

What are the implications of net zero for UK agriculture?



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and Climate Change

Teagasc webinar
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Leading the way in Agriculture and Rural Research, Education and Consulting



COP26



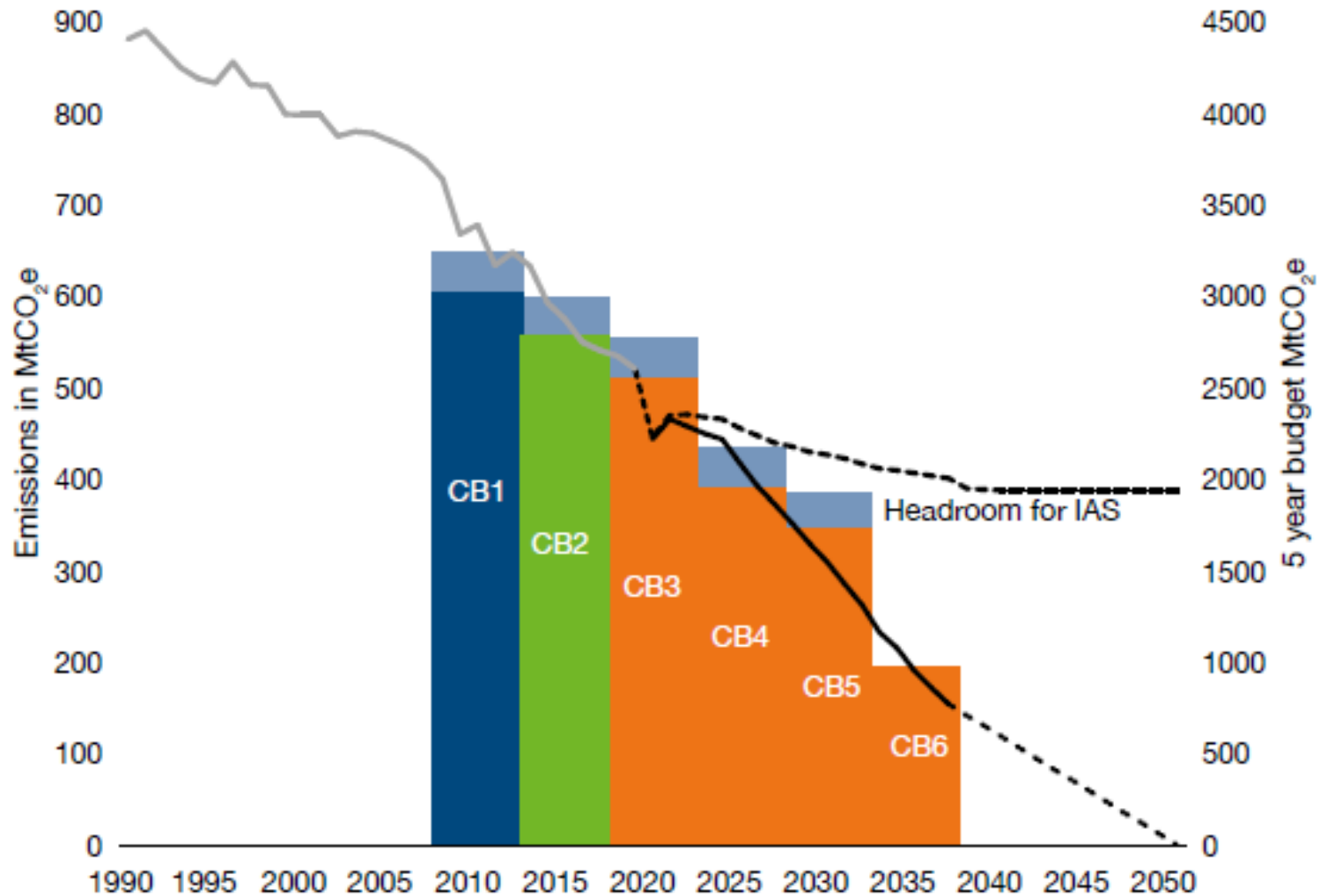
Article 37: Invites Parties to consider further actions to reduce by 2030 non-carbon dioxide greenhouse gas emissions, including methane



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The net zero target

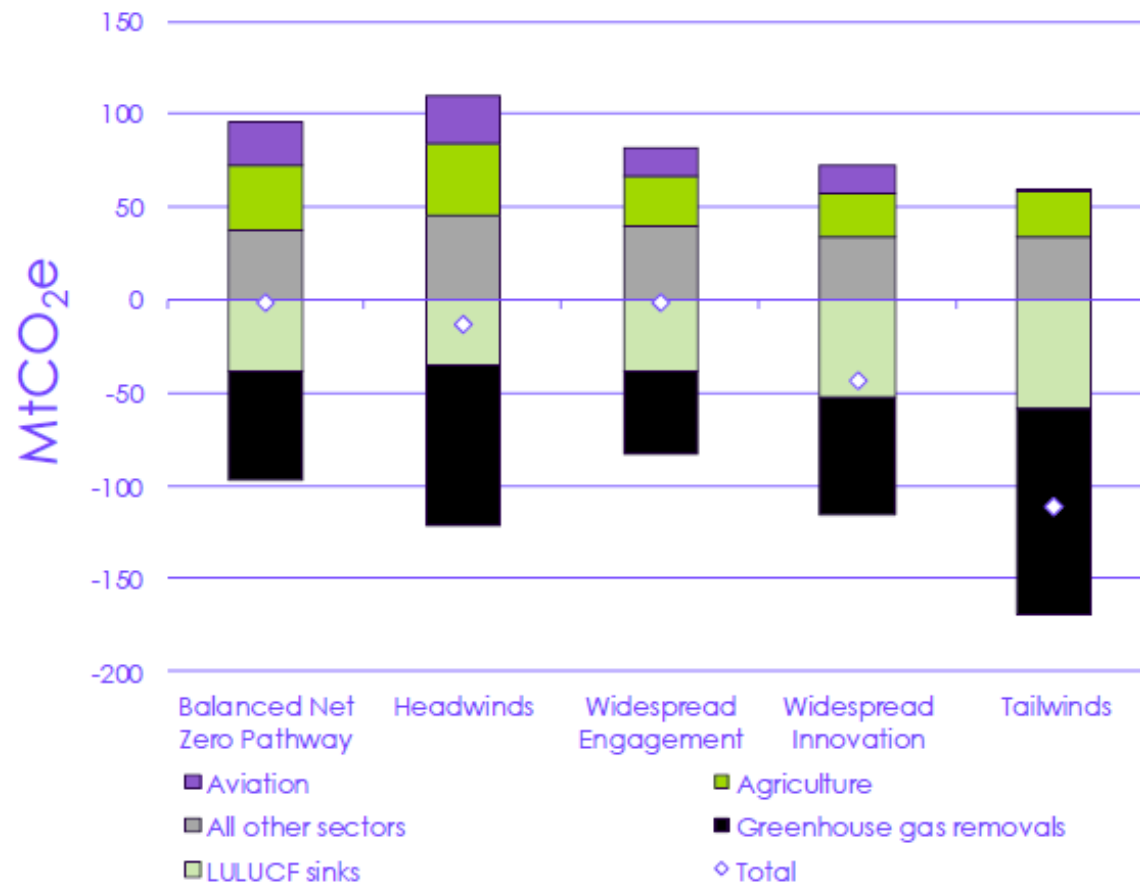


Net zero

- The point at which GHG emissions are balanced by removals
- Targeted at a country level, not individual enterprises
- GHG removals needed to offset residual emissions

