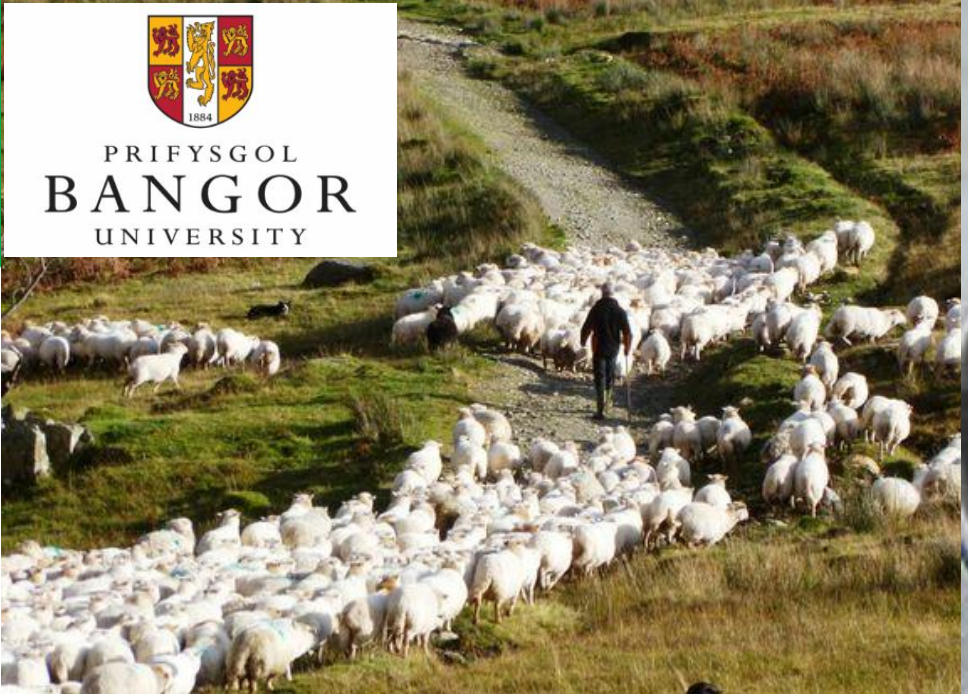


Meeting Net Zero on Welsh farms

Prysor Williams

Ysgol Gwyddorau Amgylchedd & Naturiol /
School of Environmental & Natural Sciences

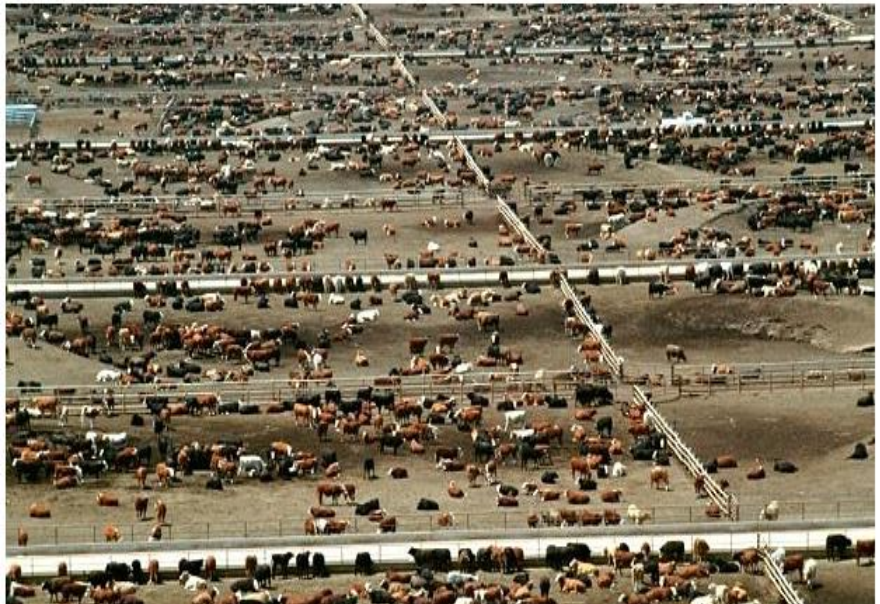
Prifysgol Bangor University

Background

- Very significant pressure on the livestock sector to reduce its environmental impacts

Giving up beef will reduce carbon footprint more than cars, says expert

Study shows red meat dwarfs others for environmental impact, using 28 times more land and 11 times water for pork or chicken



The EU Nitrates Directive

WATER

The background to the Directive

Pure, clean water is vital to human health and well-being, as well as to natural ecosystems, so safeguarding water quality is one of the cornerstones of European environmental policy. Because water sources are not restricted within national boundaries, an EU-wide approach is crucial to tackling problems of pollution. The 1991 Nitrates Directive is one of the earliest pieces of EU legislation aimed at controlling pollution and improving water quality.

While nitrogen is a vital nutrient that helps plants and crops to grow, high concentrations are harmful to people and nature. The agricultural use of nitrates in organic and chemical fertilisers has been a major source of water pollution in Europe. For the first time mineral fertiliser consumption registered a progressive reduction in the early 1990s and stabilised during the last four years in the EU-15, but across all 27 Member States nitrogen consumption has increased by 6%. Generally, farming remains responsible for over 50% of the total nitrogen discharge into surface waters.

The **Nitrates Directive** (1991) aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices.

It is proving effective: Between 2004 and 2007, nitrate concentrations in surface water remained stable or fell at 70% of monitored sites. Quality at 66% of groundwater monitoring points is stable or improving.

All Member States have drawn up action programmes: there are more than 300 of them across the whole EU. The quality of programmes is improving.

Across the 27 EU Member States, 39.6% of territory is subject to the implementation of action programmes.

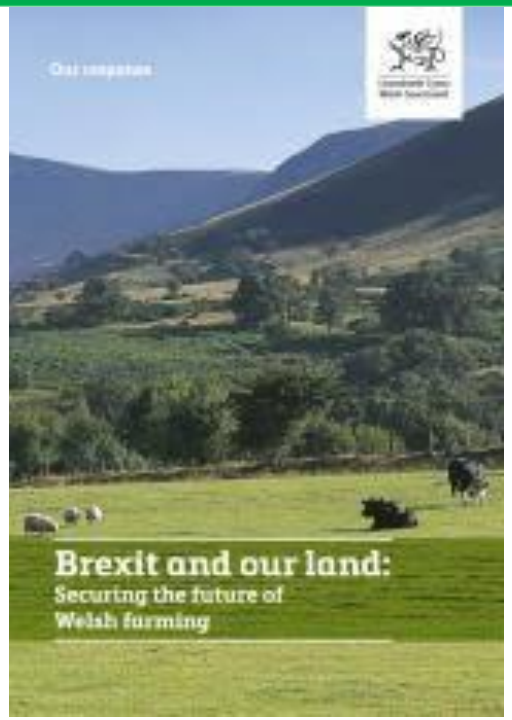
Farmers are becoming increasingly positive about environmental protection, exploring new techniques such as manure processing.

