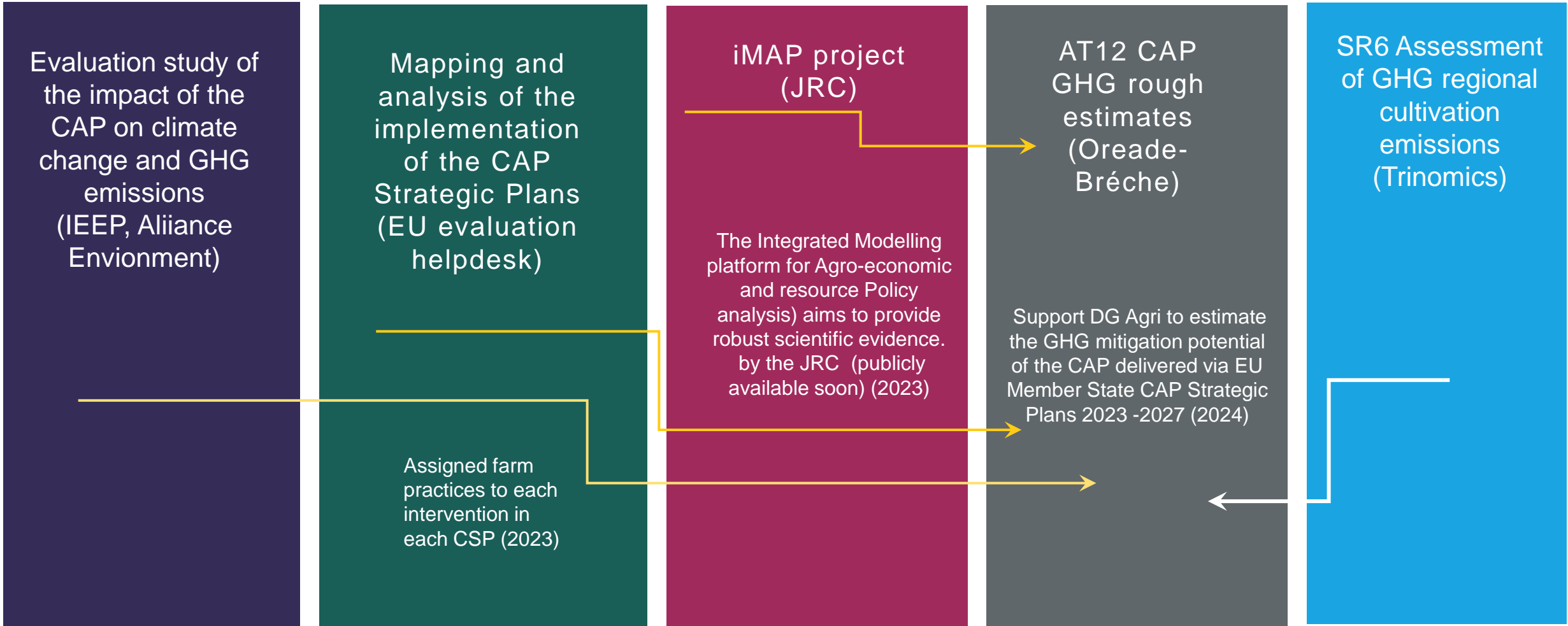


Estimating soil organic carbon
sequestration at the national scale
Good Practice Workshop