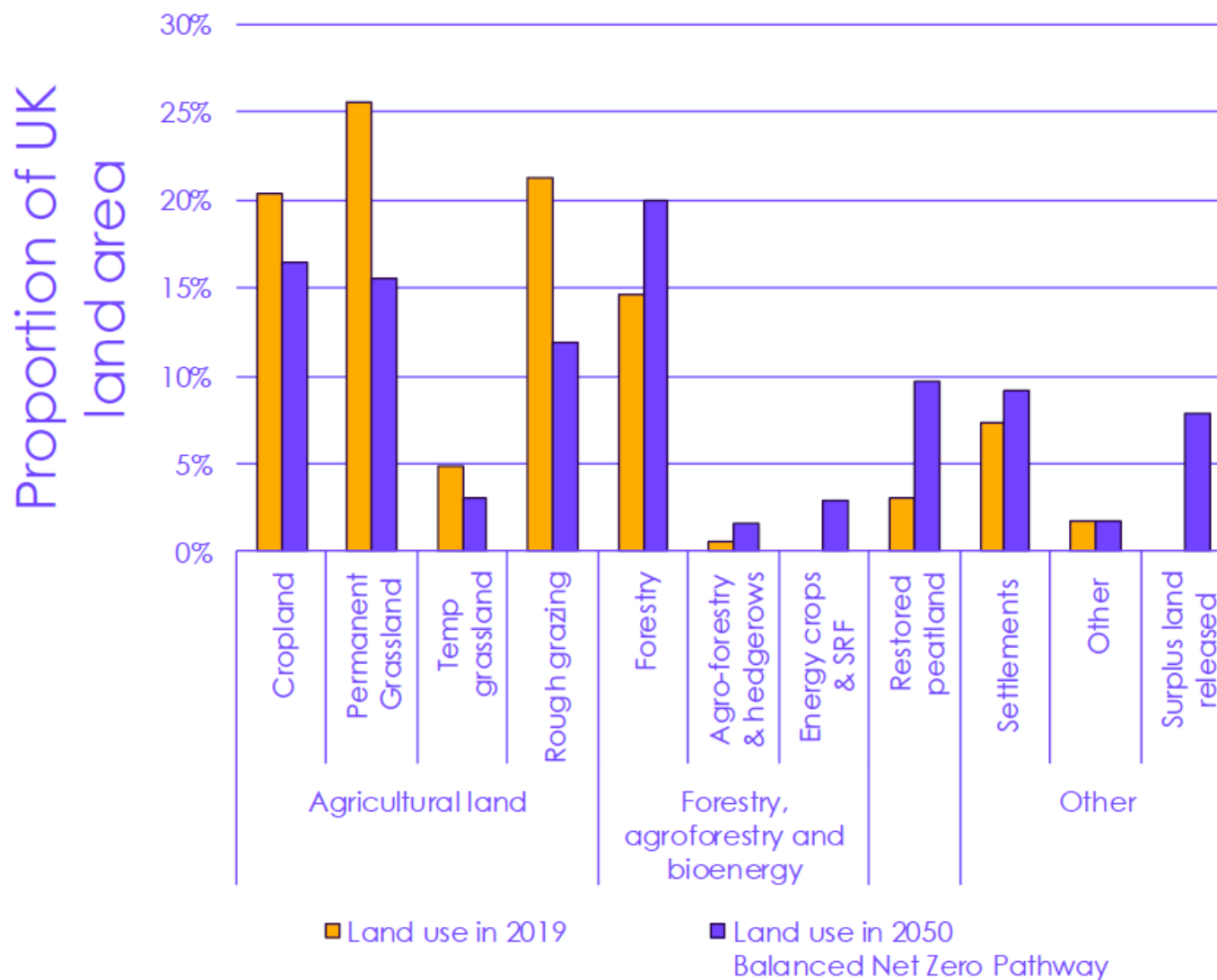


2050 Scenarios



Committee on Climate Change 2020.
Sixth carbon budget

Changed land use



Agriculture and land-use are different

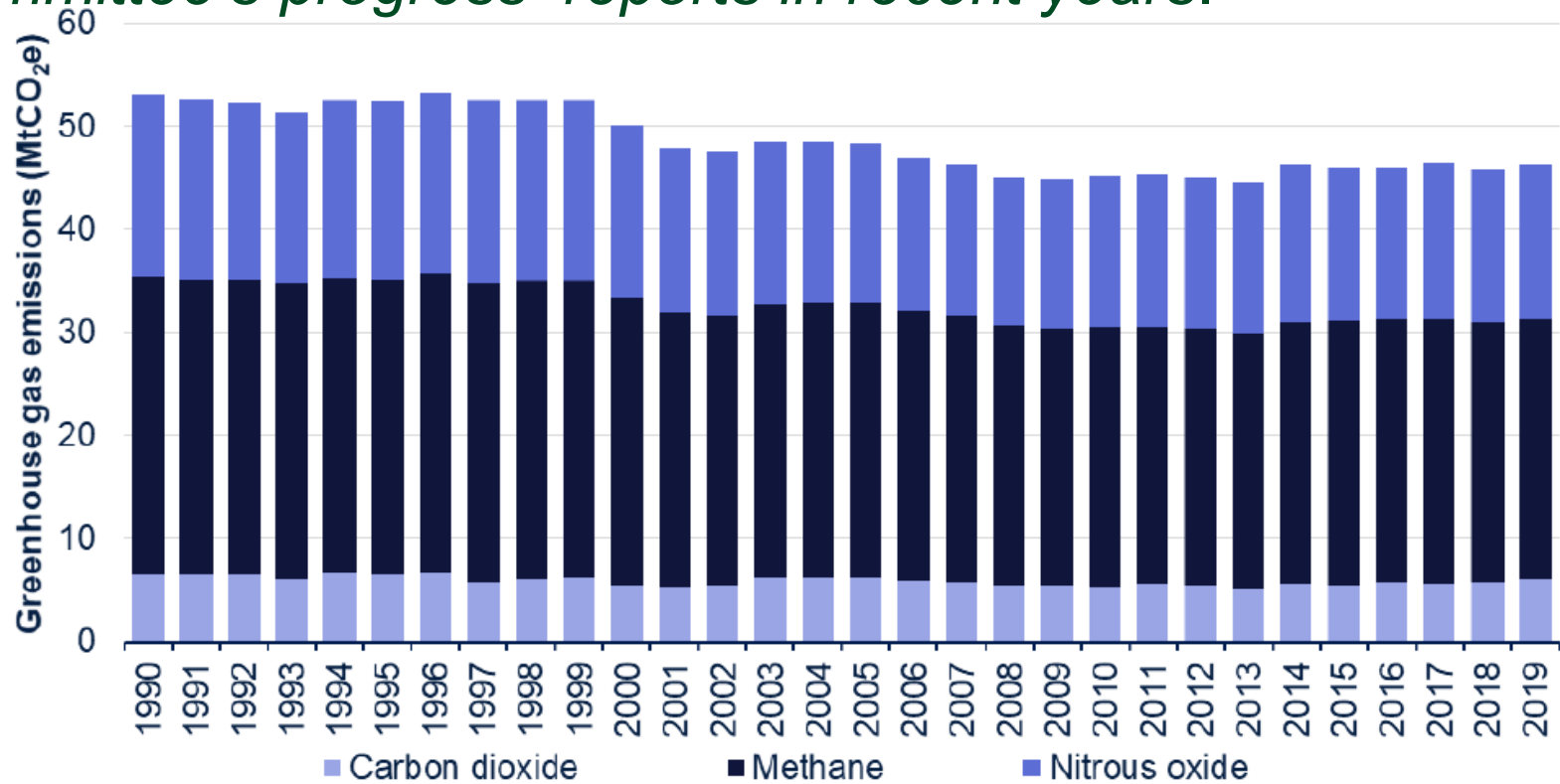
- Biological emissions
- Non-CO₂ greenhouse gases
- Emissions and uptake
- Food production is a basic human need
- Wider socio-economic implications



