HEALTHY SOILS FOR EUROPE

The contribution of

EJP SOIL at the science to policy interface

EJP SOIL
European Joint Programme

Final EU Policy Forum 2024 -11-18, Brussels

EJP SOIL has received funding from the European Union's Horizon 2020 research and innovation programme: Grant agreement No 862695

Agenda for the Day: thematic sessions

Soil Data & the Soil Monitoring Law
Moderated by Fenny van Egmond, Wageningen University & Research

Relevant scientific findings from the EJP SOIL
Maria Fantappiè
Council for Agricultural Research and Economics

A European Perspective
Svetlana Chovancova
DG Environment

A National Perspective - Belgium
Esther Goidts
Service public de Wallonie

Interactive Panel Discussion

Carbon sequestration & the Carbon Removals Regulation
Moderated by Greet Ruysschaert, ILVO

Relevant scientific findings from the EJP SOIL
Axel Don
Thünen Institute

A European Perspective
Christian Holzleitner
DG Climate Action

A National Perspective - Italy
Ilaria Falconi
Ministry of Agriculture, Food Sovereignty and Forests

Interactive Panel Discussion

Sustainable soil management practices & the CAP
Moderated by David Wall, Teagasc

Relevant scientific findings from the EJP SOIL
Frédéric Vanwindekens
Walloon Agricultural Research Centre

A European Perspective
Emmanuel Petel
DG Agriculture and Rural Development

A National Perspective - Austria & Switzerland
Elena Havlicek
Federal Office for the Environment, Section Soil, Switzerland

Interactive Panel Discussion

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Interactive Panel Discussion

Carbon sequestration for the climate

Axel Don (Thünen Institute)

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Negative emissions from soils

French Ex-ministry of agriculture Stéphane Le Foll

Soil carbon for

- Food security
- Climate adaptation
- Climate mitigation

What is the feasible C sequestration potential of European agriculture?

What are trade-offs and synergies of measures for soil C accrual?

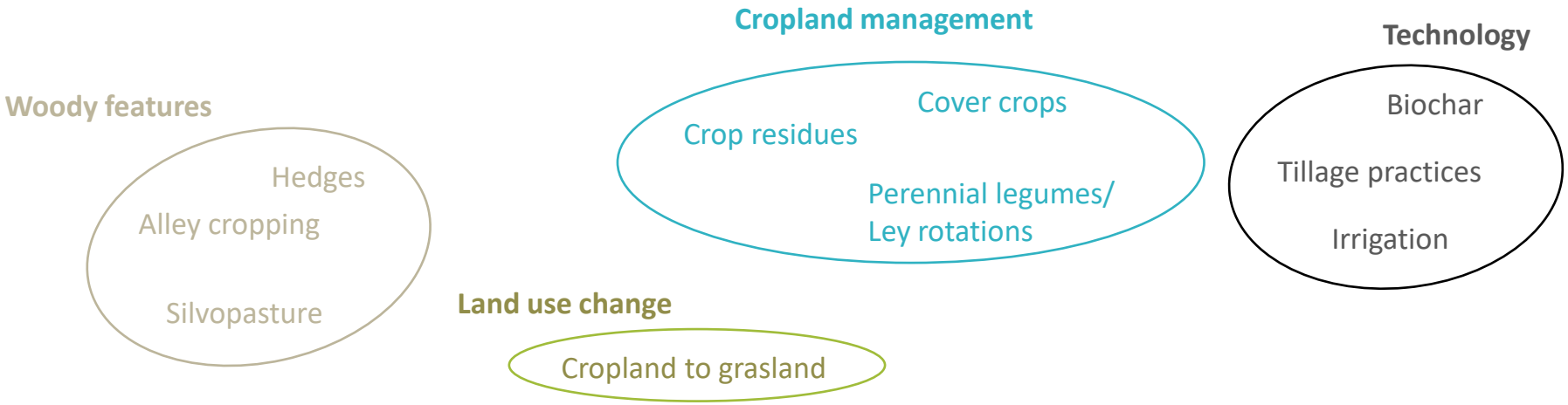
How to implement and monitor C accrual in carbon farming schemes?

- The annual increase in atmospheric CO_2 concentrations equals 4‰ of the global soil organic carbon stocks

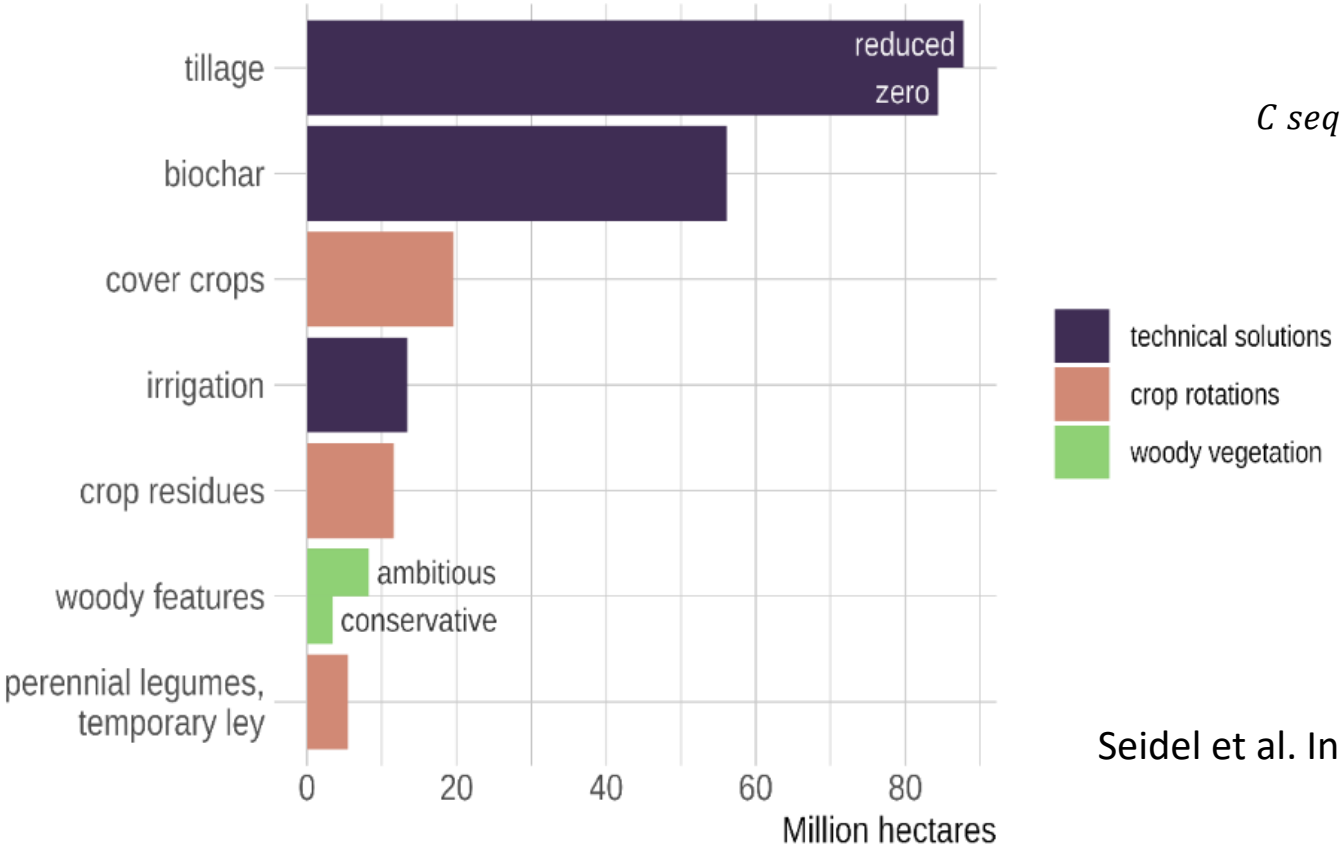
Which measures can increase SOC?

Identification of tested and validated agricultural measures for increasing soil C in mineral soils

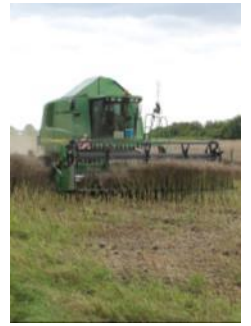
- Analysis of an EU-wide database with European (LTE) data (1394 publications)
- Identification of agricultural measures that increasing SOC based on the database



Potential area of implementation for each measure



$$C\ seq\ pot = A_{measure} * (\text{SOC stocks} * \text{EF})$$



Seidel et al. In prep

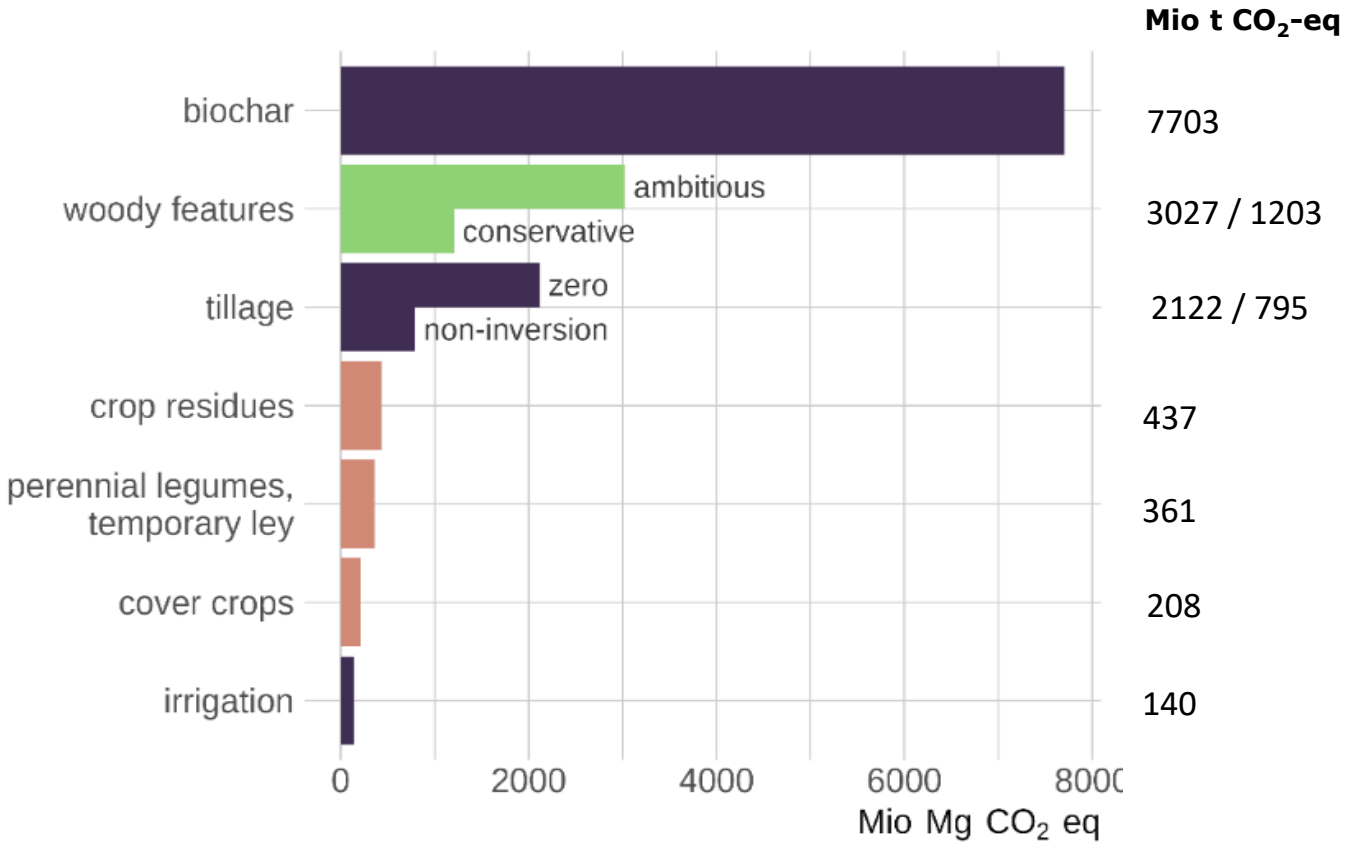
Total potential area of measures to be implemented, ranked by the size of the area in millions of hectares.

