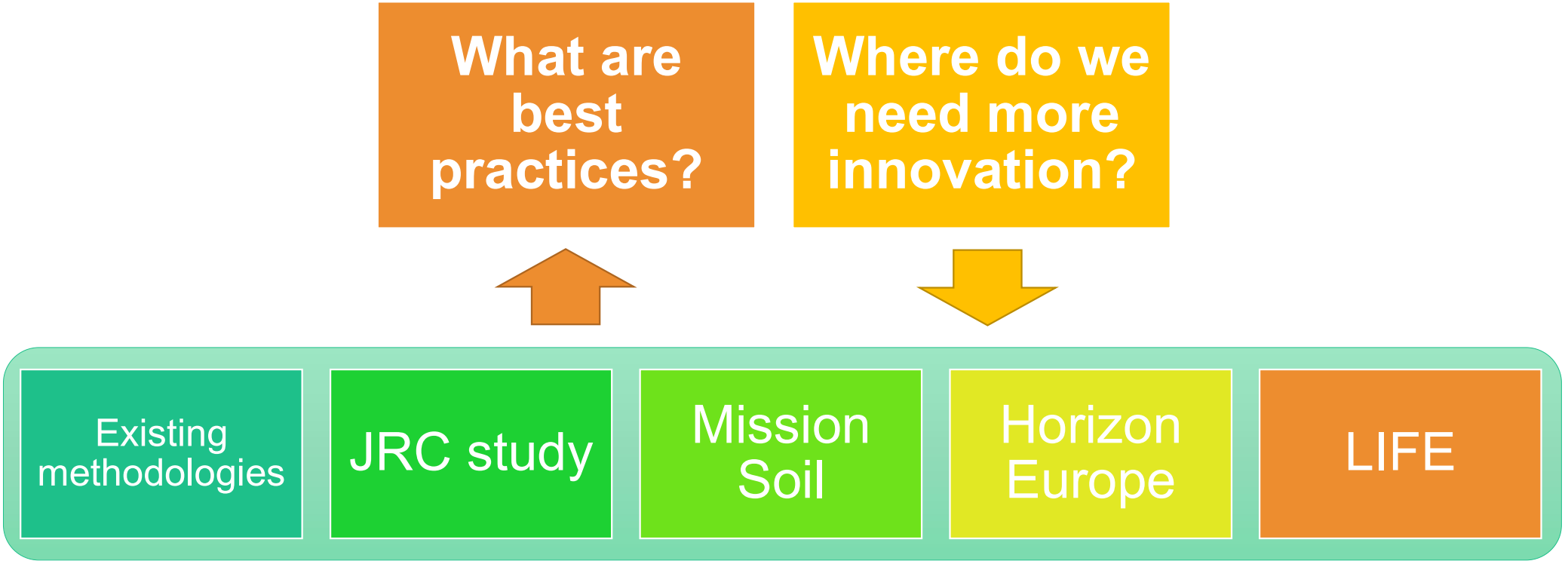
2023 Expert Group Work Program

European Commission

A tailored certification methodology for each carbon farming activity

European Commission

Guiding questions



European Commission

Success factors for carbon farming certification methodologies

Quantification

- **Hybrid approach**
  - Modelling
  - Earth Observation
  - Soil sampling

Baseline and Additionality

- 'Highly standardized' baseline based on **geographically explicit soil and forest maps** for EU

Long-term storage

- **Liability during monitoring period**
  - EU-wide insurance
  - Buffers
  - Discounts

Sustainability

- **Simple and robust requirements** building on EU rules
- Value GHG reduction (e.g. fertilisers), biodiversity, …

Digital tools

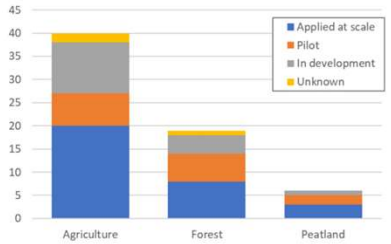
- Easy access through apps for carbon farming
- Reducing costs for earth observation and soil sampling

Uptake

- Advisory services
- Engaging land managers through peer learning

From reviewing existing methodologies to drafting EU methodologies

127 responses to Survey



Q2 and Q3 2023

Scoping papers

Assessment of best practices

Q4 2023 and Q1 2024

Draft EU methodologies ("strawman")

Q2 and Q3 2024

Discussion and input from the Expert Group and stakeholders

Basecamp

European Commission

Quantification

Framework

- **Accurate and conservative calculation**
- **Carbon removals and emission reductions from reduced carbon release – scope of LULUCF Regulation**

Methodology

- **What is the optimal mix between the use of**
  - Modelling
  - Soil sampling
  - Earth observation
- **What are the existing methods that we can build on?**
- **What is the potential of innovation to bring down monitoring costs and to increase accuracy?**
  - Can we expect significant developments up to 2030?

European Commission

CRETA – ongoing activities

Carbon Removals Expert Group

Technical Assistance

Expert Group Carbon Removals
Carbon Farming meeting 21 June 2023

Jan Peter Lesschen (WUR), Peter Karsch (PfI)

1. CRETA – Carbon Removals Expert group Technical Assistance

Support organised in three main Tasks:

1. **Support of the work of the Expert Group**
   a) Gathering background information, set-up and maintain documentation system
   b) Support in organising the Expert Group Meetings (programme, minutes)
   c) Public consultations / communication / stakeholder involvement
2. **Support development of certification methodologies for carbon farming solutions**
   a) Review existing methodologies
   b) Scoping papers
   c) Strawman proposals
3. **Framework LCA / calculation method for carbon storage in construction materials**
   a) Review of the state of the art
   b) Recommendations carbon storage in long-lasting products along the QU.A.L.ITY criteria

2. CRETA Team

Partners for Innovation

WAGENINGEN UNIVERSITY & RESEARCH

Climate Neutral Group

Task 1

Dr Francisca Wit
Coordinator / ALM

Peter Karsch
Project Manager

Marjolein Roggen
Communication Expert

Task 2

Dr Jasmijn Sybenga,
Peatland expert

Dr Jan Peter Lesschen
Scientific Coordinator

Dr Eric Arets
Forest management

Ir. Jeroen Veraart
Peatland expert

Sven van Baren
Forest management

Jos Cozijnsen,
Certification expert

Task 3

Jannes Nelissen
LCA expert

Ir. Siem Haffmans,
LCA expert

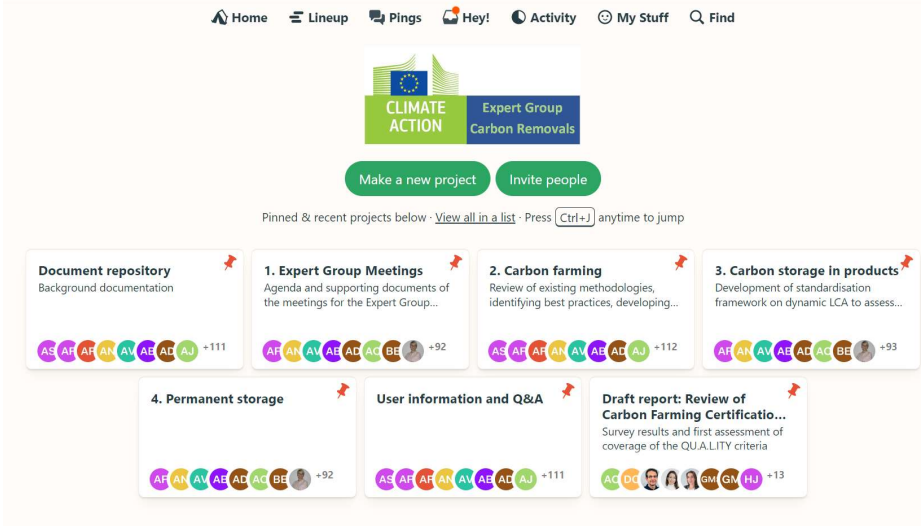
Dr Sinéad O'Keeffe
dLCA expert

Dr Mart-Jan Schelhaas
Forest management/LCA

3. Ongoing / planned activities Coming Period

Task 1 – Support the work of the Expert Group

- Follow-up of current meeting (minutes, action points)
- Organisation 3rd meeting on Industrial Removals (October / November)
- Involvement of stakeholders through social media / direct involvement
- Information and interaction on Basecamp: expand and keep up-to-date



Activities: Task 2

Task 2 – Development of certification methodologies for carbon farming

Activities:

- **Finalise the review** of existing certification methodologies on basis of the input from the current Expert Group Meeting (mid-July)
- Draft **starting points for the technical scoping papers**: how can the QU.A.L.ITY criteria best be addressed in the development of certification methodologies in the context of the CFCR (July – September 2023)
- Targeted **Expert Group / stakeholder consultation**: gather expert views on specific issues, e.g. elements of the QU.A.L.ITY criteria that are not (yet) well incorporated in current methodologies (July – October 2023)
- **Technical scoping papers submitted for review** by the Expert Group / external stakeholders (October-November 2023), final version end Q4 / early Q1 2024
- Next step: development of **Strawman Proposals (as of Q2 2024)**

Activities: Task 3

Task 3 - Framework LCA / calculation method for carbon storage in construction materials

Main aim: contribute to developing a (simple) certification methodology for carbon storage in construction materials

- State of the art: **desk research** into existing methodologies (ongoing) – input in terms of methods to be taken into account is welcome (Basecamp or by e-mail)
- Prepare **EU Survey** to gather expert input: similar to survey into certification methodologies (launch end August – open until 3rd week September)
- Prepare **comparison table** as input for discussion Expert Group meeting in Oct/Nov 2023
- On basis of identified best practices and limitations, **draft recommendations** for certification of carbon storage in long-lasting products along the QU.A.L.ITY criteria.

Activities Coming Period: Task 3 (2)

Task 3 - Framework LCA / calculation method for carbon storage in construction materials

Draft set-up comparison table:

Aspects > / Relevant schemes/methodologies	Geographical coverage	Sectoral coverage	Coverage of construction products	Method to include EoL aspects	Related database	Accessibility of data	Relation to (inter)national regulations / standards	Short synthesis: elements (not) to be retained in technical specifications	Links to other methods/schemes

Subsequent selection of applicable calculation methodologies to be further assessed along the QU.A.L.ITY criteria

Thank you for your attention!
Questions?

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janpeter.lesschen@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Partners for
Innovation

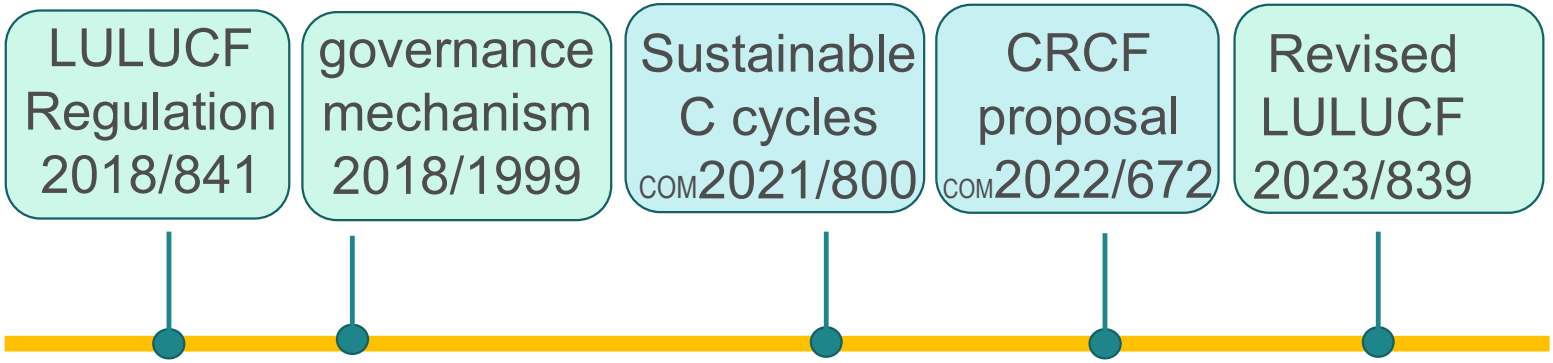
EC - Joint Research Centre
Directorate Sustainable Resources
Mirco Migliavacca, Emanuele Lugato, Giacomo Grassi, Daniele De Rosa, Wim Devos, Simona Bosco, Daniele Borio, Alessandro Cescatti, Frank Dentener, Greet Maenhout

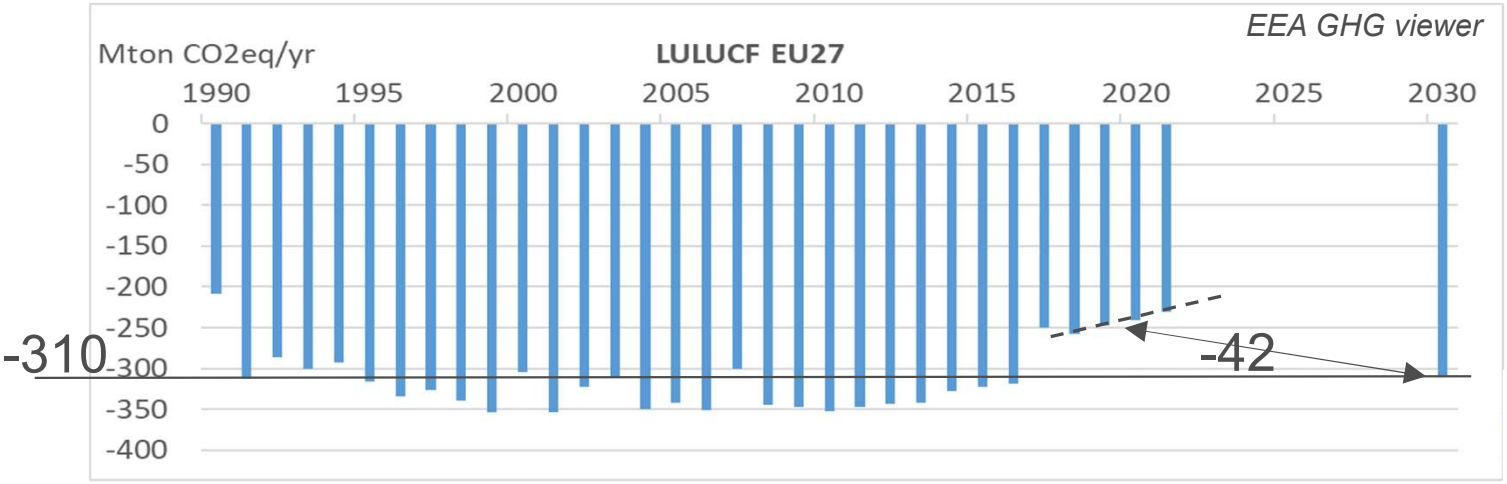
Planned Contribution to CARBON FARMING:

"Carbon Removal in Land: Activities, Budget and Verification"

1. Context, scope and objectives
2. Methodology, modelling and boundary conditions
3. Knowledge, data and expertise available

1. Policy context

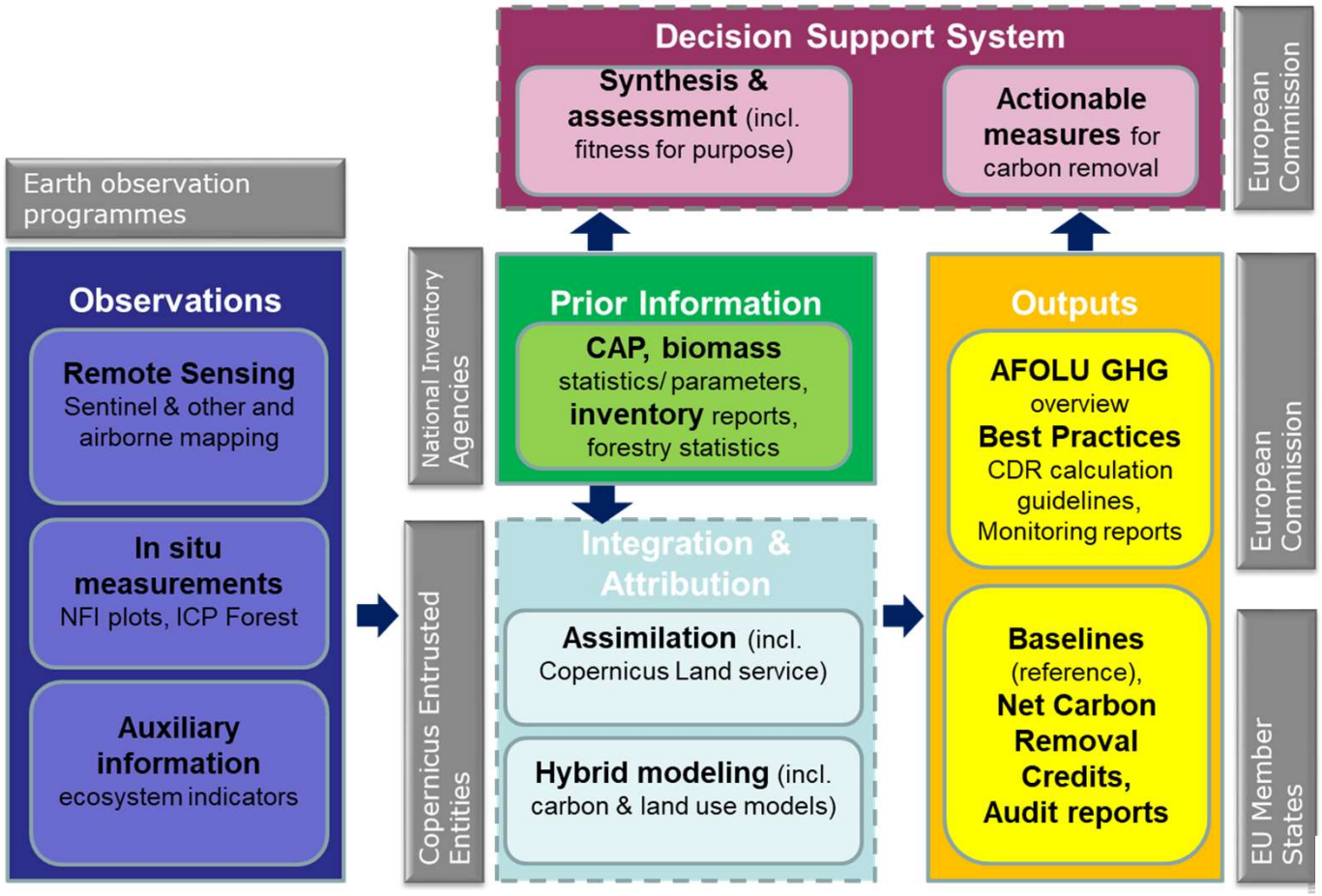




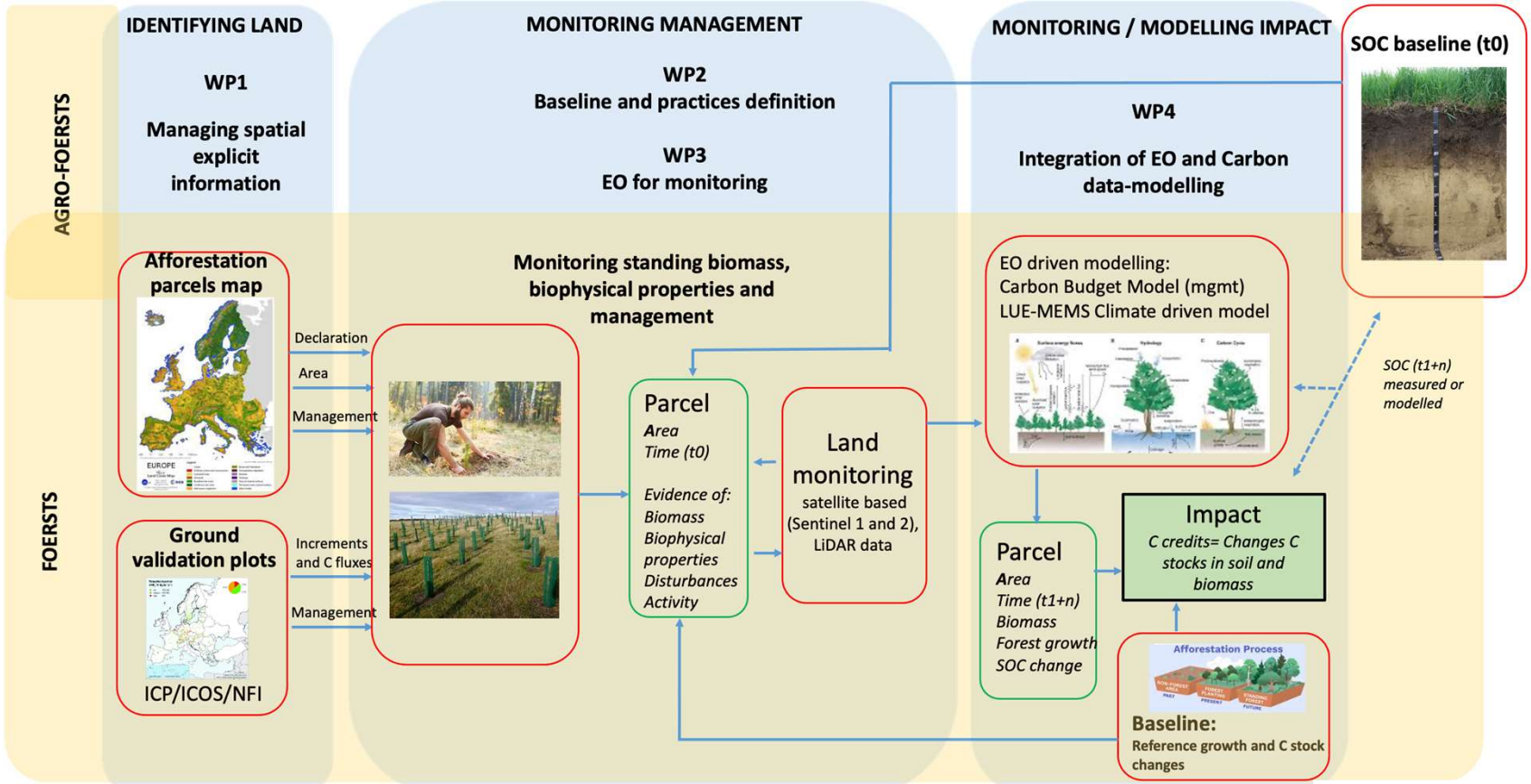
1. Scope of global carbon cycle

Friedlingstein et al. GCB (2022)