Agricultural greenhouse gas emissions



*“Progress in **agriculture and land use** has repeatedly failed to meet the indicators outlined in the Committee’s progress reports in recent years.”*





UK GHG Platform programme



SRUC



Nitrous oxide

Data synthesis

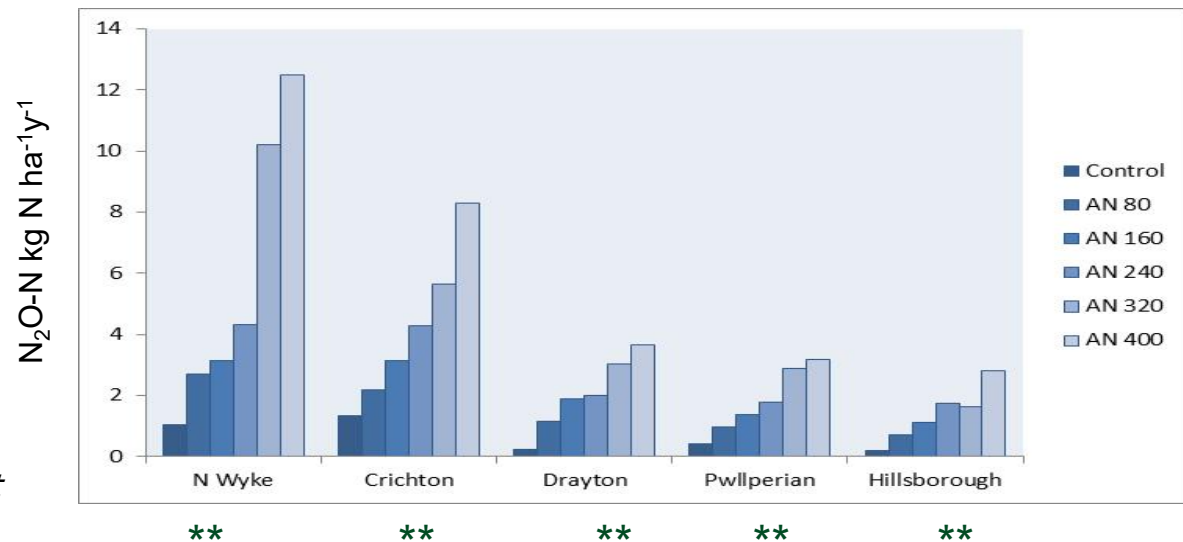
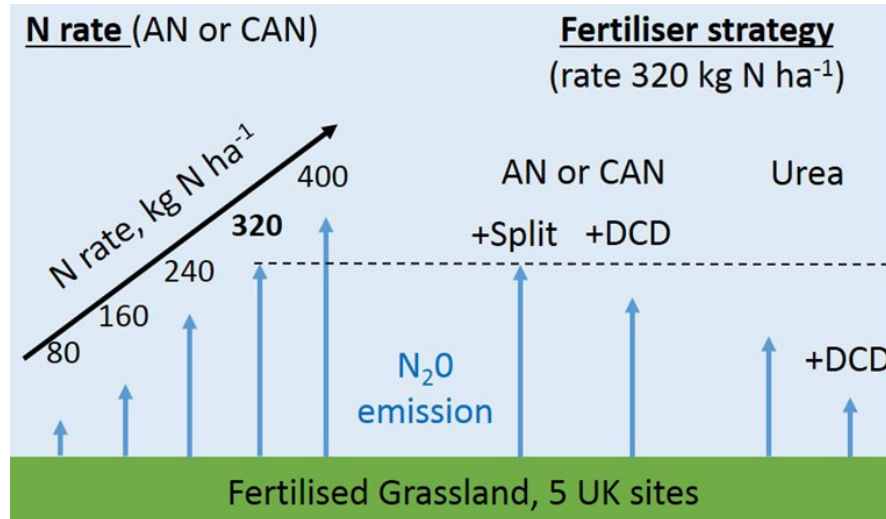
Methane



New inventory
structure



N₂O emissions from grasslands



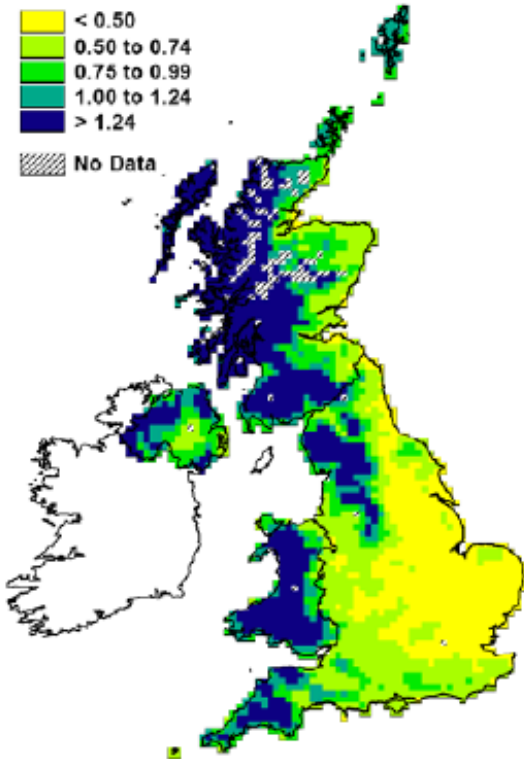
Cardenas *et al* 2019.
Science of the Total Environment

New spatial emissions maps

Grass Nitrogen Fertiliser
Emission Factor (%)



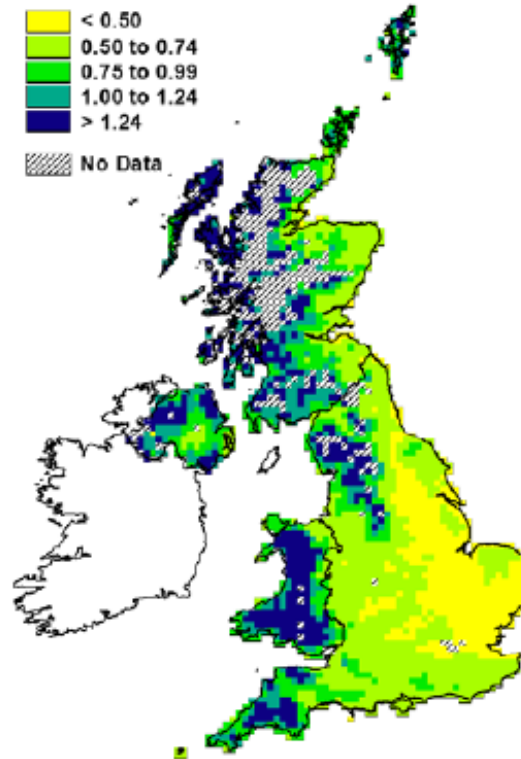
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Arable Nitrogen Fertiliser
Emission Factor (%)