Total C sequestration potentials

Baseline: Total EU+ agricultural area

= 218 Mio hectare

⇒ For each measure an area of implementation was determined



Total C sequestration potential, ranked by the amount of Mg CO_2-equivalents in millions.

Seidel et al. In prep

How feasible are the measures?

How feasible is the implementation of the biochar measure?

- *Needed*: 2.8 billion t of biochar from 12.6 billion t of biomass (dry weight)
- *Current EBC certified production*: 0.064 **Mio** tons biochar = 0.26 **Mio** tons biomass (Hagemann et al., 2024)

43,750 years needed to produce the needed biochar

Where to get additional biomass from?

From hedge prunings:

EU estimate (Dyjakon et al. 2019):

13.7 Mio tons of woody biomass

= 3.1 Mio tons biochar per year

Woody vegetation measure implemented:

Up to 36.7 Mio tons of woody biomass

= 8.2 Mio tons biochar per year

From straw available for energy production:

EU estimate (Monforti et al. 2015):

146.1 Mio tons of straw biomass

= 32.4 Mio tons biochar per year

68 years needed to produce the needed biochar

How much C accrual is possible annually?

Measure	C sequestration potential [Mio t CO_2-eq yr^{-1}]
Cover crops	4.2
Crop residues	8.7
Perennial legumes and ley management	7.2
Biochar	77.0
Zero tillage	42.4
Reduced tillage	15.9
Irrigation	2.8
Woody vegetation ambitious	95.8
Woody vegetation conservative	38.8
Conservative estimate without biochar	77.6
Conservative estimate including biochar	**154.7**

- Agricultural GHG emissions in 2020 (EU+ including LULUCF emissions): 467 Mio t CO_2-eq
- Total GHG emissions in 2022 (EU+): 3798 Mio t CO_2-eq

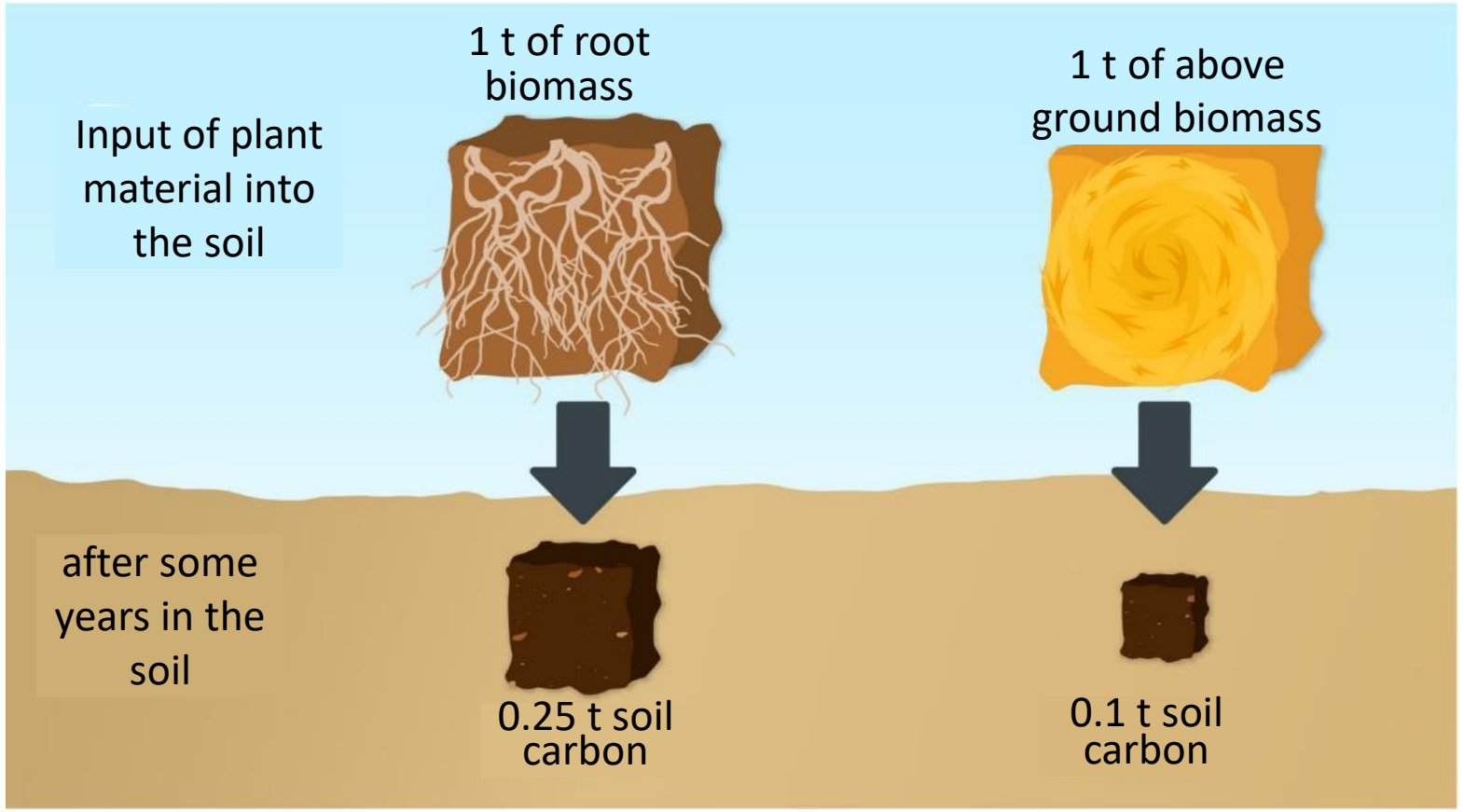
Measures increasing soil C accrual (excl. biochar) equal up to 12 % of annual agricultural GHG emissions or up to 1.5 % of total EU+ GHG emissions

Measures increasing soil C accrual and biochar equal up to 20 % of annual agricultural GHG emissions or up to 3 % of total EU+ GHG emissions

Measures increase soil C for a limited time period of a few decades

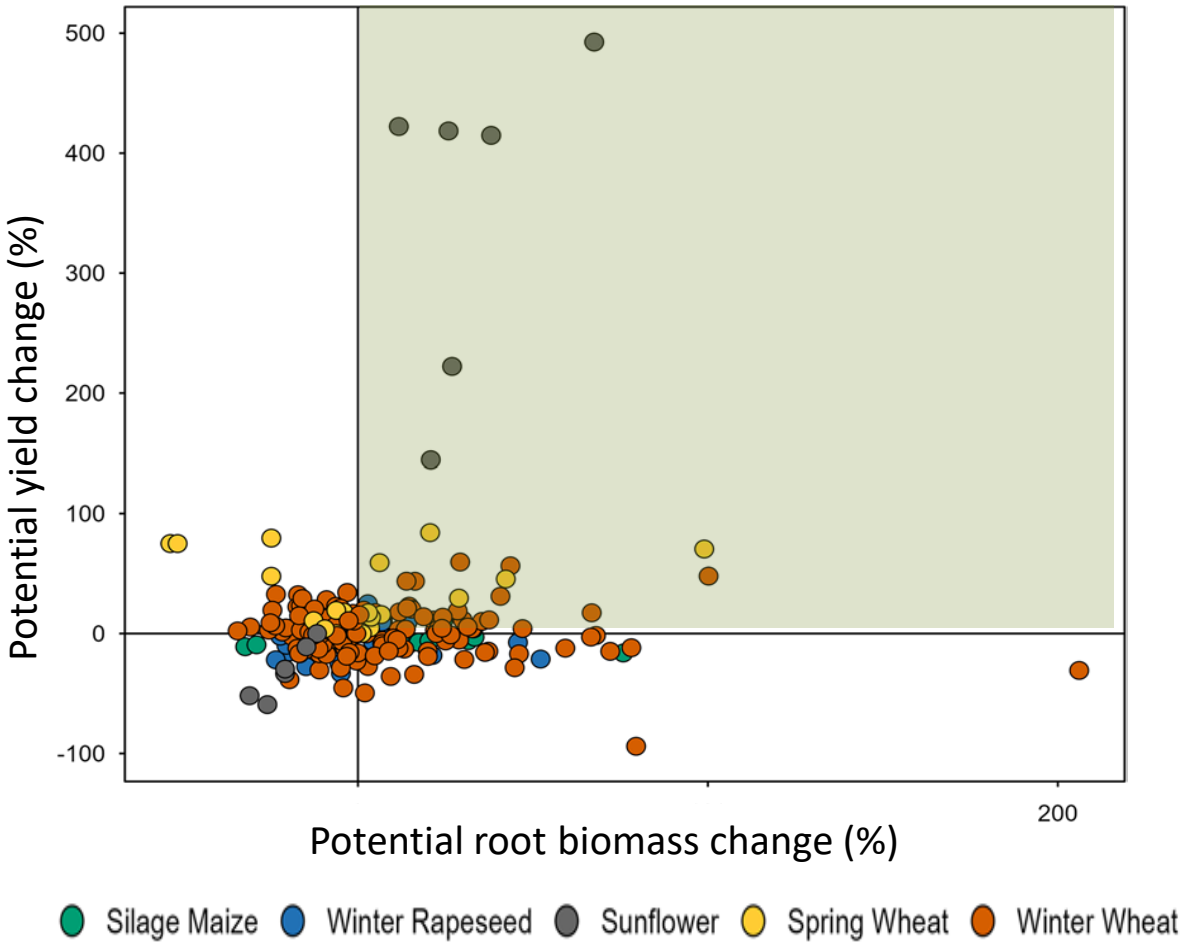
Seidel et al. In prep

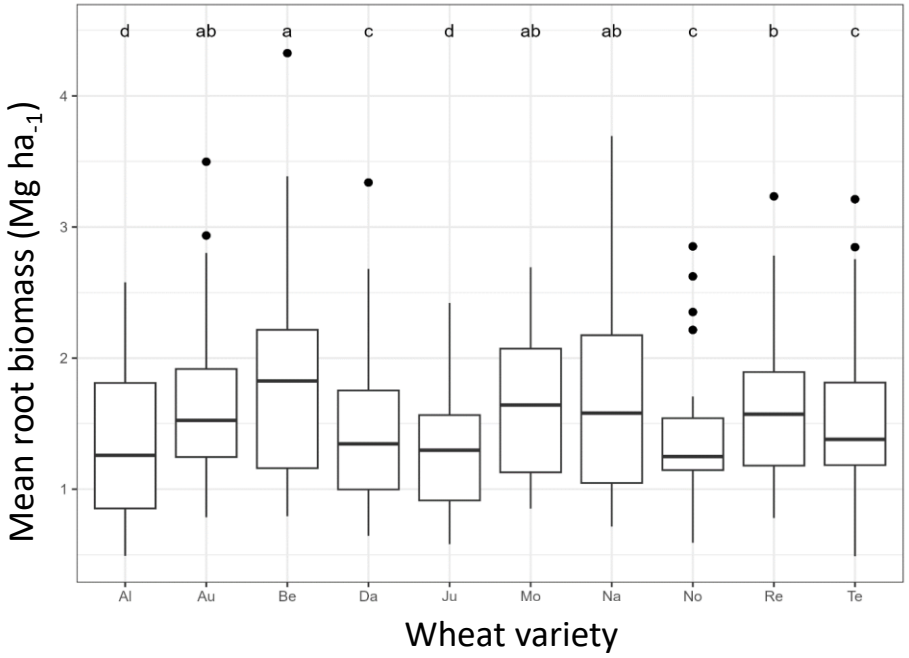
Roots to build up soil carbon



Kätterer et al, 2011, Xu et al. 2021

Roots and yield increases with crop variety selection





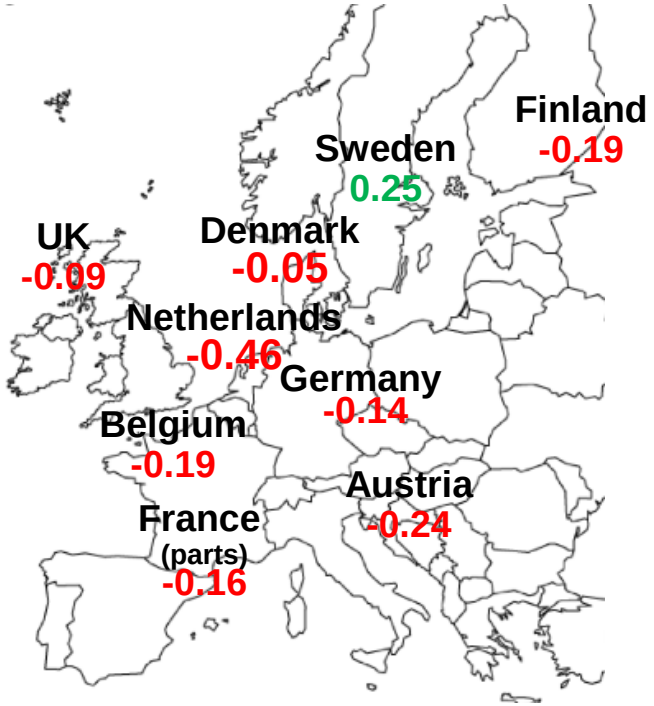
- 45% more roots in the best compared to the worst variety across 11 European sites (Heinemann et al. in prep.)
- Soil and site conditions are most important for root formation
- Variety selection is as effective measure as cover crops

