Perennial biomass crops for greenhouse gas removals (PBC4GGR)

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PERENNIAL BIOMASS CROPS
PBC4GGR
GREENHOUSE GAS REMOVAL

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Addressing the barriers to the scale up of perennial biomass crops in the UK

- What are the best planting strategies to maximise yield and minimise greenhouse gas emissions
- Improving our estimates of the carbon savings or negative emissions that biomass crops can deliver
- What is required for farmers to take on these crops and for society to be supportive
- Costs, benefits and trade-offs for biodiversity and ecosystem services

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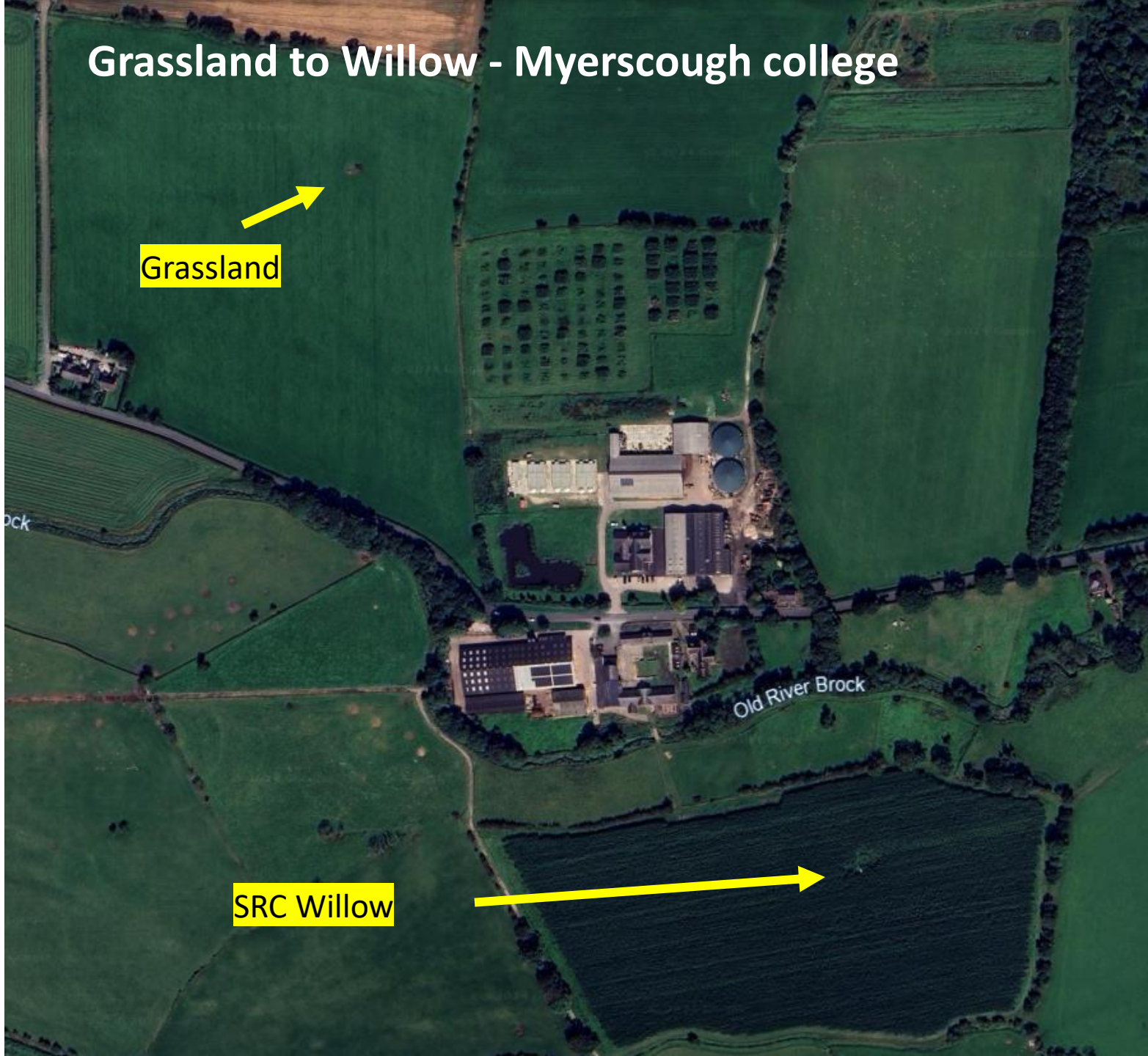
GREENHOUSE GAS REMOVAL

How much carbon does a biomass crop field remove from the atmosphere?