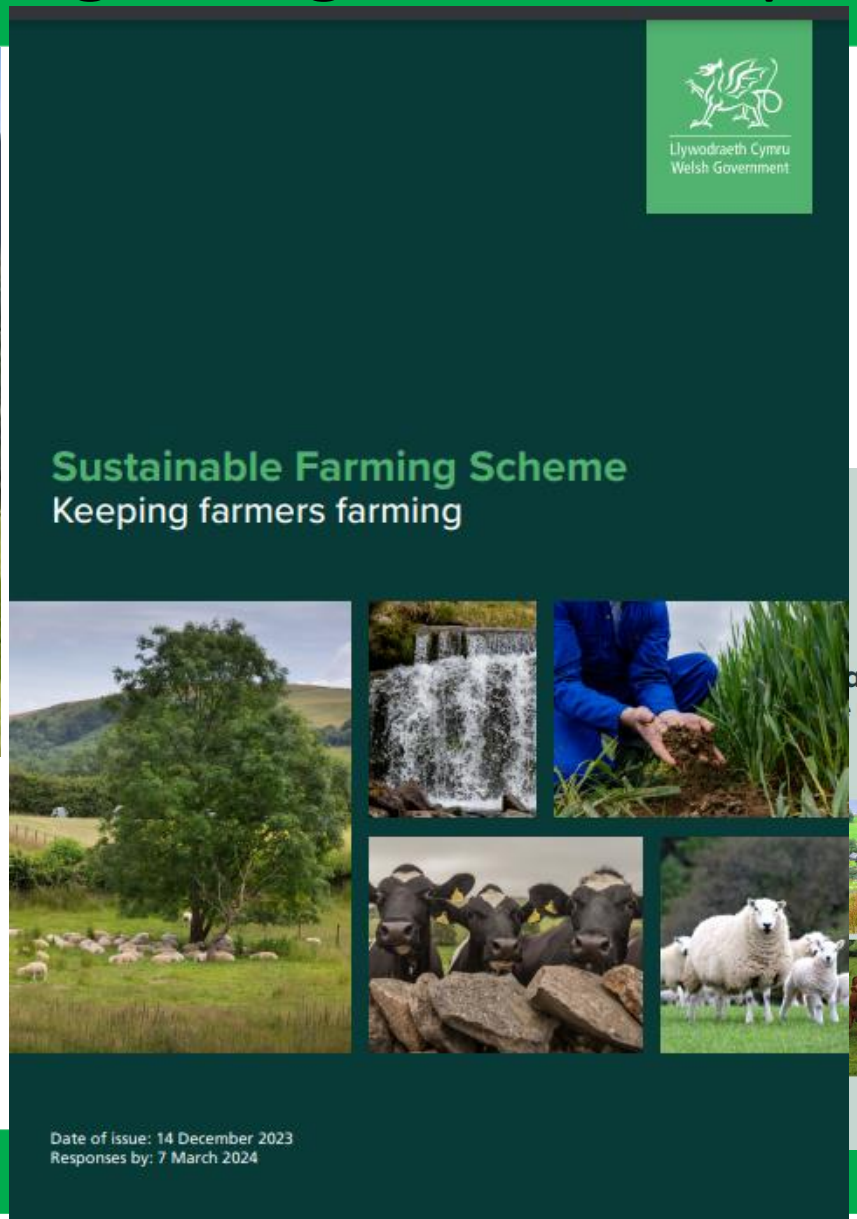
You and the environment

- Eich ffordd o fyw / Your lifestyle

Estimates based on data from the State of Massachusetts and emissions categories from the Union of Concerned Scientists.

Changes to government policy

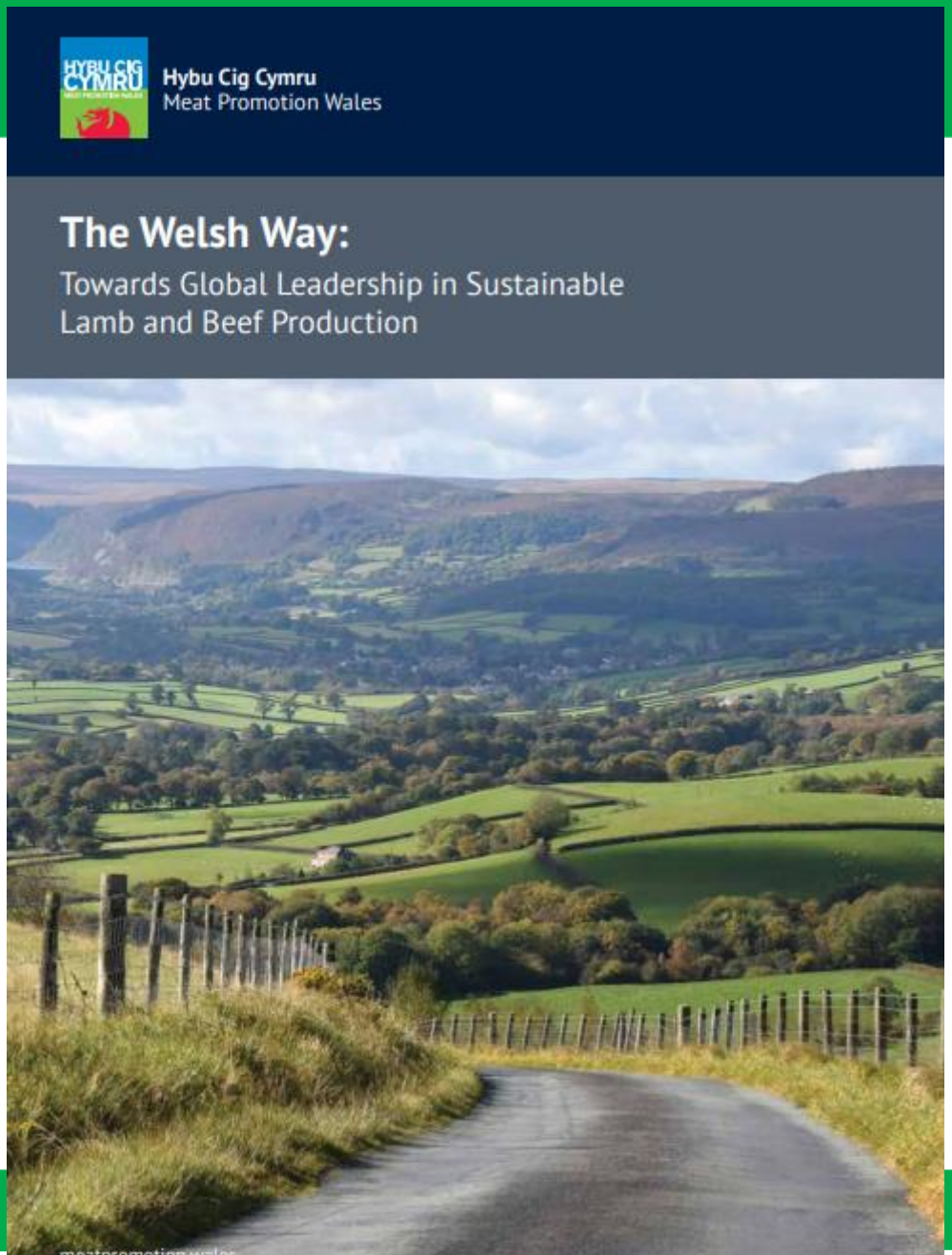




Background

- Doing nothing is not an option!

Background


Hybu Cig Cymru
Meat Promotion Wales
The Welsh Way:
Towards Global Leadership in Sustainable Lamb and Beef Production

Background

PRIFYSGOL BANGOR UNIVERSITY

Morrisons FARMING

Our Farmers | Backing British | How We Work | Where We Work | Livestock Specification | Farmers Login

- Animal Welfare
- Antibiotic Use
- R&D
- Nature Positive Farming
  - Training and Support
  - Increasing Sequestration
  - Reducing Emissions
  - Our Plans and Progress
- Farming Charities Link

Our Net Zero Ambition and How We Plan to Achieve it

UK agriculture currently accounts for 10% of all UK greenhouse gas emissions which is why we have set a ambition to become 'Net Zero' within the British farms we buy directly from by 2030, to do our part in helping tackle the global climate change crisis. At Morrisons we are in a unique position to help drive this change, buying directly from farms into our manufacturing business and as we are British Farming's biggest supermarket customer.

What do we mean by Net Zero?

By Net Zero, we mean that by 2030 we aim to be supplied by 'Net Zero' carbon British farms as a whole - with some farms that are better at carbon storage balancing other farms with higher emissions. Net Zero means that the emissions from farming activities and inputs are equal to the emissions removals from the atmosphere. We will be working closely with our farmers that supply; beef, lamb, pork, eggs, potatoes and soft fruit directly to us to help them achieve this 'Net Zero' position collectively by 2030.