Heinemann et al. 2023, Plant&Soil

DOI:10.1007/s11104-023-06068-6

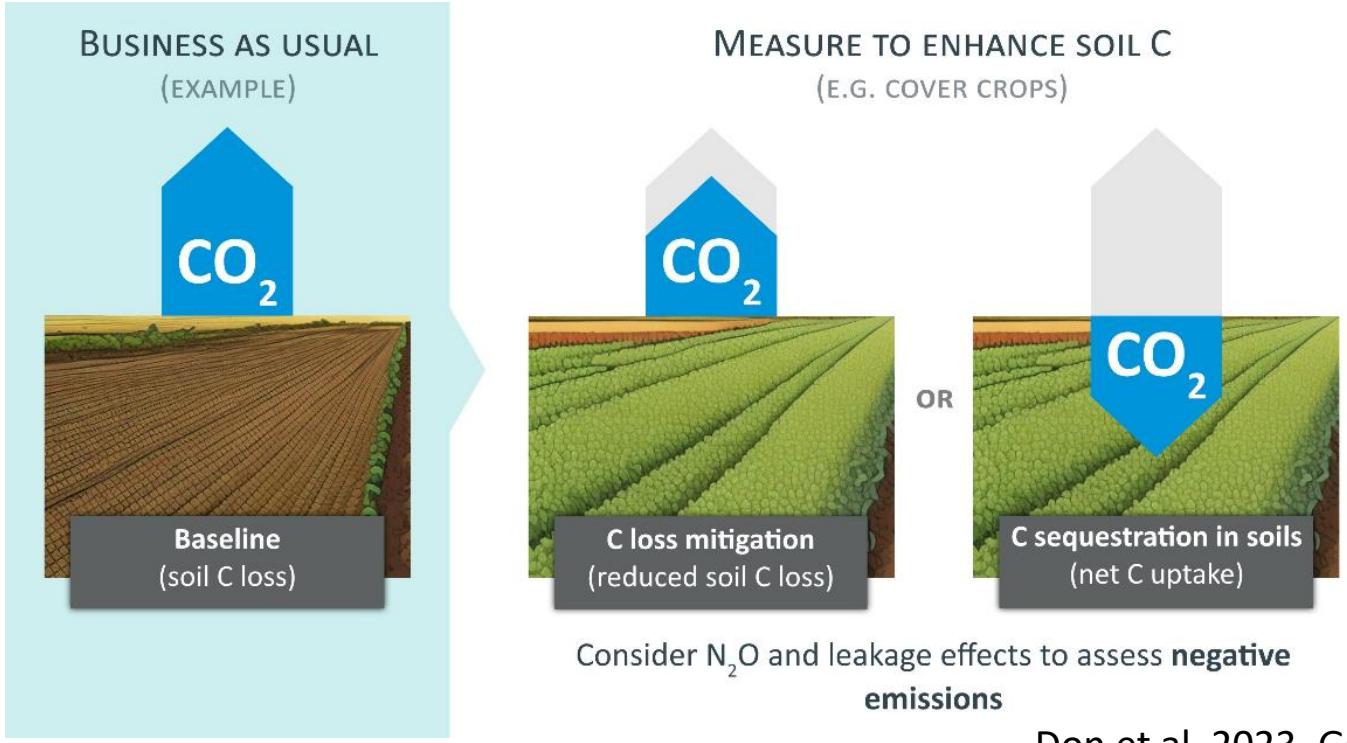
C Sequestration or C loss mitigation?

Recent soil carbon stock changes in croplands



In t C/ha/yr and based on repeated soil inventories

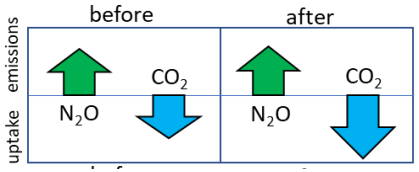
Sources: Heikkinen et al. 2013, Poeplau et al. 2015, Taghizadeh-Toosi et al. 2014, Lettens et al. 2005, Knotters et al. 2022, Dersch and Böhm 1997, Höper 2021, Antoni et al., 2008



Don et al. 2023, GCB 10.1111/gcb.16983

What is the baseline (buisiness as usual C trend) in our soils?

Soil carbon sequestration is not always climate mitigation

Management examples		SOC loss mitigation	Climate change mitigation	C sequestration / SOC accrual	Negative emissions
More cover crops		✗	✓	✓	✓

The aim of carbon farming need to be:

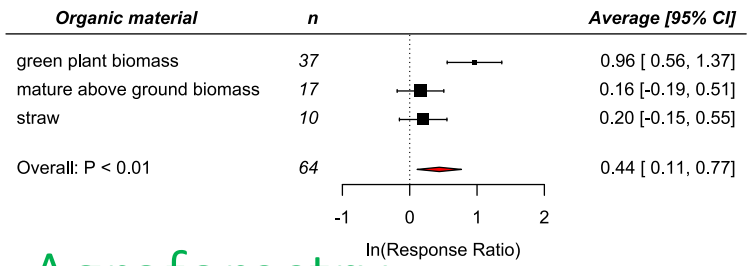
- Increasing or mainting SOC stocks (C-Seq)
- Reducing GHG-Emission
- Avoiding GHG emissions
- Additional ecosystem services

Don et al. 2023, GCB 10.1111/gcb.16983

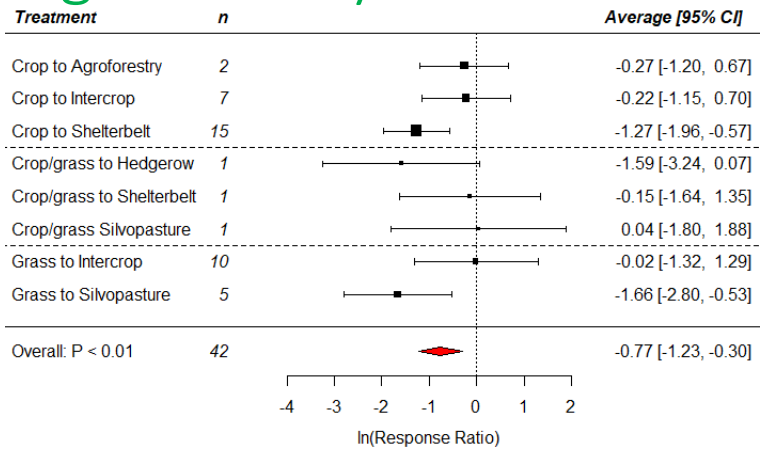
N_2O effects of C sequestration measures

Meta-analysis results on temperate cliamte field experimenst

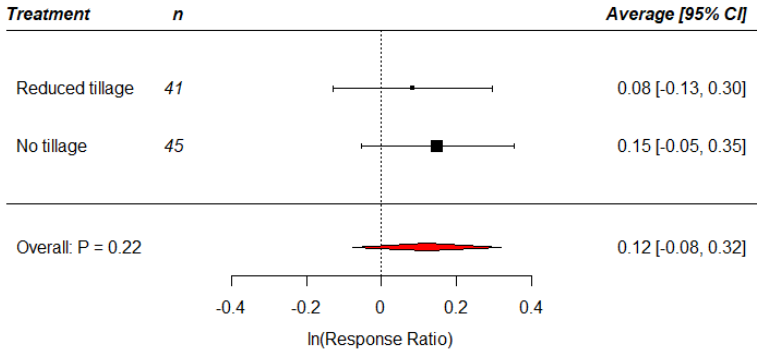
Crop residue management



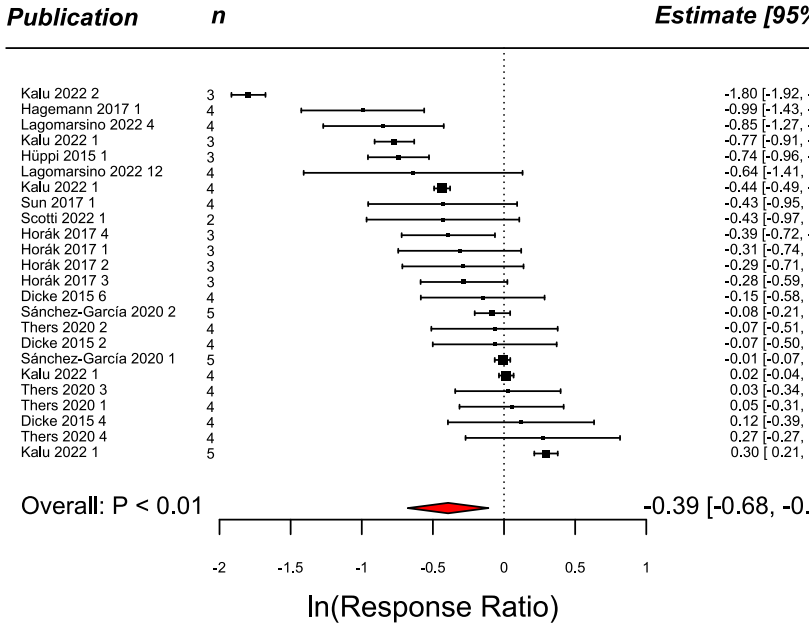
Agroforestry



Reduced and no tillage



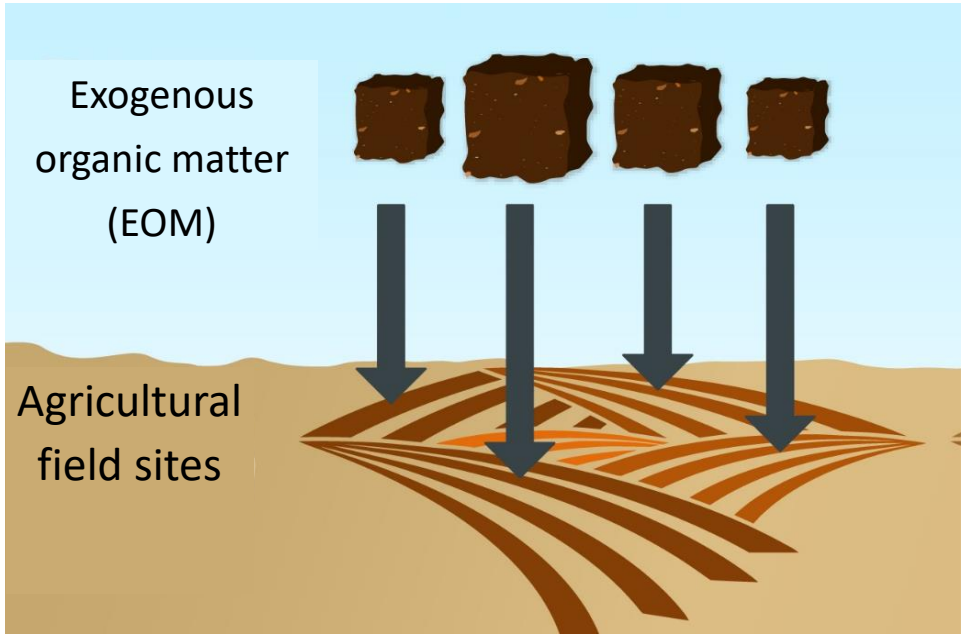
Biochar



Lessen et al. in prep

- There are trade-offs and synergies between C sequestration and N_2O emission
- C sequestration effects were reduced by enhanced N_2O emissions, but never overcompensated