How different is this to the conventional land use?



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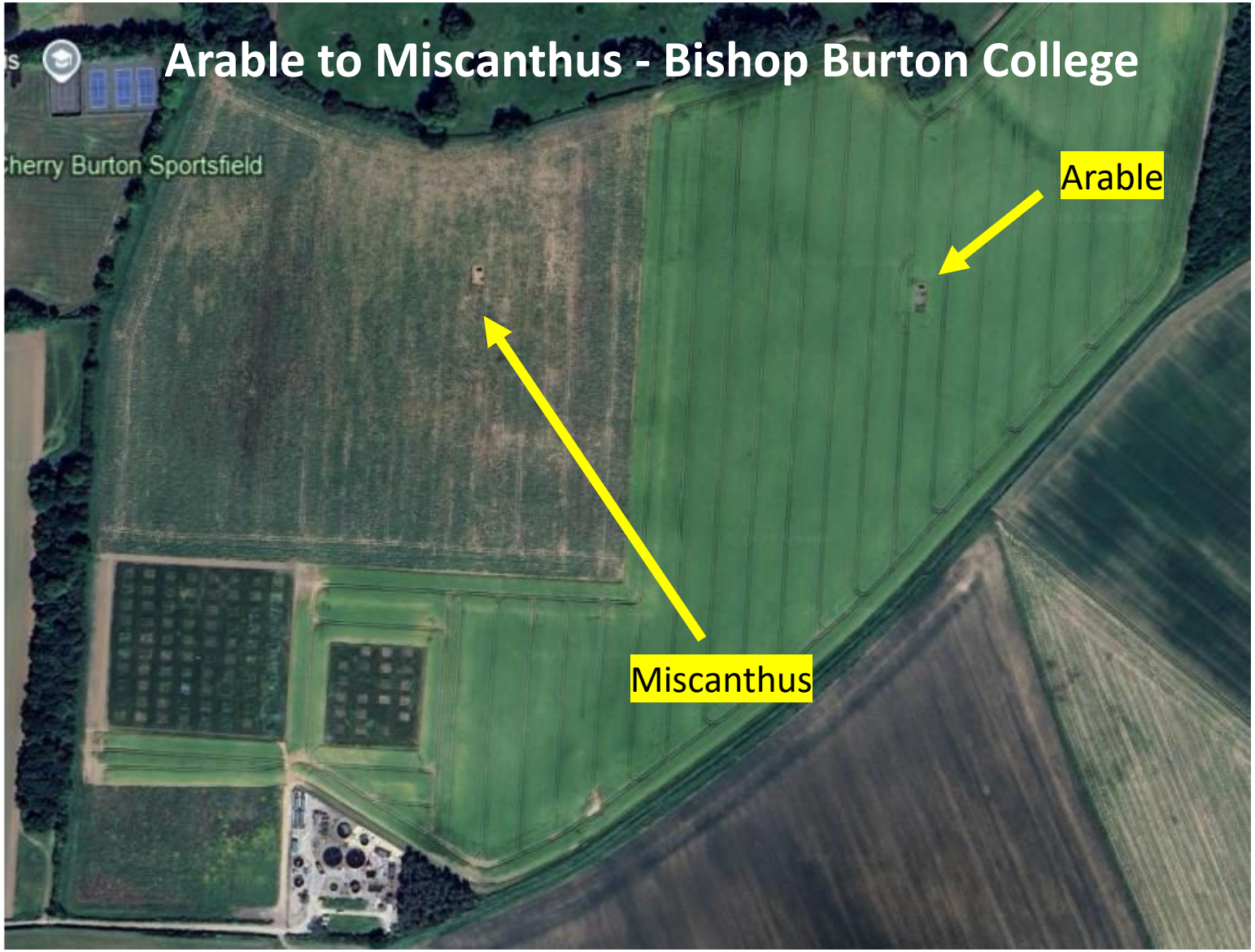