Keesje Avis, 24th June 2024

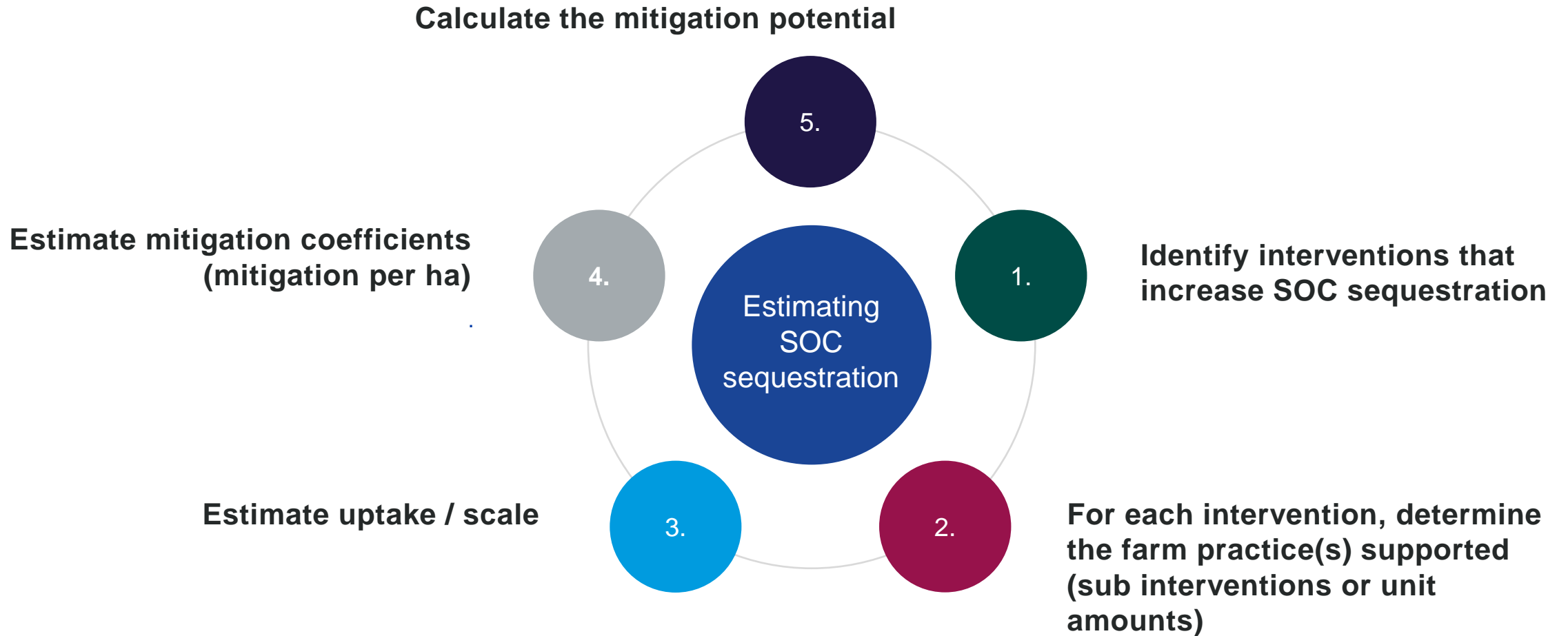
Our journey



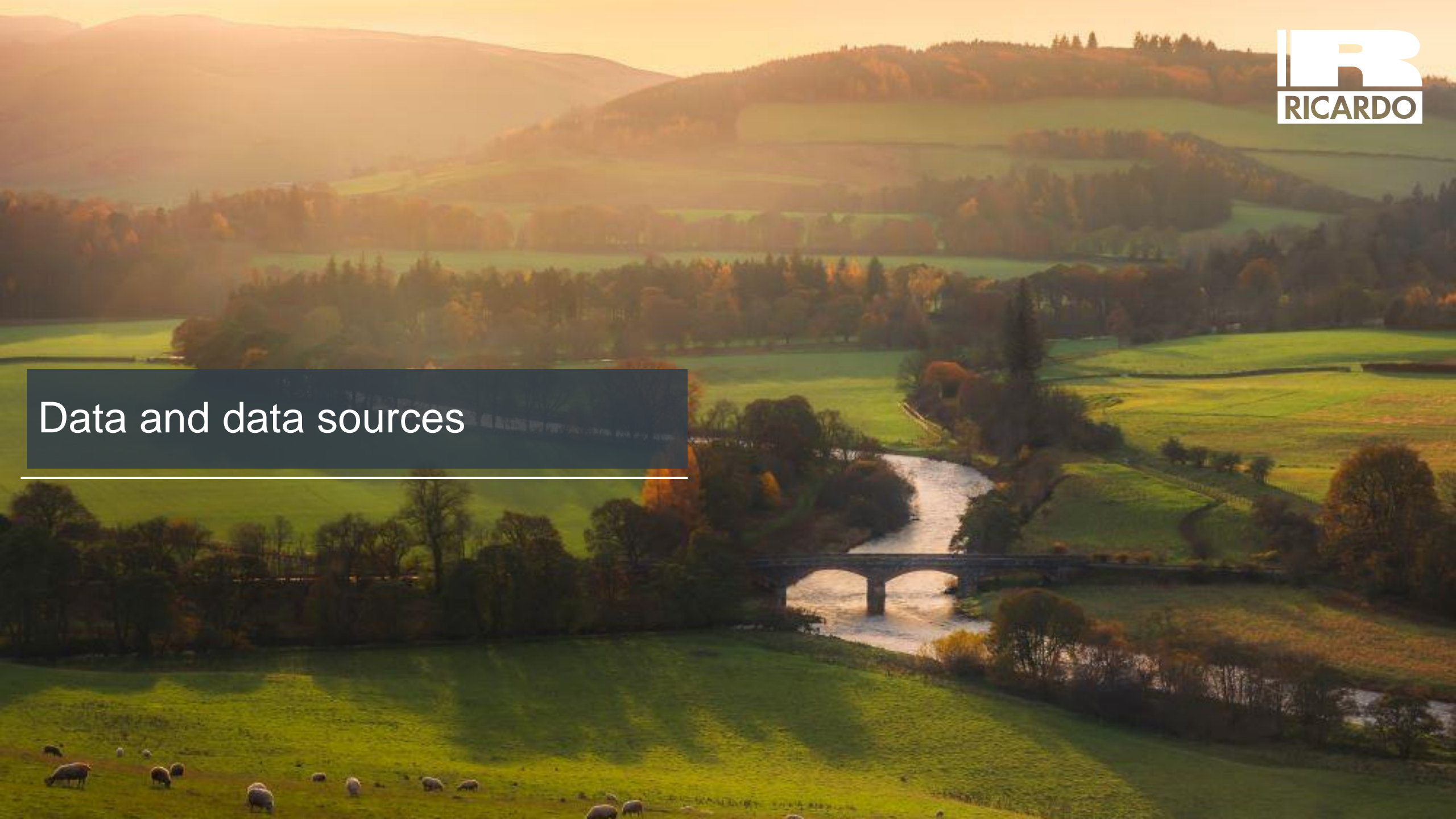
Methods



Methods - overview



Data and data sources



Data sources

Uptake values

- CAP strategic plans
- National government surveys
- Industry surveys



Emission and removal coefficients

- Collated by the JRC in the iMAP project:
 - ⇒ Based on review of academic literature
- OR – conduct your own literature review



Baseline carbon stock values

- Estimated using [EC Agri-food Data portal](#)



Estimating the scale

Uptake values



European Commission | **Catalogue of CAP interventions**
Directorate-General for Agriculture and Rural Development

SELECT VIEW: **Catalogue of CAP Interventions**

Please Make your selection

Member State: Specific Objective: Result Indicator: Output Indicator:

Intervention Type: Language Intervention: English Original

Display/Hide additional columns? CAP plan version National Intervention Code Green Intervention Territorial Scope Specific Objective Result Indicator GAEC Sectoral Objective Area of Action EU Expenditure Max of annual planned output Additional National Financing

Clear Type

Member State: Ireland > Output Indicator: 0.14

Total Expenditure		Values by Output Unit		Intervention Description									
Member State Code	Member State	Macro-type	Type of Intervention Code	Type of Intervention Description	Intervention Name - English	Sector	No. of Su...	Output Indicator Code	Sum of Planned Output (2013-2020)	Max of Annual Planned Output (2021-2023)	Output Unit		
IE	Ireland	Rural Development	ENVCLIM	Environmental, climate-related and other management commitments	Supplier Carbon Efficiency Programme	Not Applicable	N/A	0.14	1 333 334	266 667	Hectares		