2. MRV with multiple facets



2. JRC support on methodology



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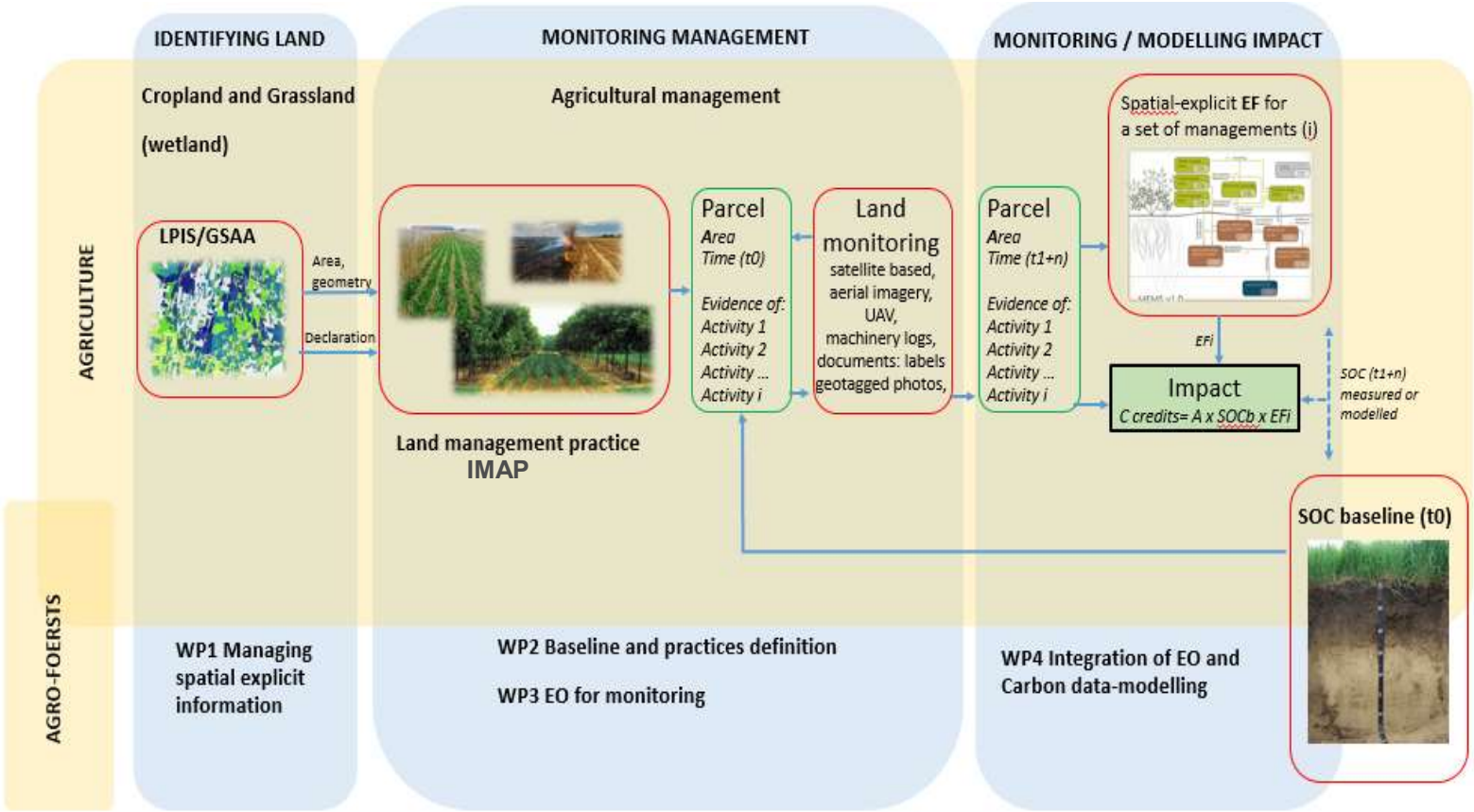
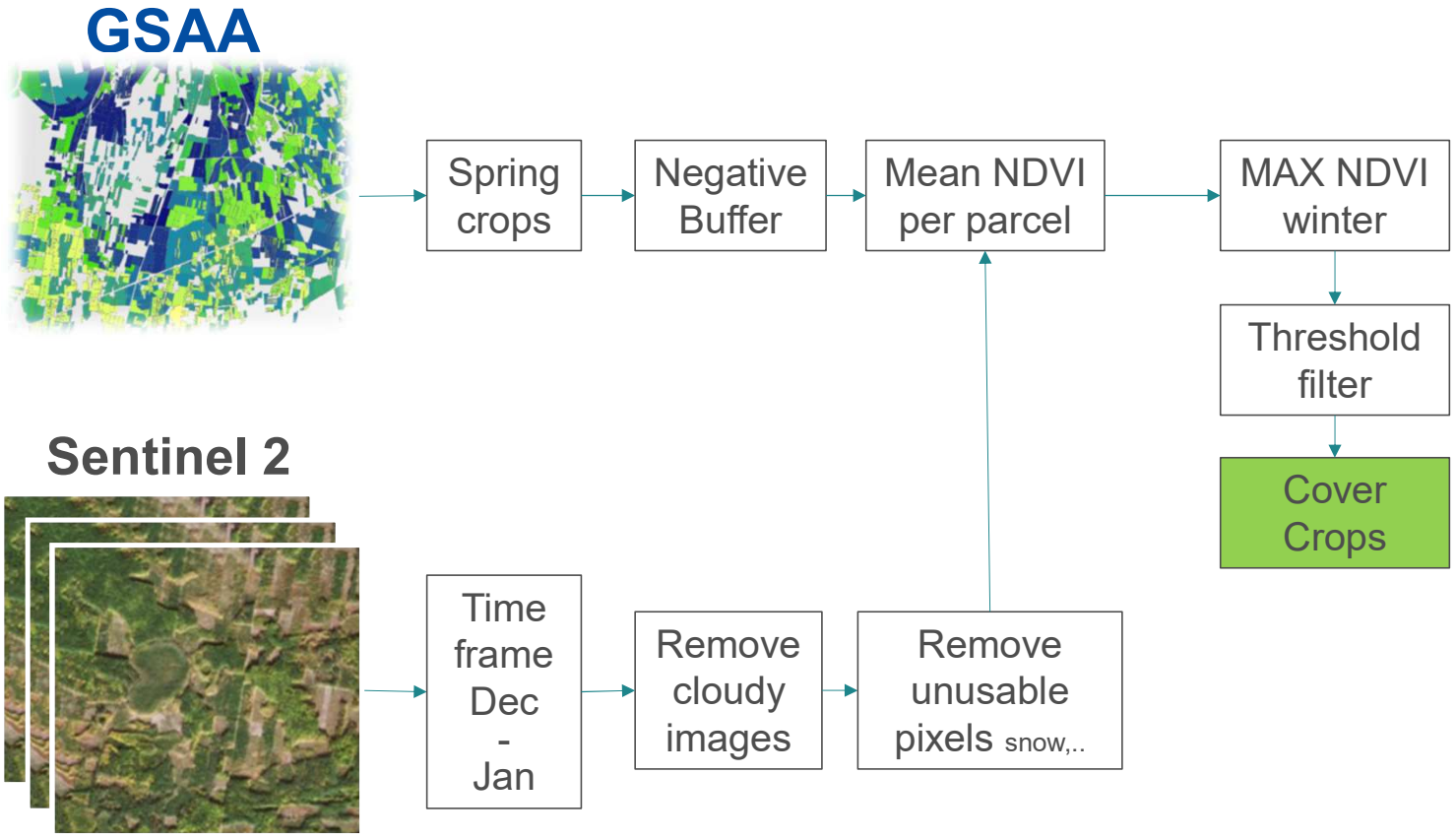


3. JRC Integrated Data-approach e.g. for agriculture



3. Data on agricultural practices

iMAP = **I**ntegrated **M**odelling platform for **A**gro-economic & resource **P**olicy analysis

SOME NUMBERS:

- **31** farming practices
- **29** impacts related to the environment and climate
- **4** impacts related to production

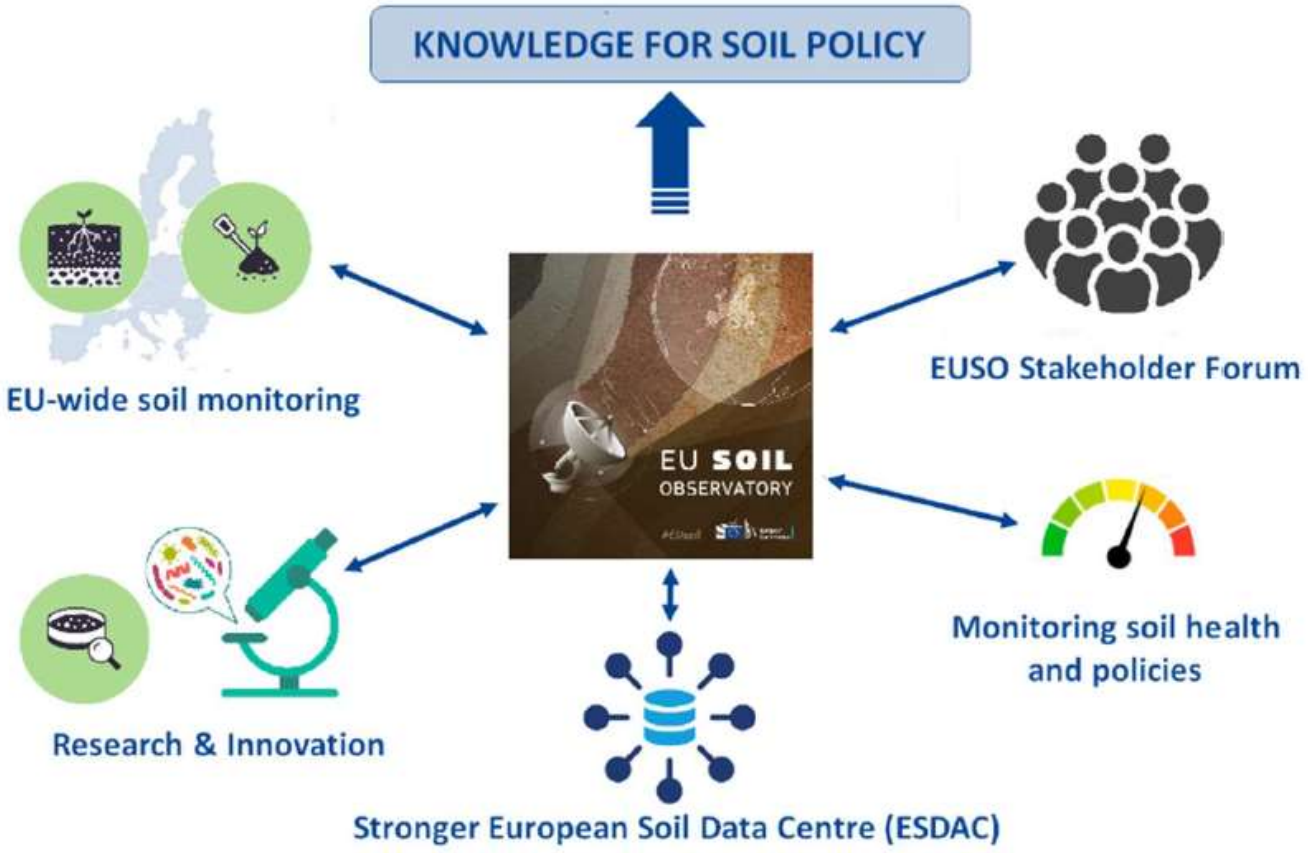
- Transparent and robust scientific evidence on the effect of farming practices on C sequestration and GHG emissions.
- Qualitative and quantitative results
- Trade-off

Farming practices		Acidification	Air pollutant (incl. NH3)	Anti-microbial resistance	Biodiversity	C sequestration	Ecotoxicity	Energy use	Eutrophication	GHG emissions	Land use	Nitrogen footprint	Nitrogen leaching and run-off	Nutrient excretions	Nutrients recovery	Odour	Pesticide use	Pests and diseases	Plant nutrient-uptake	Plastic residue	Pollination	Resource depletion	Soil biological quality	Soil erosion	Soil nutrients	Soil physico-chemical quality	Soil water retention	Water footprint	Water quality	Water use	Animal production	Crop yield	Grassland production	Production yield	N° of impacts per farming practice	N° meta-analyses included per farming practice
Farming systems	Agroforestry					■				■								■			■													9	33
	Organic farming systems	■	■			■	■		■	■	■		■					■				■	■	■		■					■			13	30
	Crop residue management		■			■				■			■					■	■			■	■	■		■			■		■			13	42
	Crop rotation					■				■								■	■			■	■	■		■					■			6	17
	Cover and catch crops				■	■				■			■					■	■		■	■	■	■		■			■		■			14	39
	Fallowing				■	■				■																					■			3	4
	Intercropping				■	■												■	■				■	■		■					■			8	25
	Landscape features				■	■							■					■			■		■	■		■		■	■	■	■			12	34
	Legouminous crops		■			■				■			■					■	■				■	■		■					■		■	11	73
	Mulching		■			■				■		■	■					■	■	■			■	■		■	■				■			16	41
	No tillage and reduced tillage		■		■	■				■								■	■				■	■		■			■		■			10	52
	Pesticide reduction strategies				■												■	■													■			4	10
Fertilisation strategies	Organic fertilisation		■			■				■			■						■				■		■						■			9	33
	Green manure									■			■					■							■						■			7	13
	Enhanced efficiency fertilisers		■							■			■						■												■			5	19
	Nitrification inhibitors		■							■			■												■						■			5	16
	Low ammonia emissions techniques for mineral fertilisation		■							■			■						■												■			5	5
Soil amendments	Soil amendment with biochar		■			■	■			■			■						■				■			■	■		■		■			11	41
	Soil amendment with lime and gypsum					■	■			■																■	■				■			7	7
Grassland	Grassland management		■		■	■	■			■			■					■	■				■	■		■					■	■		13	35
	Grassland conservation and restoration				■	■	■			■											■													5	10
	Grazing management				■	■	■			■								■					■			■	■			■		■		11	31
Livestock	Livestock dietary manipulation techniques		■					■		■	■		■	■		■														■				8	30
	Livestock housing techniques		■							■																				■				3	13
	Manure storage techniques		■							■			■																						3	14
	Manure processing techniques	■	■	■		■	■	■	■	■			■		■							■	■		■									13	17
	Manure land application techniques		■			■	■	■	■	■																					■			6	12
Wetland and peatland	Wetland management				■	■				■									■				■	■										6	8
	Wetland conservation and restoration				■	■				■			■					■					■	■			■		■					9	15
	Petland management				■	■				■													■								■			4	5
	Peatland conservation and restoration					■				■																								2	6
	Number of farming practices per impact	2	16	1	13	23	4	3	2	27	2	1	18	1	1	1	1	16	11	1	5	1	17	10	19	7	11	1	2	6	4	20	2	1	251	730

https://wikis.ec.europa.eu/display/IMAP/IMAP+Home+page

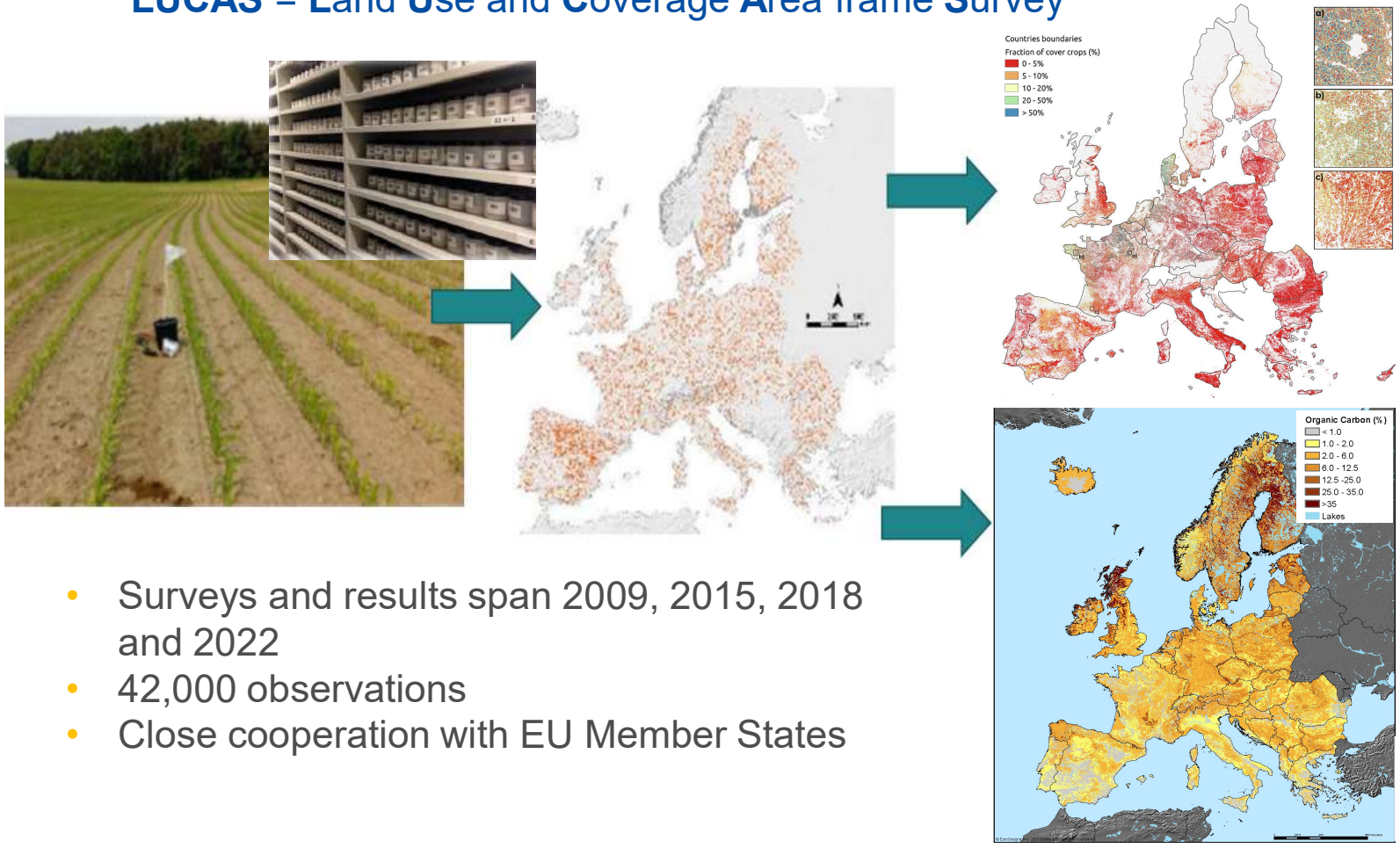
Systematic review of **meta-analyses** on the effect of **farming practices** on environment and climate

3. Knowledge at EU Soil Observatory



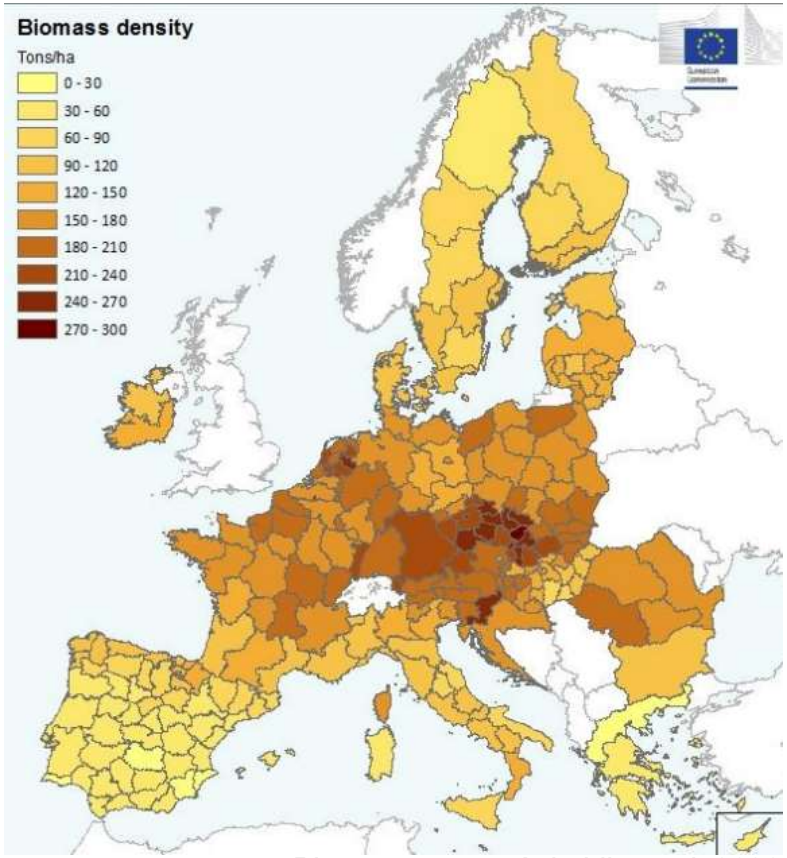
3. Data, for e.g. soil component

LUCAS = **L**and **U**se and **C**overage **A**rea frame **S**urvey

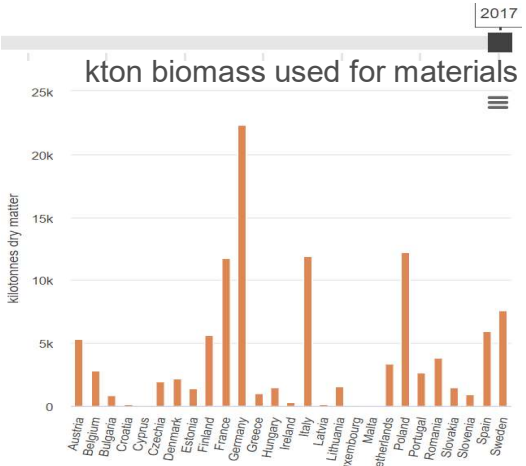


- Surveys and results span 2009, 2015, 2018 and 2022
- 42,000 observations
- Close cooperation with EU Member States

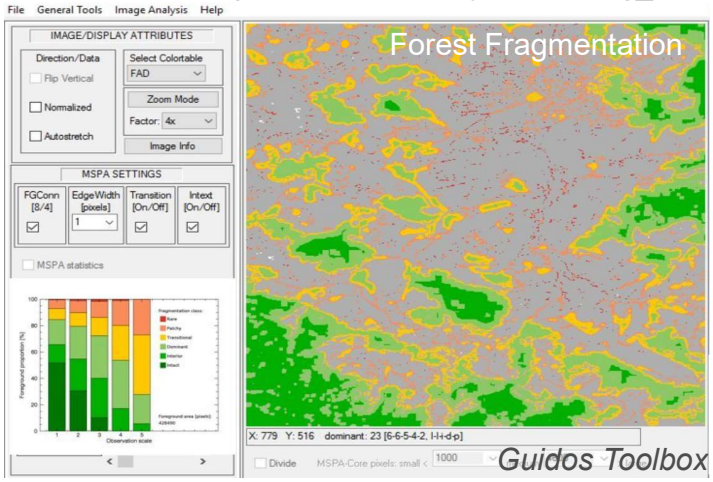
3. Data for e.g. biomass/ forest



Biomass report, Avitabile et al. 2023



https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en



Guidos Toolbox

3. JRC expertise on forest monitoring and modeling

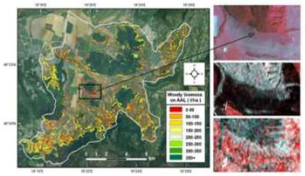
ICP FORESTS

ICOS INTEGRATED CARBON OBSERVATION SYSTEM

opernicus Europe's eyes on Earth

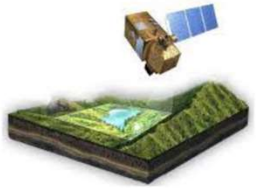
1

Properties at t0
EO based mapping standing biomass, stocks, and biophysical properties



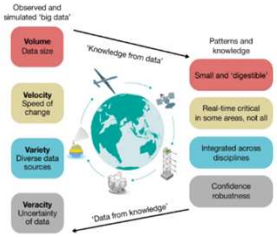
2

Management practices
from declaration and benchmarking of EO based products



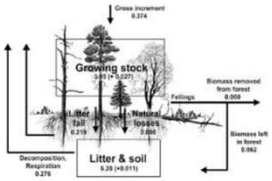
3a

Develop **hybrid modelling tool** to ingest EO information and rapidly calculate C fluxes
Data driven productivity-water use model linked with soil C model



3b

Carbon Budget Model
applied at parcel level with included climate effects and EO driven



4

Baseline and reference runs

5

Assesment of C sequestration at parcel level

EUROPEAN NATIONAL FOREST INVENTORY NETWORK

LTER Europe
European Long-Term Ecosystem Research Network

European Environment Agency (EEA): Supporting the implementation of the LULUCF regulation

© Stefan Wilmer, Well with Nature /EEA - A bed in the cornfield

CET3: Carbon Emissions and Removals Monitoring Group (Est. 2022) - Climate Change, Energy and Transport (CET) Programme of the EEA

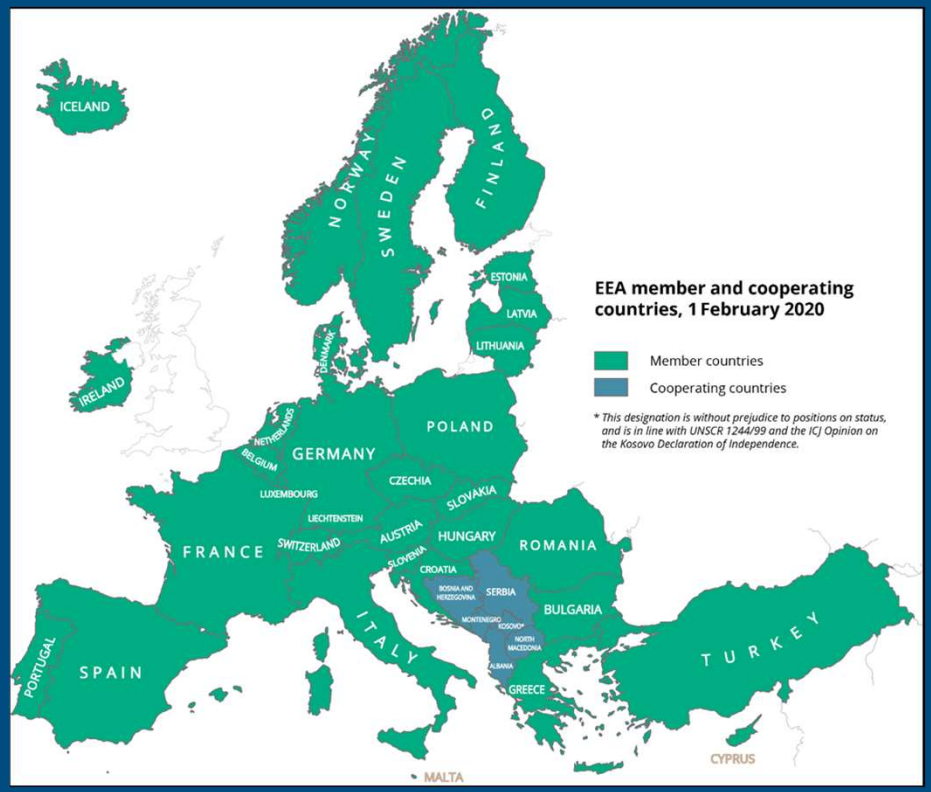
@

Carbon Removals Expert Group
Second meeting
21 and 22 June 2023

European Environment Agency

About the European Environment Agency

The European Environment Agency (EEA) is an agency of the European Union that delivers knowledge and data to support Europe's environment and climate goals.