Building up SOC with EOM – potential leakage

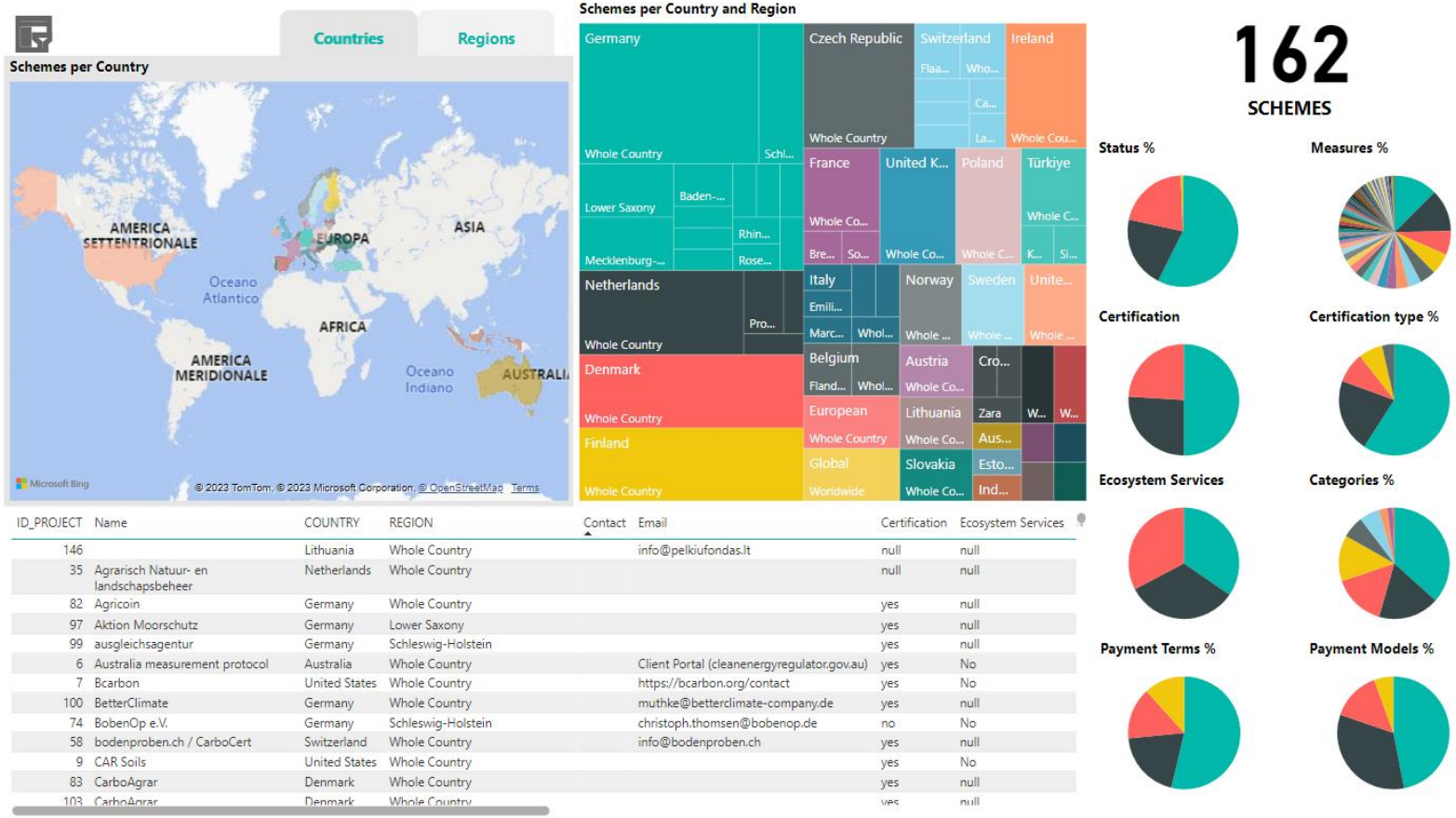


- Transfer of C with EOM but no enhanced soil C stocks at large scale
- Exceptions: If EOM is derived from actually incinerated biomass

  If improved EOM application techniques enhances plant growth

Analysis of existing carbon farming schemes

- Large differences regarding scale and monitoring systems
- 50% of existing schemes are activity based
- Cover crops and peatland are the most applied measures
- Farmers are very sceptical towards result-based schemes and have limited faith in models



Baumgarten, Thorsøe et al. in prep

- No silver bullet for perfect schemes, trade-offs and risks can hinder successful adoption and implementation
- A careful planning towards "**tailor made systems**" may increase the degree of acceptance

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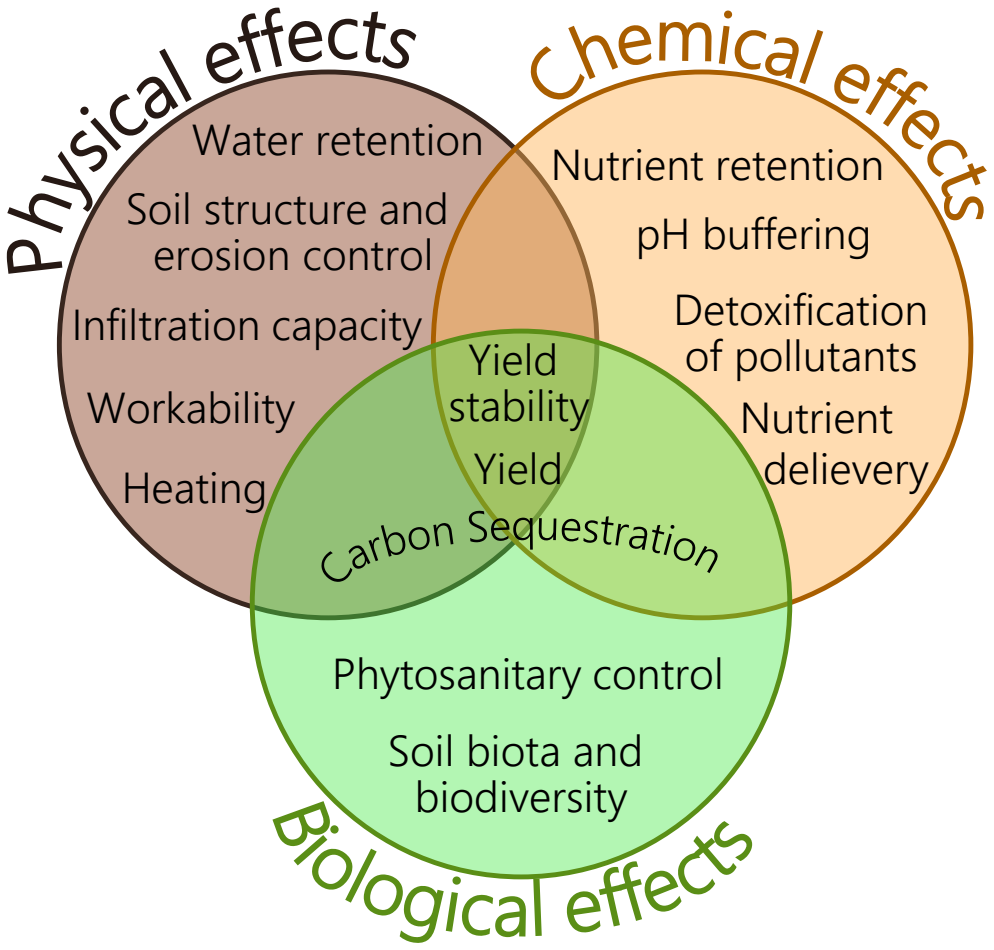
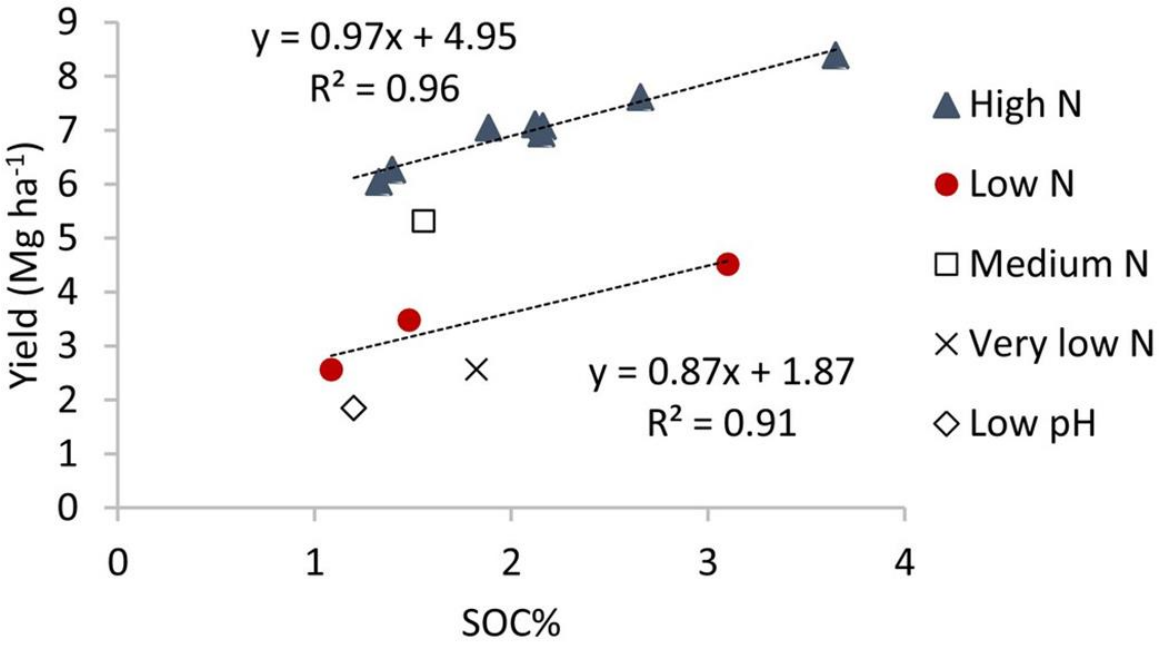
Road4Schemes