IE	Ireland	Rural Development	ENVCLIM	Environmental, climate-related and other management commitments	Dairy Beef Welfare Scheme	Not Applicable	N/A	0.14	508 908	101 782	Hectares		
IE	Ireland	Rural Development	ENVCLIM	Environmental, climate-related and other management commitments	Straw Incorporation Measure	Not Applicable	N/A	0.14	289 908	46 908	Hectares		
IE	Ireland	Rural Development	ENVCLIM	Environmental, climate-related and other management commitments	AEDM General	Not Applicable	N/A	0.14	-	-	Hectares		
IE	Ireland	Rural Development	ENVCLIM	Environmental, climate-related and other management commitments	Agri-Environment Climate Measure "AECM" - Cooperation Option	Not Applicable	N/A	0.14	-	-	Hectares		

Estimating uptake

- Planned output values from CAP interventions
- Check that uptake values are annual or apply to the time period of interest
- Sense check needed – e.g. compare with cropland and grassland areas within the country
- Avoid double counting

Estimating coefficients

Emission and removal coefficients

Search and review literature, collate mitigation potential (MP) values with units

Example: grassland restoration (land use change from cropland to grassland)

- Potential mitigation values from JRC's iMAP project

Table 98 Effect (% change) of grassland conservation on soil organic carbon (stock per hectare). Sources: own elaboration from synthesis papers in the second column.

Pairwise comparison	Reference	Population	Factor	CI_LOW	Mean	CI_HI_GH	Nc	Effect
Grassland conservation								
Ex-arable grassland ⁷⁰ as compared to ancient grassland ⁷¹	(Kämpf et al. 2016b)	Temperate grasslands	--	-2.1	-11.4	-20.7	36	Positive
Grassland restoration								
Ex-arable ⁷⁰ grassland vs. arable land	(Kämpf et al. 2016b)	Temperate grasslands	-	12.0	17.1	22.7	19	Positive
Perennial								