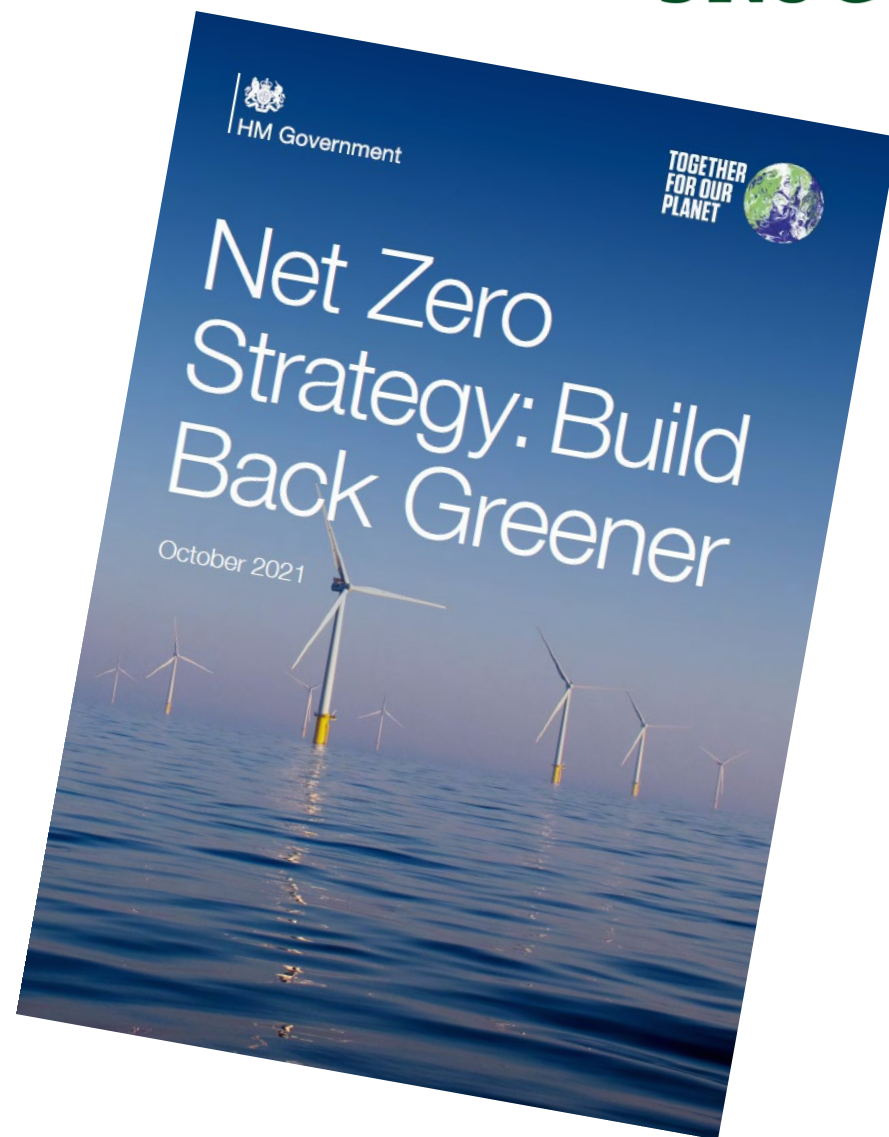
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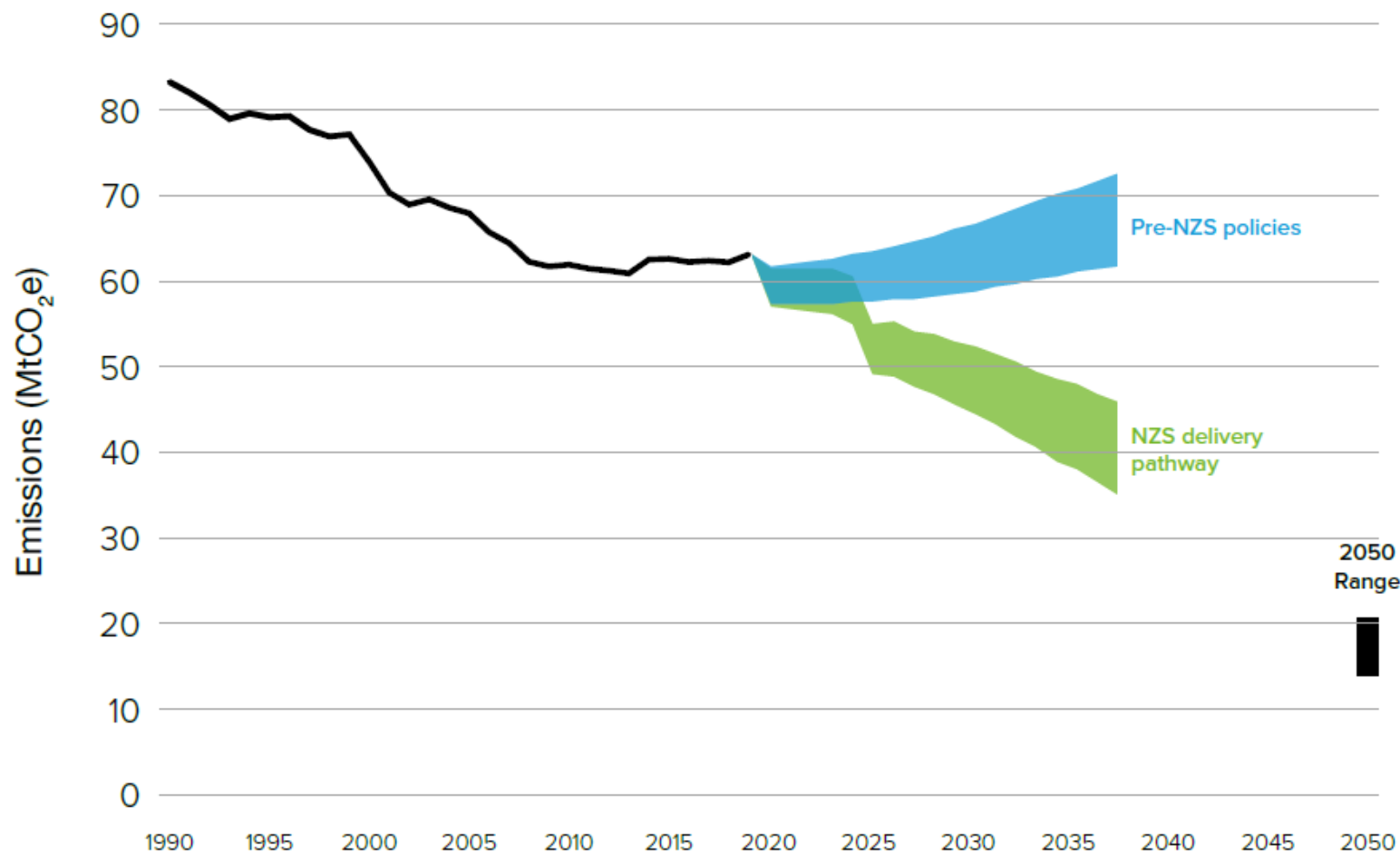
Anthony et al 2019, UK National
Inventory 2017, Technical Annex

Net zero strategy

- UK Government's strategy to meet its policy commitments to net zero
- Implementation across all sectors of the Economy