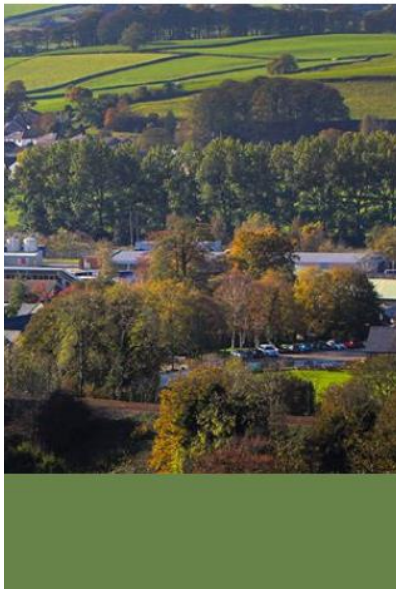
How do we plan to do this?

We are aware that this sounds like, and is a very challenging task, but we are confident that with the knowledge of industry experts, the engagement of our farmers, our team and everyone's passion to achieve this goal, we have come up with a plan that will help us achieve our target.

This plan is designed to encompass farming both now and in the future. Focusing on current farming practices in order to understand the emissions produced by our farms. While also making long lasting changes, ensuring that the work we do is embedded in the future generations of farmers to come.

1. Measuring Current Emissions

In order to set targets to achieve 'Net Zero' on our farms, we first need to know what emissions they produce. We have teamed up with industry leading company Map of Ag and developed a tried and tested measurement

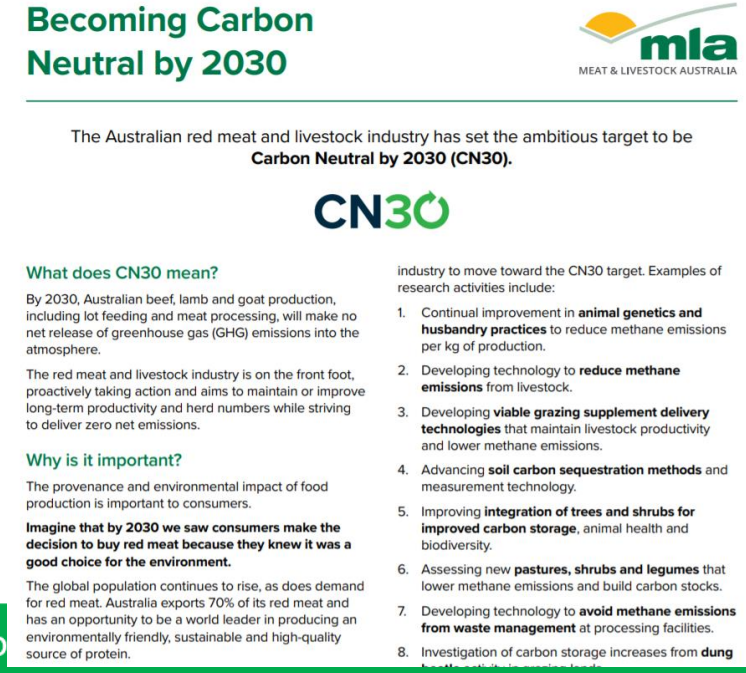


Amgylchedd@Bango

nvironment@Bangor

The Welsh Way - competition

- *Towards global leadership in sustainable lamb and beef production*
- We must be able to prove this
- Everyone is at it



Becoming Carbon Neutral by 2030

mla
MEAT & LIVESTOCK AUSTRALIA

The Australian red meat and livestock industry has set the ambitious target to be **Carbon Neutral by 2030 (CN30).**

CN30

What does CN30 mean?

By 2030, Australian beef, lamb and goat production, including lot feeding and meat processing, will make no net release of greenhouse gas (GHG) emissions into the atmosphere.

The red meat and livestock industry is on the front foot, proactively taking action and aims to maintain or improve long-term productivity and herd numbers while striving to deliver zero net emissions.

Why is it important?

The provenance and environmental impact of food production is important to consumers.

Imagine that by 2030 we saw consumers make the decision to buy red meat because they knew it was a good choice for the environment.

The global population continues to rise, as does demand for red meat. Australia exports 70% of its red meat and has an opportunity to be a world leader in producing an environmentally friendly, sustainable and high-quality source of protein.

industry to move toward the CN30 target. Examples of research activities include:

1. Continual improvement in **animal genetics and husbandry practices** to reduce methane emissions per kg of production.
2. Developing technology to **reduce methane emissions** from livestock.
3. Developing **viable grazing supplement delivery technologies** that maintain livestock productivity and lower methane emissions.
4. Advancing **soil carbon sequestration methods** and measurement technology.
5. Improving **integration of trees and shrubs for improved carbon storage**, animal health and biodiversity.
6. Assessing new **pastures, shrubs and legumes** that lower methane emissions and build carbon stocks.
7. Developing technology to **avoid methane emissions from waste management** at processing facilities.
8. Investigation of carbon storage increases from **dung**

Greenhouse gases (GHGs) from livestock systems

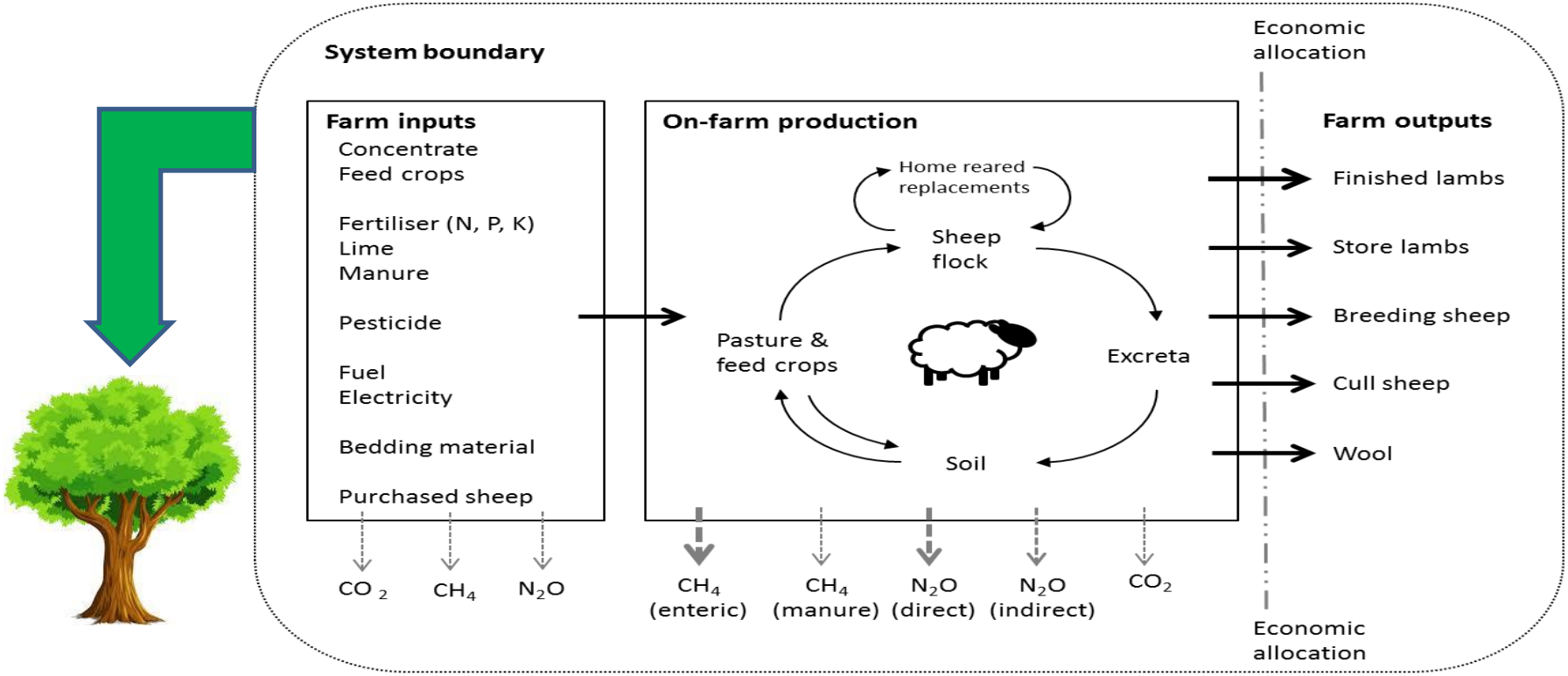
- Three major GHGs from livestock systems
- Each of a different strength

Gas Name	Symbol	1 kg in CO_2 equivalence
Carbon Dioxide	CO_2	1 kg CO_2
Methane	CH_4	25 kg CO_2
Nitrous Oxide	N_2O	298 kg CO_2

Source: Eurostat. Glossary: Carbon dioxide equivalent.