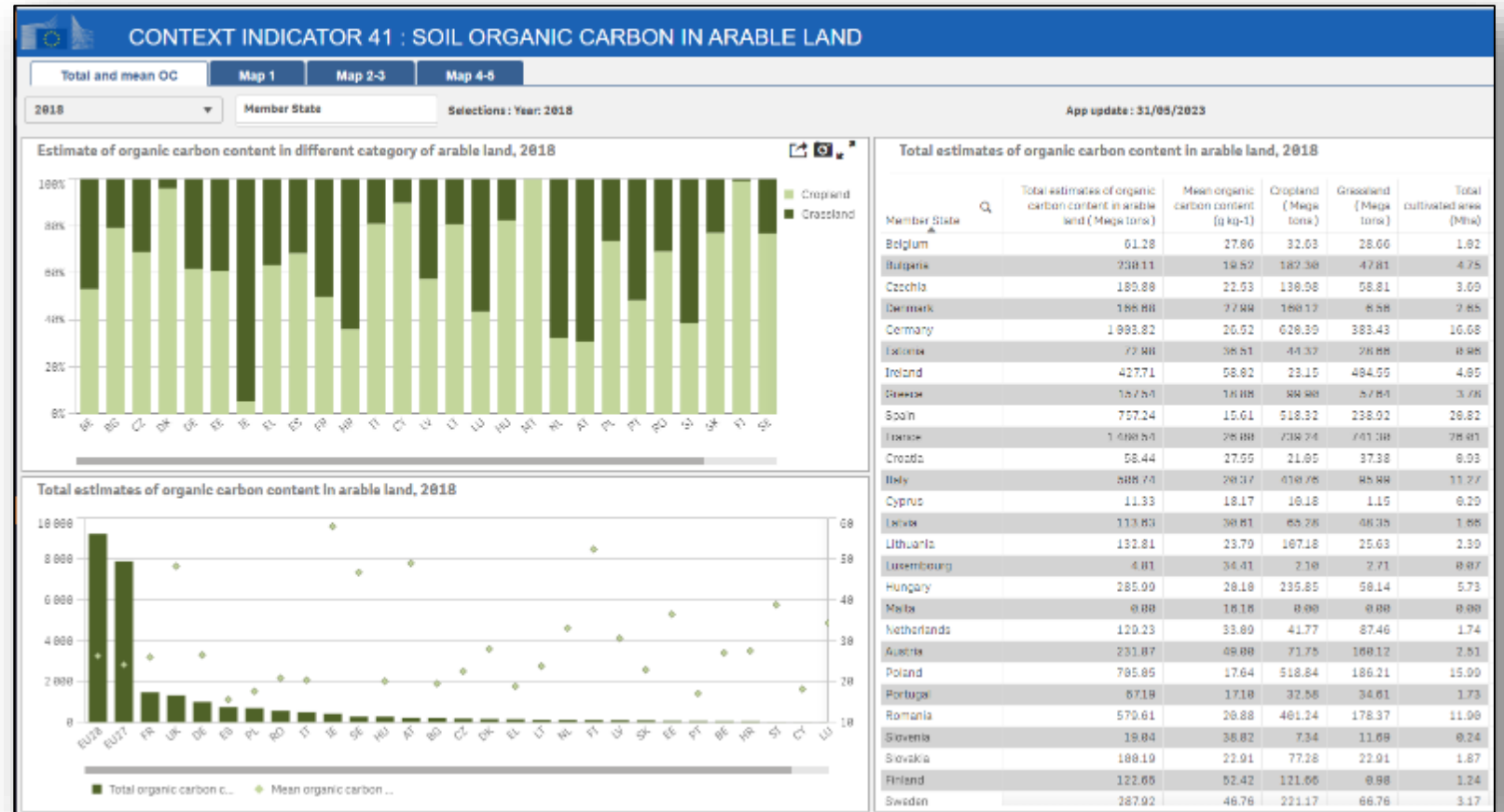
Estimating removal coefficients

Emission and
removal coefficients

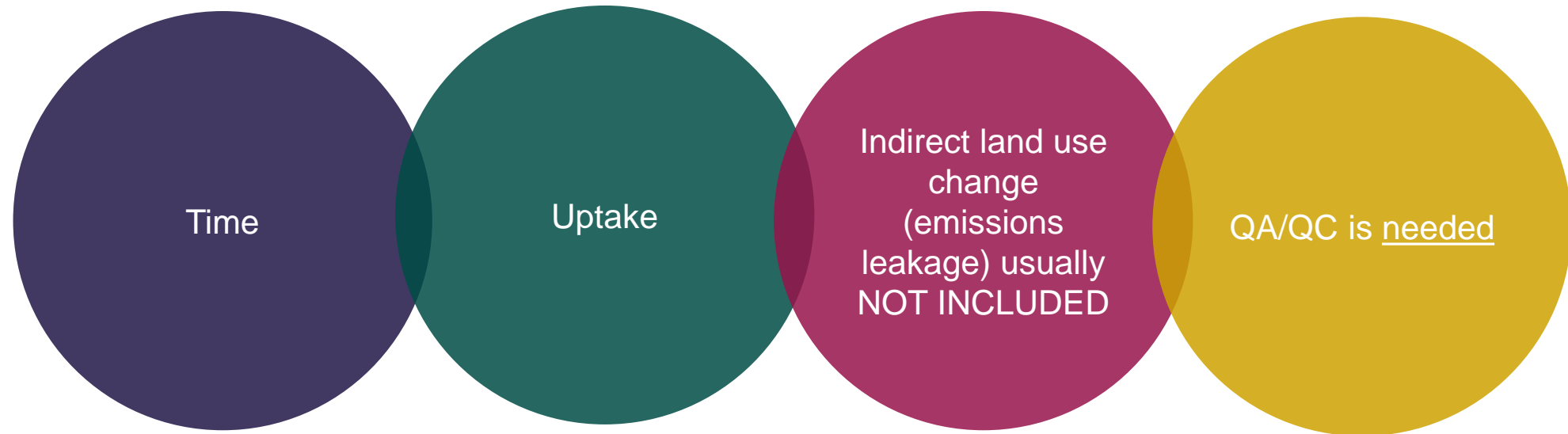


Modify the mitigation potential data to ensure the units are useful (SOC increase per ha)

- Adjust values for time dependence – for grassland restoration we assumed literature values represented change over 20 years
- Find baseline SOC stock values for cropland
- Apply the time-adjusted % change to the baseline
- Convert from C to CO₂e if required



Considerations



Results highlights



Top 15 farm practices 1.6 to 14.8 t/ha/y CO₂e

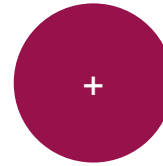
- Y11 - Afforestation of agricultural land
- Y21 - Forest restoration and reforestation
- Y22 - Sustainable Forest management (e.g. for biodiversity, C sequestration)
- Y2X - Forest management - General
- Y12 - Maintenance of afforested land
- L512 - Peatland maintenance and conservation
- L51X - Wetland and peatland maintenance and conservation - General
- L53 - Paludiculture
- F46 - Use of compost
- L111 - Creation of new hedges/wooded strips
- G27 - Conversion of arable land to grassland
- L121 - Creation of field margins
- L125 - Creation of unproductive buffer strips along water courses
- L211 - Seeded flower areas/strips
- O11 - Maintenance of organic farming practices



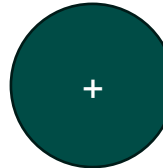
Forest land practices

- Y11 - Afforestation of agricultural land
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- Y22 - Sustainable Forest management (e.g. for biodiversity, C sequestration)
- Y2X - Forest management - General
- Y12 - Maintenance of afforested land

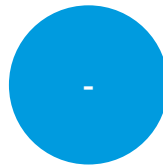
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- O11 - Maintenance of organic farming practices