Indicative agriculture, forestry and other land use emissions pathway to 2037



Net zero strategy for agriculture and land use



Support for low carbon practices and technologies

Financial incentives to improve animal health and welfare

Farming Investment Fund

Grants for new slurry stores, and other interventions

Increase investment in industry-led research

Support for agroforestry through environmental land management schemes

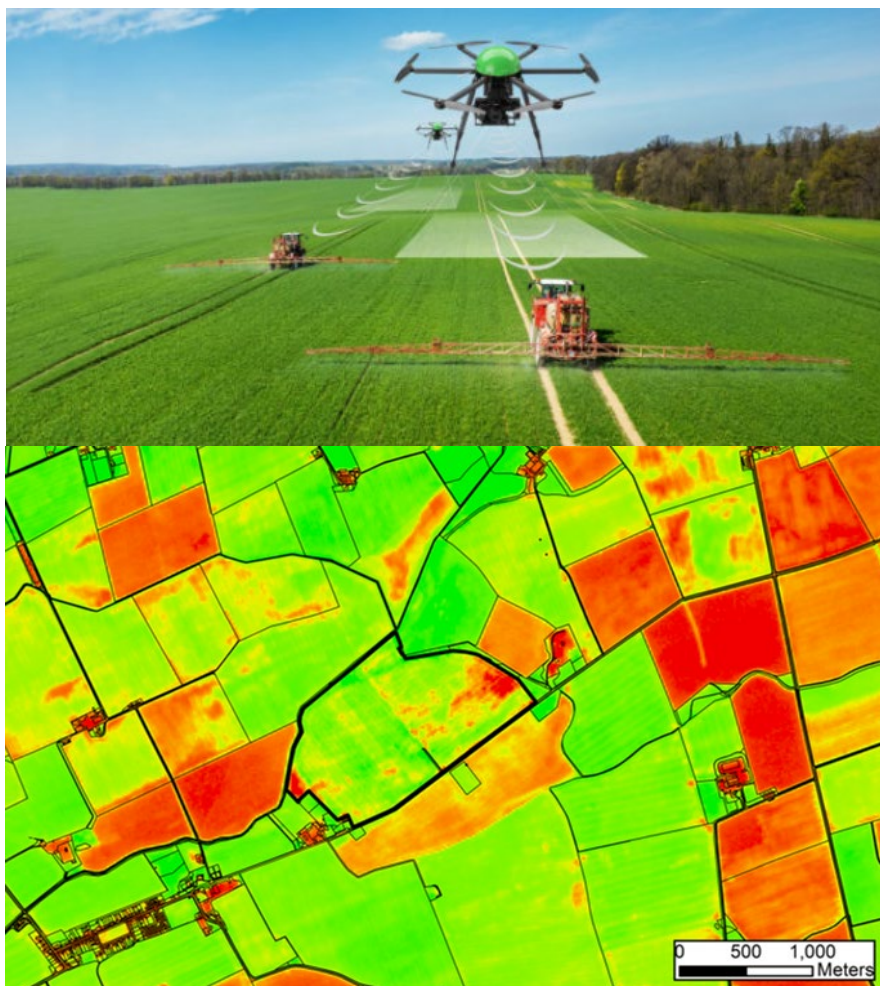
New outcome-focused approach to regulation and enforcement

Better use of manufactured fertiliser (potential regulation)

Possible new legislation to improve soil management and nutrient management

Improved monitoring, reporting, and verification of emissions in the agriculture

What needs to happen?



Deep emission cuts require transformational changes:

Low carbon farming approaches

- Improved efficiency
- Alternative cropping
- Smart farming
- Vertical farming
- Better nitrogen use efficiency

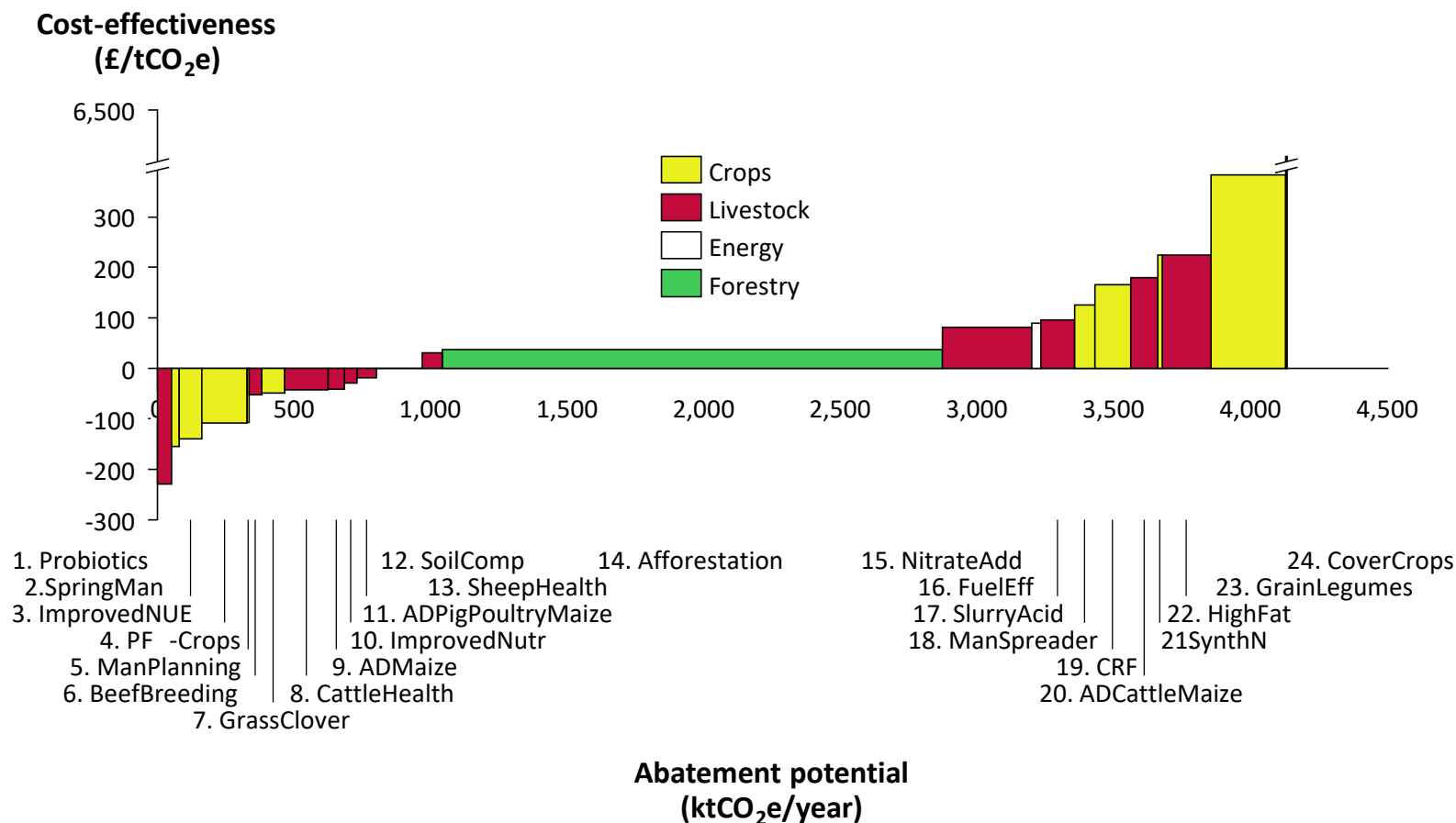
Demand side measures

- Meat/dairy
- Lab meat
- Insect protein
- Legumes

Land use change

- Land not needed for food production used for energy/biodiversity/carbon capture

Carbon mitigation – where to start? Efficiency gains.



Mitigation: Legume-grass mixtures

- UK pastures have a relatively little leguminous forage
- Increasing grass clover swards would decrease N fertiliser requirements, reducing N_2O emissions and production costs with a saving of $0.5 \text{ t CO}_{2\text{e}}/\text{ha}/\text{y}$



What does a typical farm need to do to get to net zero?