- CO_2 primarily from burning of fossil fuels (energy, fuel, fertiliser) plus some from lime
- CH_4 from ruminants
- N_2O from fertiliser and manures (deposited and spread)

Carbon footprints



Values expressed in two ways:

- **kg CO_2 eq. / kg product** and
- **kg CO_2 eq. / ha**

Calculating a farm's carbon footprint

- Many tools / models available
  - Some more accurate than others
  - Differ in a number of ways
    - E.g., what's included / not included
    - Some things are difficult to measure (soil carbon especially so, unfortunately!)
    - Some measure more than carbon
  - Caution needed when comparing results between different tools!
- "Which is best?" – depends on the purpose!

Farm Carbon Toolkit

CFT COOL FARM TOOL

SAC CONSULTING

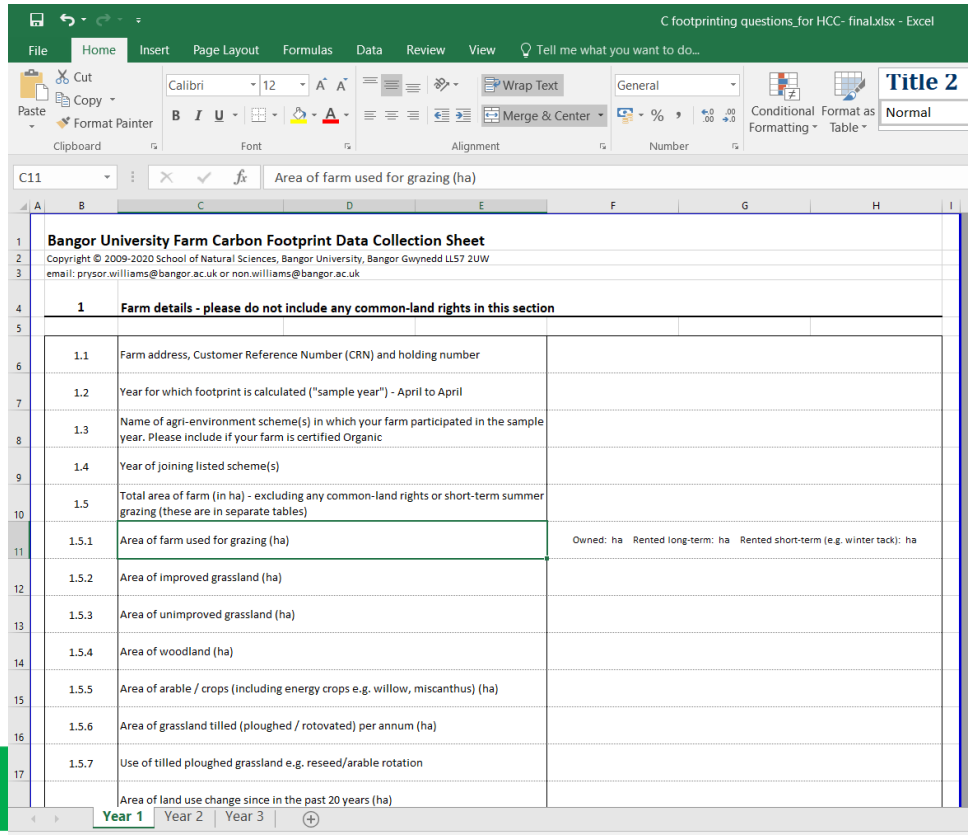
What we did

- Worked with 20 farms across Wales

- Represented a diversity of production systems
  - Hill, upland, lowland
  - Range of sizes
  - Breed types, systems
  - *Mostly* mixed beef and sheep
  - "Economic allocation"
    - E.g., where cattle represent 60% of farm income, this would account for 60% of emissions associated with fertiliser
    - Likewise with sequestration

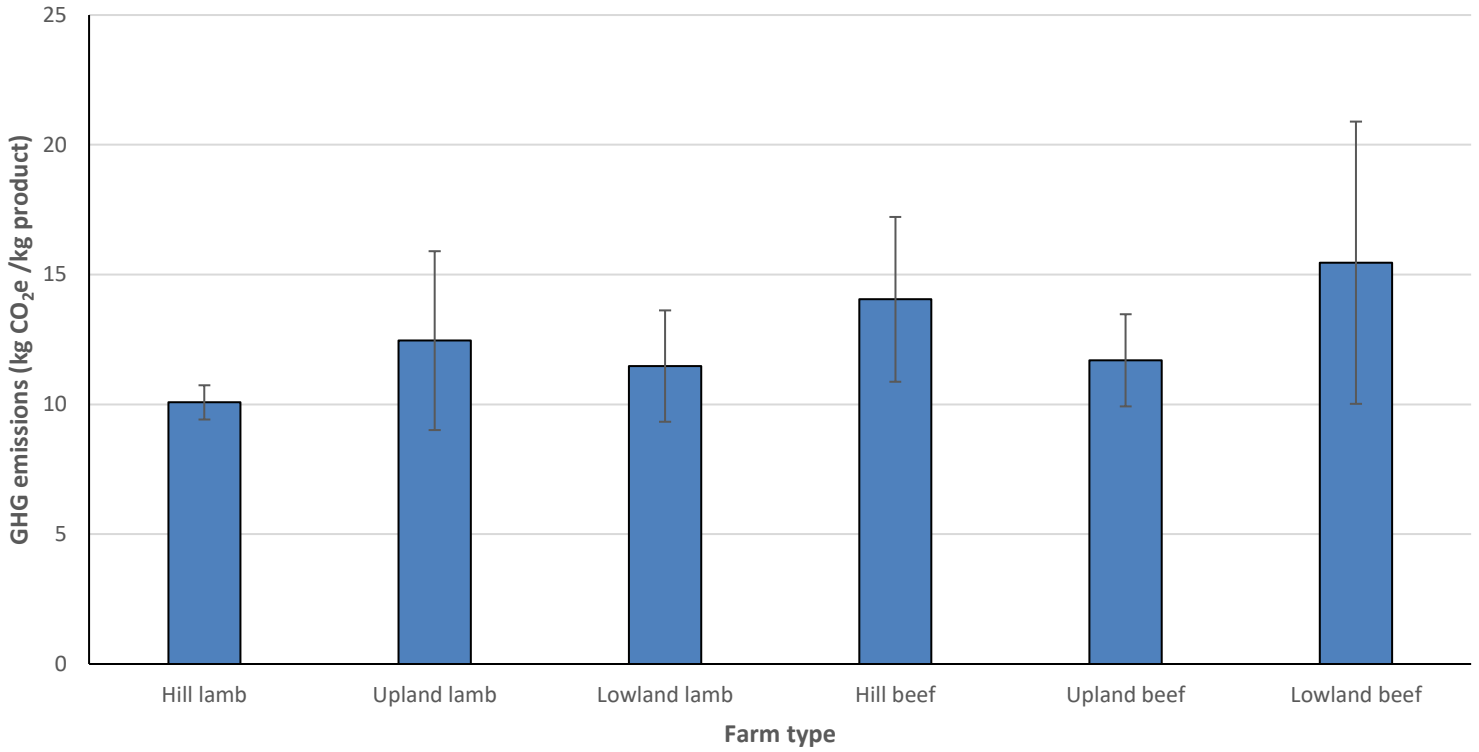
Calculating a farm's carbon footprint

- Bangor University tool is long-established
- Robustness of results
  - Updated with the most recent underpinning data
  - Uses internationally-recognised methods
- Worked with each farm
  - 12 (or more) months of data
    - Inputs
    - Outputs
    - Stock numbers
    - Length of hedgerows; tree cover
    - Soil type
    - Etc., etc.
  - Estimate the C cost and gains
    - = Net emissions