High mitigation



Important nationally in many Member States



Not relevant for many farms

Peatland practices

Y11 - Afforestation of agricultural land

Y21 - Forest restoration and reforestation

Y22 - Sustainable Forest management (e.g. for biodiversity, C sequestration)

Y2X - Forest management - General

Y12 - Maintenance of afforested land

L512 - Peatland maintenance and conservation

L51X - Wetland and peatland maintenance and conservation - General

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F46 - Use of compost

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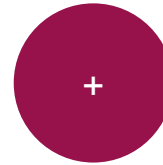
G27 - Conversion of arable land to grassland

L121 - Creation of field margins

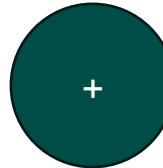
L125 - Creation of unproductive buffer strips along water courses

L211 - Seeded flower areas/strips

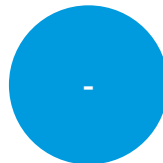
O11 - Maintenance of organic farming practices



High mitigation



Important nationally in many Member States



Not relevant for many farms

Compost

Y11 - Afforestation of agricultural land

Y21 - Forest restoration and reforestation

Y22 - Sustainable Forest management (e.g. for biodiversity, C sequestration)

Y2X - Forest management - General

Y12 - Maintenance of afforested land

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L51X - Wetland and peatland maintenance and conservation - General

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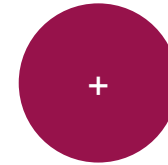
G27 - Conversion of arable land to grassland

L121 - Creation of field margins

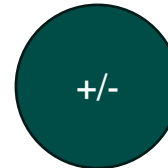
L125 - Creation of unproductive buffer strips along water courses