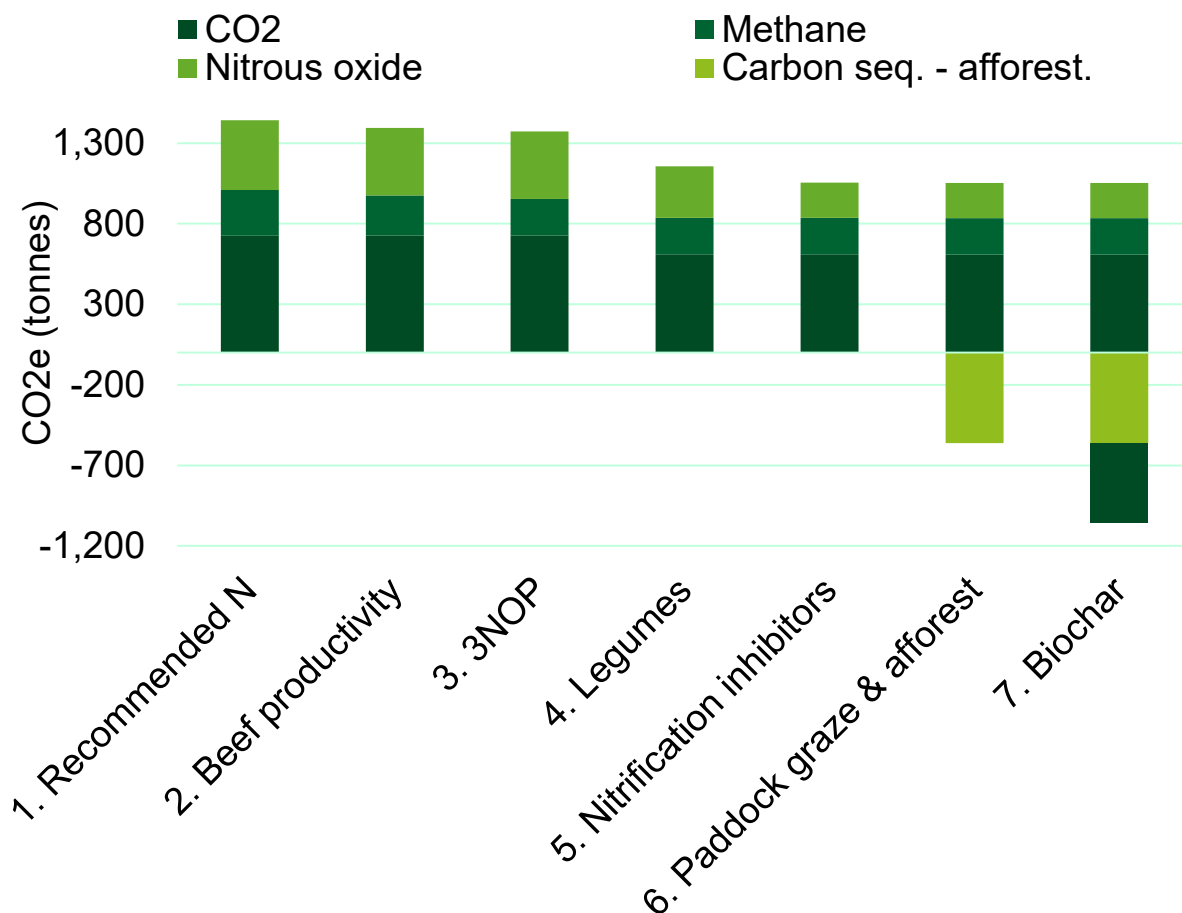


- Farming systems represent a complex interaction between management and climate
- Models can help understand the interaction between multiple interventions and emissions



Net zero farming – results - how to get there? SRUC model farm

Path to net zero - SRUC mixed farm (300ha)



Technical improvements and greenhouse gas mitigation technologies can reduce but not eliminate carbon emissions based on current technology.

Sequestration is essential.

Net zero farming – how to get there?

Technical improvements cut
carbon 30% & maintains output -

1. Adopting recommended N application rates – 4%
2. Optimising beef productivity – 3%
 - Both cost effective why wouldn't you?
3. The use of 3NOP methane inhibitors – 2%
 - Small impact, net cost
4. Increased use of legumes – 14%
 - Large impact, some costs, net financial impact varies
5. The use of urease and nitrification inhibitors – 7%
 - Large impact, net cost but small

Net zero farming – how to get there?

Sequestration key to 0%



Sequestration

**6. Improved grassland management + planting trees –
works but takes too much land**

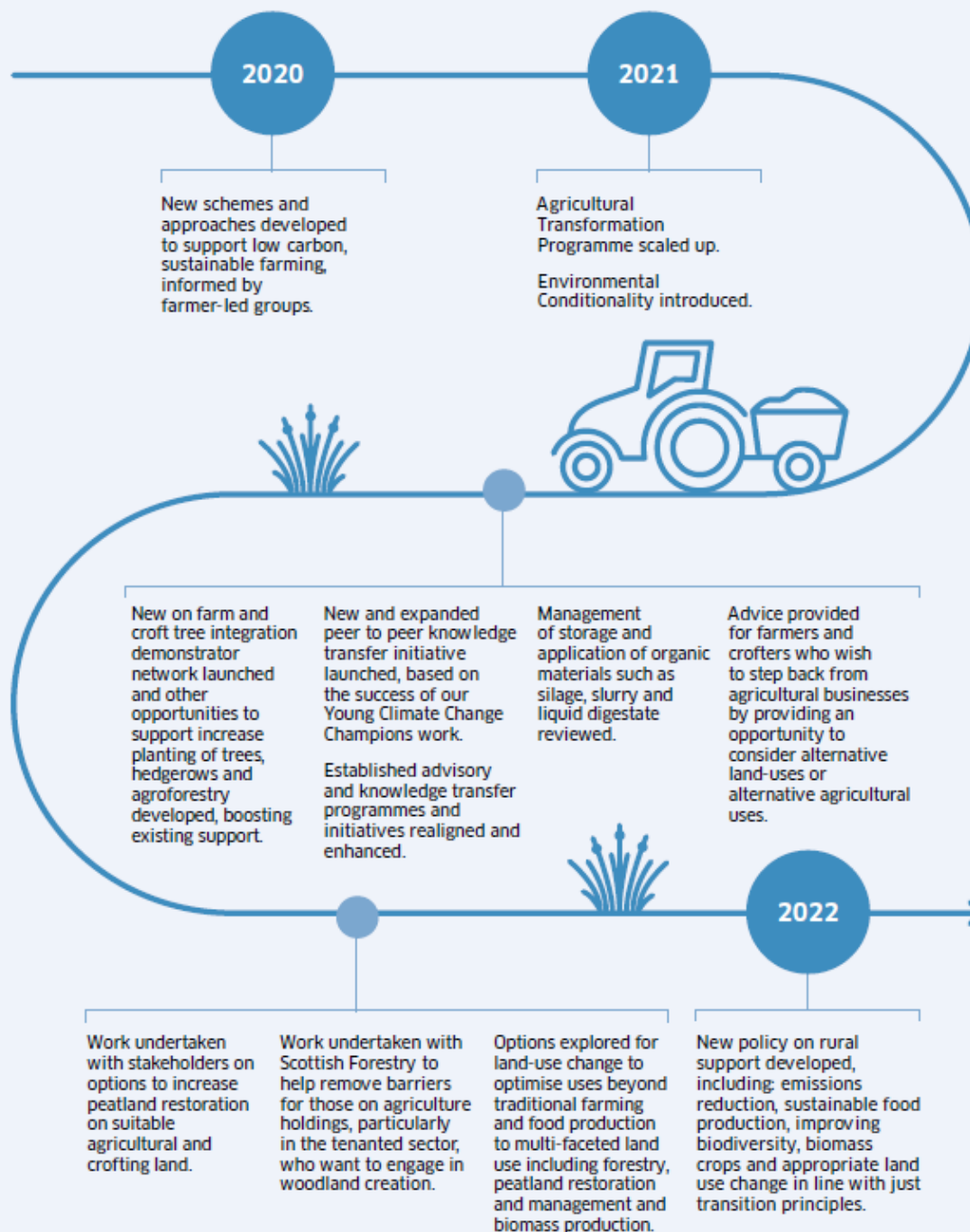
**7. Soil carbon sequestration – straw to biochar – can
capture enough carbon but costs high at present**

Scottish policy

- Scotland is committed to reducing its greenhouse gas emissions to net zero by 2045.