Biodiversity and ecosystems (NIVA)

Climate change adaptation and LULUCF (CMCC)

Climate change mitigation (VITO)

Data integration and digitalization (EAA)

Human health and the environment (NILU)

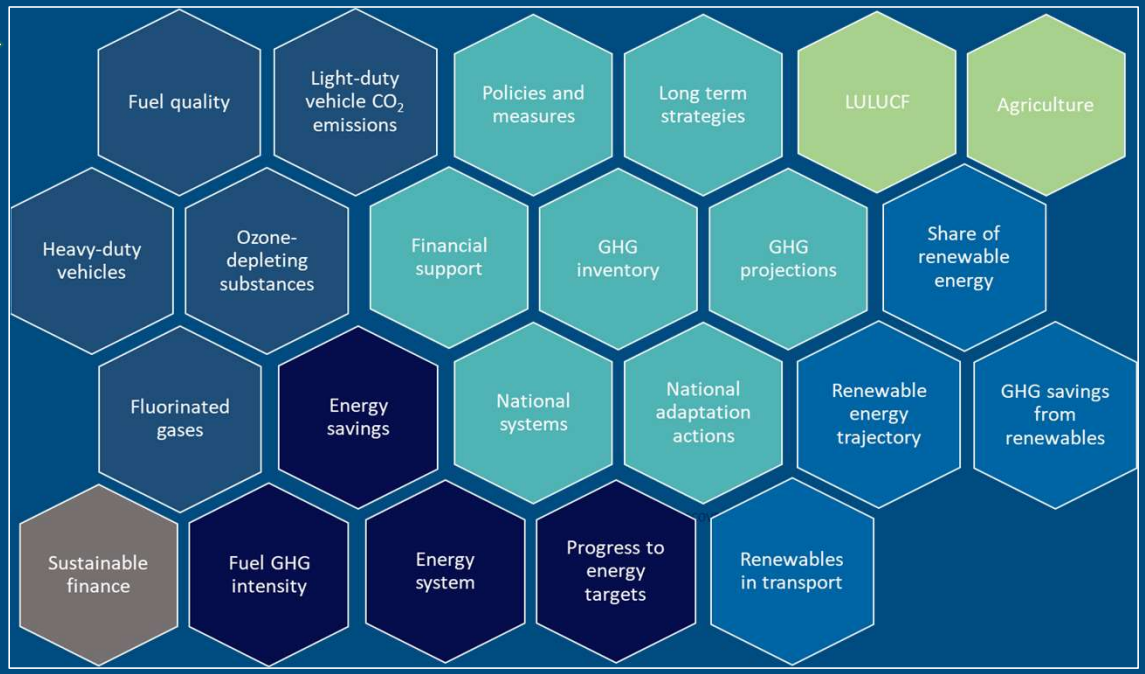
Resource use and circular economy (VITO)

Sustainability transitions (SYKE)

EIONET European Environment Information and Observation Network

European Environment Agency

Core business: Data and monitoring that track climate progress and assessments



European Environment Agency

CET3: Carbon Emissions and Removals Monitoring Group (Est. 2022)

Mandate: providing reliable data on greenhouse gas emissions and carbon removals at EU and MS level, supporting the implementation of the LULUCF regulation, the EU carbon removal certification framework, and the performance of assessments on options to increase carbon removals that do not lead to significant negative consequences on the environment.

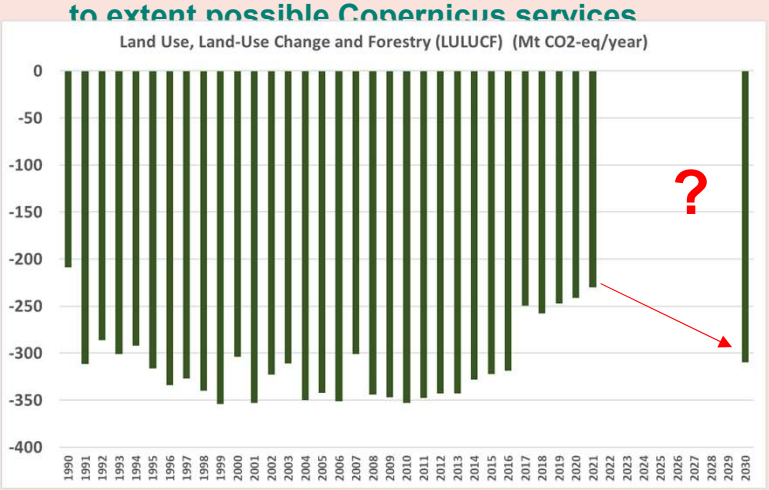
Expertise: GHG emissions; carbon removals; monitoring, reporting, verification (MRV), agriculture, forestry, land use, geographic information systems, spatial data integration, policy making, international negotiations, cross-cutting assessments.

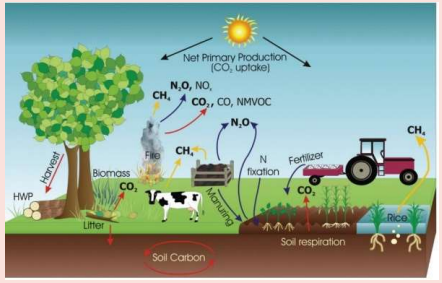
European Environment Agency

Priorities for EEA/CET3 in the coming years

EEA being instrumental in the implementation of the LULUCF legislation.

- **Perform annual quality checks on agriculture and LULUCF emission inventories and capacity building activities**
- **Lead a comprehensive review of the agriculture and LULUCF sector inventories in 2025, 2027 and 2032 and follow up actions**
- **Ensure gradual improvement of greenhouse gas inventories for the agricultural and LULUCF sector: (i) facilitate improved and annual geographic tracking of carbon pools by Member States and (ii) develop a pan-European datasets for progress tracking and assessment studies using to extent possible Copernicus services**





Land based carbon sink declining due to for example EU forest age structure, harvest and climate impacts
(data: EU GHG inventory, EEA, 2023)

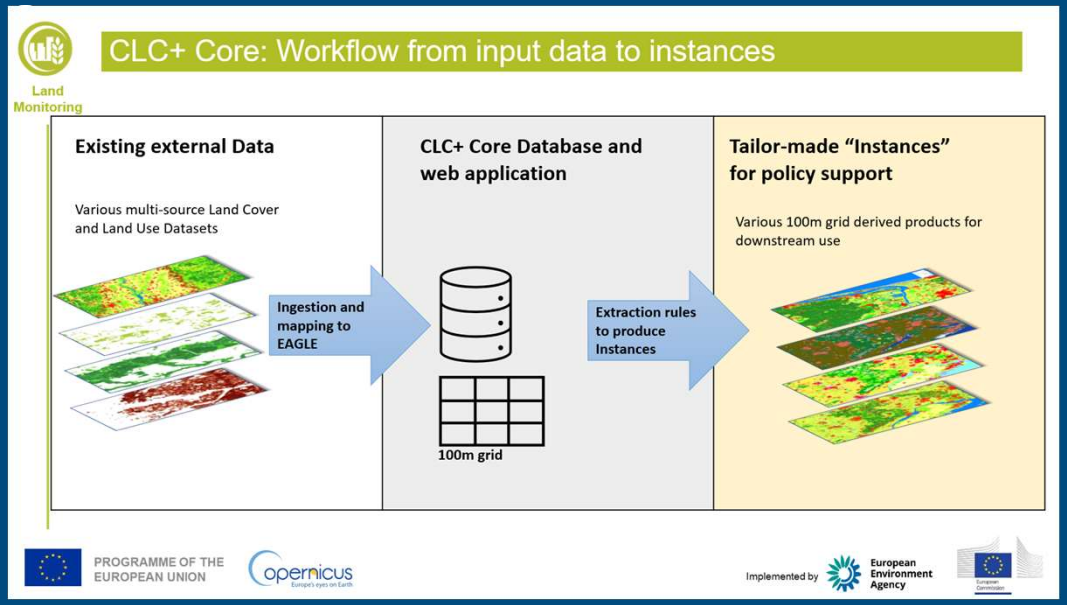
EEA as one-stop shop of reliable greenhouse gas emissions and carbon removal data and supporting EU and international Monitoring, Reporting and Verification (UNFCCC)

- **EU annual greenhouse gas emission inventory**
- **EU QA/QC system to ensure reliability of MS inventory data (initial checks and review)**
- **Providing support to EC in safeguarding transparent international (UNFCCC) reporting obligations**

EEA supporting policy implementation to reduce GHG emissions and increase carbon removals.

- **Support the setup and implementation of carbon farming certification in the EU**
- **Targeted assessments on policy options to make the AFOLU sector delivering long term net negative emissions**
- **Assess the impact of increased need of carbon removals on other Green Deal objectives**

Improved geographical tracking LULUCF – Copernicus Land Monitoring



Principle – Improved geographic tracking carbon pools

- EEA is developing an Earth Observation based "LULUCF instance" product:
  - Quality checks/MRV MS data at EEA: independent proxy for LULUCF activity data (land conversion matrix analysis)
  - Emission Inventory Improvements MS: available for country experts to explore and use also for their own LULUCF related purposes
  - Assessments performed by EEA: data for supporting pan-European analysis on carbon removals and options to increase those

Planning

- Significantly improved 2018 beta version now available
- Testing of beta version and comparison of statistics with country reported data in preparation
- 2021 inventory year LULUCF instance in Q4/2023
- Production in sync with inventory years from late 2024 provision of 2022/2023 inventory year (able to support comprehensive review in 2025)
- outreach to countries for cooperation/feedback and possible training

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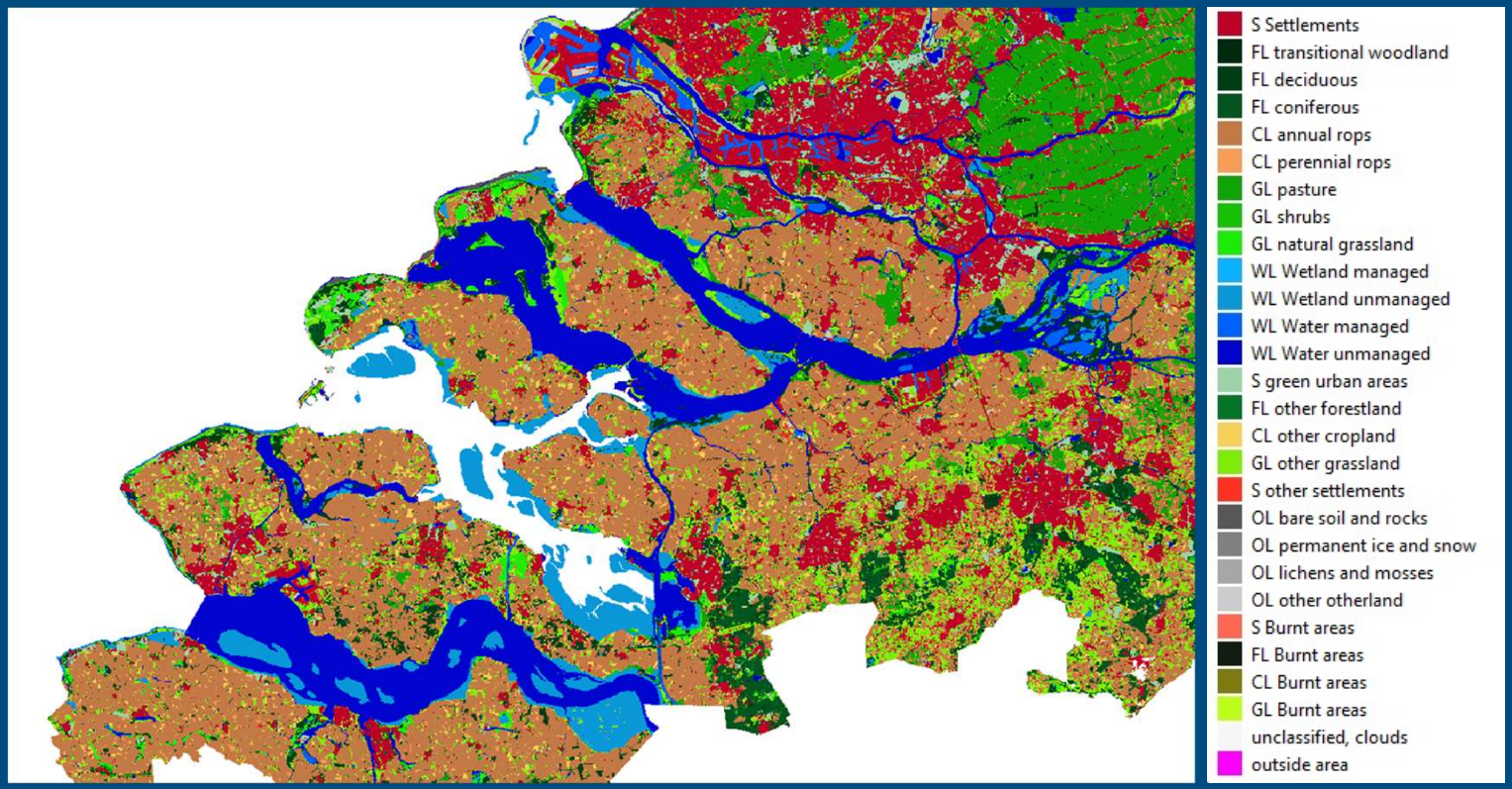
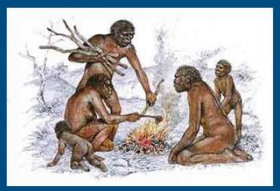
First example beta (final prototype) 2018 LULUCF instance (100 m resolution)



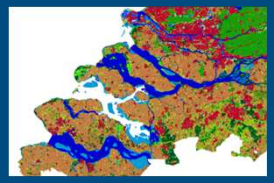
- Emissions = activity data x emission factor !
- Quality of LULUCF inventories and carbon removal data also need representative (100 m?) data on carbon stocks and fluxes for a given year.

European Environment Agency

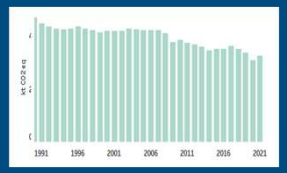
Key products to come in 2023 and 2024



2023: **The European biomass puzzle** – an EEA report highlighting opportunities and challenges of the role of biomass in the EU economy in relation to the objectives of the European Green Deal, in particular on reaching the climate objectives.



2023/2024: **LULUCF instance** - Copernicus Land Monitoring Service (CLMS) geospatial data to support reliable activity data for LULUCF sector calculations. Detailed (100 meter grid) data on land cover and land use data covering the EU and used for QA/QC, capacity building and assessments.



2024: **Annual European Union greenhouse gas inventory 1990 – 2022 and inventory report 2024** -
official inventory submission of the European Union (EU) for 2023 under the United Nations Framework Convention on Climate Change (UNFCCC).

2024: **Land-based carbon removal options in Europe** –EEA report (a first of a bi-annual series) presenting methods, datasets and a selection of land management measures to provide a pan-European map of present-day land-carbon stock and removals and including maps to illustrate where in Europe selected measures can have a large impact on carbon removals.

European Environment Agency

Thank you for your attention !

More information?

- direct access to data and analysis on key areas for achieving climate neutrality, based mainly on official information submitted by European countries to the European Environment Agency: https://climate-energy.eea.europa.eu/
- EEA greenhouse gas data viewer: https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer
- Copernicus Land Monitoring Service CLC+: CLC+ — Copernicus Land Monitoring Service

Dr. John van Aardenne
Head of Group - Carbon Emissions and Removals Monitoring
Climate Change, Energy and Transport Programme
European Environment Agency

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eea.europa.eu
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European Environment Agency

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Mission Soil, its role in carbon removals and related Horizon Europe projects

Kerstin Rosenow
Head of Unit – Research and Innovation
DG Agriculture and Rural Development
European Commission

#EUmissions #HorizonEU #MissionSoil

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Horizon Europe
R&I Missions

Linking EU's research and innovation to major societal needs; with strong visibility and impact

A mission is a portfolio of actions across disciplines intended to achieve a **bold and inspirational and measurable goal** within a set timeframe, with **impact** for society and policy making as well as relevance for a significant part of the European population and wide range of European citizens.

Horizon Europe defines **5 missions areas**:

Adaptation to Climate Change	Cancer	Climate-neutral and Smart Cities	Restore our Ocean and Waters	Soil Deal for Europe
				

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Soil health issues today

Cropland soils **losing carbon** at a rate of 0.5% per year; 50% of peatlands drained and losing carbon – contributing to the climate crisis

24% of land with **unsustainable water erosion rates**

25% of land at High or Very High risk to **desertification** in Southern, Central and Eastern Europe in 2017

2.8 million potentially **contaminated sites** posing major health risks

65-75% of agricultural soils with nutrient inputs at levels risking **eutrophication of soils and water** and affecting biodiversity

The **costs** associated with **soil degradation** in the EU exceed **50 billion €** per year

The effects of climate change put further pressure on soils and accelerate land degradation!

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Mission goal and specific objectives

100 living labs and lighthouses to lead the transition towards healthy soils by 2030

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How is the Mission implemented?

Activities under **four building blocks** to address **soil health** and its **drivers**

Communication, training and advise targeted to different target groups; specialised “soil advisors”

Knowledge, data, technologies and infrastructures to support practices and business models for soil health

Harmonization **of soil health monitoring and reporting** across Europe; contribution to European Soil Observatory

A comprehensive **network of real-life sites** for co-creating, testing, demonstrating and upscaling of solutions

Co-implementation of the Mission by: researchers, land managers, regions, businesses, policy makers, citizens and international partners

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Carbon farming in the Mission R&I programme (1/2)

- **Coordination** of and **support** for current/future CF initiatives
  - Project **ORCaSa** (2022-2025): organising an international research consortium on soil carbon (incl. non-European partner countries/institutes)
  - Project **CREDIBLE** (2023-2026): setting up a 'network of networks' for favouring transparency, environmental integrity, and standardisation in soil carbon accounting
- Monitoring, reporting and verification (**MRV**) of soil carbon and greenhouse gas balance
  - Projects **MRV4SOC** (2023-2026) and **MARVIC** (-2027)
  - Common scope; somewhat different emphases (e.g. agricultural and/or other soils, utilisation of AI tools)

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Carbon farming in the Mission R&I programme (2/2)

- Carbon farming **living labs**
  - WP 2023 – call open until 20 September
  - 12M € earmarked for project involving 4-5 living labs, 3+ countries (Member States or Associated Countries)
  - Each living lab including ~10-20 experimental sites
- Other Mission activities are more indirectly related, e.g.:
  - Cooperation with the Joint Research Centre on soil **monitoring**
  - Incentives and **business models** for soil health (WP 2021, 3 projects)

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Other relevant projects: *Horizon 2020* (2014-2020)

- European Joint Programme *Towards climate-smart management of agricultural soils*: **EJP SOIL** (2020-2025)
  - Co-funded by EU and Member States/neighbouring countries (40M € each)
  - 26 internal (among consortium members) and 18 external projects concluded or ongoing
  - Focus on soil carbon sequestration and climate change mitigation
  - Cf. separate presentation this afternoon

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Other relevant projects: Horizon Europe *Cluster 6*

- Project **ClieNFarms** (2022-2025):
  - Innovation Action for climate-neutral and climate-resilient farms across Europe; incl. soil sampling methodology to measure organic carbon
- Multi-layer demonstration network on climate-smart farming
  - Pilot farms (project **Climate Farm Demo**, 2022-2029)
  - Advisory services (project **ClimateSmartAdvisors**, 2023-2030)
  - Research stations (WP 2023, TBD)
- **Paludiculture** (WP 2024, call opening in October)
  - Socio-economic analysis and modelling
  - Large-scale demonstrations

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Stay tuned!

- **Info Days** on Cluster 6 Work Programme 2024, 27-28 September 2023
- European **Mission Soil Week**, Madrid, 21-23 November 2023
- **Mission** Work Programme **2024** – under development

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Thank you!

For further information and questions please contact the Mission Secretariat:

EU-HORIZON-MISSION-SOIL@ec.europa.eu

#MissionSoil #EUmissions #HorizonEU

Guiding questions – learning from existing methodologies

General

- Best balance accuracy / costs
- Key to successful uptake
- Need for more innovation

Quantification

- Optimal mix between different data inputs?

Baseline

- How to define 'Highly standardized' baseline?
- How often should it be updated?

Additionality

- Most used additionality approaches?

Long-term storage

- Most used liability approaches?
- Length of monitoring period?

Sustainability

- How to ensure no-harm?
- How to reward co-benefits?