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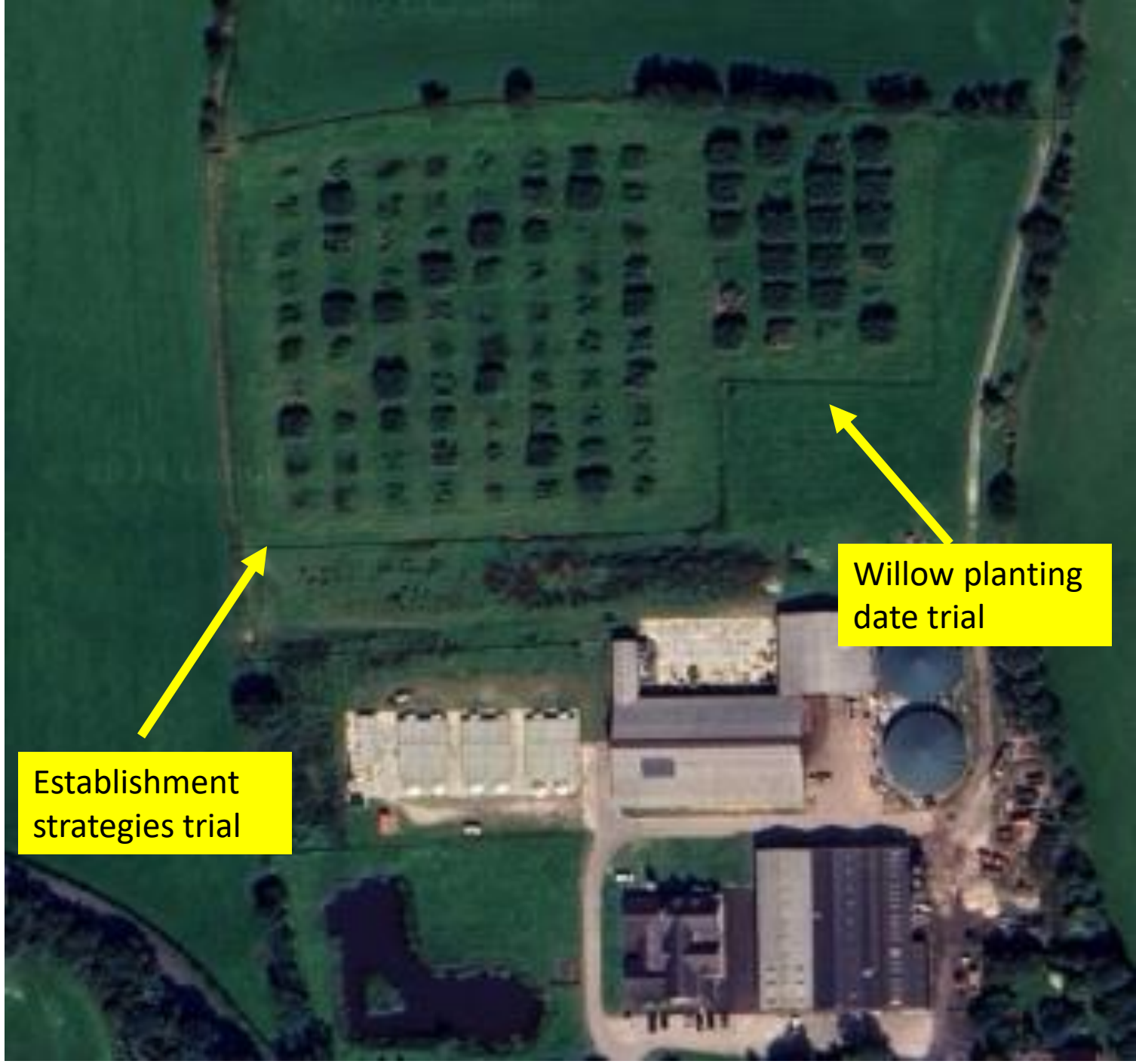
Can we maximize yield and minimize greenhouse gas emissions by altering the method of land preparation and planting?

How early or late in the year can we plant without affecting yield?



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Soil carbon and biomass crops