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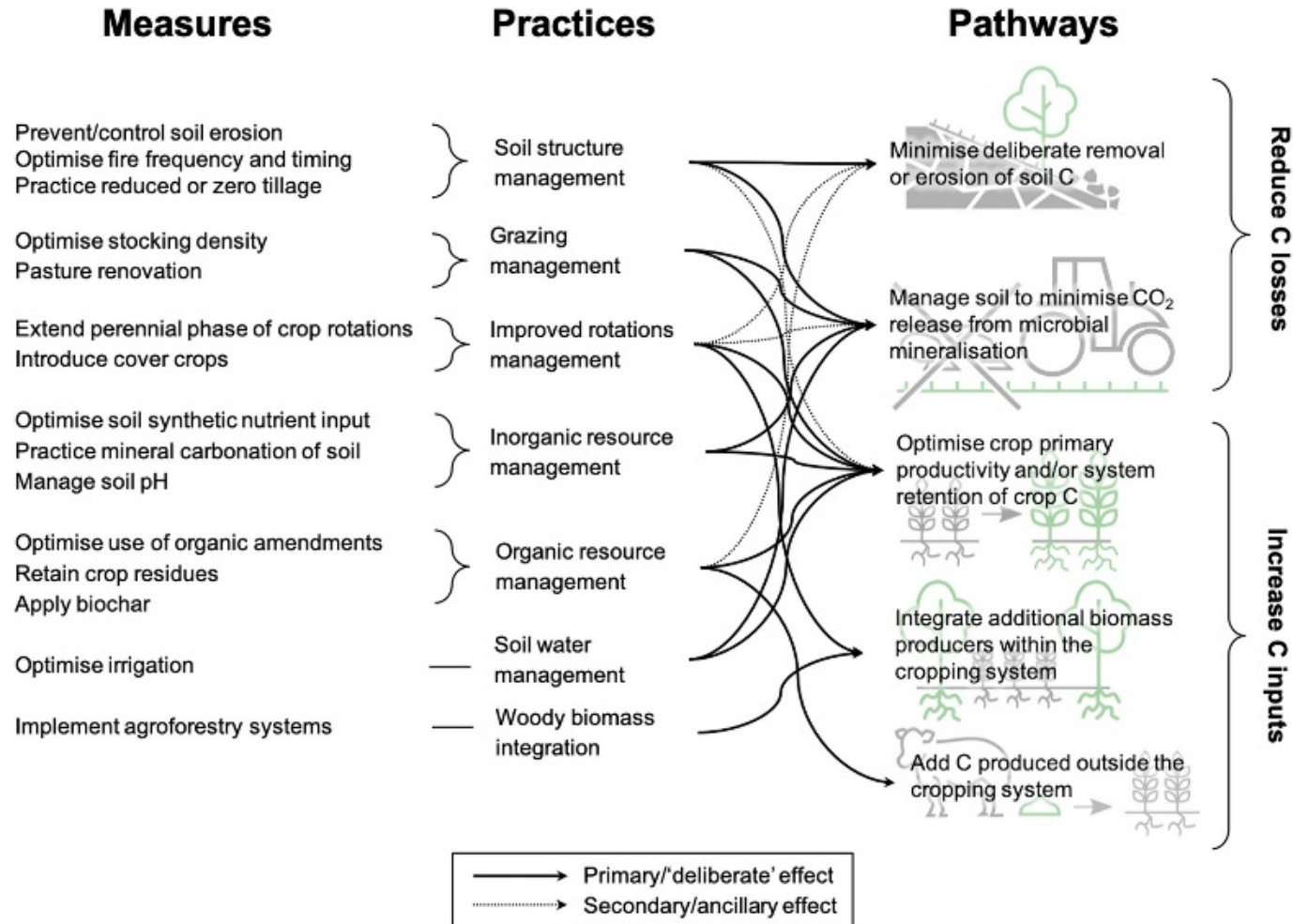


The mitigation gap



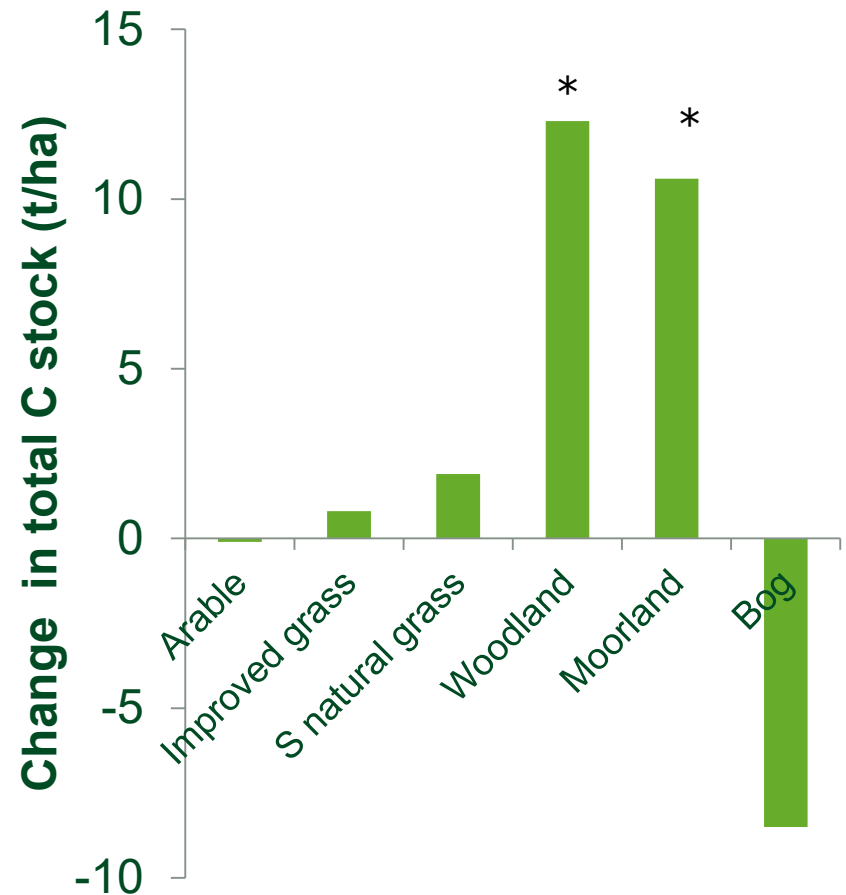
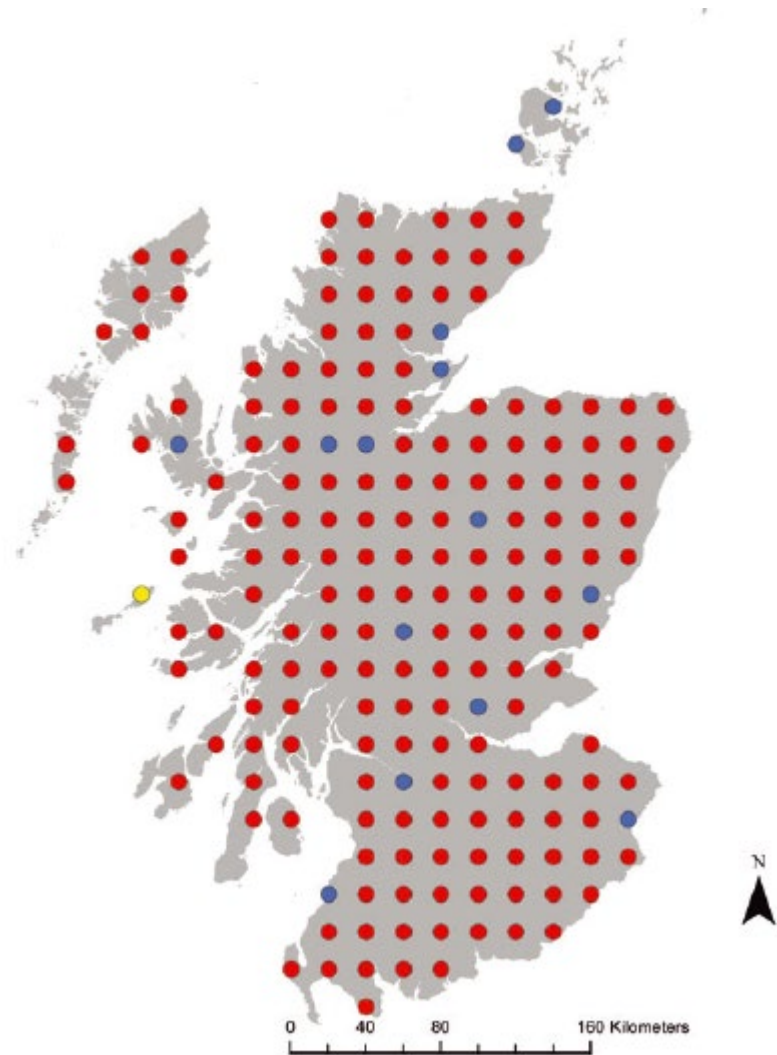
- Current analysis suggests that we are not close to meeting policy targets in agriculture:
- Total agricultural emissions; 7.5 Mt (2019)
- Target by 2032; 5.1 Mt
- Existing approaches get to; 6.5 Mt
- Gap in ambition 1.4 Mt