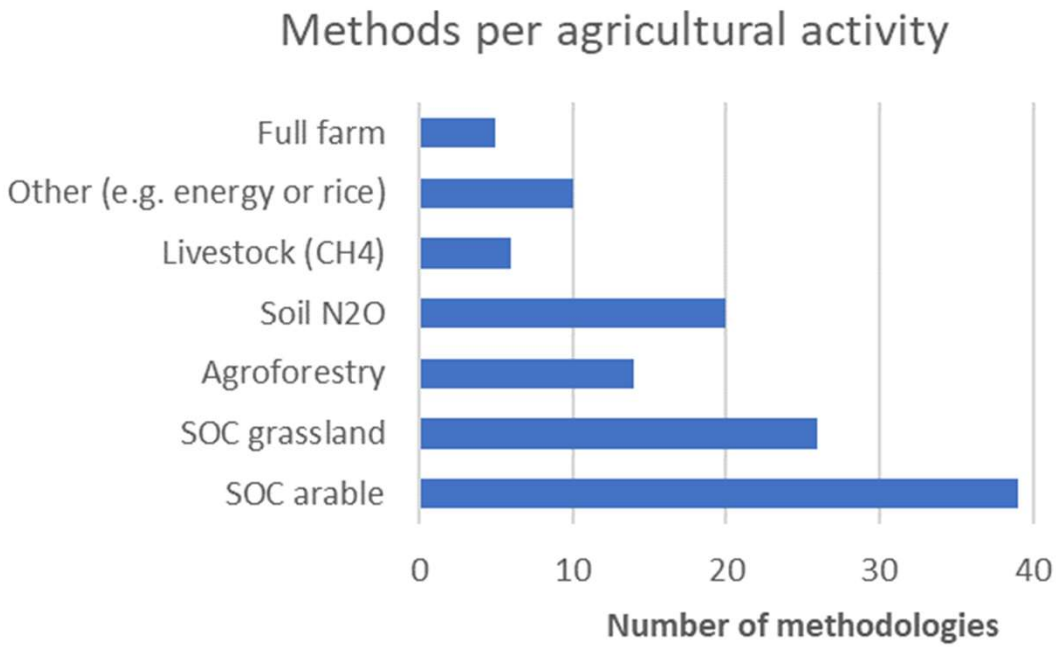
Review existing Carbon Farming certification methodologies - Agriculture

Carbon Farming meeting 21 June 2023

Jan Peter Lesschen (WUR)

Results of survey for Agricultural land management

- 54 responses
- 46 individual methodologies
  - 24 international focus
  - 22 national focus (11 countries)
- 26 methodologies assessed on QU.A.L.ITY criteria



Overview of assessed methodologies

VERRA
Indigo Ag - Verra
eAgronom - Verra
Seqana - Verra

Gold Standard

CAR Soil Enrichment Protocol

Nori Croplands

Ormex

Esca factor - EU Renewable Energy Directive

Climate Farmers

Soil Capital Carbon

Carboneg

Boomitra

CAR Avoided grassland conversion

Avoided conversion of Grassland - ACR

Trinity NCM

AgreenaCarbon Project

PanXchange Carbon

AUS Emissions Reduction Fund

C-farms

Label Bas Carbone - Grandes Cultures
Label Bas Carbone - Plantation de vergers
Label Bas Carbone - Carbon Agri
Label Bas Carbone - Haies

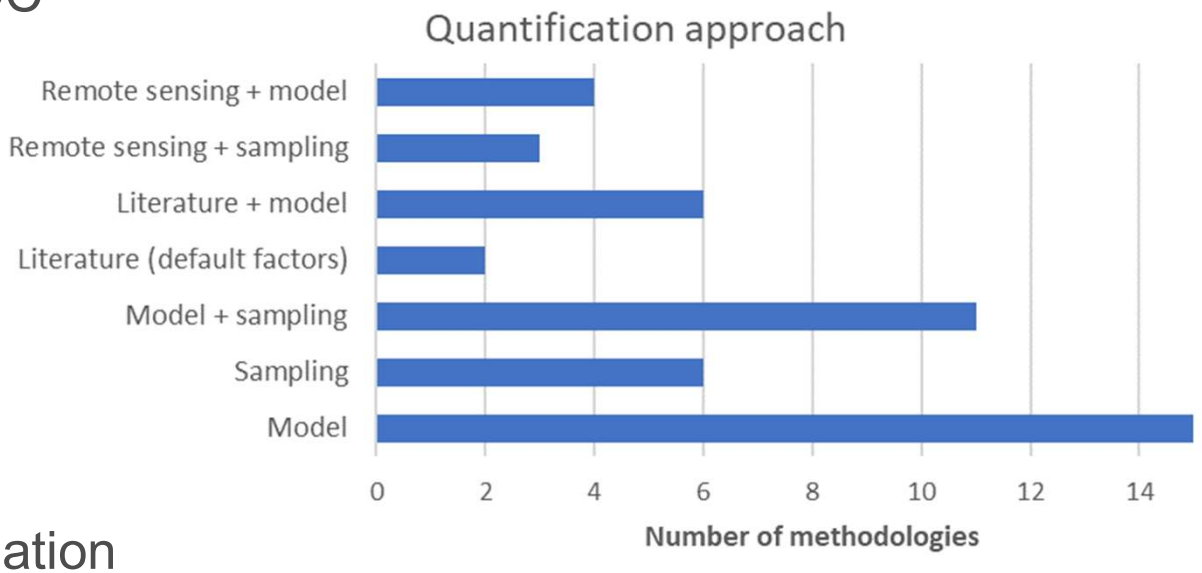
ReGeneration Soil Carbon

SNK Blijvend Grasland (Permanent pasture)

QUANTIFICATION - Approach

Approaches for quantifying SOC change

1. Default factors
2. Soil carbon model
3. Remote sensing
4. Soil sampling over time



Best practice would be combination of approaches (model, sampling and remote sensing)

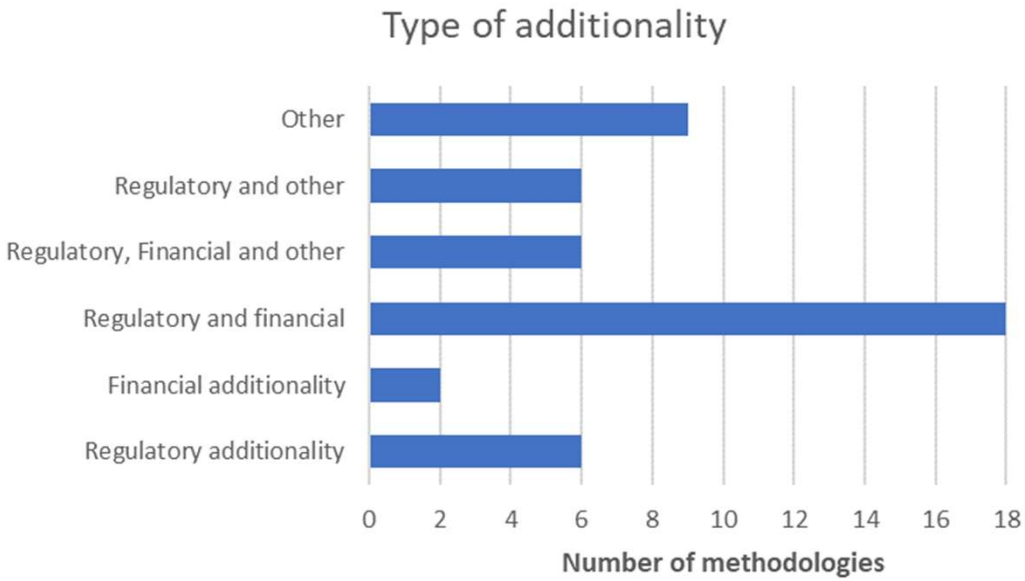
"No one trusts a model, except the man who wrote it; everyone trusts an observation, except the man who made it" Harlow Shapley (astronomer)

QUANTIFICATION - Baseline

- Most baselines are project based
- Few methodologies have standardised baseline
  - For regionalised baseline data is still lacking
  - Some just assume baseline zero, all SOC stock increase is additional

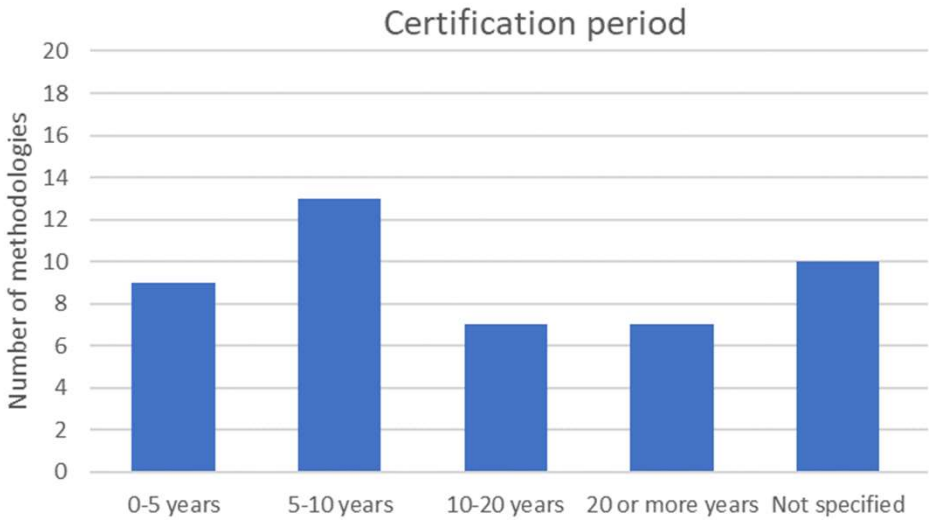
Additionality

- Both regulatory and financial additionality are addressed in most methodologies
- VERRA method:
  - Regulatory surplus
  - Barrier analysis
  - Common practice: 20% adoption as threshold
- For financial additionality need for further harmonisation, e.g. are CAP subsidies such as eco-scheme payments allowed?



Long-term storage

- Certification period varies
- Minimum of at least 10 years or longer would be recommended
- Most methodologies use buffer approach (5%-50%)
- Remote sensing is used for monitoring activity in 7 methodologies



Sustainability

- Most methodologies address the no-harm principle
- Co-benefits are often mentioned, based on literature and stakeholder involvement, but not monitored
- Some methodologies refer to the SDGs, but often very general and reporting on voluntary basis
- Few methodologies, e.g. Trinity NCM and Climate farmers, explicitly monitor biodiversity impacts

First conclusions

QU.
- Different quantification approaches are used, combination of model, soil sampling and remote sensing is recommended
- Most methodologies use project-based baselines, good examples of standardised baseline are lacking

A.
- Both regulatory and financial additionality are addressed in most methodologies

L.
- Certification period varies among methodologies, periods less than 10 years are too short to ensure long-term storage

ITY
- Most methodologies comprise no harm principal, only few go beyond and require also improvement for e.g. biodiversity

Thank you

Contact:

janpeter.lesschen@wur.nl

Inventory of CF schemes

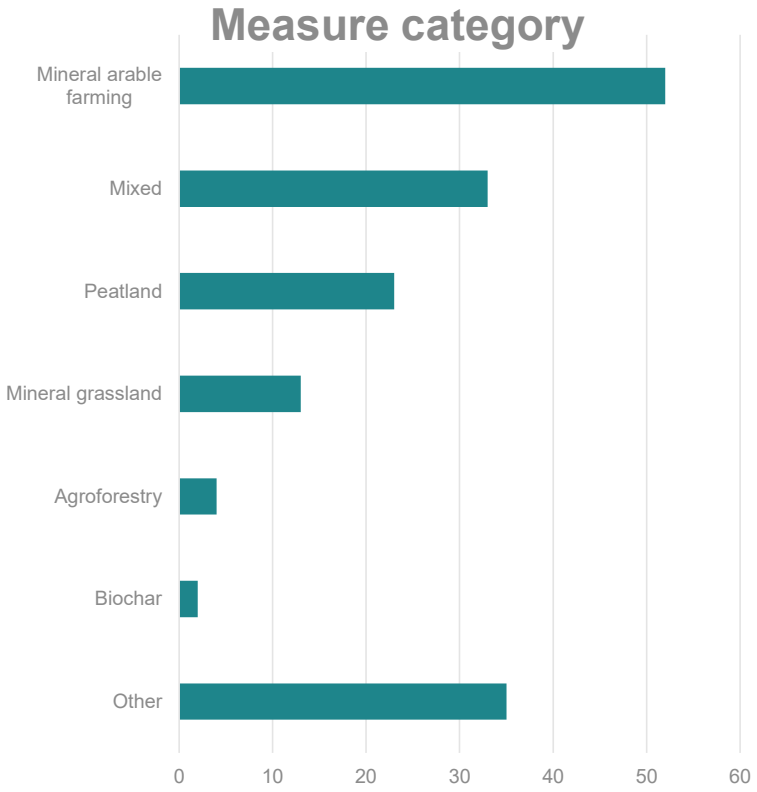
AARHUS UNIVERSITY
DEPARTMENT OF AGROECOLOGY

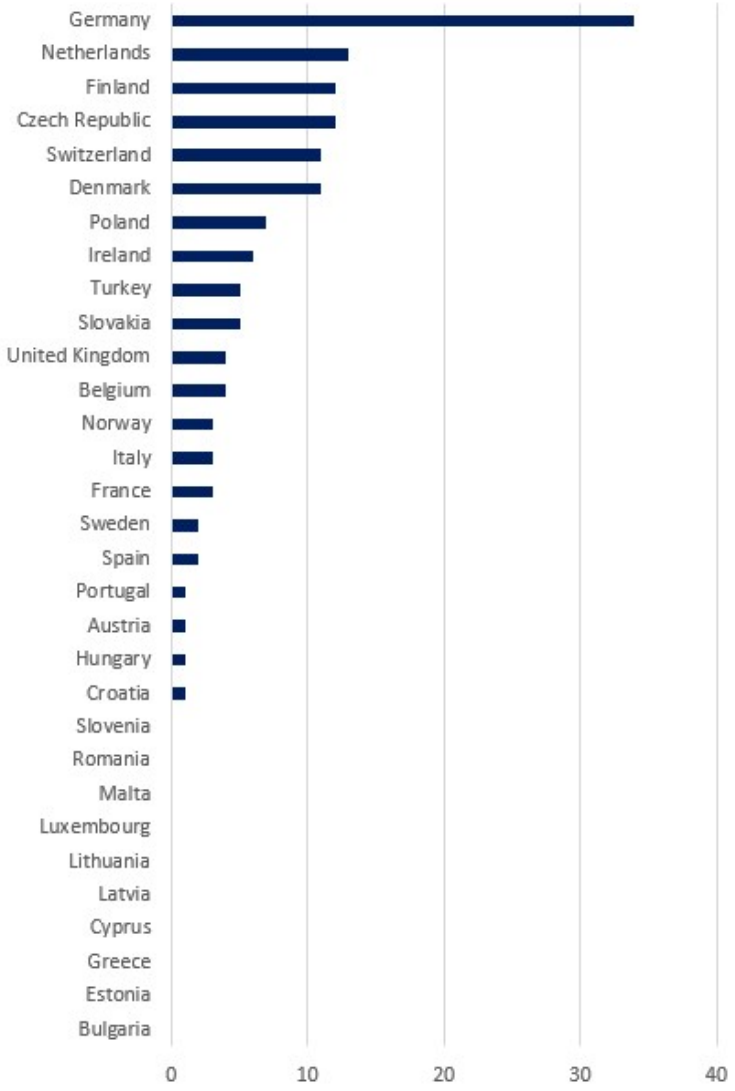
11 JUNE 2023

MARTIN HVARREGAARD THORSØE
RESEARCHER

Road4Schemes Inventory

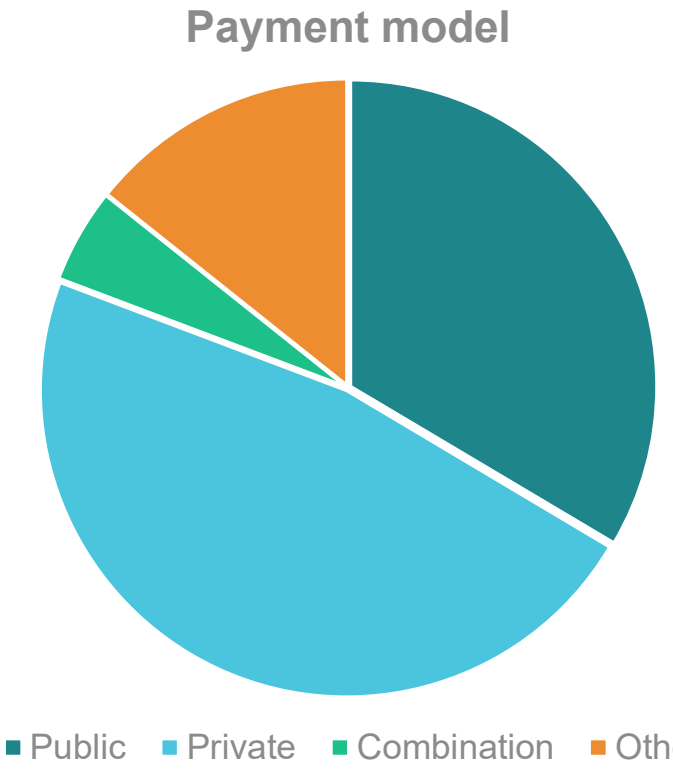
- Measures and countries

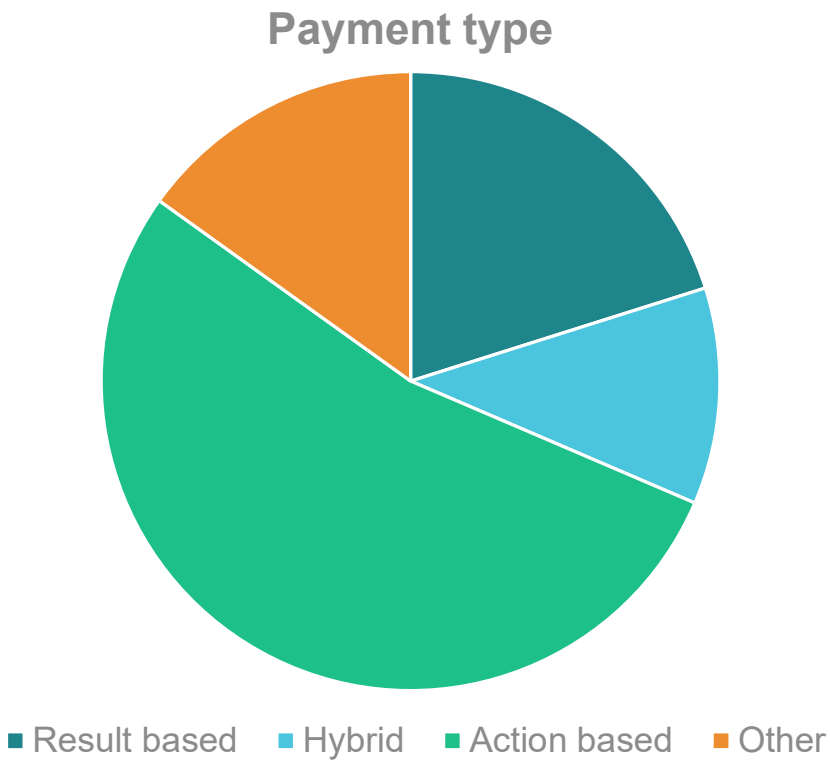




Road4Schemes Inventory (2)

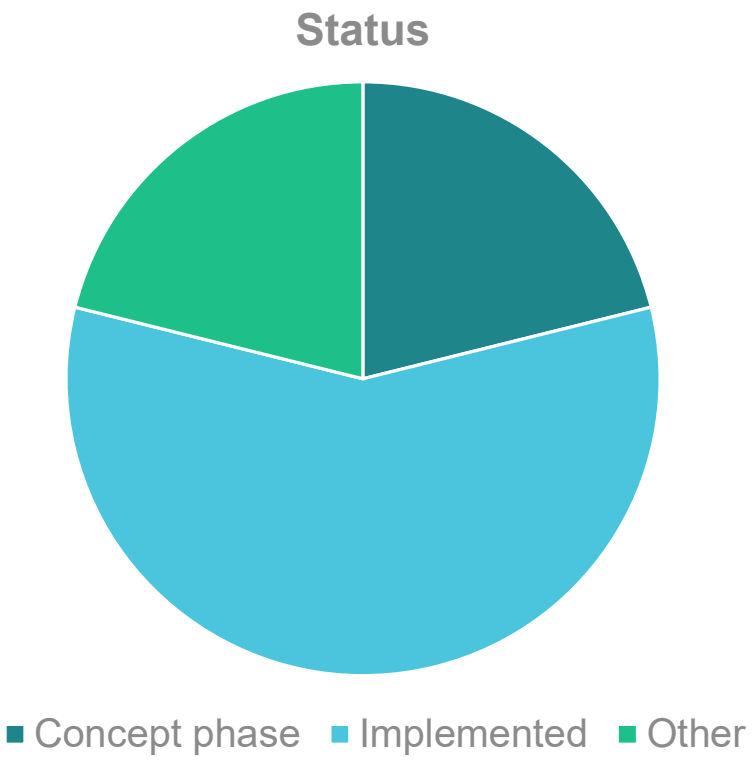
- Payment model and type





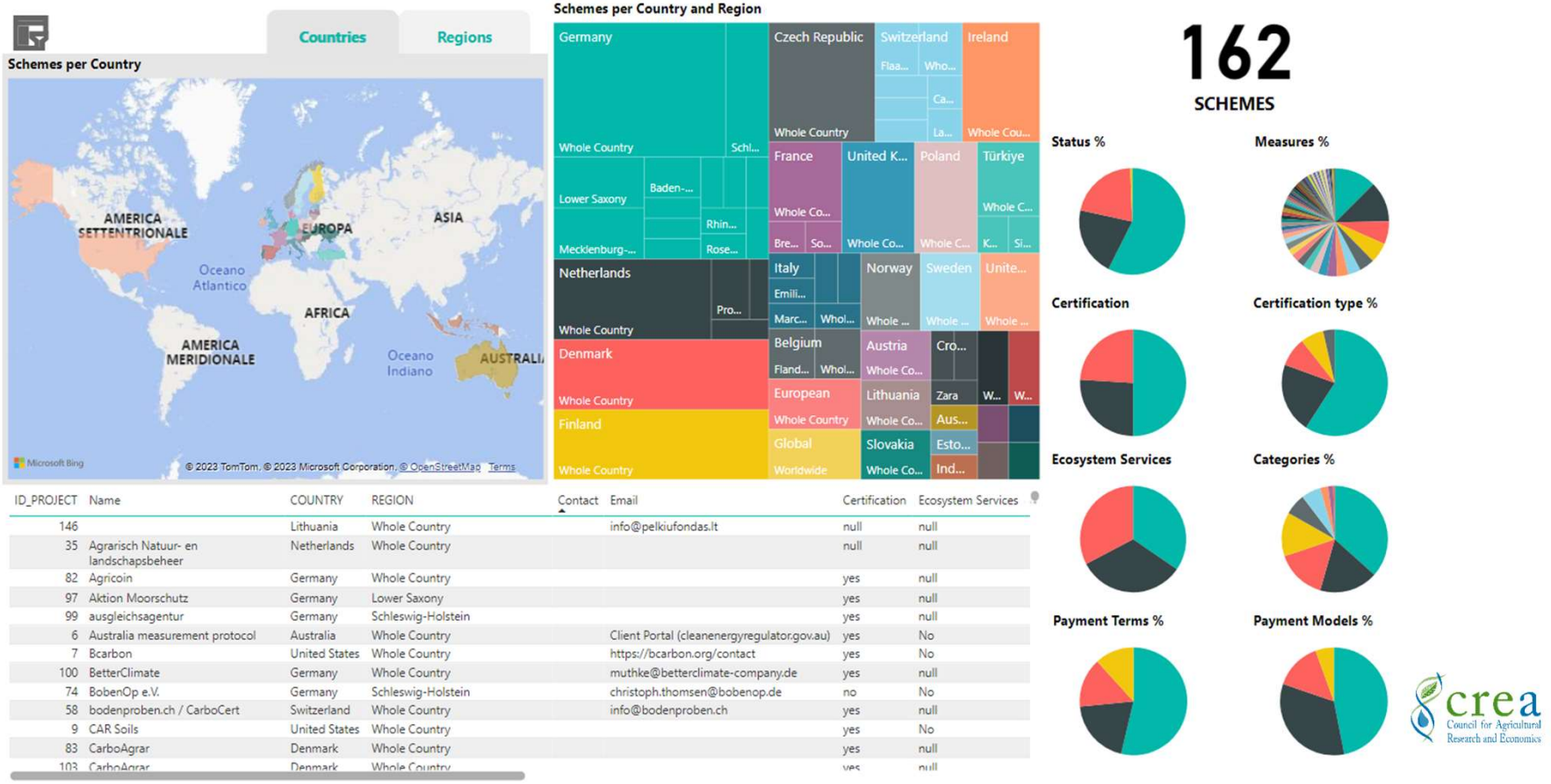
Road4Schemes first Inventory (2)

- Implementation status and focus



Road4Schemes first Inventory (3)

- web registry of CF schemes



ID_PROJECT	Name	COUNTRY	REGION	Contact	Email	Certification	Ecosystem Services
146		Lithuania	Whole Country		info@pelkiufondas.lt	null	null
35	Agrarisch Natuur- en landschapsbeheer	Netherlands	Whole Country			null	null
82	Agricoin	Germany	Whole Country			yes	null
97	Aktion Moorschutz	Germany	Lower Saxony			yes	null
99	ausgleichsagentur	Germany	Schleswig-Holstein			yes	null
6	Australia measurement protocol	Australia	Whole Country		Client Portal (cleanenergyregulator.gov.au)	yes	No
7	Bcarbon	United States	Whole Country		https://bcarbon.org/contact	yes	No
100	BetterClimate	Germany	Whole Country		muthke@betterclimate-company.de	yes	null
74	BobenOp e.V.	Germany	Schleswig-Holstein		christoph.thomsen@bobenop.de	no	No
58	bodenproben.ch / CarboCert	Switzerland	Whole Country		info@bodenproben.ch	yes	null
9	CAR Soils	United States	Whole Country			yes	No
83	CarboAgrar	Denmark	Whole Country			yes	null
103	CarboAgrar	Denmark	Whole Country			yes	null

crea
Council for Agricultural Research and Economics

Scheme characteristics

	Farm payments	Supply chain	Voluntary Markets
Scheme types	Activity	Result/Whole farm/Activity	Activity/Result/Hybrid
Contract duration	Typically 1 yr	1-10 yr	(1) 5-10 yr
CO_2e price	NA	€20-€50	€30-€500
Ownership to reduction	Government	Value chain	Farmer
Additional ESS	NO	Some schemes	NO

Carbon Farmers

- is result based carbon farming relevant for farmers?