L211 - Seeded flower areas/strips

O11 - Maintenance of organic farming practices



Adding organic matter can boost SOC



Availability of compost must be considered

Change to perennial vegetation

Y11 - Afforestation of agricultural land

Y21 - Forest restoration and reforestation

Y22 - Sustainable Forest management (e.g. for biodiversity, C sequestration)

Y2X - Forest management - General

Y12 - Maintenance of afforested land

L512 - Peatland maintenance and conservation

L51X - Wetland and peatland maintenance and conservation - General

L53 - Paludiculture

F46 - Use of compost

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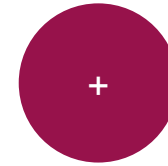
G27 - Conversion of arable land to grassland

L121 - Creation of field margins

L125 - Creation of unproductive buffer strips along water courses

L211 - Seeded flower areas/strips

O11 - Maintenance of organic farming practices



These practices build SOC, through change to perennial vegetation with less soil disturbance

Next 12 ranked farm practices - 0.6 to 1.5 t/ha/y CO₂e

- G25 - Ban of ploughing of grassland
- G26 - Conservation/maintenance of grassland
- R15 - Multicropping / mixed cropping / intercropping
- R13X - Land laying fallow - General
- L112 - Maintenance and conservation of hedges/wooded strips
- L11X - Hedgerows/individual or group of trees/ trees in line - General
- L5X - Management of wetland/peatland - General
- R17 - Catch crops
- S232 - Winter cover crop
- S23X - Cover crops - General
- S25 - Green cover on permanent crops
- S2X - Soil cover - General



Main findings

G25 - Ban of ploughing of grassland

G26 - Conservation/maintenance of grassland

R15 - Multicropping / mixed cropping / intercropping

R13X - Land laying fallow - General

L112 - Maintenance and conservation of hedges/wooded strips

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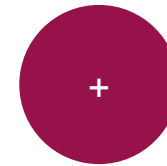
R17 - Catch crops

S232 - Winter cover crop

S23X - Cover crops - General

S25 - Green cover on permanent crops

S2X - Soil cover - General



Protection of existing SOC stock

Main findings

G25 - Ban of ploughing of grassland

G26 - Conservation/maintenance of grassland

R15 - Multicropping / mixed cropping / intercropping

R13X - Land laying fallow - General

L112 - Maintenance and conservation of hedges/wooded strips

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L5X - Management of wetland/peatland - General