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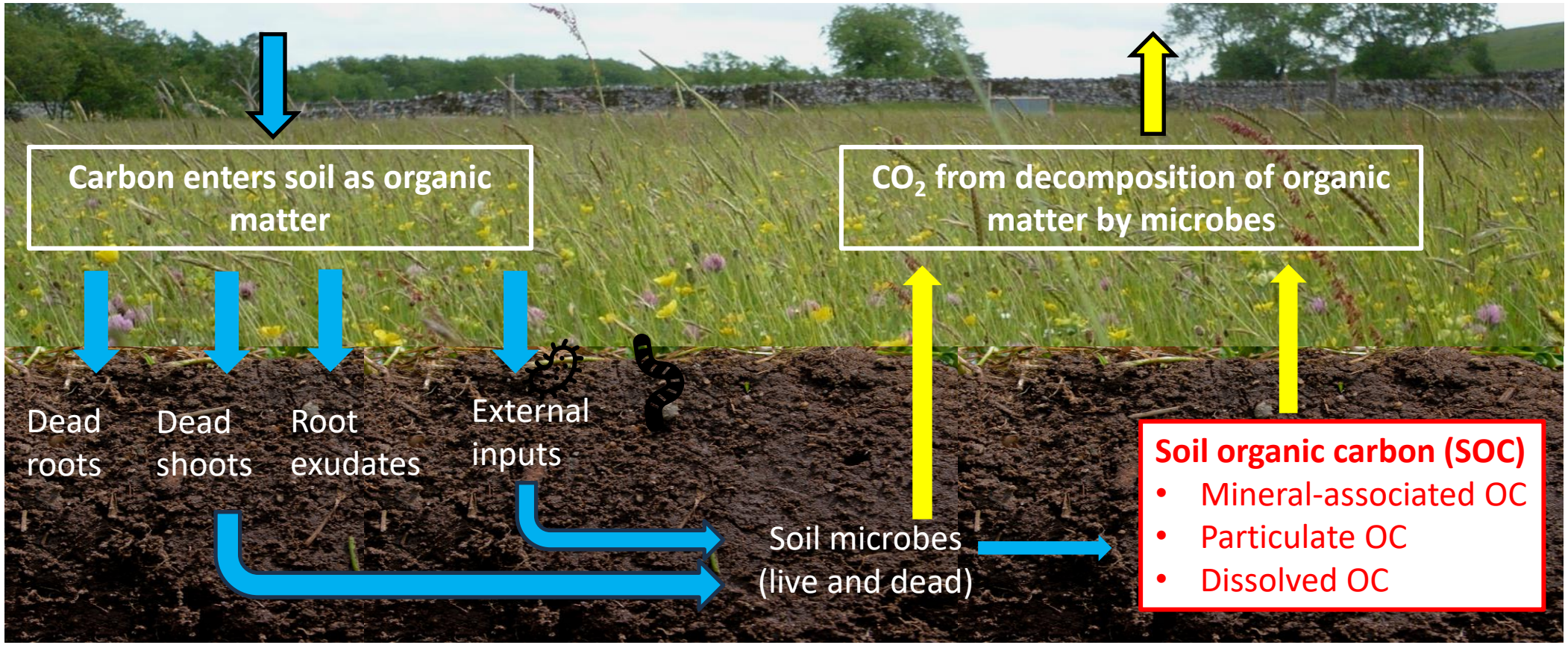
What is soil carbon?

- organic carbon in soil organic matter, derived from living things
- inorganic carbon from carbonate minerals



Why does soil carbon matter?

Soil carbon is a key indicator of soil health

For land managers protecting or increasing soil carbon has benefits for:

- soil fertility
- water retention and infiltration
- soil structure and aeration
- resilience to drought /flooding / erosion

For society keeping carbon in soils or increasing soil carbon helps to mitigate climate change

UK soils store over 10 billion tonnes of organic carbon

UK arable soils have lost 11% soil C over last 25 years

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How does soil carbon increase or decrease?

Land management affects the amount and type of carbon entering the soil and soil properties (e.g. bulk density, nutrient status)

Decreases soil carbon	Increases or maintains soil carbon
Tillage	Reduced or no-tillage
Monoculture, limited rotation	Diversifying rotation /cover crops/grass & legume leys
Over-use of fertilizer	Optimal use of fertiliser / manure
Heavy machinery	Minimize heavy machinery

Measuring soil carbon

- Three methods which measure the amount of soil carbon with varied precision
- How accurate you need to be will depend on what you want to use the information for

Increasing difficulty, cost & accuracy

<u>Organic matter content (%)</u>
Loss on ignition – combustion at 400 ^{o}C
Organic matter is approx. 50% carbon

<u>Total organic carbon (%)</u>
Combustion at 975 ^{o}C with acidification
Amount of organic carbon by weight

Increasing soil bulk density can result in more carbon in topsoil but this isn't sequestration

<u>Stock of soil organic carbon</u>
Tonnes /hectare of carbon in a given volume of soil, also requires bulk density

Need to measure concentration and bulk density to be confident that sequestration has occurred

Biomass lifecycle and soil carbon


Grassland / Arable

Tillage

Biomass growth

Harvest

Biomass growth

Reversion (15-20yrs)


Arable / Grassland / Biomass ?

Soil carbon stock change



What's the counterfactual?