Highest interest (DK, TR): New revenue stream

Medium interest (CZ)

Mixed and low interest (particularly DE, NL, BE): 1) Lack of knowledge, 2) monitoring uncertainty and costs and 3) additional stress (weather extremes)

General conclusion

Result-based payments for carbon farming is seen as potential additional revenue not an incentive for CF.

Questions

1. Enough knowledge to accurately document result-based CF?
2. Are the payments reliable and do farmers get a fair share?

Ecologic Institute
Science and Policy
for a Sustainable World

The challenges of certifying carbon farming

Evidence from existing soil carbon removal certification mechanisms

- Aaron Scheid, Fellow, Ecologic Institute

- **2nd Expert Group meeting, 21-22 June 2023**

Overview of the research project

What is the potential of NbS for climate mitigation on a global scale?	- Assessing the potential of Nature-based Solutions for avoiding, reducing and removing GHG emissions ✓ Study published in January 2022[1]
What is the potential of soil mitigation in the EU and what are the challenges?	- Analysing specific measures for climate-friendly soil use ✓ 10 factsheets to be published soon[2]
What kind of funding instruments should be used to promote climate-friendly soil management? Should market-based approaches play a role?	- Analysing approaches to support measures for climate-friendly soil use, particularly results-based payment approaches, including offsetting ✓ Report and 14 factsheets on key issues for approaches to support climate-friendly soil use[3] **Analysis of 10 selected methodologies for crediting climate-friendly soil management (forthcoming)**
What is the current legal framework? Which developments are ongoing?	- Analysis of legal and political framework for climate-friendly soil use ✓ Assessment of the QU.A.L.ITY criteria[4]

[1] https://www.umweltbundesamt.de/publikationen/nature-based-solutions-global-climate-protection
[2] www.umweltbundesamt.de/publikationen/Role-of-soils-in-climate-change-mitigation
[3] www.umweltbundesamt.de/publikationen/Funding-climate-friendly-soil-management
[4] https://www.ecologic.eu/19080

Objective

- Assessment of 10 methodologies for crediting climate-friendly soil management
- Assessment against key aspects that should be accounted for when designing policy instruments that support the implementation of climate-friendly soil management measures
- Alignment with QU.A.L.I.TY criteria

Not a quality assessment of the crediting programmes and their certificates

Evaluation criteria

- Quantification

- Robust quantification methods in place?
- Process for adoption of new methodologies?
- Leakage risk addressed?
- Treatment of uncertainty?
- Conservativeness principle applied?
- Length of crediting period?

Double-counting

- Well-functioning registry in place?
- Documentation of credits use?
- Provisions to avoid double registration, double issuance and double claiming?

Additionality

- Additionality requirements in place?
- Rules for assessing whether legal requirements are in place?
- Rules for assessing financial additionality?

Non-permanence

- Duration of liability post crediting?
- All types of reversals to be compensated?
- Project owner (primarily) liable of compensating
- Operation of buffer pool?
- Risk assessment in place?
- Rules in case of bankruptcy?

Env. / social impacts

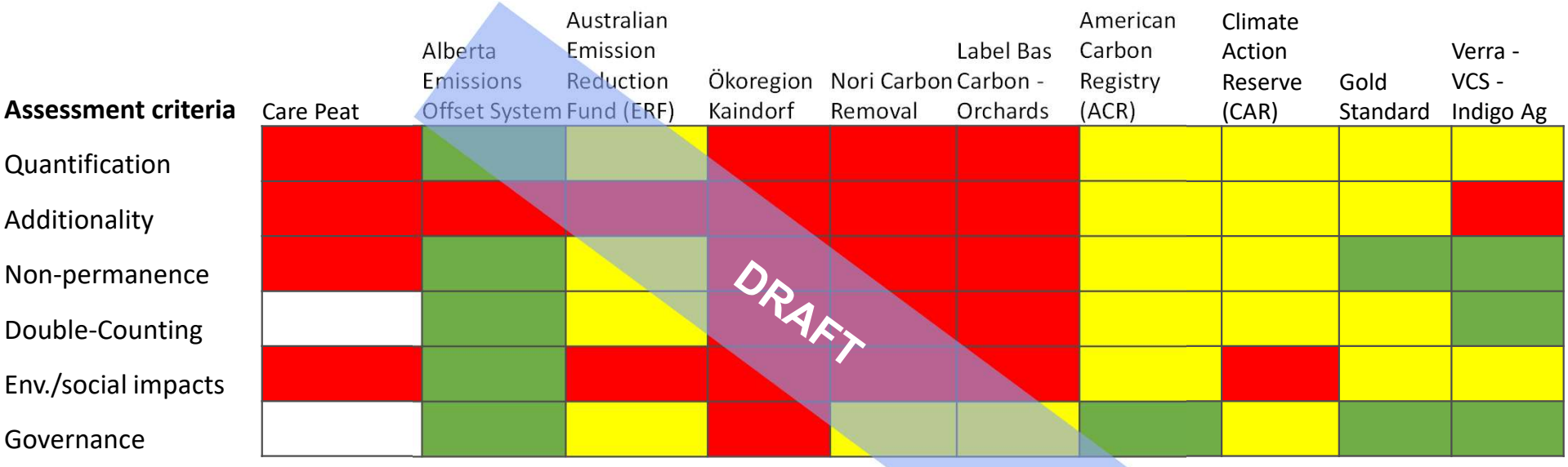
- Identify and mitigate negative env./soc. Impacts?
- Env./soc. Safeguards in place
- Impacts assessment?
- Monitoring of env./soc. Impacts?
- Grievance mechanism in place?
- Stakeholder consultation?
- Gender policy?

Governance

- Overall programme governance?
- Transparency of operation of programme?
- Third party auditing?

Assessment overview

Not a quality assessment of the crediting programmes and their certificates



Legend:

- Not sufficiently addressed
- Partly addressed/ missing information
- Addressed
- Not yet assessed

Key insights

- Soil carbon poses fundamental challenges for certification: quantification, non-permanence, non-additionality, sustainability
- None of the assessed crediting programmes address all of the key aspects that need to be considered when rewarding climate-friendly soil use
- Some crediting programmes address some of the key aspects
- Fundamental risk that the Carbon Removal Certification Framework will not sufficiently address all of the key aspects

Limit the use of carbon removal certificates: exclude offsetting for soil carbon removals ("carbon farming")

Outlook:
Evaluation of agricultural practices against key aspects

Measures	Mitigation potential	Leakage	Long-term storage	Quantifiability	Additionality
Conversion from arable to grassland					
Rewetting of organic soils					
Agroforestry					
Mixed-crop livestock systems					
Etc.					

Objective

Carbon farming measures have some potential for carbon removals

They are not equal

Identification of key issues

Evaluation of carbon farming measures against key issues

Aaron Scheid
aaron.scheid@ecologic.eu

Thank you

VCS VM0042 Methodology for Improved Agricultural Land Management
&
Climate Action Reserve Soil Enrichment Protocol

Summary for the EU Carbon Removals Certification Expert Group

Max DuBuisson, Head of Sustainability Policy & Engagement

indigo™
from questions we grow

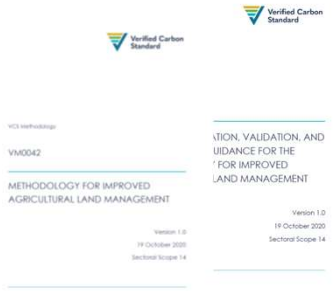
June 21, 2023

Overview

CLIMATE ACTION RESERVE

VERRA

Verified Carbon Standard



Climate Action Reserve Soil Enrichment Protocol

- US-only
- Developed by CAR staff with expert stakeholder working group and two rounds of public comments
- 3 active projects
- 133,646 credits issued (133,614 by Indigo)

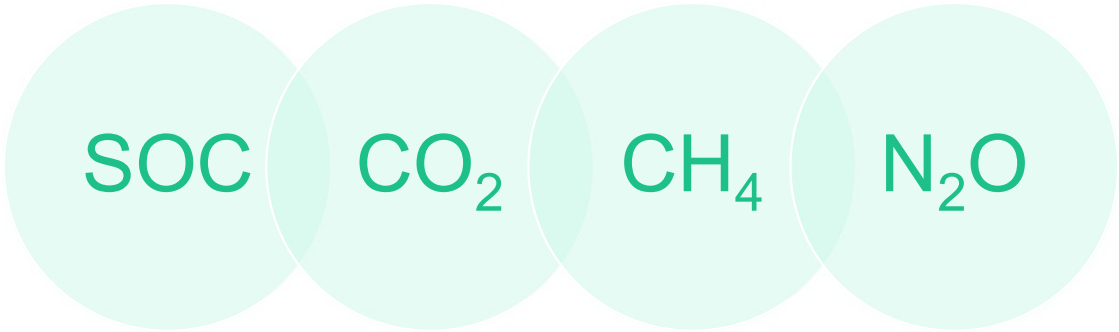
VCS VM0042 (methodology) and VMD0053 (modeling guidance)

- Globally applicable
- V1.0 was authored by Indigo and Terracarbon, with independent validation, then updated by Verra staff for v2.0
- 74 active projects
- 40+ projects in validation or have requested registration

Scope (both methodologies)

Broadly-applicable, scalable, & flexible:

- Applies to cropland and grazing land
- Applies to multiple management practices
- Applies to multiple crops/cropping systems
- Enables tech and model updates over time



Focus on changes to:

- Fertilizer application
- Water management/irrigation
- Tillage and/or residue management
- Crop planting and harvesting
- Fossil fuel usage
- Application of other synthetic inputs
- Grazing practices and emissions

QUantification | Additionality | Long term storage | SustainabilITY

(Red text indicates differences)

	CAR SEP	VM0042
SOC quantification	• Hybrid approach, incorporating soil sampling and modeling; SOC quantification requires modeling	• Choice of hybrid approach OR measurement-only approach using paired control sites
GHG quantification	• CO_2, CH_4, and N_2O may be modeled or use default equations derived from IPCC Guidelines	• CO_2, CH_4, and N_2O may be modeled or use default equations derived from IPCC Guidelines
Soil Sampling	• Soil samples collected from random points based on statistical design; resample every 5 years	• Soil samples collected from random points based on statistical design; resample every 5 years

Baselines	• Baseline uses historical field data to model BAU management with project-year weather
	  • Choice of matched or blended approach
		• Baseline uses historical field data to model BAU management with project-year weather
		  • Must use matched approach
		• If Verra approves a performance benchmark for a region, this must be used by all projects

Management data	• Required at the field level, with flexibility around data sources & documentation and opportunity for conservative gap-filling	• Required at the field level, with flexibility around data sources & documentation and opportunity for conservative gap-filling
Leakage	• Monitoring and accounting for leakage related to yield declines and/or displacement of livestock	• Monitoring and accounting for leakage related to yield declines and/or displacement of livestock
Uncertainty	• Sources: Sampling, measurement, & model prediction • Uncertainty deduction applies probability of exceedance approach at a threshold of 70%	• Sources: Sampling, measurement, & model prediction • Uncertainty deduction applies probability of exceedance approach at a threshold of 66.7%

QUantification | **Additionality** | Long term storage | SustainabilITY

(Red text indicates differences)

	CAR SEP	VM0042
Timing	• Field start date defined by cultivation cycle in which a new, eligible practice is adopted • Fields must be submitted to the registry within 12 months of their field start date	• Field start date defined by cultivation cycle in which a new, eligible practice is adopted • Projects must be listed in the pipeline within 3 years of earliest field start date, and validated within 5 years
Regulatory	• Project activities must not be required by law or any other legally binding mandate	• Project activities must not be required by law or any other legally binding mandate
Barriers assessment	• Assessment of social and cultural barriers to adoption of eligible practices • Conducted by CAR and applied to all projects	• Assessment of social and cultural barriers to adoption of eligible practices • Conducted by the project proponent covering the project region and assessed at validation
Common practice assessment	• Four main practices (no-till, reduced till, cover crops, rotational grazing) assessed by CAR using USDA data at the county level across the U.S. • Common practice = adoption at 50% or greater by area	• Assessed by the project proponent for project region • Common practice = adoption at 20% or greater using a weighted average of project practices by area within the project • Weighted average approach means the adoption rate for the overall project could change from year to year depending on management changes and new fields

(Red text indicates differences)

	CAR SEP	VM0042
Length of permanence	• 100 years	• 100 years
Identification of reversals	• Negative SOC results go into the net accounting at the project level • Overall net negative results = reversal	• Negative SOC results go into the net accounting at the project level • Overall net negative results = reversal
Compensating for reversals	• Avoidable reversals (e.g., grower behavior) paid by project proponent • Unavoidable reversals (e.g., natural events) covered by registry-held buffer pool	• Non-catastrophic reversals (e.g., grower behavior) paid by project proponent • Catastrophic reversals (e.g., natural events) covered by registry-held buffer pool
Buffer pool contribution	• Risk-based contribution at each issuance • Risk assessed using default values in the SEP (between 5% - 16.8%)	• Risk-based contribution at each issuance • Risk assessed using tool for assessing non-permanence of AFOLU projects (between 10% - 60%) • Verra anticipates developing an ALM-specific tool
Permanence after the crediting period	• Project proponent signs legal contract (Project Implementation Agreement) with registry • Monitoring continues with reporting and verification at least every 5 years unless CAR has approved an alternative mechanism • Encourages remote monitoring of management events	• At present, Verra will cancel all buffer credits from the project at the end of the crediting period • In the future, Verra has discussed developing their own remote monitoring system for AFOLU projects

(Red text indicates differences)

	CAR SEP	VM0042
No net harm	• Project activities must not cause environmental harm • Project sites must be in material compliance with applicable laws	• Project activities must not cause environmental harm • Project sites must be in material compliance with applicable laws
Public consultation	• Public comment periods during protocol development and significant protocol updates	• Public comment periods during protocol development and significant protocol updates • Public comment period at each project listing
SDG reporting	• Voluntary indication of SDG alignment in public registry • Voluntary reporting of SDG alignment using standard template (qualitative and/or quantitative)	• Voluntary indication of SDG alignment in public registry

Certification of non-GHG benefits	• None	• CCB: Option for verification and certification under the Climate Community & Biodiversity Standard (attached to the carbon unit)
		• SDVISta: three options for SDG-specific certification:
		  • Claims: Not listed in registry, reviewed by independent expert and communicated via project documents
		  • Labels: Listed in registry, verified by VVB and tied to project VCUs
		  • Assets: Listed in registry, verified by VVB against approved SDVISta methodology; creates a tradable unit

Key takeaways from implementation

Scale	• ALM generates small per-acre impacts, so large scale is needed • Uncertainty declines with scale
Aggregation	• Need field-level data, but project-level quantification • Must manage permanence at the project level • Must enable fields to come and go over time
Modeling guidance	• Annual crediting is not possible without models • Rigorous scientific guardrails on use of models is absolutely critical to maintain integrity • Need global collaboration around model expertise and assessment of cal/val reports
Adaptability	• Must enable crop rotations and other agronomic changes over time • Must enable improvements to tools and methods over time, or adoption of new technology, without completely redoing the project

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English edition Legislation Volume 61
21 December 2018

REDII (2018)

Contents

(1) Text with EEA relevance.

EN

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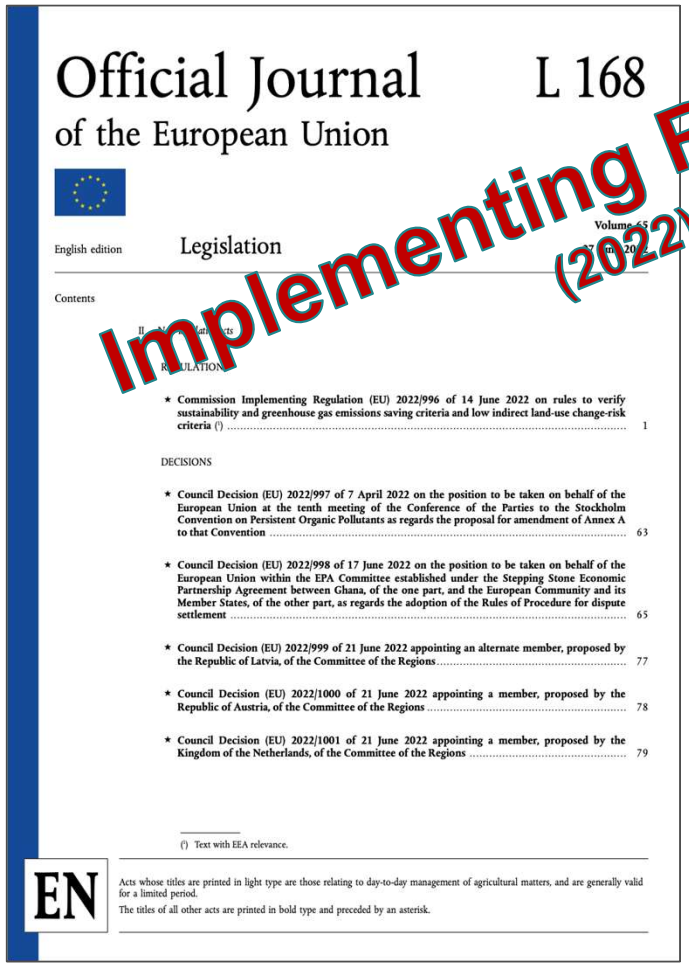

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17 June 2022

Implementing Regulation (2022)

Contents

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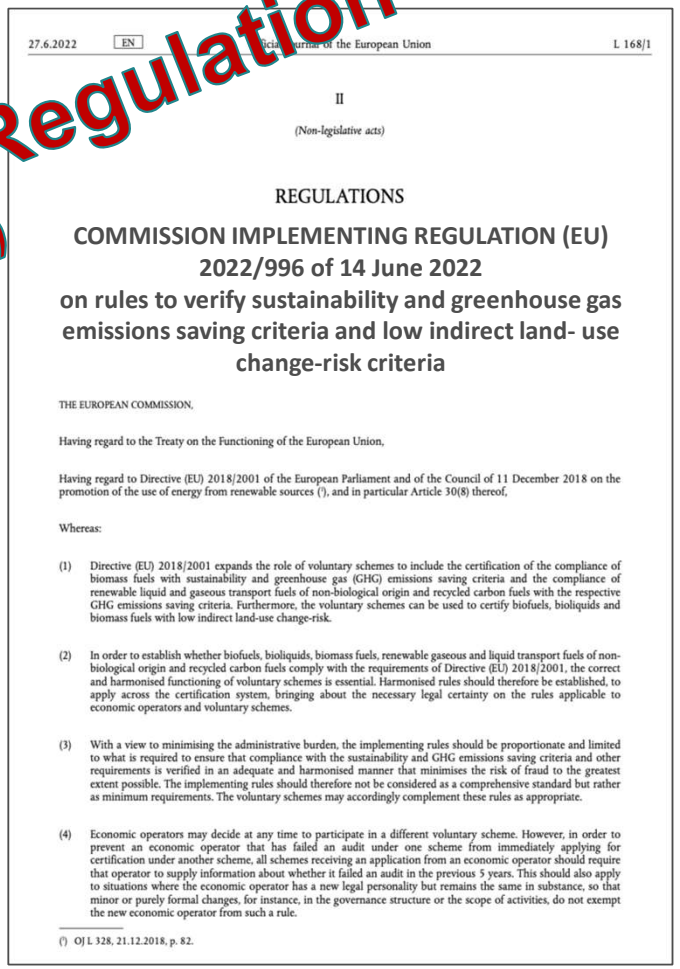


II

(Non-legislative acts)

REGULATIONS

COMMISSION IMPLEMENTING REGULATION (EU) 2022/996 of 14 June 2022 on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land- use change-risk criteria

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (1), and in particular Article 30(8) thereof,

Whereas:

(1) Directive (EU) 2018/2001 expands the role of voluntary schemes to include the certification of the compliance of biomass fuels with sustainability and greenhouse gas (GHG) emissions saving criteria and the compliance of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels with the respective GHG emissions saving criteria. Furthermore, the voluntary schemes can be used to certify biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

(2) In order to establish whether biofuels, bioliquids, biomass fuels, renewable gaseous and liquid transport fuels of non-biological origin and recycled carbon fuels comply with the requirements of Directive (EU) 2018/2001, the correct and harmonised functioning of voluntary schemes is essential. Harmonised rules should therefore be established, to apply across the certification system, bringing about the necessary legal certainty on the rules applicable to economic operators and voluntary schemes.