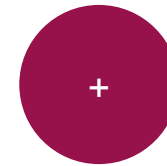
R17 - Catch crops

S232 - Winter cover crop

S23X - Cover crops - General

S25 - Green cover on permanent crops

S2X - Soil cover - General



Avoiding bare soil can increase SOC stocks

Other farm practices - 0.15 to 0.6 t/ha/y CO₂e

R131 - Short-term fallow

R11 - Crop rotation

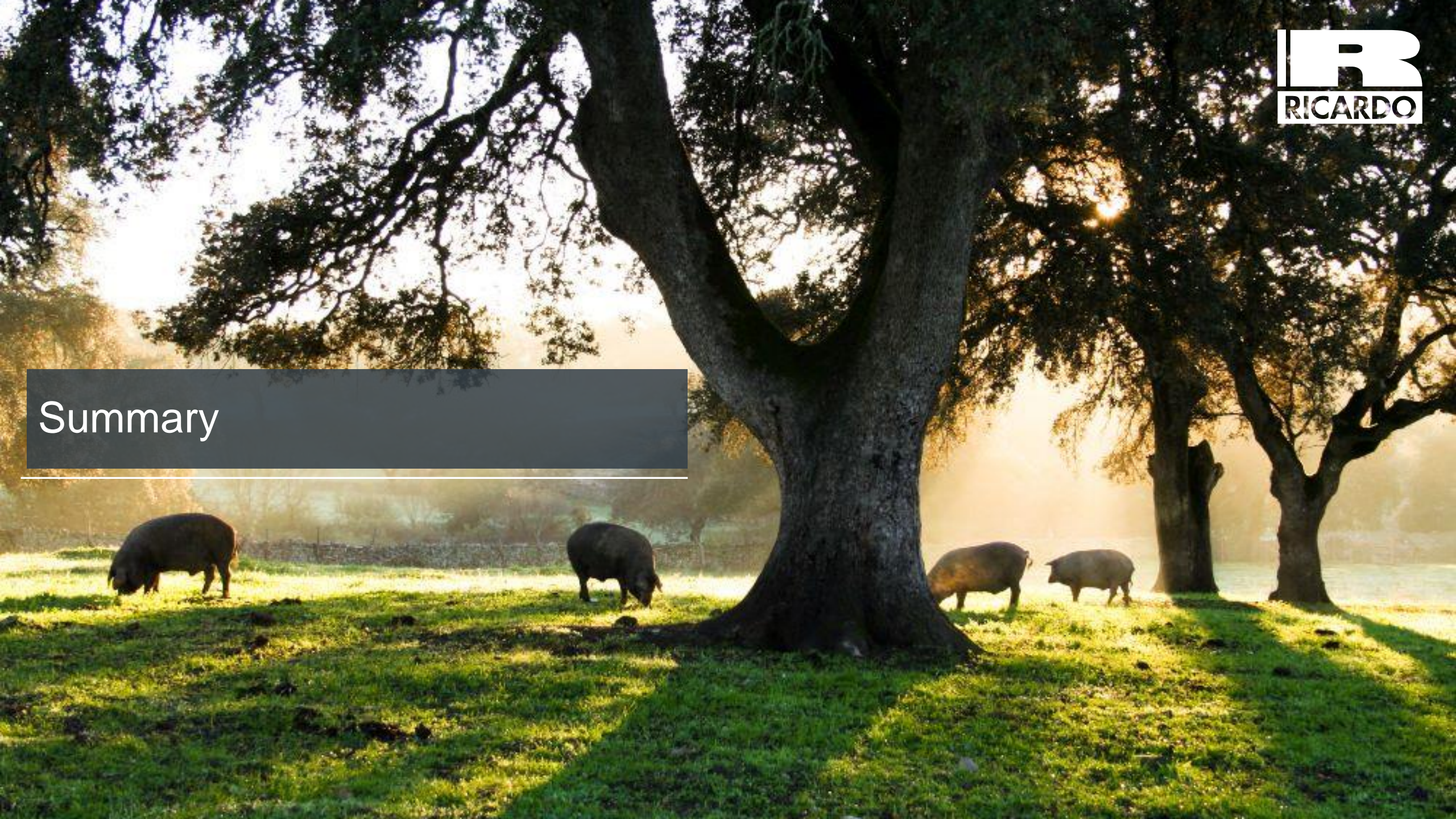
R14 - Crop diversification

R1X - Crop rotation or Crop diversification – General

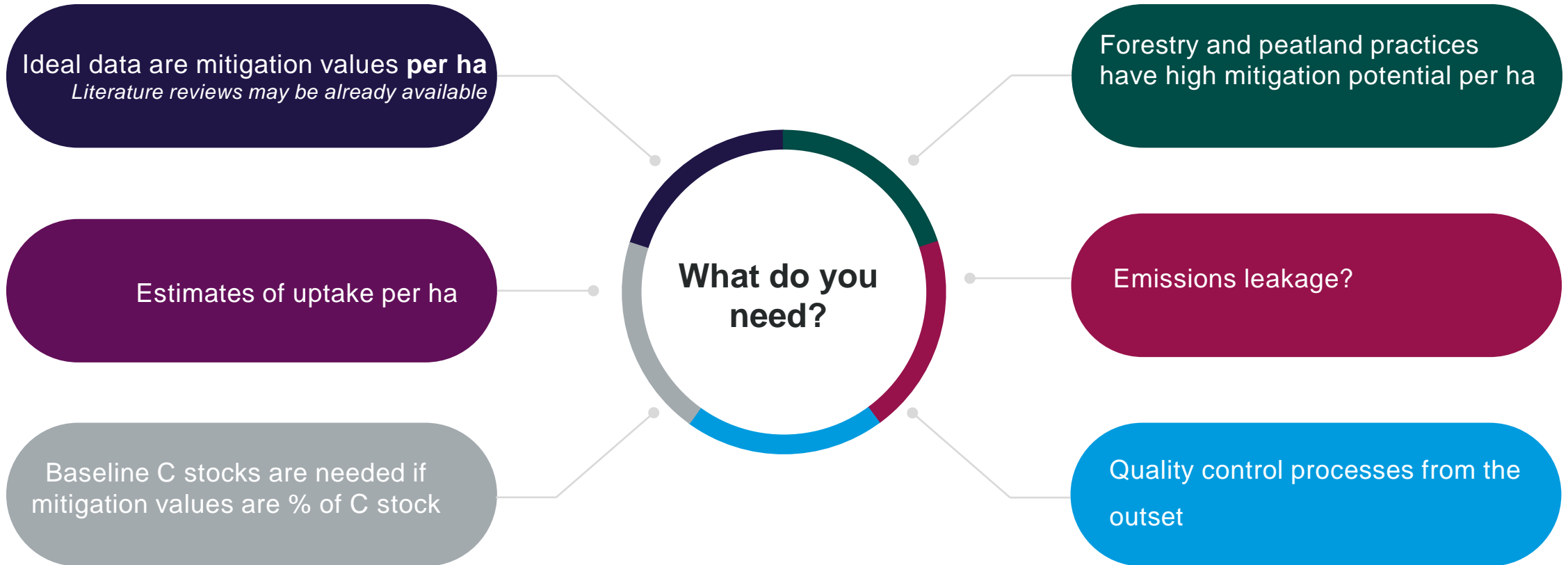
S22 - Crop residues left on soil, leaving stubbles on the field