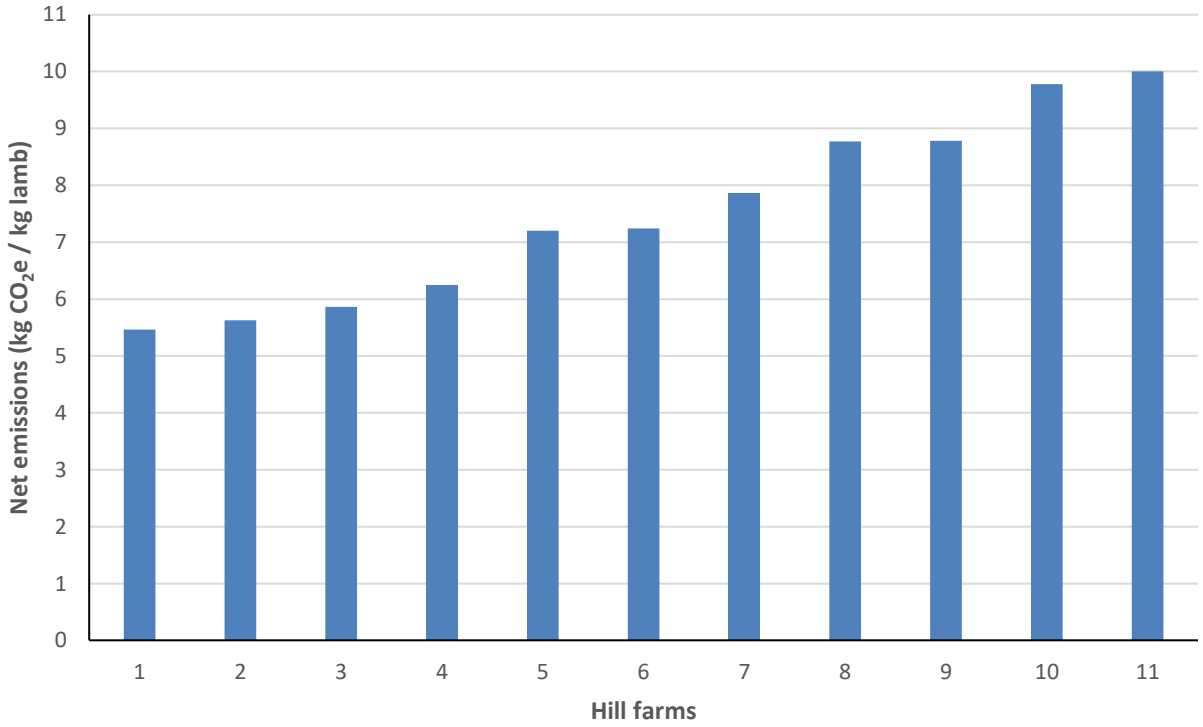
Results: emissions

Results: emissions



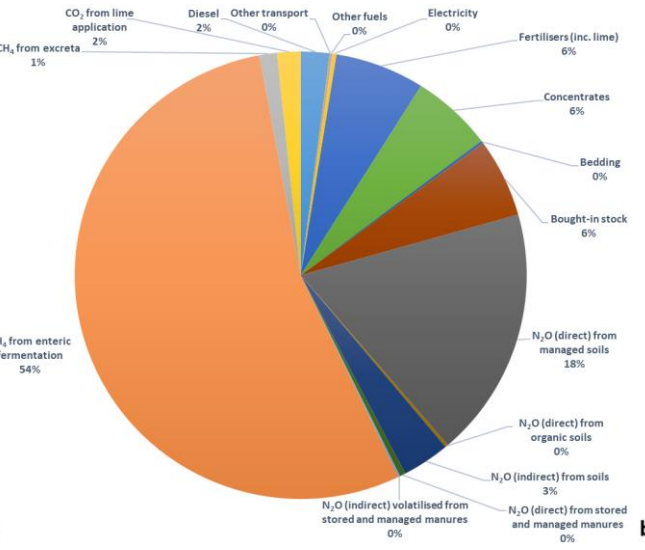
- Average GHG emissions per kg LW product across the study farms (± standard error of the mean)

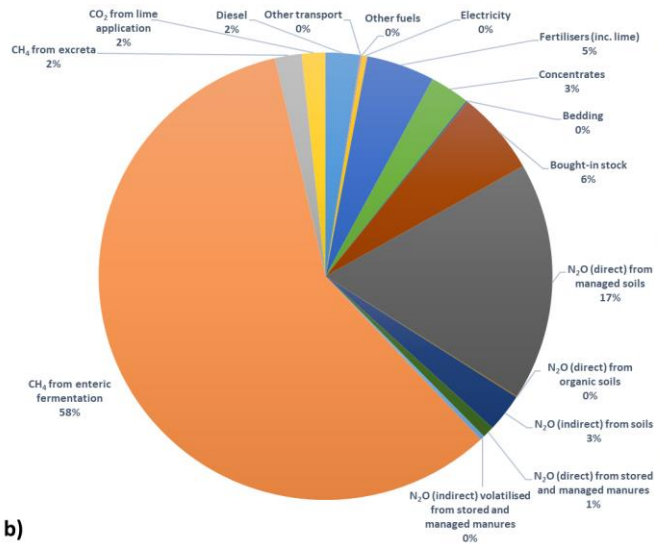
Results: emissions

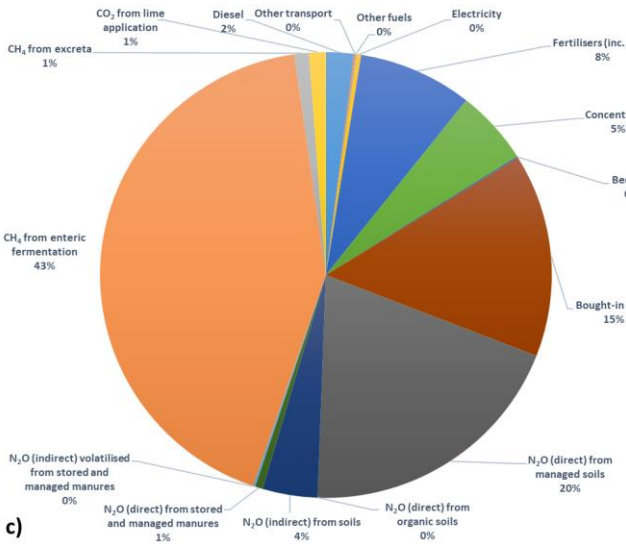


- Lamb net emissions of the eleven hill farms from smallest to greatest – the range in results was evident