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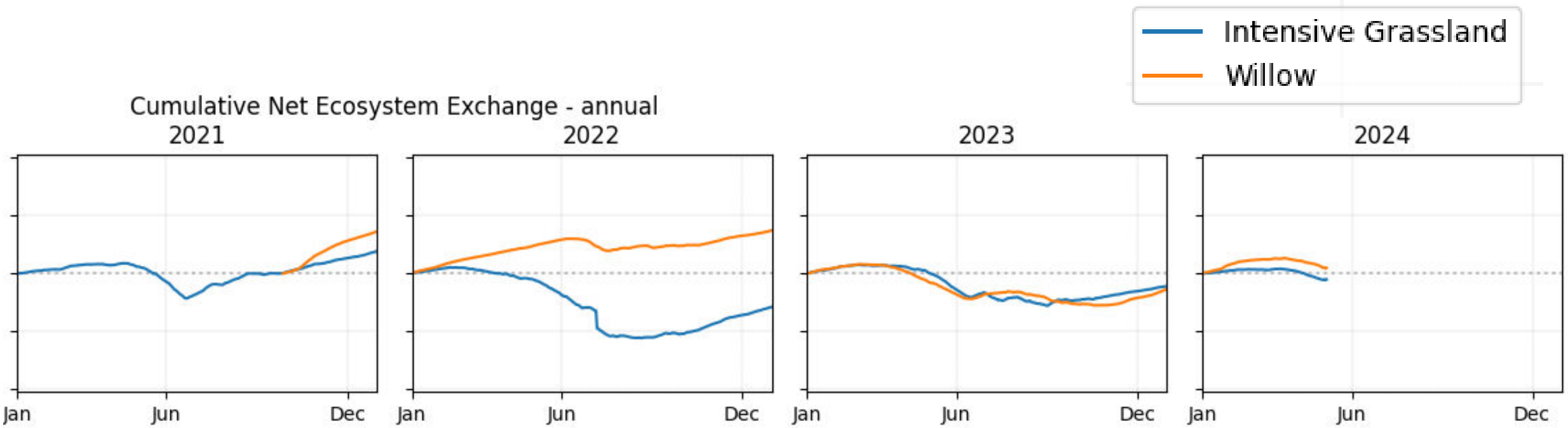
Myerscough carbon flux data



	Total organic C (0-30 cm)	Bulk density (0-100cm)	C stock to 80 cm	C stock to 100 cm
	%	(g / cm3)	tonnes/ha	tonnes/ha
Grassland	2.56	1.41	166.8	194.6
SRC Willow	2.87	1.38	135.4	132.2

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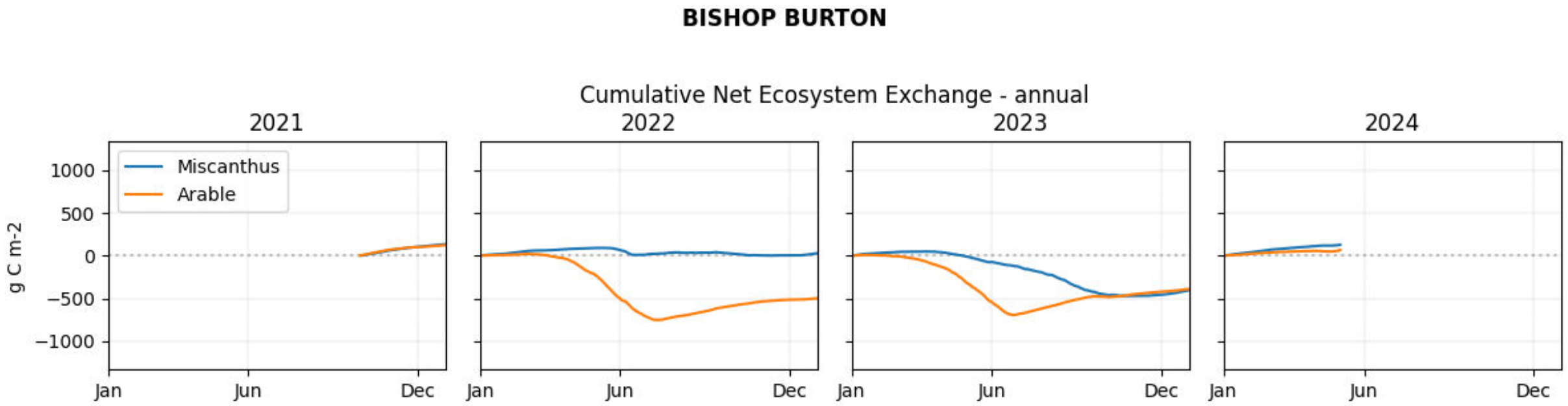
Bishop Burton carbon flux data



	Total organic C (0-30 cm)	Bulk density (0-100cm)	C stock to 60 cm	C stock to 100 cm
	%	(g / cm3)	tonnes/ha	tonnes/ha
Arable	1.83	1.52	110.3	163.3
Miscanthus	1.78	1.52	100.6	133.9

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