(3) With a view to minimising the administrative burden, the implementing rules should be proportionate and limited to what is required to ensure that compliance with the sustainability and GHG emissions saving criteria and other requirements is verified in an adequate and harmonised manner that minimises the risk of fraud to the greatest extent possible. The implementing rules should therefore not be considered as a comprehensive standard but rather as minimum requirements. The voluntary schemes may accordingly complement these rules as appropriate.

(4) Economic operators may decide at any time to participate in a different voluntary scheme. However, in order to prevent an economic operator that has failed an audit under one scheme from immediately applying for certification under another scheme, all schemes receiving an application from an economic operator should require that operator to supply information about whether it failed an audit in the previous 5 years. This should also apply to situations where the economic operator has a new legal personality but remains the same in substance, so that minor or purely formal changes, for instance, in the governance structure or the scope of activities, do not exempt the new economic operator from such a rule.

(1) OJ L 328, 21.12.2018, p. 82.

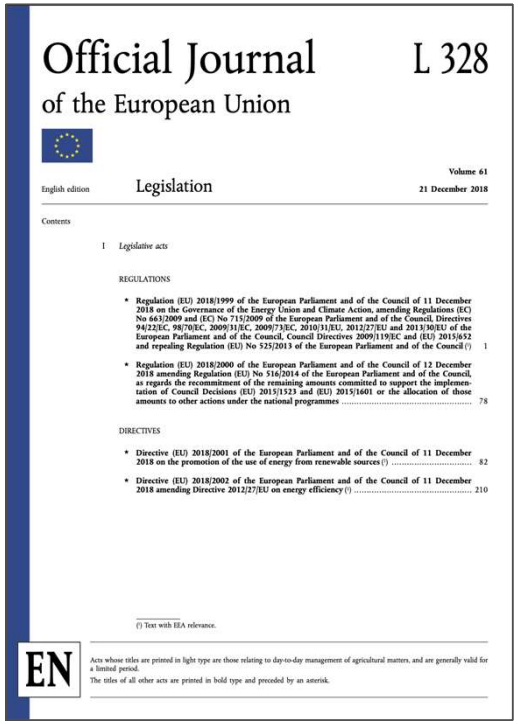
Carbon and Sust.Fuels: REDII

(a) greenhouse gas emissions from the production and use of biofuels shall be calculated as:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr},$$

where

E	=	total emissions from the use of the fuel;
e_{ec}	=	emissions from the extraction or cultivation of raw materials;
e_l	=	annualised emissions from carbon stock changes caused by land-use change;
e_p	=	emissions from processing;
e_{td}	=	emissions from transport and distribution;
e_u	=	emissions from the fuel in use;
e_{sca}	=	emission savings from soil carbon accumulation via improved agricultural management;
e_{ccs}	=	emission savings from CO_2 capture and geological storage; and
e_{ccr}	=	emission savings from CO_2 capture and replacement.



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I Legislative acts

REGULATIONS

* Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (1) 1

* Regulation (EU) 2018/2000 of the European Parliament and of the Council of 12 December 2018 amending Regulation (EU) No 516/2014 of the European Parliament and of the Council, as regards the recommitment of the remaining amounts committed to support the implementation of Council Decisions (EU) 2015/1523 and (EU) 2015/1601 or the allocation of those amounts to other actions under the national programmes 78

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* Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (1) 82

* Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency (1) 210

(1) Text with EEA relevance.

EN

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Solid evidence C increase to be provided

6. For the purposes of the calculation referred to in point 1(a), greenhouse gas emissions savings from improved agriculture management, e_{sca}, such as shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management, and the use of organic soil improver (e.g. compost, manure fermentation digestate), shall be taken into account only if solid and verifiable evidence is provided that the soil carbon has increased or that it is reasonable to expect to have increased over the period in which the raw materials concerned were cultivated while taking into account the emissions where such practices lead to increased fertiliser and herbicide use (1).

Carbon and Sust.Fuels: REDII–Implementing Regulation

(a) greenhouse gas emissions from the production and use of biofuels shall be calculated as:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr},$$

where

$$e_{sca} = (CS_A - CS_R) \times 3{,}664 \times 10^6 \times \frac{1}{n} \times \frac{1}{P} - e_f$$

Where:

CS_R	is the mass of soil carbon stock per unit area associated with the reference crop management practice in Mg of C per ha.
CS_A	is the mass of soil estimated carbon stock per unit area associated with the actual crop management practices after at least 10 years of application in Mg of C per ha.
3,664	is the quotient obtained by dividing the molecular weight of CO_2 (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) in g CO_{2eq}/g C.
n	is the period (in years) of the cultivation of the crop considered.
P	is the productivity of the crop (measured as MJ biofuel or bioliquid energy per ha per year).
ef	emissions from the increased fertilisers or herbicide use

Improved agriculture management practices, accepted for the purpose of achieving emission savings from soil carbon accumulation, include shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management, and the use of organic soil improver (e.g. compost, manure fermentation, digestate, biochar, etc.).

The calculation of the actual values of CS_R and CS_A shall be based on measurements of soil carbon stocks. The measurement of CS_R shall be carried out at farm level before the management practice changes in order to establish a baseline, and then the CS_A shall be measured at regular intervals no later than 5 years apart.

ANNEX V

METHODOLOGY FOR DETERMINING THE EMISSION SAVINGS FROM SOIL CARBON ACCUMULATION VIA IMPROVED AGRICULTURAL MANAGEMENT

II

(Non-legislative acts)

REGULATIONS

COMMISSION IMPLEMENTING REGULATION (EU) 2022/996 of 14 June 2022

on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land- use change-risk criteria

(1) Directive (EU) 2018/2001 expands the role of voluntary schemes to include the certification of the compliance of biomass fuels with sustainability and greenhouse gas (GHG) emissions saving criteria and the compliance of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels with the respective GHG emissions saving criteria. Furthermore, the voluntary schemes can be used to certify biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

(2) In order to establish whether biofuels, bioliquids, biomass fuels, renewable gaseous and liquid transport fuels of non-biological origin and recycled carbon fuels comply with the requirements of Directive (EU) 2018/2001, the correct and harmonised functioning of voluntary schemes is essential. Harmonised rules should therefore be established, to apply across the certification system, bringing about the necessary legal certainty on the rules applicable to economic operators and voluntary schemes.

(3) With a view to minimising the administrative burden, the implementing rules should be proportionate and limited to what is required to ensure that compliance with the sustainability and GHG emissions saving criteria and other requirements is verified in an adequate and harmonised manner that minimises the risk of fraud to the greatest extent possible. The implementing rules should therefore not be considered as a comprehensive standard but rather as minimum requirements. The voluntary schemes may accordingly complement these rules as appropriate.

(4) Economic operators may decide at any time to participate in a different voluntary scheme. However, in order to prevent an economic operator that has failed an audit under one scheme from immediately applying for certification under another scheme, all schemes receiving an application from an economic operator should require that operator to supply information about whether it failed an audit in the previous 5 years. This should also apply to situations where the economic operator has a new legal personality but remains the same in substance, so that minor or purely formal changes, for instance, in the governance structure or the scope of activities, do not exempt the new economic operator from such a rule.

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where

$$e_{sca} = (CS_A - CS_R) \times 3{,}664 \times 10^6 \times \frac{1}{n} \times \frac{1}{P} \times -e_f$$

The entire area for which the soil carbon stocks are calculated shall have a similar climate and soil type as well as similar management history in terms of tillage and carbon input to soil. If the improved management practices are only applied to part of the farm, the GHG emissions savings can only be claimed for the area covered by them. If different improved management practices are applied on a single farm, a claim of GHG emission savings shall be calculated and claimed individually for each e_{sca} practice.

To ensure reduced year-to-year fluctuations in the measured soil carbon stocks and to reduce associated errors, fields that have the same soil and climate characteristics, similar management history in terms of tillage and carbon input to soil and that will be subject to the same improved management practice may be grouped, including those fields belonging to different farmers.

After the first measurement of the baseline, the increase in soil carbon can be estimated based on representative experiments or soil models, before a second measurement of the increase in carbon stock is made. From the second measurement onwards, the measurements shall constitute the ultimate basis for determining the actual values of the increase in soil carbon stock.

Possible use of validated models is introduced here

However, after the second measurement, modelling to enable economic operators to estimate the annual increase in soil carbon stocks may only be permitted until the next measurement if the models used have been calibrated, based on the real values measured. Economic operators shall be obliged to use only models that have been validated by voluntary schemes. Voluntary schemes shall be obliged to inform the economic operators and the certification bodies, performing audits on their behalf, about the models that they have validated for such use.

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where

$$e_{sca} = (CS_A - CS_R) \times 3{,}664 \times 10^6 \times \frac{1}{n} \times \frac{1}{P} - e_f$$

A long-term commitment by the farmer or economic operator to continue applying the improved management practice for a minimum of 10 years shall be required by voluntary schemes in order for GHG emission savings to be taken into account. Such commitment may be implemented as a 5-years renewable commitment.

In addition, a continuous minimum period of 3 years for the application of the improved management practice shall be required before a claim can be made.

The maximum possible total value of the annual claim of emission savings from soil carbon accumulation due to improved agricultural management (e_{sca}) shall be capped to 45 g CO_2eq/MJ biofuel or bioliquid for the entire period of application of the Esca practices, if biochar is used as organic soil improver alone or in combination with other eligible e_{sca} practices. In all other cases, the cap referred to above shall be 25 g CO_2eq/MJ biofuel or bioliquid for the entire period of application of the e_{sca} practices.

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Carbon and Sust.Fuels: REDII–Implementing Regulation

ANNEX VI

NON-EXAUSTIVE LISTS OF EXAMPLES OF ESSENTIAL MANAGEMENT AND MONITORING PRACTICES TO PROMOTE AND MONITOR SOIL CARBON SEQUESTRATION AND SOIL QUALITY

Examples of essential soil management practices to promote soil carbon sequestration (given the absence of residues) and promote soil quality

Requirement	Soil quality parameter
At least a 3-crop rotation, including legumes or green manure in the cropping system, taking into account the agronomic crop succession requirements specific to each crops grown and climatic conditions. A multi-species cover crop between cash crops counts as one.	Promoting soil fertility, soil carbon, limiting soil erosion, soil biodiversity and promoting pathogen control
Sowing of cover/catch/intermediary crops using a locally appropriate species mixture with at least one legume. Crop management practices should ensure minimum soil cover to avoid bare soil in periods that are most sensitive.	Promoting soil fertility, soil carbon retention, avoiding soil erosion, soil biodiversity
Prevent soil compaction (frequency and timing of field operations should be planned to avoid traffic on wet soil; tillage operation should be avoided or greatly reduced on wet soils; controlled traffic planning can be used).	Retention of soil structure, avoiding soil erosion, retaining soil biodiversity
No burning of arable stubble except where the authority has granted an exemption for plant health reasons.	Soil carbon retention, resource efficiency
On acidic soils where liming is applied, where soils are degraded and where acidification impacts crop productivity.	Improved soil structure, soil biodiversity, soil carbon
Reduce tillage/no tillage – Erosion control – addition of organic amendments (biochar, compost, manure, crop residues) – use of cover crops, rewetting Revegetation: planting (species change, protection with straw mulch) – landscape features – agroforestry	Increase soil organic carbon

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Carbon and Sust.Fuels: REDII–Implementing Regulation

ANNEX VI

NON-EXAUSTIVE LISTS OF EXAMPLES OF ESSENTIAL MANAGEMENT AND MONITORING PRACTICES TO PROMOTE AND MONITOR SOIL CARBON SEQUESTRATION AND SOIL QUALITY

Table 1

Examples of monitoring practices for soil quality and carbon mitigation impacts

Monitoring approach	Method of verification/demonstration
Risk assessment	Identifying areas with high risk of soil quality decline helps prevent these risks and focus on areas with the greatest impact.
Soil organic matter analysis	Consistent sampling of soil organic matter improves monitoring so that this matter can be maintained or improved.
Soil organic carbon analysis	Soil organic carbon is seen as a good marker for wider soil quality.
Soil conditioning index sampling	A positive value indicates the system is expected to have increasing soil organic matter.
Soil erosion assessment	Ensures that erosion is below a tolerable level, e.g. USDA Agricultural Research Service 't' levels.
Nutrient management plan	A plan outlining nutrient strategy (focusing mostly on N, P, K) and fertiliser regimes can prevent nutrient imbalances.
Regular soil pH analysis	Monitoring pH helps identify imbalances in pH.

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on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land- use change-risk criteria

(1) Directive (EU) 2018/2001 expands the role of voluntary schemes to include the certification of the compliance of biomass fuels with sustainability and greenhouse gas (GHG) emissions saving criteria and the compliance of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels with the respective GHG emissions saving criteria. Furthermore, the voluntary schemes can be used to certify biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

(2) In order to establish whether biofuels, bioliquids, biomass fuels, renewable gaseous and liquid transport fuels of non-biological origin and recycled carbon fuels comply with the requirements of Directive (EU) 2018/2001, the correct and harmonised functioning of voluntary schemes is essential. Harmonised rules should therefore be established, to apply across the certification system, bringing about the necessary legal certainty on the rules applicable to economic operators and voluntary schemes.

(3) With a view to minimising the administrative burden, the implementing rules should be proportionate and limited to what is required to ensure that compliance with the sustainability and GHG emissions saving criteria and other requirements is verified in an adequate and harmonised manner that minimises the risk of fraud to the greatest extent possible. The implementing rules should therefore not be considered as a comprehensive standard but rather as minimum requirements. The voluntary schemes may accordingly complement these rules as appropriate.

(4) Economic operators may decide at any time to participate in a different voluntary scheme. However, in order to prevent an economic operator that has failed an audit under one scheme from immediately applying for certification under another scheme, all schemes receiving an application from an economic operator should require that operator to supply information about whether it failed an audit in the previous 5 years. This should also apply to situations where the economic operator has a new legal personality but remains the same in substance, so that minor or purely formal changes, for instance, in the governance structure or the scope of activities, do not exempt the new economic operator from such a rule.

(1) OJ L 328, 21.12.2018, p. 82.

Biochar and C-farming under REDII-IR

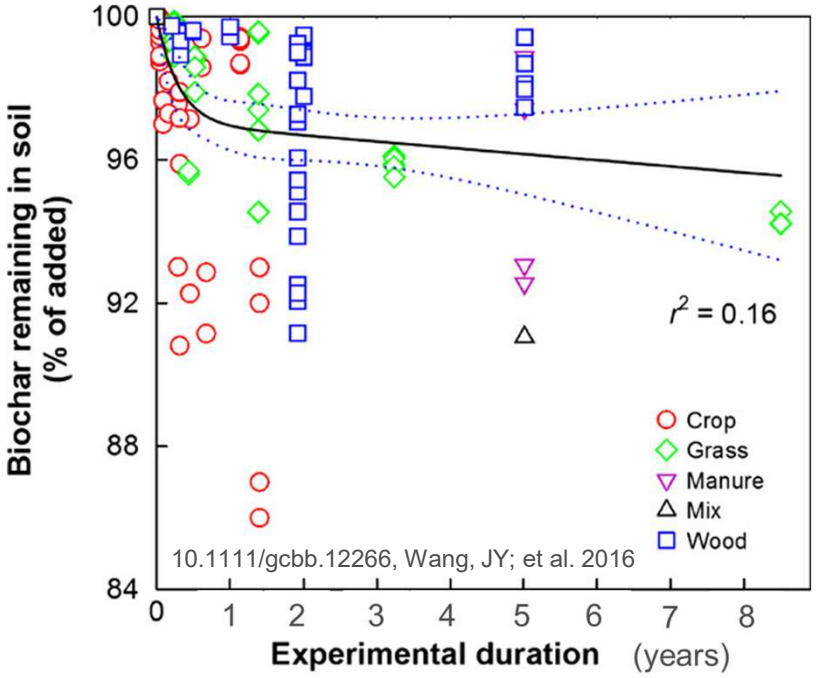
- ✓ **Quantification, Permanence and Additionality for Biochar**
  - **verifiable and measurable, accuracy ensured (evidence of product characteristics and incorporation in soil)**
  - **long-lived C removal and use (CCU)**
  - **amounts of C sequestered is related to the energy yield per ha**
  - **the highest C-removal threshold in REDII-IR (45 gCO_2/MJ)**
- ✓ **Methodology to implement REDII-IR: under development**
  - **Soil sampling and C accounting: assessment of C-removal should be different for biochar and other Carbon-farming methods**
- ✓ **Low ILUC feedstock, severely degraded land (REDII-DA).**
  - **C farming and agriculture: win-win approach. Clear co-benefits: enabler of more sustainable agriculture.**
  - **SOC threshold: to be defined**

Biochar - Carbon decay rate

Model of decay rates:

- labile fractions (3% of biochar) = 3% /y (108 days)
- **recalcitrant fractions (97% of biochar) = 0.0018% /y(556 y)**

Models based on 10 years experiments.



IMAP project (Evidence Map)

- >7000 abstracts screened
- >1900 full texts screned
- Around **600** meta-analyses selected and analysed

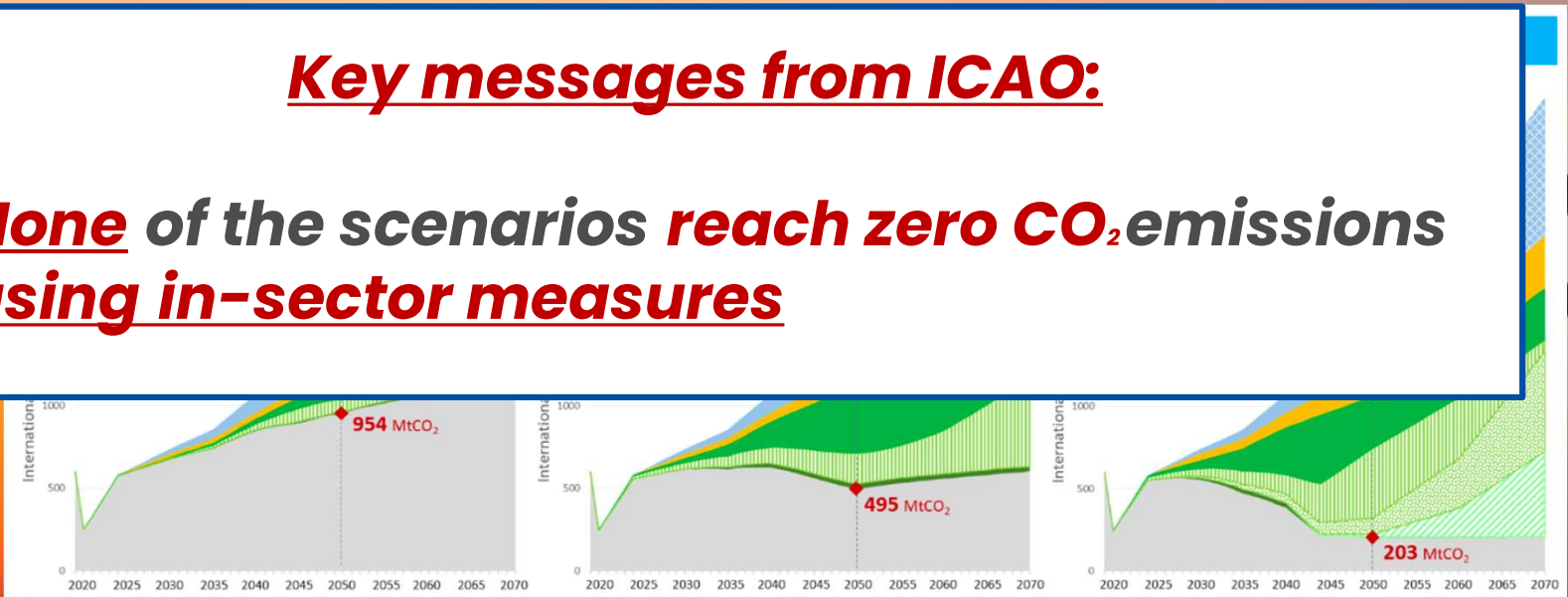
https://wikis.ec.europa.eu/display/IMAP/Impacts+of+farming+practices+on+environment+and+climate

- **ICAO, 2017 → 142** Mt CAF at 2010 → 570-**860** Mt at 2050 (Intern. Aviation) + 400-600 % !!
- **100% CAF substitution (MAX scenario)** – **170 new biorefineries each year** from **2020 to 2050** (15-60 $B/y) –
- **MAX** would **reduce CO_2 emission by 63%**

LTAG Scenarios *(March 2022)*

Key messages from ICAO:

1. ***None** of the scenarios **reach zero CO_2** emissions*
2. ***using in-sector measures***



† Caution required with the interpretation of absolute CO_2 emissions levels after 2050 due to modelling assumptions e.g., frozen aircraft technology after 2050. Under these assumptions, CO_2 emissions are higher than in an alternative scenario (and modelling approach) where aircraft technology would continue to improve after 2050.

Figure 1. CO_2 emissions from international aviation associated with LTAG Integrated Scenarios

Aircraft Technology

Operations

Biomass SAF
Gaseous Waste SAF

Atmospheric CO2 SAF

Hydrogen

- ***Aircraft Techn**: Advanced tube and wing, unconventional airframe/propulsion concept aircraft, non-drop-in fuels such as battery electric etc*
- ***Operations**: improvements in the performance of flights across all phases*

BIKE

Bringing organic C back to soil, and promoting **soil health** and **fertility** , are key elements for Sus
as E
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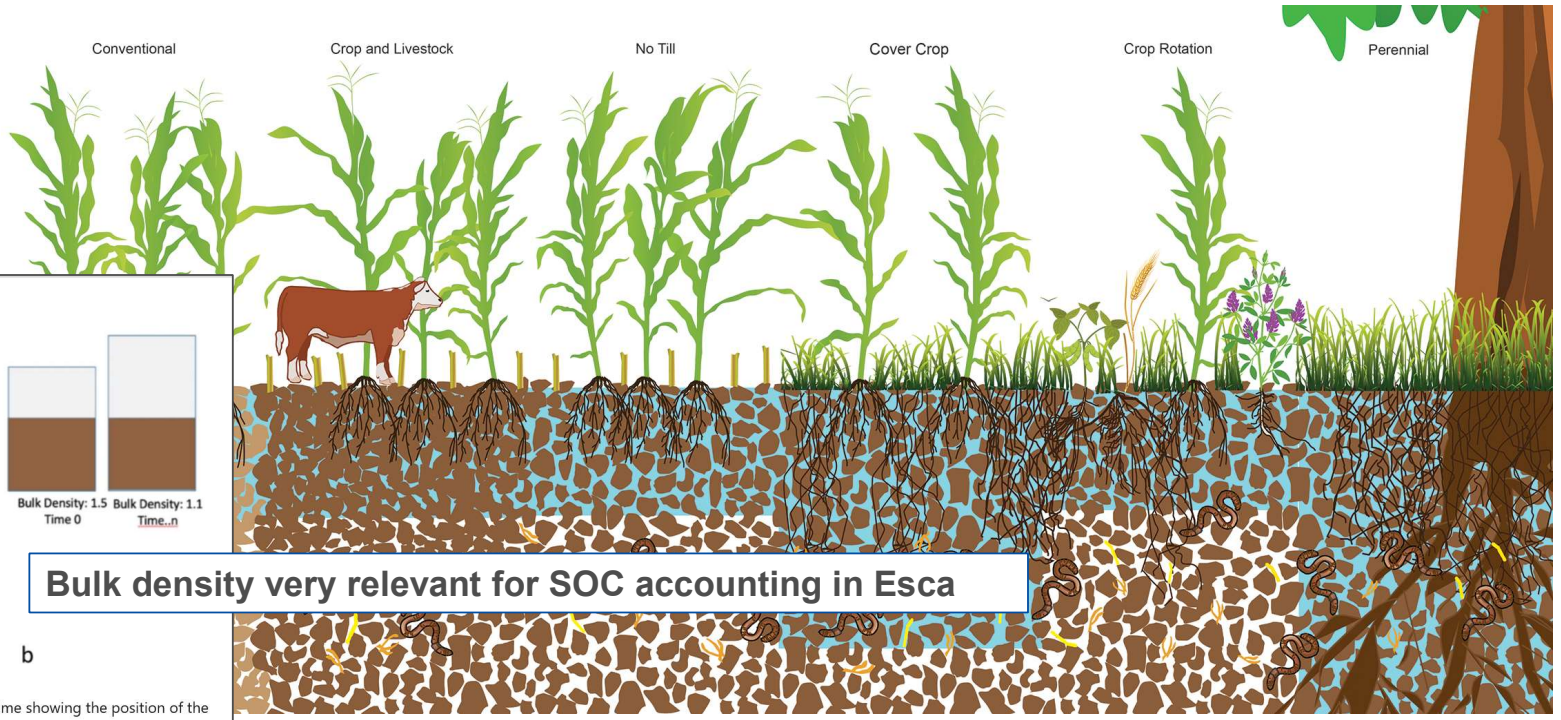
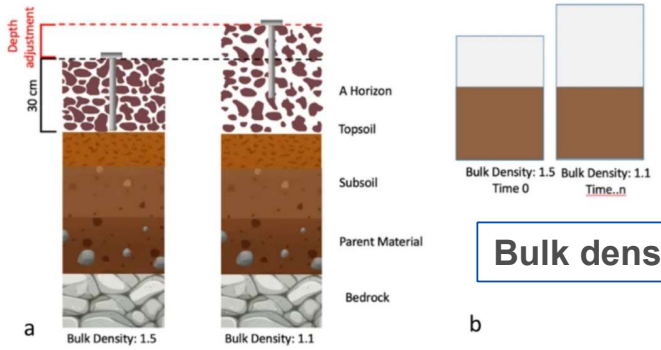


Figure 1



(**a**) Example of pedon alteration due to changes in bulk density over time showing the position of the soil sampling device from the soil surface to the same fixed depth. (**b**) Example of pedon after the correction showing the difference in air space, while the soil mass remains constant.