Results: emissions

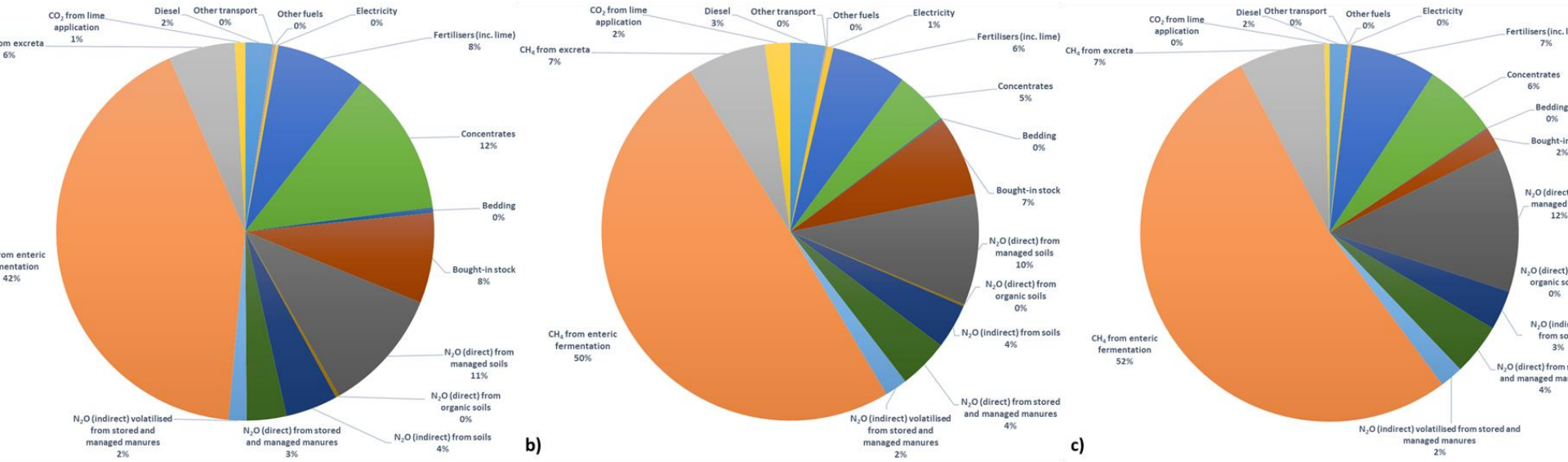






- Breakdown of lamb GHG emissions sources across the study farms (a = hill, b = upland, c = lowland)

Results: emissions

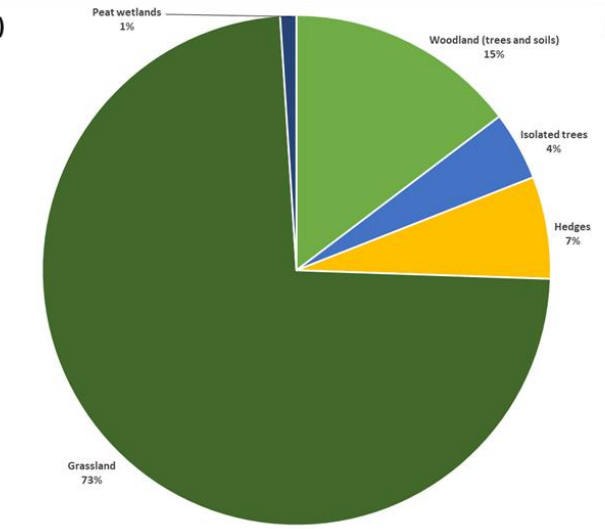


- Breakdown of beef GHG emissions sources across the study farms (a = hill, b = upland, c = lowland)

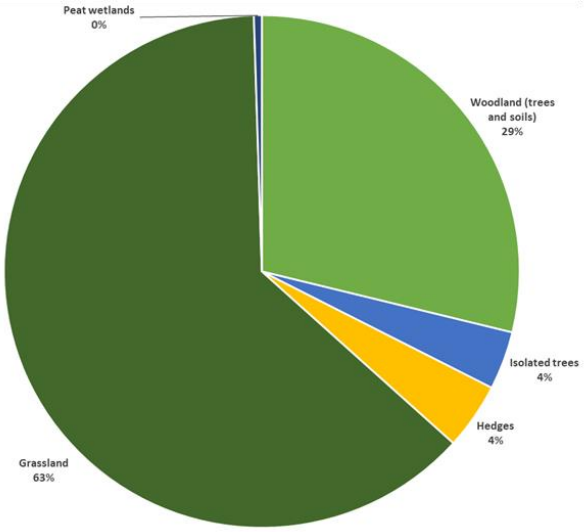
Results: emissions

- Methane is the biggest factor, every time (40-54% of emissions)
  - Reducing this has to be a priority
- Nitrous oxide also notable impact
  - Fertiliser – often very low due to low-intensity systems
  - Manure – linked to livestock numbers
- Impact of concentrate use notably varied
  - Generally greater in beef systems
- Contribution of electricity and fuel use generally very low
- Farm type and size not really important
- Some very efficient systems

Results: sequestration



b)



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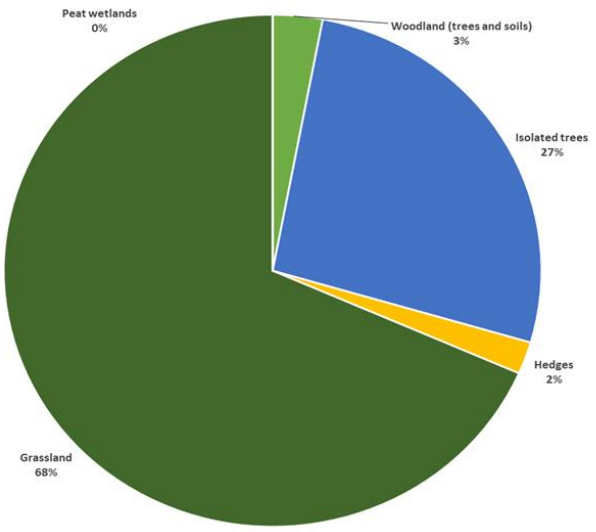
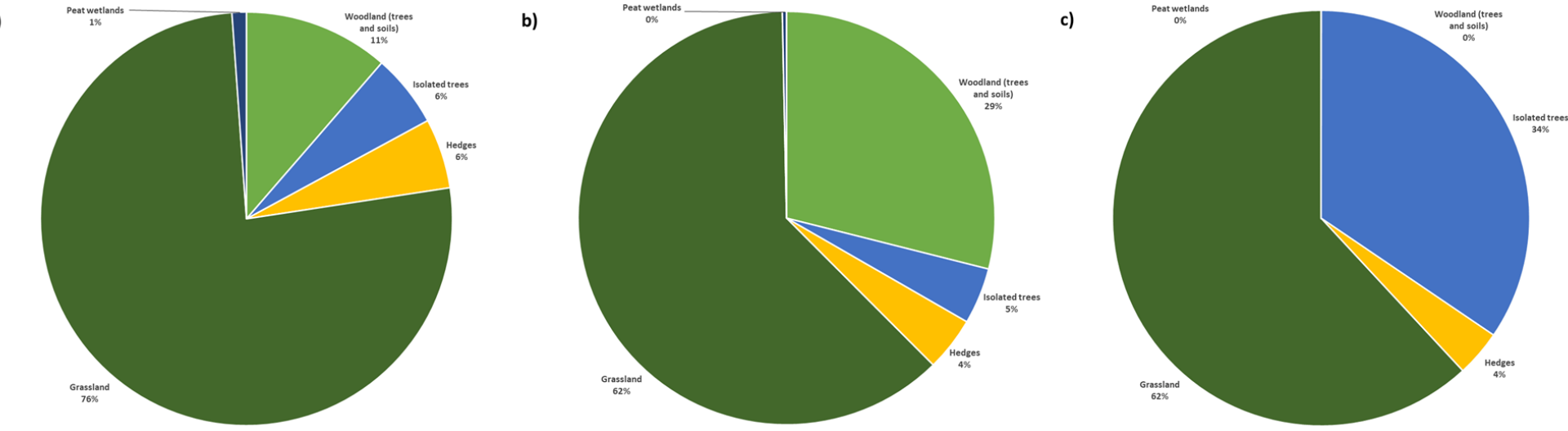