Soil carbon functions





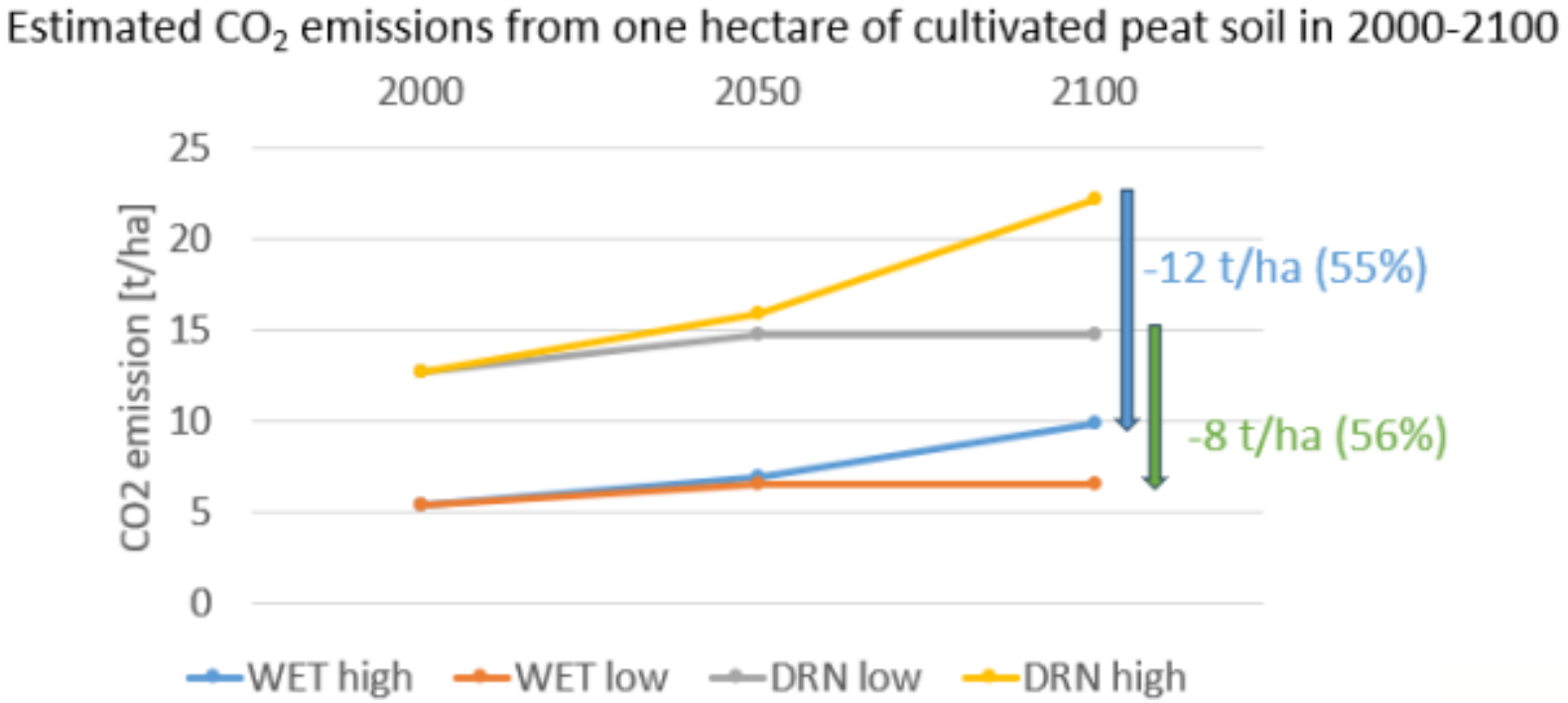
Higher yields due to higher SOC (if other environmental parameters such as N or pH are not limiting), mostly due to **improved soil physical properties** (Swedish LTE with maize).

Kätterer & Bolinder 2024, EJSS

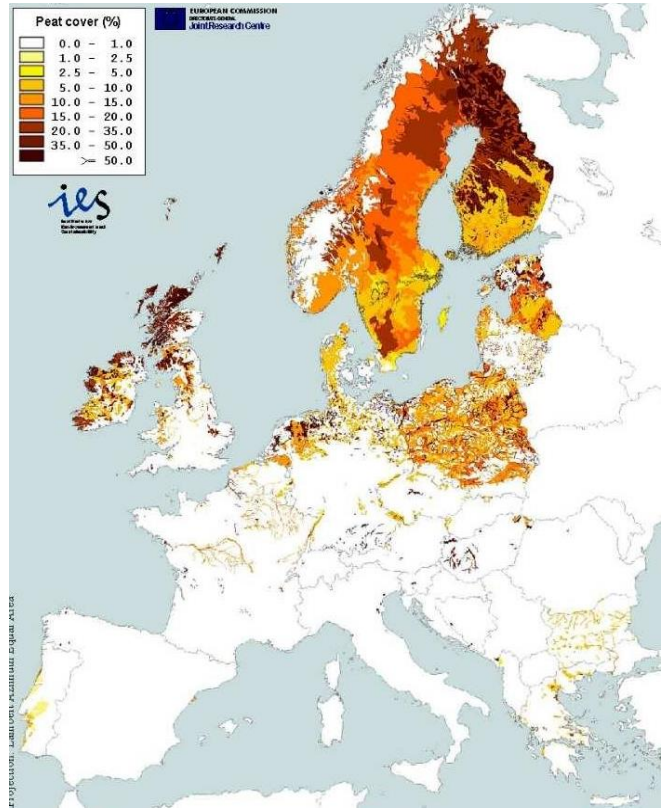
DOI: 10.1111/ejss.13482

Peatland rewetting for C loss mitigation

Annual GHG emissions from drained peat soils are >100 million tonnes CO_{2eq} in the EU.
Raising the ground water table can stop peat loss and CO_2 emissions.
Rewetting reduces the emission per unit area more than other management options.

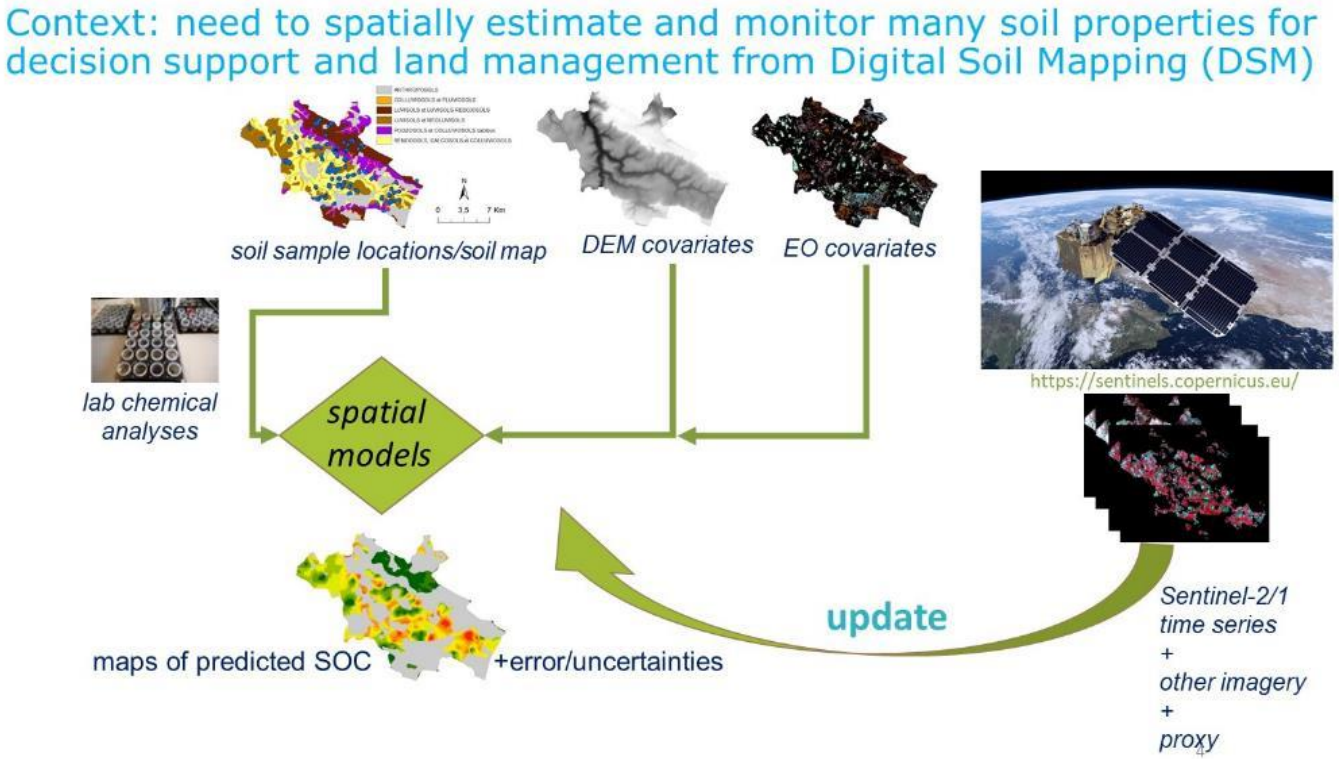


DRN=Conventional management with water table at 44 cm; WET=raised water table at 15 cm;
high=climate warming +4°C; low=climate warming +1.6°C



Peatlands in Europe

Remote sensing for estimating SOC trends on croplands



Earth Observation: high potential, BUT

1. Transparency needed on validity and accuracies
2. Harmonised protocols needed
3. Recommended to establish network of benchmark sites

Castaldi et al. 2023, ISPRS J Rem Sens. DOI: 10.1016/j.isprsjprs.2023.03.016

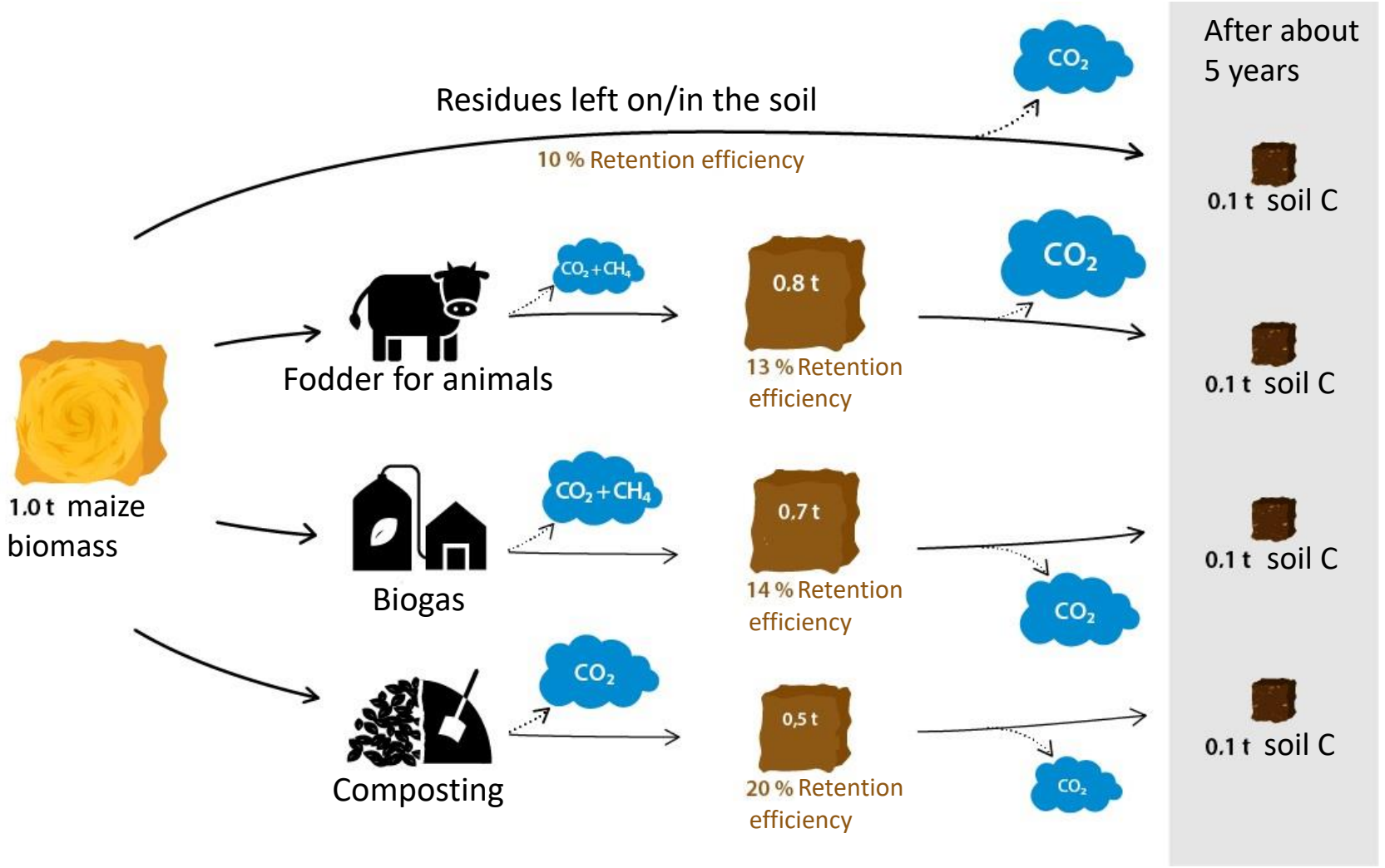
Vaudour et al. 2022, Remote sens. DOI: 10.3390/rs14122917

- Support for carbon farming schemes with the detection of **land use and management and biomass**
- Remote sensing detection of soil carbon trends is challenging and only possible on long-term
- Remote sensing could be used to **independently validate carbon farming schemes**

Conclusions

- There is a **significant potential** to contribute to climate change mitigation through C accrual in soils and agricultural biomass, in the magnitude of 20% of the actual GHG emissions from agriculture.
- **C loss mitigation is the precondition for C sequestration**. Measures for C sequestration in soils can only compensate GHGs (negative emissions) if there is no C loss from soils anymore (mineral soils and peatlands)
- Multiple **synergies with C sequestration** measures exist and should be explored
  - More roots for main crops (climate adapation)
  - More hedges and agroforestry (biodiversity and soil protection)
  - Biochar (water retention, less N_2O emissions)
- Existing carbon farming schemes are divers and farmers prefer activity-based schemes over result-based schemes. **A robust baseline as reference is crucial.**
- Investments into soils and soil carbon will pay of on long-term due to improved soil fertility and yields.