Greenhouse gas removals

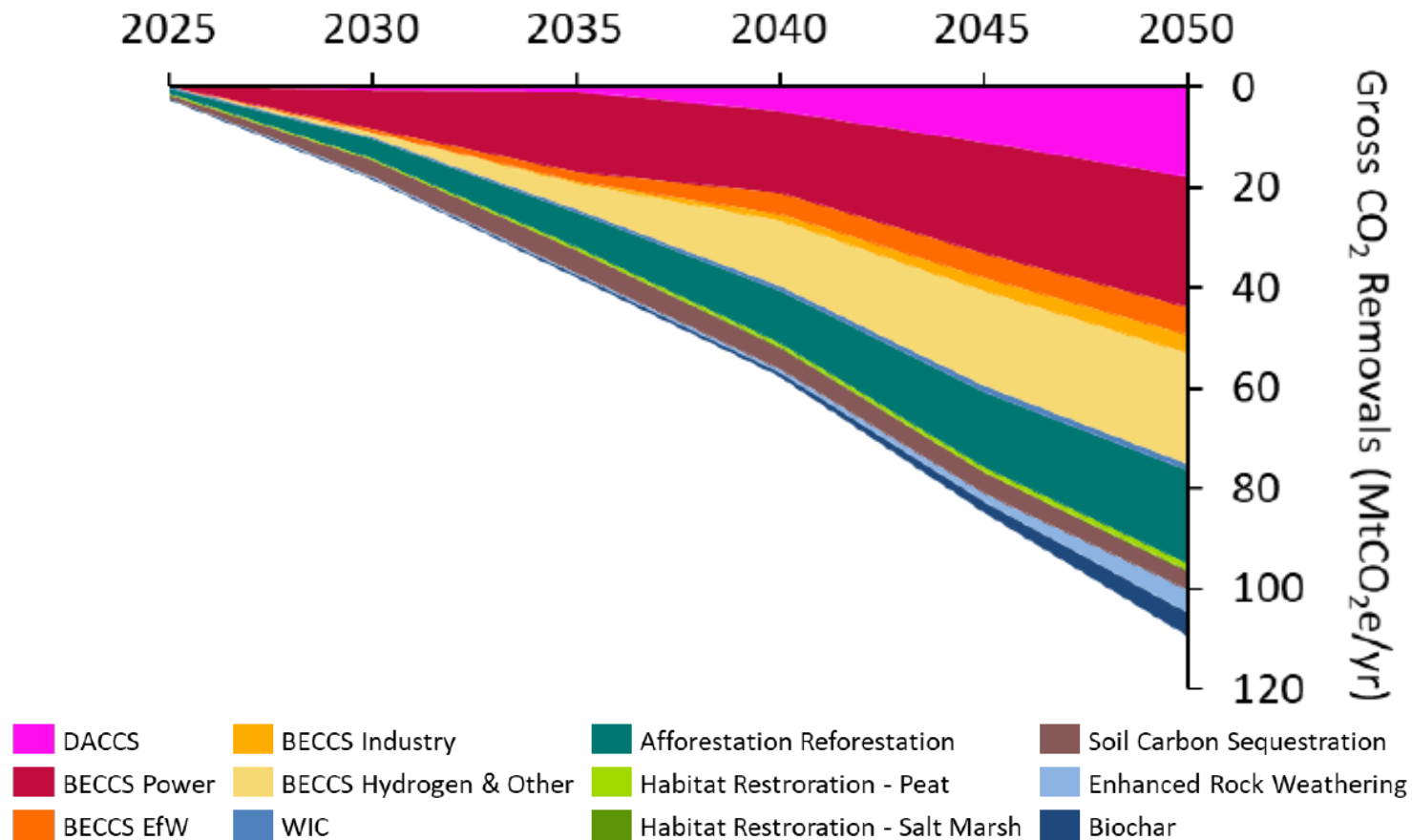


Can we increase soil carbon stocks?

Changes in soil carbon in Scotland 1978-2009



Projections of carbon capture technologies



Other greenhouse gas removal technologies

- Biomass Energy Carbon Capture and Storage
- Mineral Weathering
- Direct Air Capture
- Ocean uptake
- Biochar



Conclusions

- The pathway to net zero emissions will require deep cuts in greenhouse emissions across all sectors
- For agriculture this will still result in a significant residual emission requiring offsets
- We are likely to require multiple technologies; Afforestation SCS, BECs, & Biochar to achieve this
- The land use sector will play a critical role in delivering net zero emissions, but many unknowns
 - How will carbon uptake interact with GHG mitigation?

Thank you



The banner features a green header with the AAB logo (Association of Applied Biologists) on the left. To the right of the logo are links for 'Summary and Call for Abstracts' and 'Registration Details', followed by a 'Register Now' button. The main body of the banner has a background image of a green field with white agricultural structures. The text 'GHG Mitigation 2022' is prominently displayed in the center, followed by the dates '22 March 2022 – 24 March 2022'. Below this, the venue 'Macdonald Holyrood Hotel' and its address '81 Holyrood Rd, Edinburgh, EH8 8AU' are listed. At the bottom, a blue bar contains the text 'Agricultural greenhouse gas and ammonia mitigation: Solutions, challenges, and opportunities'.

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22 March 2022 – 24 March 2022

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Agricultural greenhouse gas and ammonia mitigation: Solutions, challenges, and opportunities

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