- Breakdown of carbon sequestration sinks against lamb production across the study farms (a = hill, b = upland, c = lowland)

Results: sequestration



- Breakdown of carbon sequestration sinks against beef production across the study farms (a = hill, b = upland, c = lowland)

Results: sequestration

- Soils under grassland were the overwhelmingly biggest sink
  - **BUT**, there is considerable uncertainty in the data
    - Soil types
    - Bulk density
    - Management
    - Whether already at saturation
- A lack of trees on farms (but for one)

	Percentage of woodland cover on farms (%)	
	Mean	**Range**
Hill	5.5	0.5 – 26.7
Upland	7.9	5.0 – 10.8
Lowland	2.2	0.5 – 5.4

  - Sequestration depends on, e.g.,
    - Management
    - Woodland age

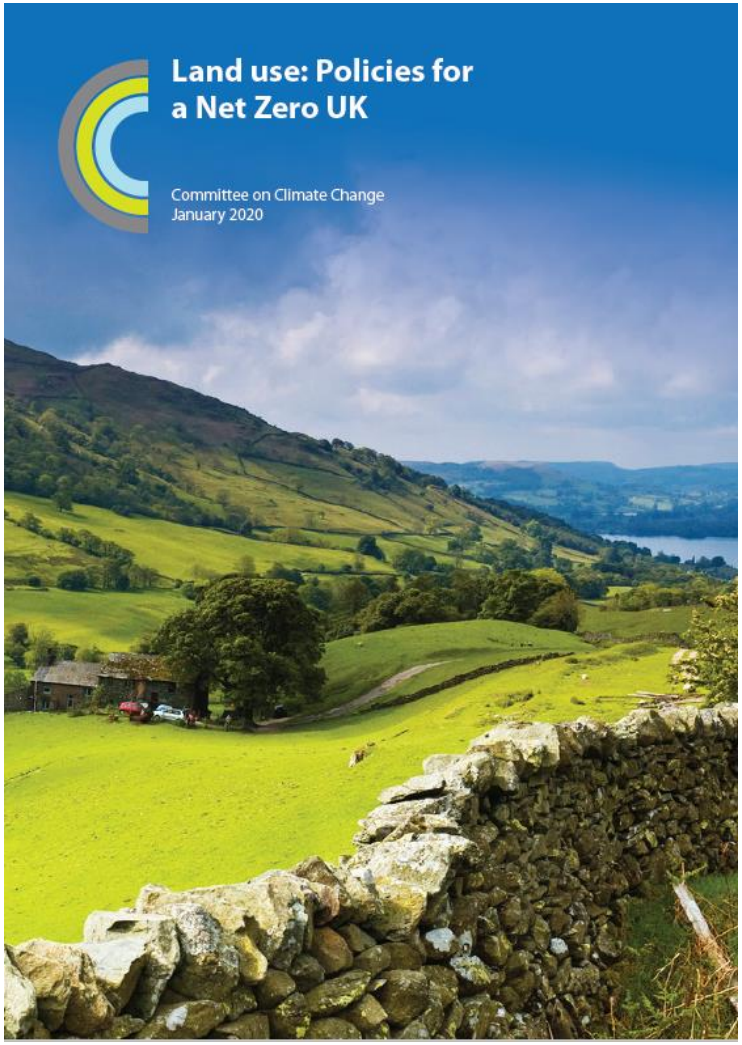
Net zero: are we there yet?

- Mean percentage of GHG emissions sequestered (in woody biomass and soils) across the study farms

	Percentage of GHG emissions sequestered (%)	
	Mean	**Range**
Hill lamb	24.0	8.5 – 49.0
Upland lamb	20.7	6.8 – 32.9
Lowland lamb	15.6	4.4 – 28.8
Hill beef	26.9	6.5 – 82.8
Upland beef	24.0	11.0 – 42.7
Lowland beef	10.8	9.1 – 13.8

- No farm was net zero; one farm was relatively close
- Scope to improve

How can Welsh agriculture achieve net zero?



Llywodraeth Cymru
Welsh Government

Cymraeg

Home > Announcements > All announcements > Wales commits to net zero by 2050, but sets out ambitions to get ther

PRESS RELEASE

Wales commits to net zero by 2050, but sets out ambitions to get there sooner

Welsh Government has today set out its legal commitment to achieve net zero emissions by 2050, but is pushing to "get there sooner" as it gets ready for COP26 (26th United Nations' Climate Change Conference of the Parties) in November.

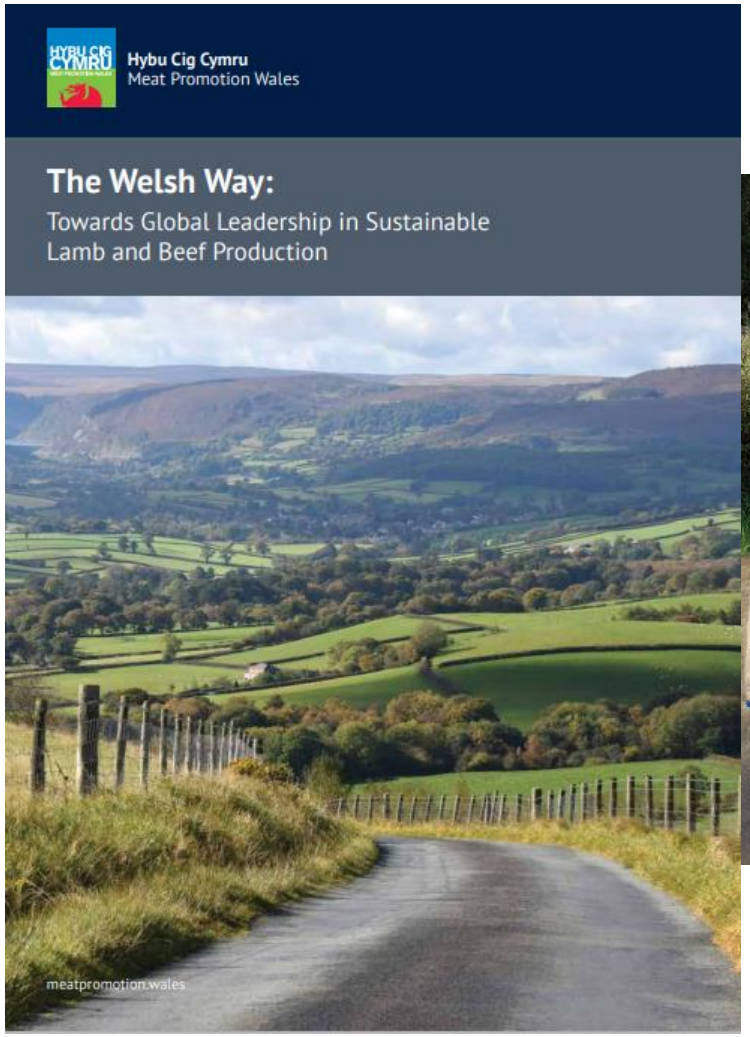
Organisation: Climate Change Committee
First published: 9 February 2021
Last updated: 9 February 2021

The move comes following a **recommendation report** by the independent Climate Change Committee (CCC), that revealed net zero emissions, previously thought unachievable and unaffordable by experts, was now possible with ambitious policy and a 'Team Wales' effort.

The new evidence from the CCC says greater reductions within the industrial sector will help achieve this goal, as a large proportion of Welsh emissions come from a small number of big emitters, such as Port Talbot steelworks.

Share this page:

How can Welsh agriculture achieve net zero?



How can Welsh agriculture achieve net zero?