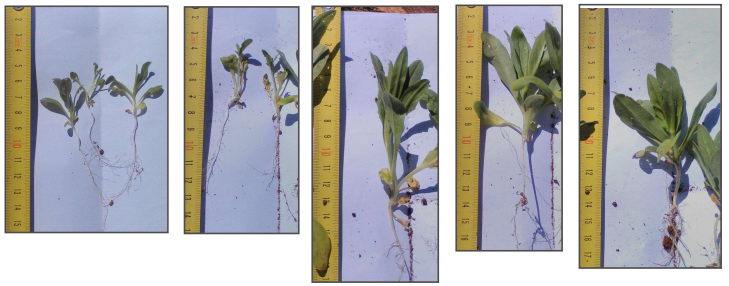
Bulk density very relevant for SOC accounting in Esca

Comparing infiltration rates in soils managed with conventional and alternative farming methods: A meta-analysis
Andrea D. BascheMarcia S. DeLonge

FOOD, FEED AND ENERGY (FUELS)

Reverse ILUC approach:
Barley & Camelina in recovered soil in Spain.

Food/feed otherwise not produced.



Bio4A

Offsetting - Compensating

- ✓ **Low-ILUC** : Camelina&Barley in recovered land under marginalization (**BIO4A, BIKE**)
- ✓ **Nature-based offsetting** next to SAF production, or in combination with it (**BIO4A, BIKE**)



→ **Energy** can **support more sustainable agriculture** through **Biofuels Done Right models**


Thanks for your attention
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1859

Agricultural methodologies in the French Label bas-carbone

Expert group on carbon removals

Clothilde Tronquet – Institute for Climate Economics (I4CE)

Agricultural methodologies in the Label Bas-Carbone

- 6 out of 13 methodologies focus on the agricultural sector

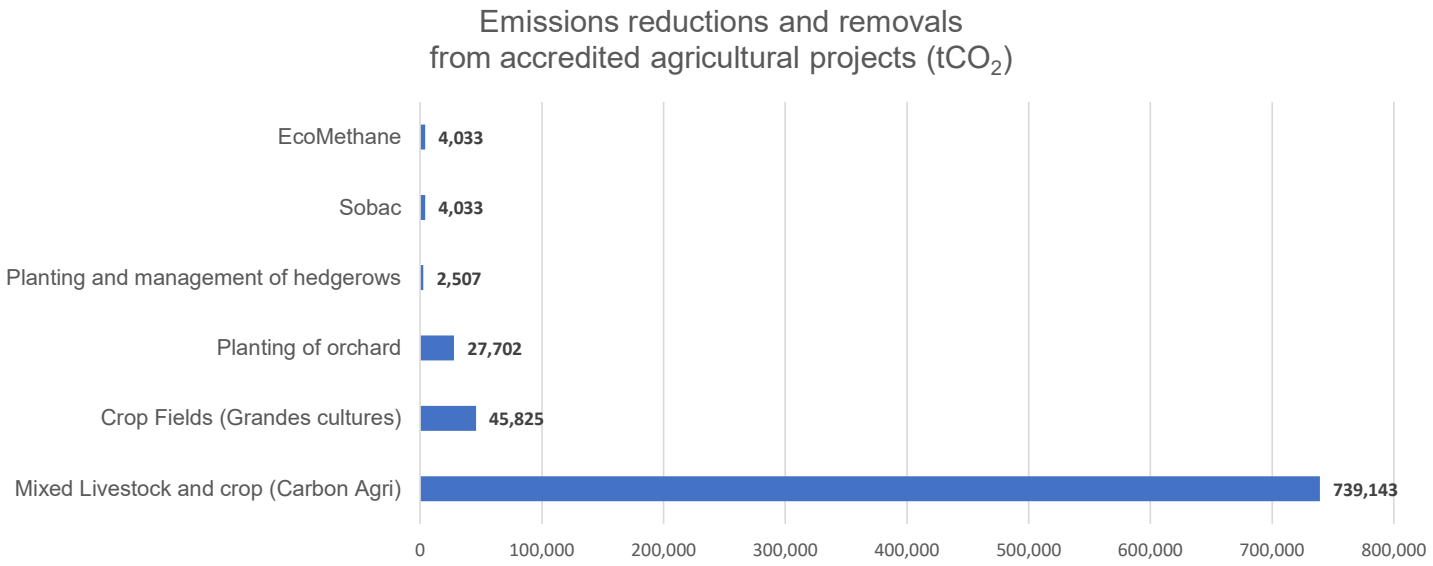
1.	Méthode CarbonAgri	Mixed livestock and crops
2.	Méthodes Grandes Cultures	Crop fields
3.	Méthode Plantation de vergers	Planting of orchards
4.	Méthode Haies	Planting and management of hedgerows
5.	Méthode Sobac'Eco-TMM	Management of inputs
6.	Méthode Ecomethane	Cattle feeding

- Pig farming
- Viticulture
- Agroforestry

- More agricultural methodologies to come

Agricultural methodologies in the Label bas-carbone

- **To date, half of the 1,6 $MtCO_2eq$ of certified emissions reductions and removals comes from the agricultural sector**

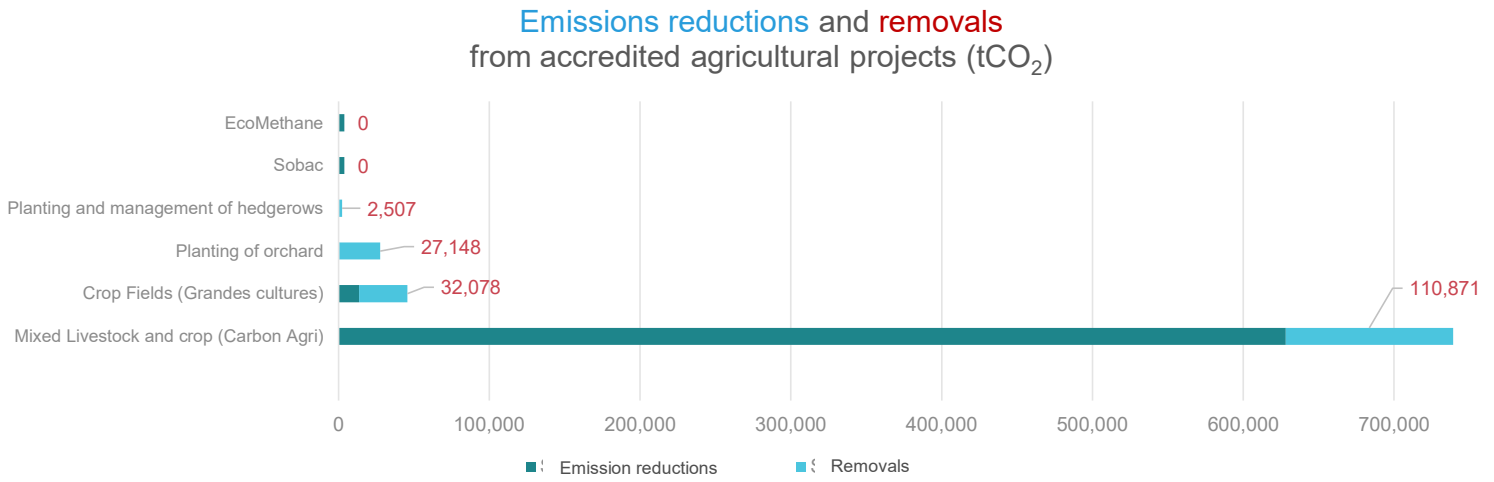


Source: I4CE, based on Label bas carbone website (16/0
https://label-bas-carbone.ecologie.gc

Agricultural methodologies in the Label bas-carbone

To date:

- 677 233 $MtCO_2$: > 80 % of the certificates in agriculture are emission reductions (CH_4 and N_2O)
- **146 009 $MtCO_2$: < 20 % of the certificates in agriculture are carbon removals (CO_2)**



Source: I4CE, based on Label bas carbone website (16/06/23)
https://label-bas-carbone.ecologie.gouv.fr/

➢ **Certifying Carbon Removals without Emission Reductions would make agricultural projects substantially less attractive for farmers**

The Label Bas-carbone philosophy

Quality Criteria	Quantification	Baseline and additionnality	Management of non-permanence	Sustainability
General Label Bas-Carbone philosophy	• **Emission reductions and carbon removals are accounted** ***" Verified Emission Reductions "*** = Carbon Removals – GHG increase + GHG reductions + Indirect emissions reductions (upstream and downstream, including substitution effects) • **Preference for project specific scenario** • Generic data associated with discount rates	• **Preference for project specific baseline** • Generic baselines associated with discount rates • **Systematic additionality demonstration** • Competition with public aid usually managed with discount rates	• **Permanent credits associated with discount rates** • No pre-established liability mechanism	• Evaluation grid on environmental, social and economic impacts

Méthode CarbonAgri : Mixed Livestock & Crops

Since September 2019

- 10 projects registered (including 2 major collective projects), corresponding to 739 143 tCO_2eq emission reductions and carbon removals

Quality Criteria	Scope and quantification	Baseline and additionnality	Management of non-permanence	Sustainability
Features of the methodology	- **CAP'2ER® Diagnosis & Action Plan** <u>Removals</u> - Management of cropland (extending grassland) - Agroforestry ➢ 10-15 % of the certificates <u>Emission reductions</u> - Herd and feeding management - Manure storage - Mangement - Crop management ➢ 75-80 % of the certificates <u>Indirect emission reductions</u> - Production of inputs (fertilizers) - Animal feed ➢ <10 % of the certificates	<u>Baseline:</u> - **Specific baseline (CAP'2ER®)** - Generic baseline associated with 10% discount <u>Additionnality:</u> - CAP Greening and GAEC incentives considered null - Subsidies for energy efficiency (Certificats d'Economies d'Energie, CEE), associated with 20 % discount	<u>Crediting period</u> - 5 years, renewable <u>Monitoring period</u> - 5 years, renewable (ex post crediting) <u>Reversal risk</u> - 20 % discount on removals (10 % discount for hedgerows)	<u>Evaluation grid</u> Indicators to be monitored: - Biodiversity - Air Quality - Water resource - Renewable energy - Reduction of soja consumption - Intercrop surfaces - Short marketing circuits

Méthode Grandes Cultures : Crop fields

Since July 2021

- 19 projects registered, corresponding to 45 825 tCO_2eq carbon removals and emission reductions (on average 2 400 tCO_2/ project)

Quality Criteria	Scope and quantification	Baseline and additionnality	Management of non-permanence	Sustainability
Features of the methodology	<u>Removals</u> - Intermediary crops - Temporary grassland ➢ 70 % of the certificates <u>Emission reductions</u> - Reduction of nitrogen fertilizers - Optimization of the use of fertilizers ➢ 20 % of the certificates <u>Indirect emission reductions</u> - Production of inputs (fertilizers) - Improvement of drying process ➢ 10 % of the certificates	<u>Baseline:</u> - **Specific baseline is the default option using historical data from the farm** - Generic baseline with 10 % discount, only if data is unavailable (installation, takeover...) <u>Additionnality:</u> - Regulatory analysis based on CAP requirements - Public aid analysis (outside CAP 1st pilar), in case such aid exists, a financial analysis is required, or 20 % discount	<u>Crediting period</u> - 5 years, renewable <u>Monitoring period</u> - 5 years, renewable (ex post crediting) - <u>Reversal risk</u> - 20 % discount on removals, - OR 10% discount if the practices are maintained - OR 0% discount if the LBC project is renewed	<u>Evaluation grid</u> Compulsory indicators: - Energy consumption - Air Quality - Soil Protection - Nitrate leaching - Water resource - Phytosanitary products Optional indicators: - Biodiversity - Phosphorus consumption - Local communities - Income and work conditions

Méthode Vergers: Planting of orchards

Since November 2020

- 60 projects registered, corresponding to 27 702 tCO_2 carbon removals and emission reductions (on average 460 tCO_2/ project)

Quality Criteria	Scope and quantification	Baseline and additionnality	Management of non-permanence	Sustainability
Features of the methodology	Removals - Removals in the ecosystem - **Generic data is the default option, associated with 10 % discount rate** Emission reductions - Energy consumption Indirect emission reductions - Production of inputs - Substitution effect through bioenergy (optional)	Baseline: - **Generic baseline: Continuation of the previous land use** (arable land, viticulture, permanent grasslands) Additionnality: - Public aid analysis : subsidies shouldn't represent more than 50 % of the investment	Crediting period - 20 years for removals Monitoring period - 5 years (ex post and ex ante crediting) Reversal risk - 10 % discount on removals	Evaluation grid Optional indicators - Biodiversity - Water Resource - Soil Protection - Labels: Organic or High Environmental Value (Haute Valeur Environnementale, HVE) - Socio-economic conditions

Méthode Haies: Planting of hedgerows

Since January 2021

- 1 collective project registered, corresponding to 2 507tCO_2 carbon removals and emissions reductions

Quality Criteria	Scope and quantification	Baseline and additionnality	Management of non-permanence	Sustainability cobenefits
Features of the methodology	<u>Removals</u> - Removals in the ecosystem - **Sustainable management plan required (Plan de Gestion Durable des Haies)** - **Reference database only available for one region; 5 to 50% discount rate are applied for other regions** <u>Indirect emission reductions</u> - Substitution effect through bioenergy (optional)	<u>Baseline:</u> - **Specific baseline, based on the sustainable management plan** <u>Additionnality:</u> - Combination with public aid is partially authorised:	<u>Crediting period</u> - 15 years <u>Monitoring period</u> - **5 years (renewable twice, up to 15 years) (ex post crediting)** <u>Reversal risk</u> - 10% discount rate on removals	- **Eligibility criteria** prohibits chemical treatments; clear cut of high stands; invasive species etc. <u>Evaluation grid</u> - Engaging in the hedgerow label (Label Haies) - Biodiversity, hedgerow density, fighting erosion; socio-economic benefits

Lessons learnt

- Economic model still to be found
  - Trade-offs between costs and precision of MRV
  - High costs of the projects > Prices on voluntary carbon markets
  - Co-funding models to develop
  - Insufficient valuation of sustainability impacts

Lessons learnt

- Key factors of success
  - Simplicity of the methodologies
  - Data availability
  - Appropriation and leadership from the sector
  - Technical support and counselling, for GHG diagnosis and implementing action plans

I4CE
INSTITUTE FOR CLIMATE ECONOMICS
Une initiative de la Caisse des Dépôts et de l'Agence Française de Développement

I4CE – Institute for Climate Economics
20-22 Rue des Petits Hôtels, 75010 Paris
www.i4ce.org | contact@i4ce.org

Merci!

LIFE 20 PRE IT/017

C·FARMs
CARBON FARMING CERTIFICATION SYSTEM

Maps of carbon sequestration potential in agricultural land – lessons learnt from project LIFE C-Farms

Lucia Perugini

C-FARMs at a glance

LIFE 20 PRE IT/017

C·FARMs
CARBON FARMING CERTIFICATION SYSTEM

FEDERLEGNOARREDO

- **Coordinator:**

Federlegno arredo

- **TITLE**

C-FARMs

Carbon Farming Certification System

- **DURATION**

01.12.2021 – 31.08.2023 (21 Months)

- **COUNTRY / REGION**

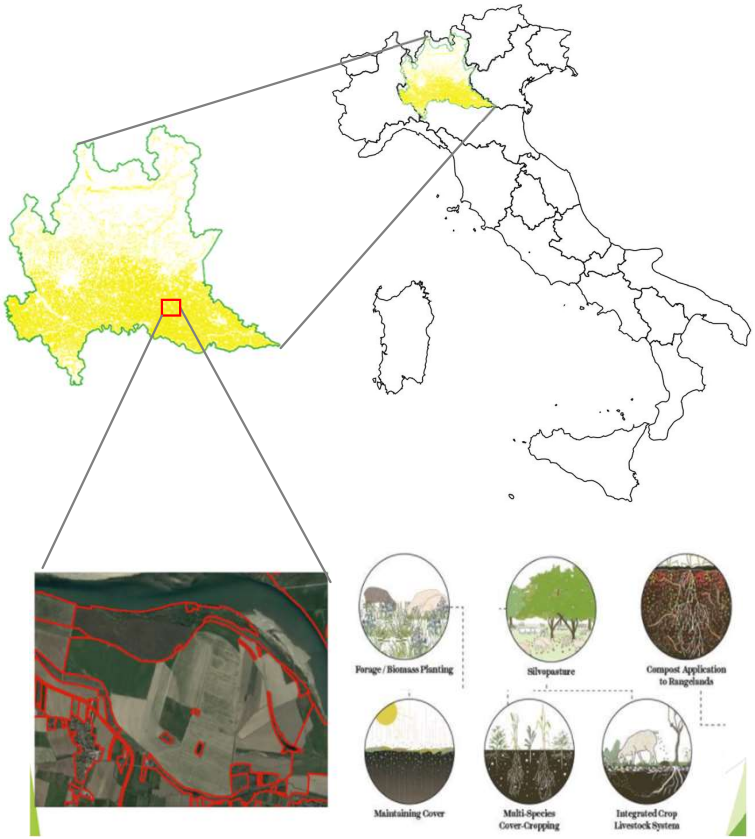
Italy / Lombardy

WEBSITE

www.c-farms.eu

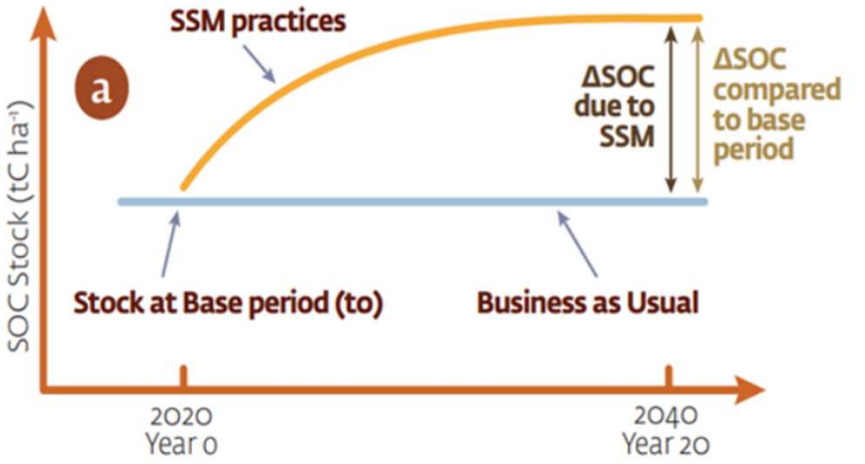
Objectives of the Project

- **Systematizing existing knowledge and data**
- Creating **high-resolution demonstrative geospatial information system (GIS-FARMs)**
- Supporting the **development of a regulatory framework** for a carbon certification
- Exploring **common methods and/or reference data and/or data sets in combination with GHG reporting institution**



Carbon farming practices: Cropland

Selections of the carbon farming practices suitable in the Lombardy context

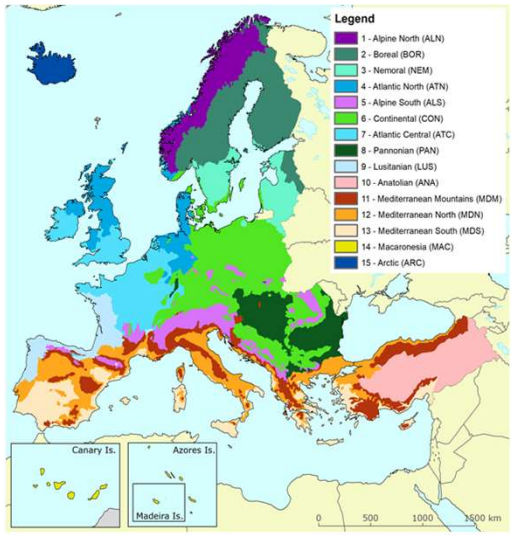


SINK

572 data entries (44 practices)