Pathways of biomass use – implications for soil C



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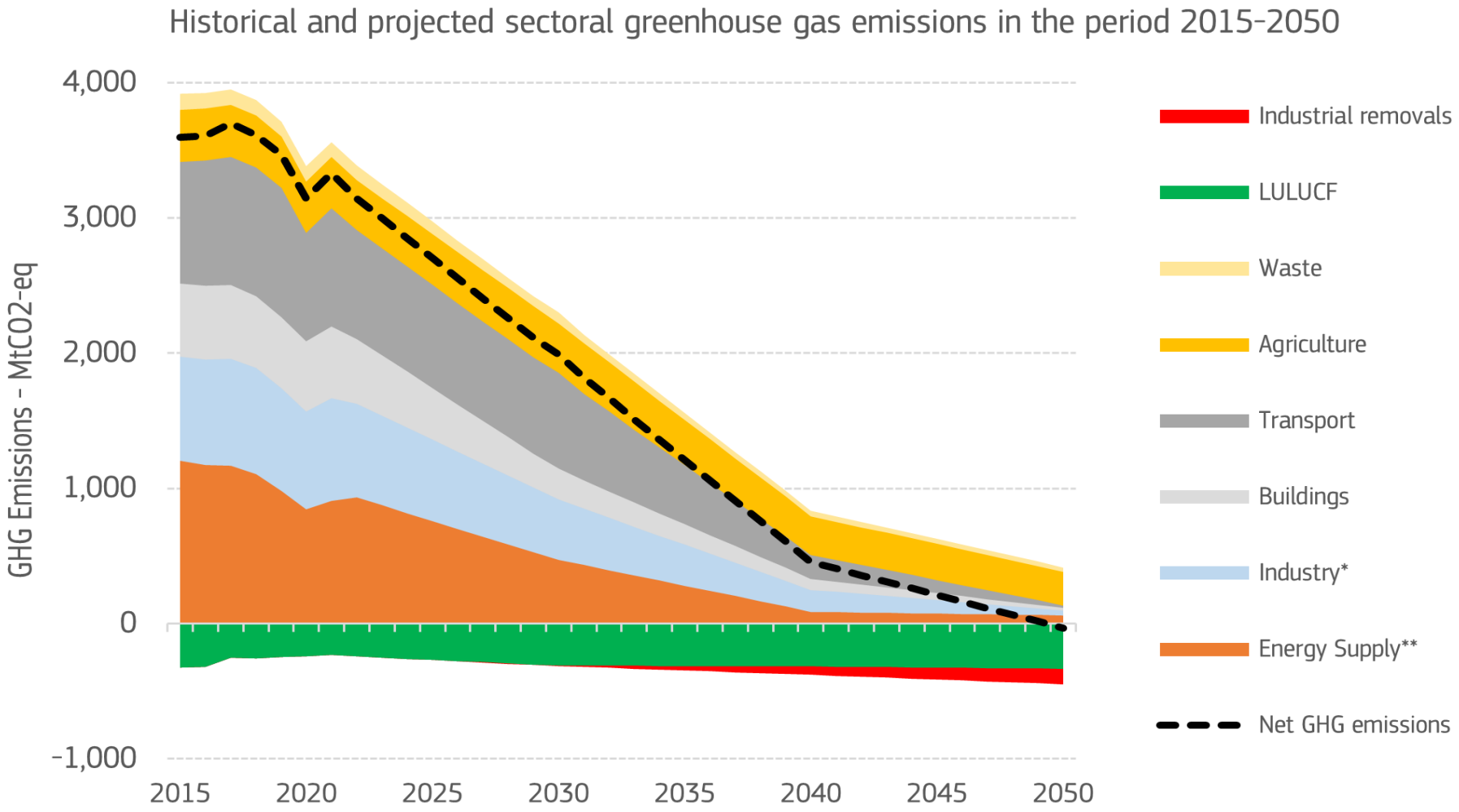
EU Climate policy for Bioeconomy, agriculture, and forestry

18 November 2024

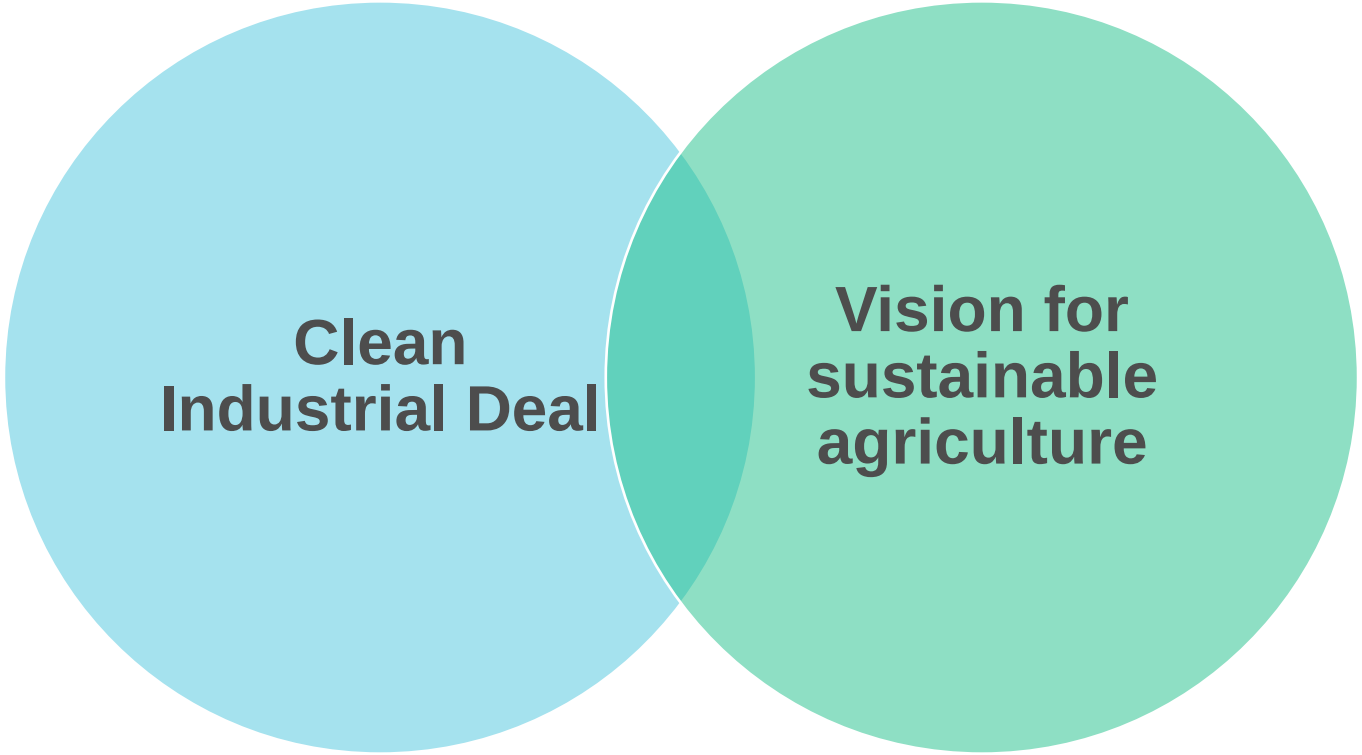
Pathway to climate neutrality



*Excluding non-BECCS industrial removals
**Including bioenergy with carbon capture and storage (BECCS)

European Commission

Two keys for climate neutrality



Certification of carbon farming and removals

Carbon **R**emoval and **C**arbon **F**arming Regulation (**CRCF** Regulation)

- **Soil emissions reductions**
  - More efficient use of fertilizers
  - Rewetting of peatlands
- **Carbon farming sequestration**
  - Carbon removals in soils and forests
- **Livestock emissions reductions**
  - Not yet included in scope but pilot methodology by 2026
- **Carbon storage in buildings**
  - Long lasting use of biomaterials
- **Permanent removals**
  - Bioenergy with Carbon Capture and Storage (BECCS),
  - Biochar,
  - Direct Air Capture and Storage (DACCS)

Starting up carbon farming

On-farm monitoring

EU Certification Framework

Soil and Forest Monitoring Laws

Project development and advisory services

Private initiatives

Public support

Financing

Corporate Sustainability Reporting

- Sustainable Reporting Standards on Climate

Green Claims

- Commission proposal from March 2023 on climate-neutrality claims

Post-2030 Climate Policy

- Study on Emissions and Removals Trading in the AGRI-FOOD value chain

How does certification work?

CRCF Regulation

EU certification methodology

QUALITY criteria
- Quantification
- Additionality
- Liability
- **Sustainability**

Commission establishes certification methodologies in consultation with **expert group**

Certification process

Private and public certification schemes recognised by the Commission

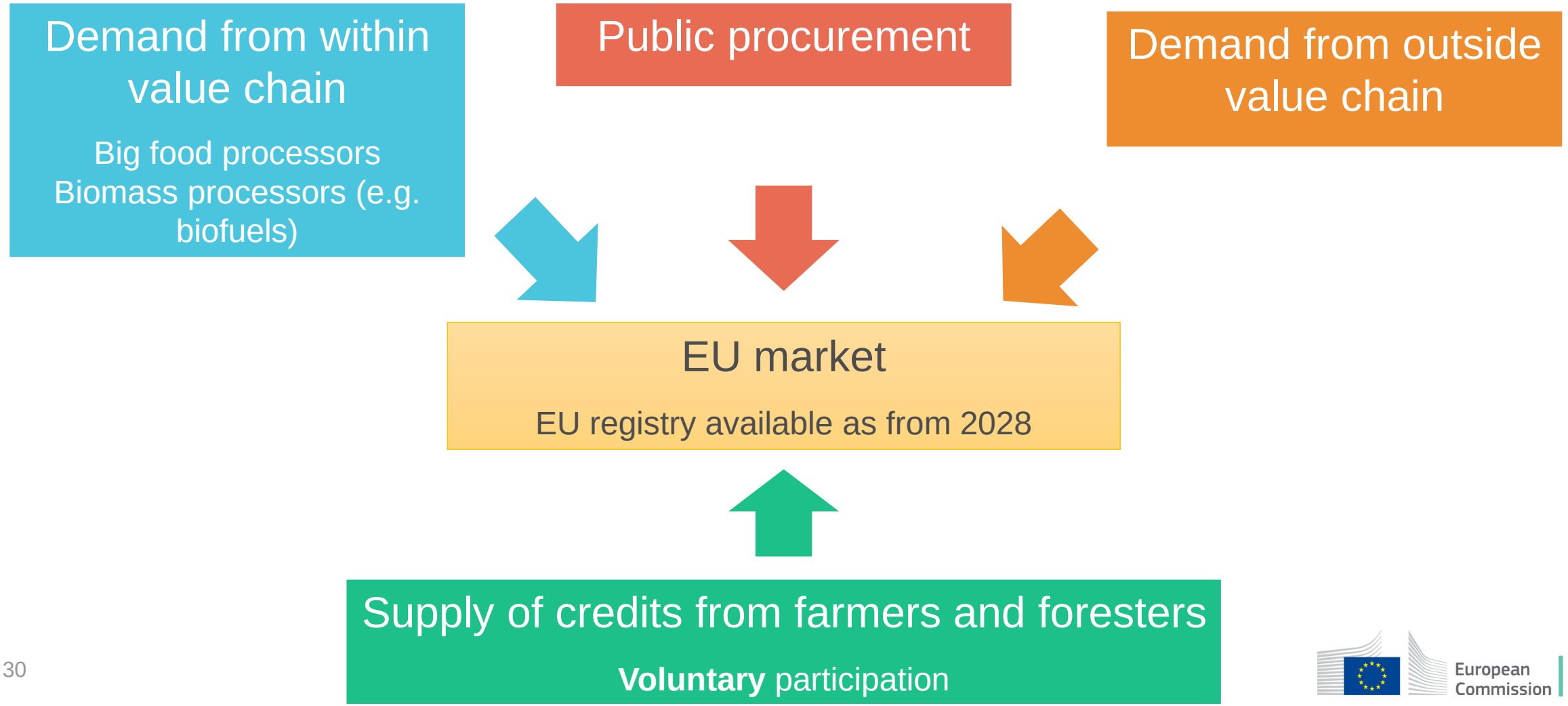
Independent certification bodies to issue
- Audit reports
- Certificate of compliance
- **Group audits possible!**