Summary



How to avoid a lot of head scratching



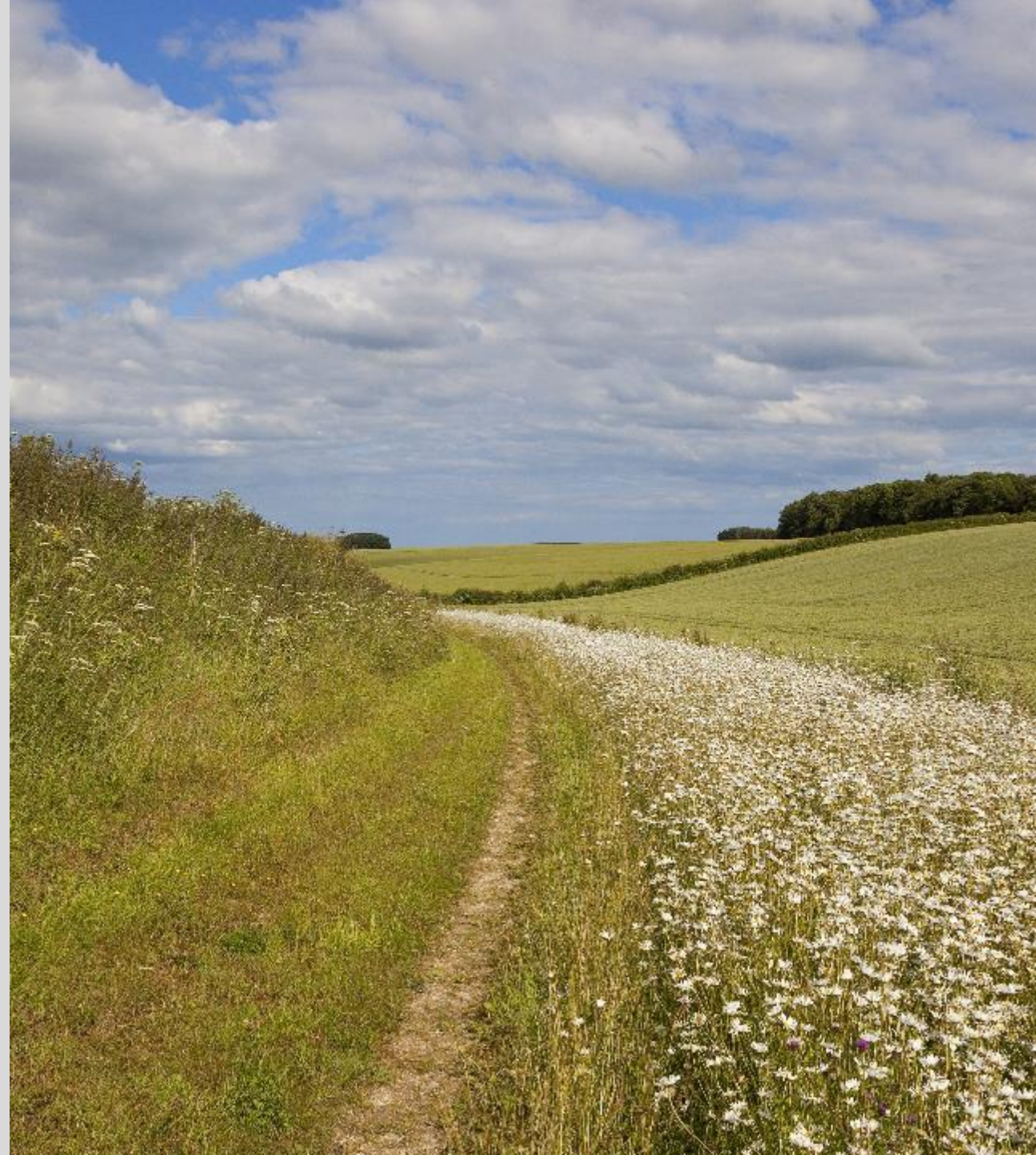


Thank you!

Any questions?

Keesje Avis – Keesje.avis@ricardo.com

[Keesje \(Crawford\) Avis | LinkedIn](#)



Background and method development

Important terms:



- **The estimation of carbon stock change per ha when farm practices are changed**
 - ⇒ Soil organic carbon (SOC) stock change is the change in quantity of SOC in soil
 - ⇒ An increase in SOC stock is carbon sequestration, also known as CO₂ removal from the atmosphere