-70%

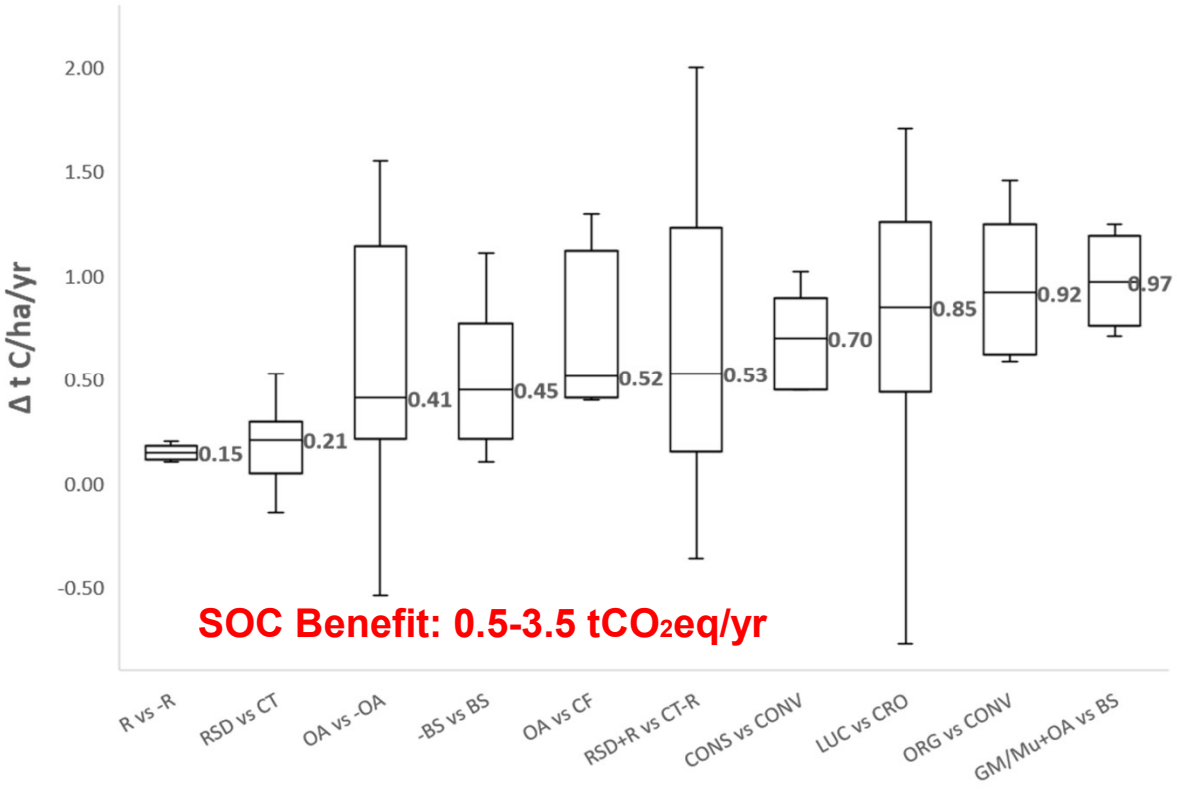
143 data entries



- 11 carbon-farming practices annual crops
- 3 practices for perennial crops

Carbon-farming practices for annual crops

ΔSOC_{REL} median values for *annual croplands* in Lombardy



Legend

R vs **-R:** crops residue maintenance vs residues removal

RDS vs **CT:** Reduced soil disturbance vs conventional till

OA vs -OA: organic amendment vs unfertilized

-BS vs BS: avoiding bare fallow with cover crops vs bare fallow

OA vs CF: organic amendment vs chemical fertilizer

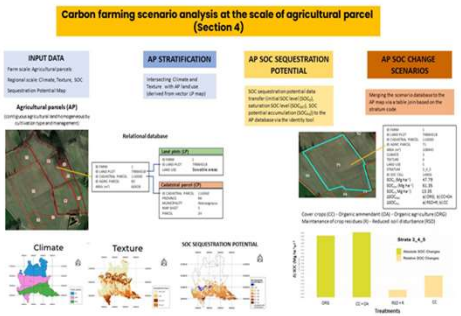
RDS+R vs **CT-R**: Reduced soil disturbance + crop residues vs conventional till and residues removal

CONS vs CONV: Conservation agriculture vs conventional

LUC vs CRO: Land-use-change of annual cropland vs annual cropland

GM / Mu + OA vs **BS**: Cover crops as green manure or mulch, and application of organic amendment

GIS FARMs



- **Decision support system (DSS)**
- **Knowledge hub**
- **Repository of monitoring information**
- **Registry/verification tool**

Functions	*End users*
Selection and simulation of the effects of the CF practices at **farm level**	
Upload **monitoring and measurement** data	*Farmers*
Selection and simulation of the effects of the CF practices at **landscape level**	*Policy makers*
Validation, storage, registry, link with LPIS system, **Link with GHG inventory agency**	*Scheme owner/payment operators*

INPUT DATA

- Climate
- Texture
- Land Use
- Initial Soil Carbon Content (SOC) from the FAO GSOC Map

STRATIFICATION (Section 1)

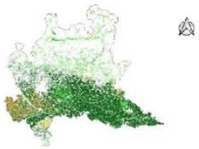
Intersecting Climate, Texture and Land Use

(Map of 53 unique strata homogenous for climate, texture and land use)

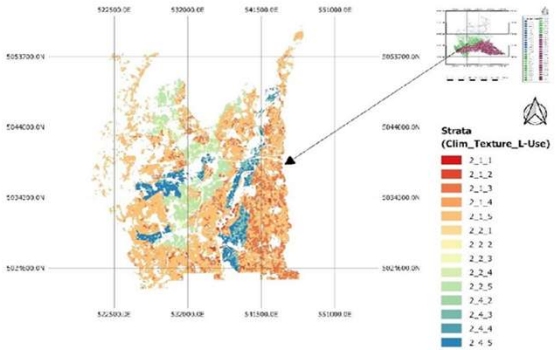
Climate

Texture

Land Use



Extract from the map of the Strata

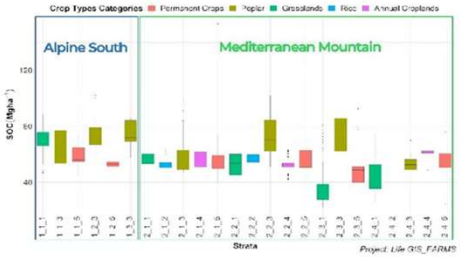


CHARACTERIZATION OF SOC CONTENT OF THE STRATA (Section 2)

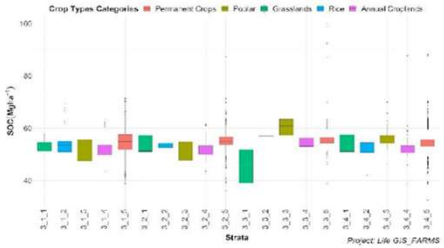
GSOC map vectorization for Lombardy region

Extraction of SOC Statistics for Strata

Alpine South & Mediterranean Mountain



Mediterranean North

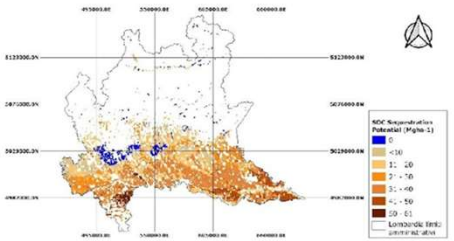


SOC SEQUESTRATION POTENTIAL (SOC_{SP}) (Section 3)

Descriptive Statistics on SOC for Strata homogenous for climate and texture (11 Strata)

Derivation of SOC Saturation level for the 11 strata (SOC_{SAT})

SOC SEQUESTRATION POTENTIAL
$SOC_{SP} = SOC_{SAT} - SOC$

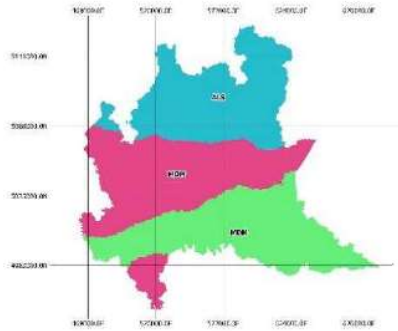


SHAPEFILE GIS-FARMS

Strata_Section_1

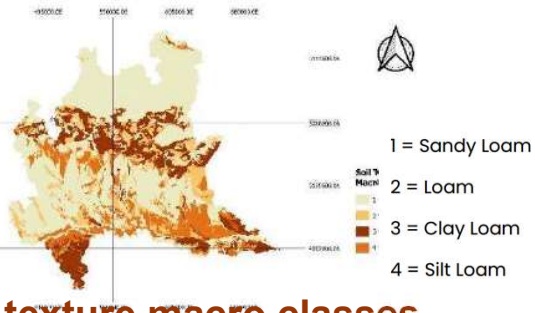
SOC_Sequestration_Potential_Map

STRATIFICATION



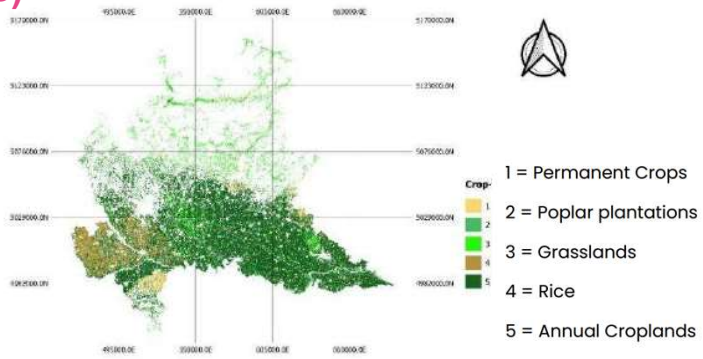
1 = Alpine South
2 = Mediterranean Mountain
3 = Mediterranean North

IPCC climatic zones
(3 classes)



1 = Sandy Loam
2 = Loam
3 = Clay Loam
4 = Silt Loam

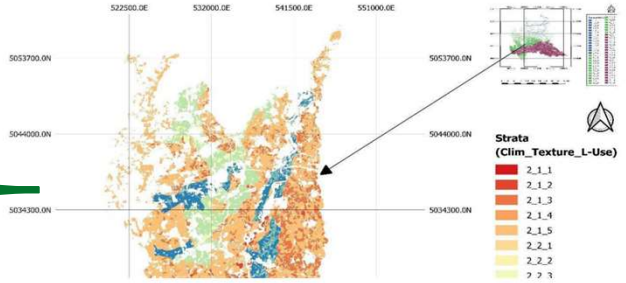
Soil texture macro classes
(4 classes)



1 = Permanent Crops
2 = Poplar plantations
3 = Grasslands
4 = Rice
5 = Annual Croplands

Crop types categories
(5 classes)

53 Classes

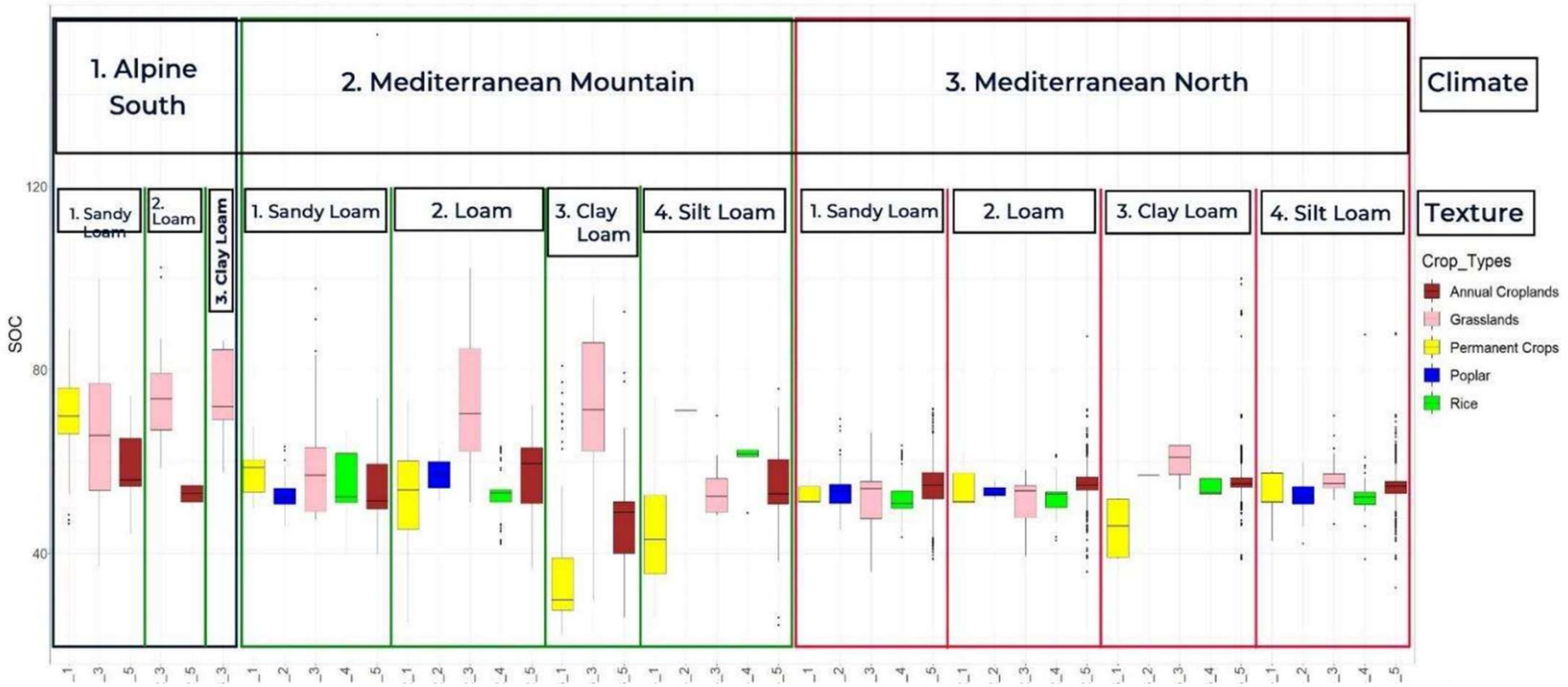


Most represented strata:

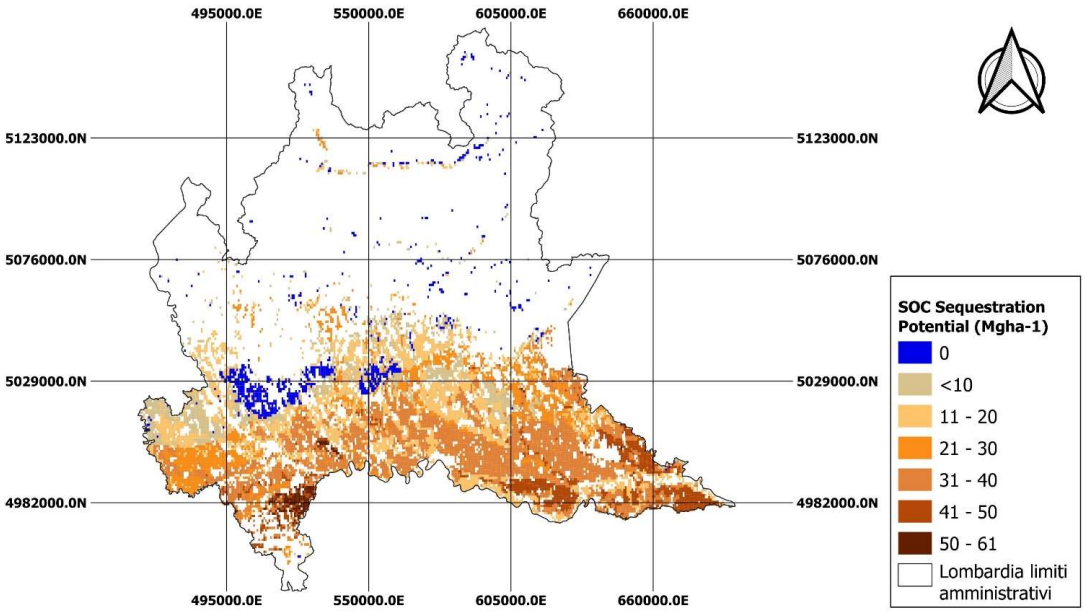
- Mediterranean north climate
- Annual croplan
- sandy loam

Attribution of SOC to each strata

FAO GSOC Data



Sequestration potential map



SOC SEQUESTRATION POTENTIAL (SOC_{SP}) (Section 3)

Descriptive Statistics on SOC for Strata homogenous for climate and texture (11 Strata)

Derivation of SOC Saturation level for the 11 strata (SOC_{SAT})

SOC SEQUESTRATION POTENTIAL
$SOC_{SP} = SOC_{SAT} - SOC$

Carbon farming scenario analysis at the scale of agricultural parcel (Section 4)

INPUT DATA

Farm scale: Agricultural parcels

Regional scale: Climate, Texture, SOC Sequestration Potential Map

Agricultural parcels (AP)

(contiguous agricultural land homogeneous by cultivation type and management)

AP STRATIFICATION

Intersecting Climate and Texture with AP land use (derived from vector LP map)

Relational database

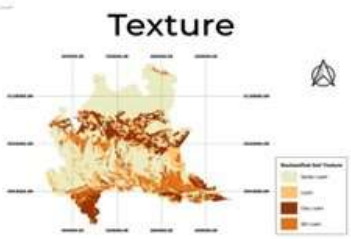
ID FARM	1
ID LAND PLOT	79884018
ID CADASTRAL PARCEL	116060
ID AGRIC PARCEL	92
AREA (m²)	66928

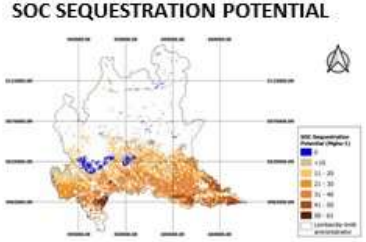
Land plots (LP)

ID FARM	1
ID LAND PLOT	79884018
LAND USE	Sowable areas

Cadatstral parcel (CP)

ID CADASTRAL PARCEL	116060
PROVINCE	MI
MUNICIPALITY	Abbiategrasso
MAP SHEET	5
PARCEL	24





AP SOC SEQUESTRATION POTENTIAL

SOC sequestration potential data transfer (initial SOC level (SOC_0), saturation SOC level (SOC_{SAT}), SOC potential accumulation (SOC_{PA})) to the AP database via the identity tool

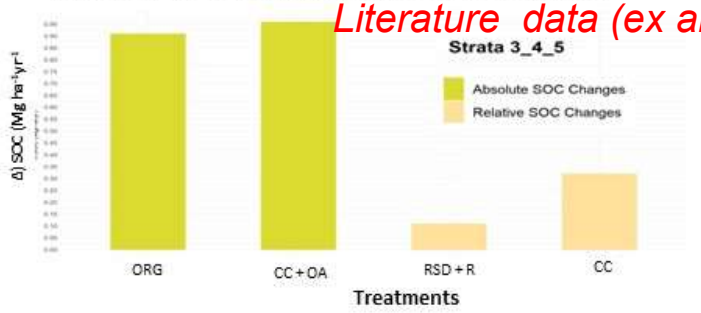
AP SOC CHANGE SCENARIOS

Merging the scenario database to the AP map via a table join based on the stratum code

ID FARM	1
ID LAND PLOT	79884018
ID CADASTRAL PARCEL	116060
ID AGRIC PARCEL	71
AREA (m²)	108945
CLIMATE	3
TEXTURE	4
LAND USE	5
STRATUM	3_4_5
ID SOC CELL	14806
SOC_0 (Mg ha^{-1})	47.79
SOC_{SAT} (Mg ha^{-1})	61.35
SOC_{PA} Mg ha^{-1})	13.35
ΔSOC_{ABS}	a) ORG; b) CC+OA
ΔSOC_{REL}	a) RSD+R; b) CC

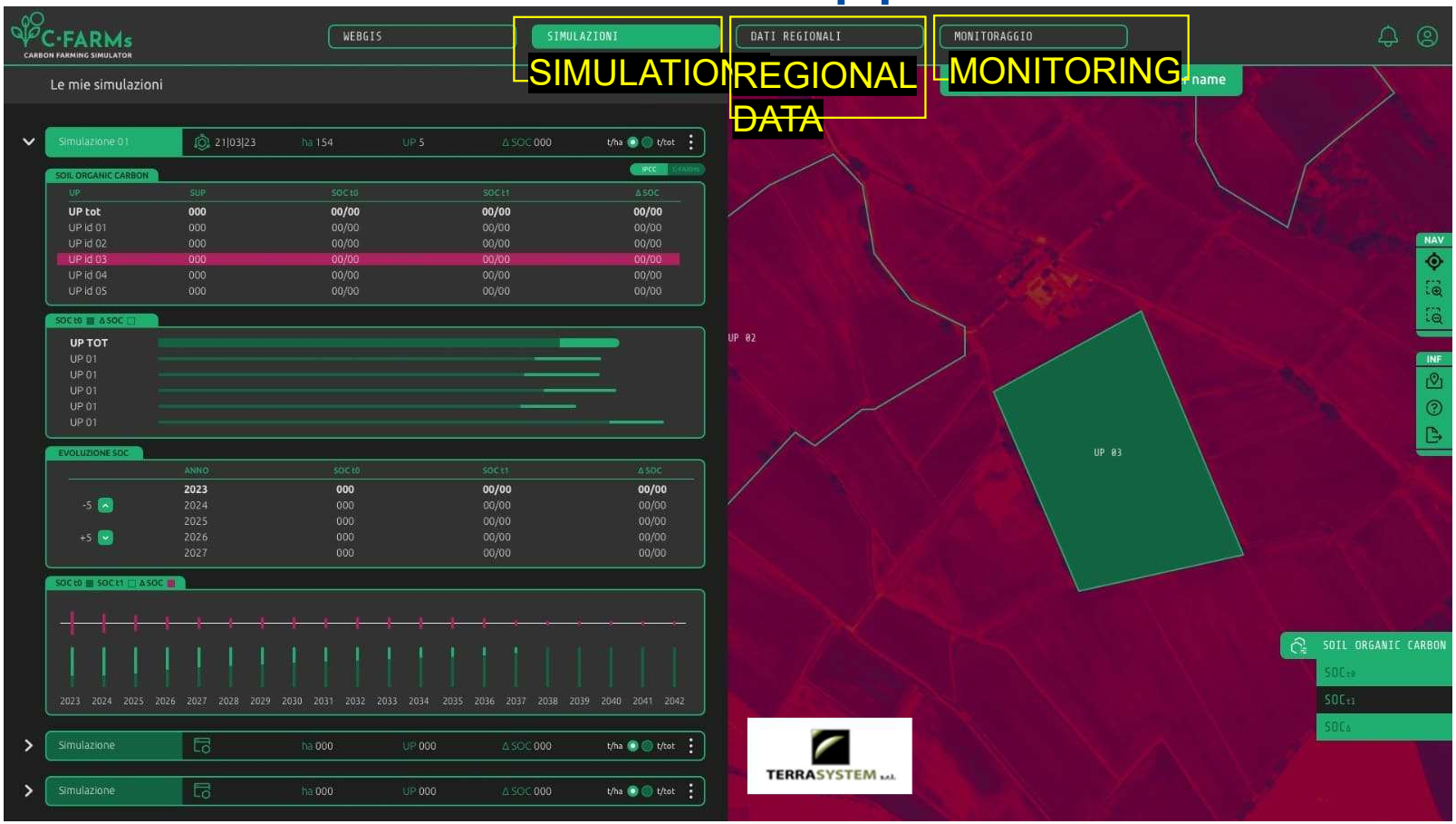
Cover crops (CC) - Organic ammendant (OA) - Organic agriculture (ORG)
Maintanance of crop residues (R) - Reduced soil disturbance (RSD)

Literature data (ex ante)



Tier 1 IPCC default factors (ex ante)

C-Farms web application



Conclusions

- **The GIS FARM platform** is an example of integration spatial data from different sources (dependent on available data)
- Allow users to geo-locate agricultural lands and display their relevant characteristics for carbon farming decision →**tool to inform Regional Public Authorities and farmers on potentials!**
- **From literature: only 54% of cropland area with data for a limited set of CF options→ Data needed! (in the meanwhile use of IPCC default value)**
- **Link with LPIS** is needed to extract management information (current and past)
- **LPIS information need to be complemented with management information** (depth of tillage, fertilization, crop rotation, historical information)
- **Upload of monitoring data** can improve the estimations (modeling validation!)→ IMPROVEMENT OF NATIONAL GHG INVENTORY ESTIMATIONS

THANK YOU!!!!

The "Carbon Farming Certification System" (C-FARMs) LIFE project is coordinated by FederlegnoArredo with CREA, Confagricoltura, University of Tuscia, PEFC Italy, Reteclima, CMCC and Terrasystem

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