Certification registries and Union-wide CRCF registry from 2028

Publicly accessible information on activities and operators
- Audit reports
- **Certificates of compliance**

Quantity and status of certified units
- Carbon farming sequestration unit
- Soil emissions reduction unit

EU market for CRCF credits



Next steps towards certification

December 2024	Publication of CRCF in Official Journal	CRCF Regulation (linguist lawyer version): CO_TA (europa.eu)
2025	Proposal of delegated acts on certification methodologies	Permanent removals Carbon farming Carbon storage in long-lasting buildings
	Proposal of implementing act on verification and registries	
2026	Start of certification	EC recognition of certification schemes
		First issuance of certified units
2028	Start of EU registry	

European Commission

More information:

- DG CLIMA website on Carbon Removals and Carbon Farming
- CRCF Regulation (linguist lawyer version): CO_TA (europa.eu)
- FAQ: a8abe1c4-a3c6-4c94-be0e-4b76f7fd0308_en (europa.eu)
- EU carbon removals newsletter

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A National Perspective

Dr. Ilaria Falconi

Italian Ministry of Agriculture, Food Sovereignty and Forestry

Italian National Rural Network

EU member group experts carbon farming

Bruxelles – 18 November 2024

EJP SOIL
European Joint Programme

crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Italian Political Framework


Senato della Repubblica

Proposta di modifica n. 45.6 (testo 2) al DDL n. 564

Approvato

Dopo il comma 2, aggiungere i seguenti:

«2-*bis*.Al fine di valorizzare le pratiche di gestione agricole e forestali sostenibili, in grado di migliorare le capacità di assorbimento del carbonio atmosferico, e aggiuntive rispetto a quelle prescritte dalla normativa unionale e nazionale in materia di conduzione delle superfici agricole e forestali, è istituito, presso il Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria CREA, il Registro pubblico dei crediti di carbonio generati su base volontaria dal settore agroforestale nazionale, di seguito denominato "Registro". I crediti di cui al presente comma sono utilizzabili nell'ambito di un mercato volontario nazionale, in coerenza con le disposizioni relative al Registro nazionale dei serbatoi di carbonio agro-forestali di cui al decreto del Ministro dell'ambiente e della tutela del territorio e del mare, di concerto con il Ministro delle politiche agricole, alimentari e forestali del 1aprile 2008.

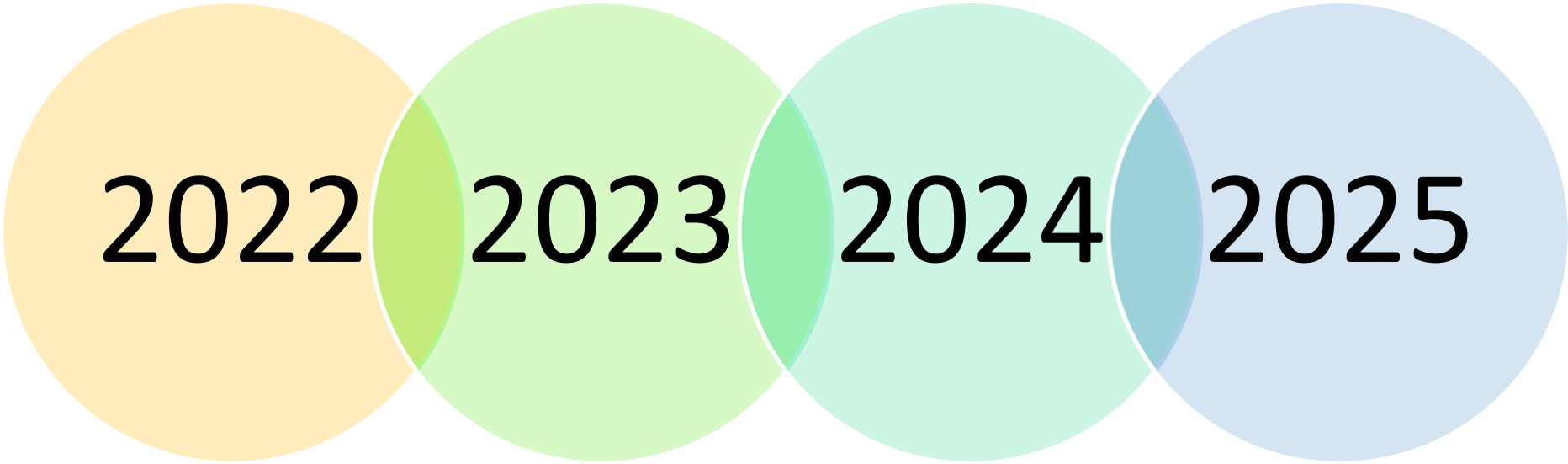
The paragraph 2-quinquies of art. 45 of L. n. 41/2023 states that »The credits referred to in paragraph 2-quater may not be used in the EU ETS market referred to in legislative decree 9 June 2020, n. 47, and in the CORSIA market referred to in Regulation (EU) 2017/2392 of the European Parliament and of the Council, of 13 December 2017, and while contributing to the achievement of national targets for the absorption of greenhouse gas emissions accounted by the Institute for Environmental Protection and Research (ISPRA) in the context of international obligations».

The guidelines cover three sectors: agriculture, forestry and livestock.

The time path

Analysis and study of MRV systems in the EU and non-EU countries.

Public consultation with stakeholders.



First draft of carbon credits guidelines.

?

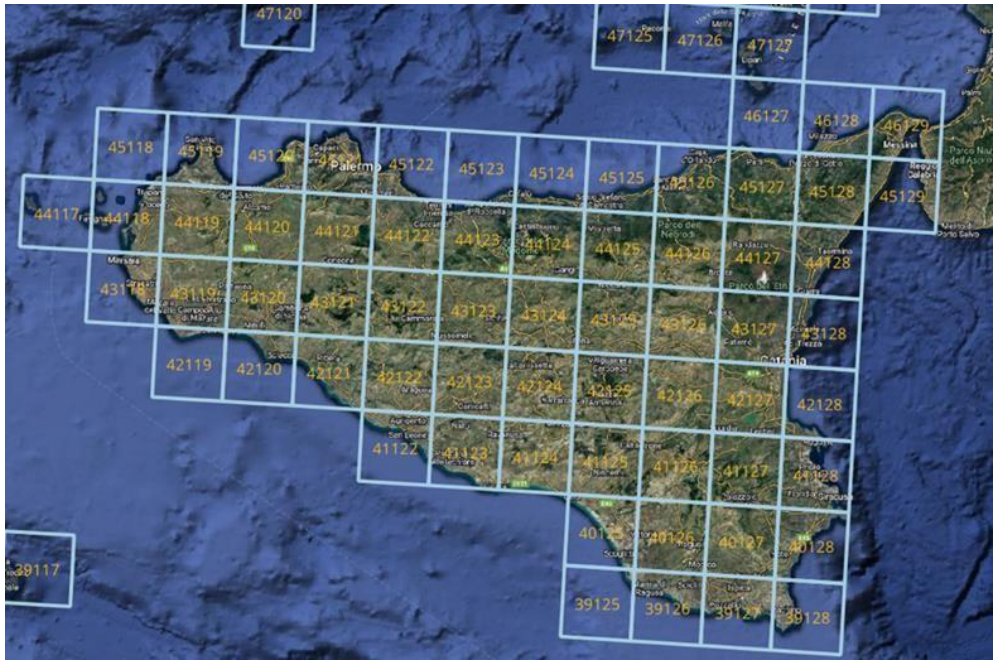
Examples of eligible activities

- ✓ Improved crop management that increases soil cover and/or that increases the amount of carbon input from crop residues to the soil (e.g. use of cover crops, crop rotations, crop residue management);
- ✓ Conservation tillage practices that aim at reducing soil disturbances combined with cover crops or crop residue management;
- ✓ Improved grassland management (e.g. convert arable land for fodder crops to permanent grassland, rotational grazing, mixed swards);
- ✓ Reducing fertiliser application, e.g. by precision fertilisation or leguminous crops;
- ✓ Using organic soil improvers/amendments (e.g. biochar, compost, manure and digestate);
- ✓ Agroforestry, sustainable forest management and poplar growing.

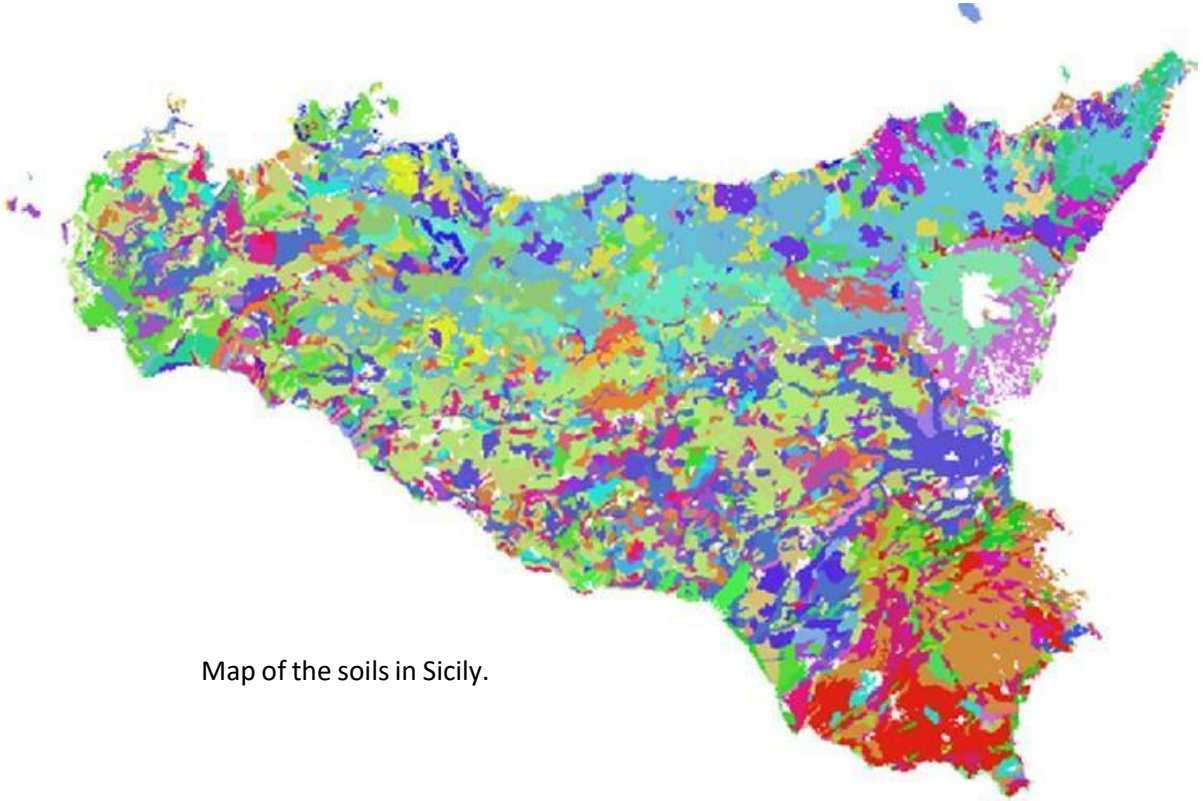
Criteria

QU.	***Net benefit from carbon absorption by the soil, reduction of direct and indirect greenhouse from agricultural soils (*** *N_2O and CO_2).* Include GHG reductions from **livestock sector.** Inclusion of methane emissions in the carbon budget.
A.	**Use of soil organic carbon maps and use of cross-compliance (good agricultural and environmental conditions - GAEC) as the minimum regulatory framework to be respected.** **GAECs more than 90% of the EU's agricultural land.** **Regulatory additionality.**
L.	***Agricultural carbon farming activities must be carried out for a period of at least five years.*** *The risk of reversal should be taken into account by maintaining a fixed proportion (%) of the credits as unsold reserve.* *The share of reserve credits should be higher for shorter-duration projects (15% for agricultural management linked to land management practices in arable or tree crops and 8% for land management related to land use change on agricultural land such as conversion from arable land to permanent crops, herbaceous and/or arboreal).*
ITY	*At least soil protection (including prevention of soil degradation) and protection and restoration of biodiversity should be ensured as mandatory.*

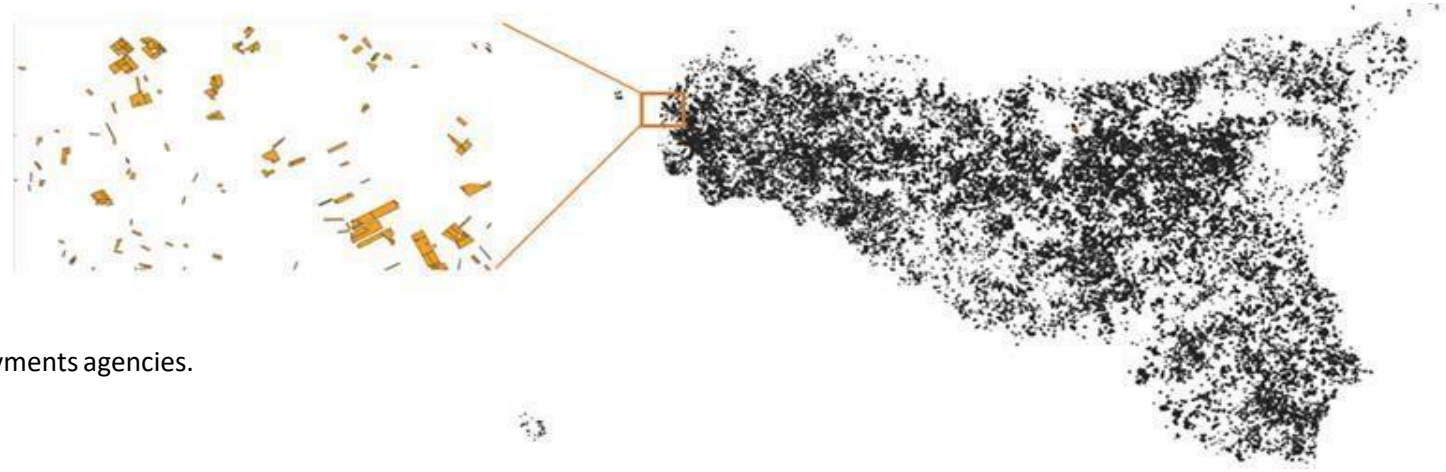
Quantification



25x25 km grid for weather data in Sicily as provided by the European climate database AGRI4CAST (https://agri4cast.jrc.ec.europa.eu/DataPortal/Index.aspx).



Map of the soils in Sicily.

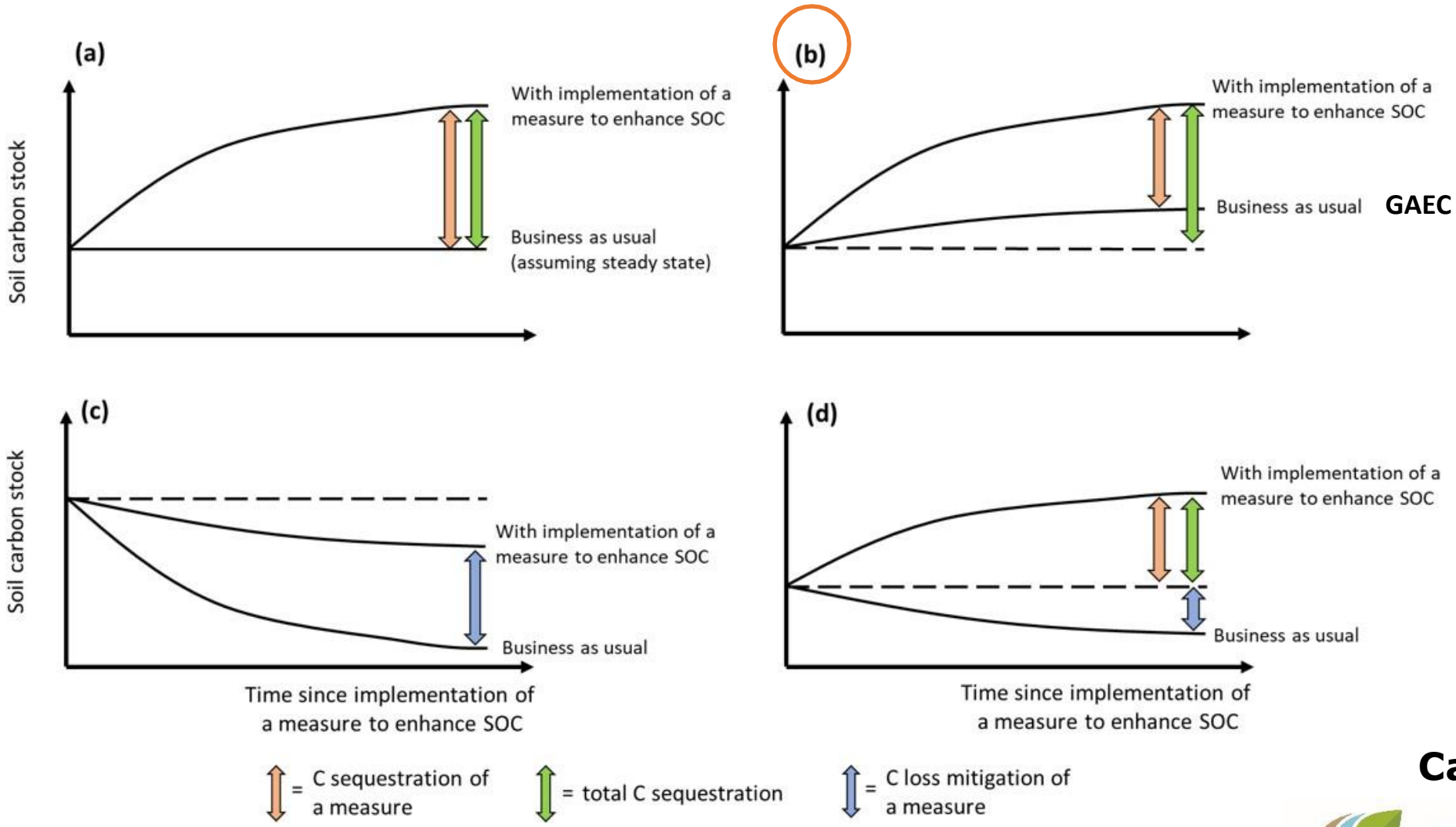


RDP measures from CAP payments agencies.

Carboseq

EJP SOIL
European Joint Programme

Baseline and additionality



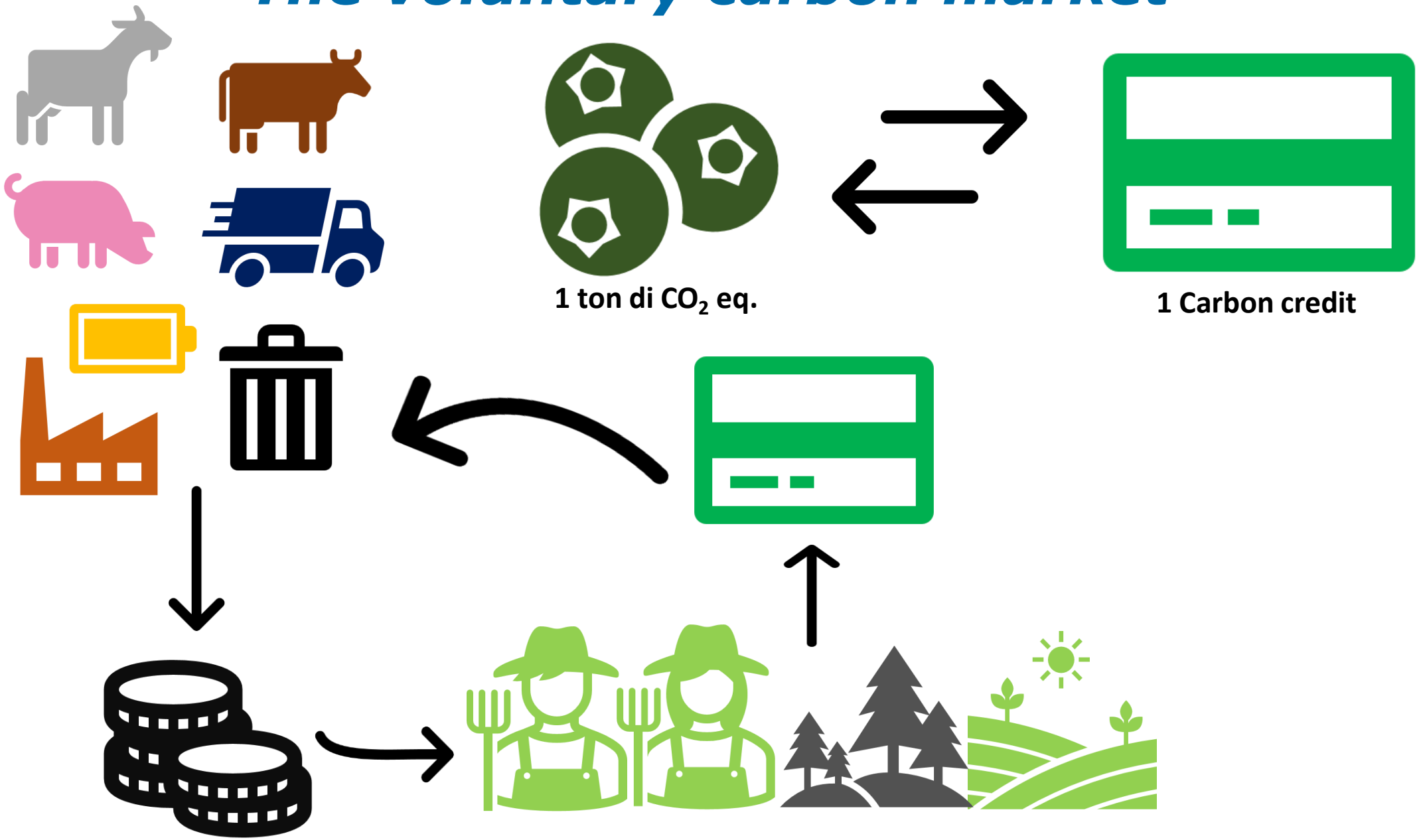
Application of agro-ecological practices

GAEC

Carboseq

EJP SOIL
European Joint Programme

The voluntary carbon market



Conclusions

1.**Which areas?:** It is necessary to start from the marginal areas, abandoned or at risk of erosion and desertification, that is from those able to guarantee the highest potential of increase of carbon stock.

2.**Project costs:** The design costs are high and can be met through cooperation between farms. Trade organizations could play a key role in aggregating producers and managing carbon farming projects. Transaction costs that include the calculation and certification of credits may be financed by public subsidies.

3.**Avoid greenwashing**: It is necessary to provide that carbon farming practices are closely linked to agroecological principles (as defined by the FAO) in order to encourage holistic and sustainable agricultural techniques that can produce real environmental benefits.

4. **Price of credits**: A minimum basic price for carbon credits should be established to ensure income compensation for farmers and to prevent market fluctuations.

5. **Protection of virtuous farms**: it is not appropriate to penalise farms that have implemented virtuous practices in recent years (e.g. organic farming, conservation farming, etc.).

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Grazie per l'attenzione!