1. Reduce emissions in the first place

2. Enhance sequestration to off-set more emissions

- **Options will vary between farms…**

- **…But <u>all farms can do something</u>**

1. Reduce emissions in the first place

Reduce inputs / Maintain inputs, whilst increasing outputs

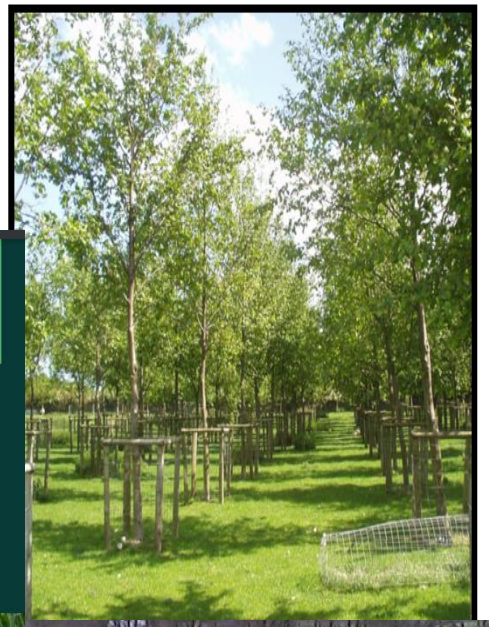
- Less “passengers”
  - Calving interval; lambing ewe lambs
  - Barren rate; reduce losses
  - % of cow/sheep weight, weaned
- Grassland management
- Optimise diet
- Improve genetics
- Nutrient management
- Manage peats and soils

Most of these make financial sense!

2. Enhance sequestration to off-set more emissions

Some emissions are unavoidable, but they can be off-set

- Trees and soils
- Hedges – don't underestimate them



Increasing tree cover: right tree, right place

Ysgoloriaethau Sgiliau Economi Gwybodaeth
Knowledge Economy Skills Scholarships

3. Learning from each other

- Huge potential from implementing best-practise
  - The right opportunities need to be in place

Agricultural Systems 147 (2016) 123–131

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Improving livestock production efficiencies presents a major opportunity to reduce sectoral greenhouse gas emissions

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Keywords:
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Meat
Resource efficiency
Sustainable intensification

ABSTRACT

The livestock sector is under considerable pressure to reduce greenhouse gas (GHG) emissions. Repeated measurements of emissions over multiple years will indicate whether the industry is on course to successfully meet emission reduction targets. Furthermore, repeated analyses of individual farm emissions over different timeframes allow for a more representative measure of the carbon footprint (CF) of an agricultural product, as one sampling period can vary substantially from another due to multiple stochastic variables. To explore this, a CF was measured for 15 livestock enterprises that had been assessed three years previously. The aims of the research were to: (1) objectively compare CFs between sampling periods; (2) assess the relationship between enterprise CF and input efficiency; (3) use scenario analyses to determine potential mitigation measures. Overall, no significant difference was detected in beef and lamb enterprise CFs between the two sampling periods. However, when all observations were pooled together, the lowest-emitters were found to have more efficient systems with higher productivity with lower maintenance "overheads", compared with their higher-emitting counterparts. Of significance, scenario analyses revealed that the CF of beef and lamb could be reduced by 15% and 30.5%, respectively, if all enterprises replicated the efficiency levels of the least-emitting producers. Encouraging and implementing efficiency gains therefore offer the livestock industry an achievable method of considerably reducing its contribution to GHG emissions.

How c… …t zero?

- It is not …
- Practical …
- **…But op…**
- Some ar…

Agricultural Systems 215 (2024) 103852

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journal homepage: www.elsevier.com/locate/agsy

Net Zero requires ambitious greenhouse gas emission reductions on beef and sheep farms coordinated with afforestation and other land use change measures

Louise C. McNicol [a,*], Non G. Williams [a], Dave Chadwick [a], David Styles [b], Robert M. Rees [c], Rachael Ramsey [c], A. Prysor Williams [a]

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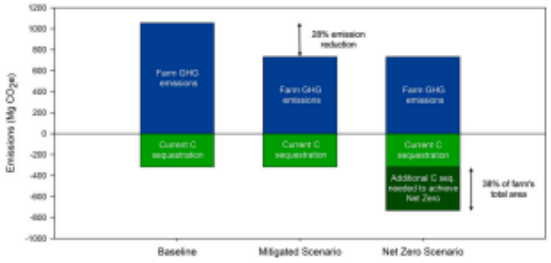
[c] Scotland's Rural College, West Mains Road, Edinburgh EH9 3JG, UK

HIGHLIGHTS

- Baseline GHG emissions were calculated for 20 grassland-based beef and sheep farms.
- Cost-effective abatement options could reduce GHG emissions by 28% on average.
- Large-scale land use change is needed to offset remaining GHG emissions.
- Woodland needed to achieve farm-level Net Zero equivalent to 8–85% of farms' area.
- Net Zero is more achievable and logical at a sector-level rather than a farm-level.

GRAPHICAL ABSTRACT



ARTICLE INFO

Editor: Mark van Wijk

Keywords:
Carbon sequestration
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Food security
Grasslands
Mitigation measures
Sustainable agriculture

ABSTRACT

CONTEXT: The UK Climate Change Committee has recommended a 64% reduction in greenhouse gas emissions from the agriculture and land-use sector to meet the 2050 Net Zero target in the UK. However, it is unclear how this reduction can be achieved at a farm level.

OBJECTIVE: Using detailed real farm data and novel modelling approaches, we investigated the management interventions and afforestation that would be required to deliver Net Zero within the farm boundary.

METHODS: Baseline carbon footprints were calculated for twenty Welsh beef and sheep farms using the Agrecalc carbon calculator, whilst carbon sequestration was estimated using Bangor University's Carbon Footprinting Tool. Scenarios were created to determine the emissions reductions achievable on each farm through implementation of cost-effective mitigation measures. Mitigation measures and their abatement potentials were sourced from the most recent UK Marginal Abatement Cost Curve, which allow emissions to be reduced mostly through improvements in efficiency thus maintaining the production of the system. Area footprints were calculated for production, with and without offset (afforested) areas needed to achieve Net Zero.

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E-mail address: lsm20fqj@bangor.ac.uk (L.C. McNicol).

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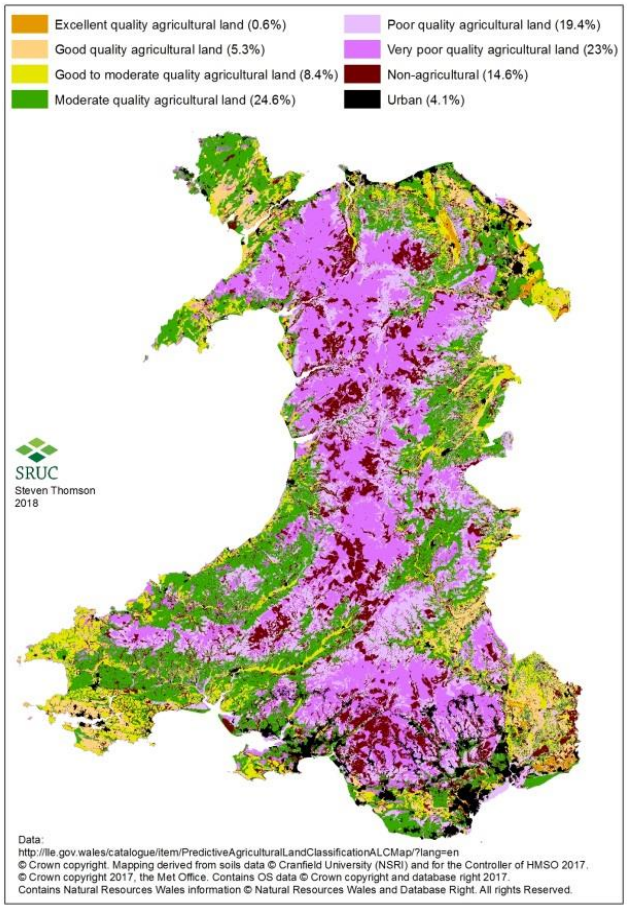
Not all systems are equal

Not all systems are equal

- Grass-based systems *can* have a lower environmental impact
- …and also deliver environmental benefits

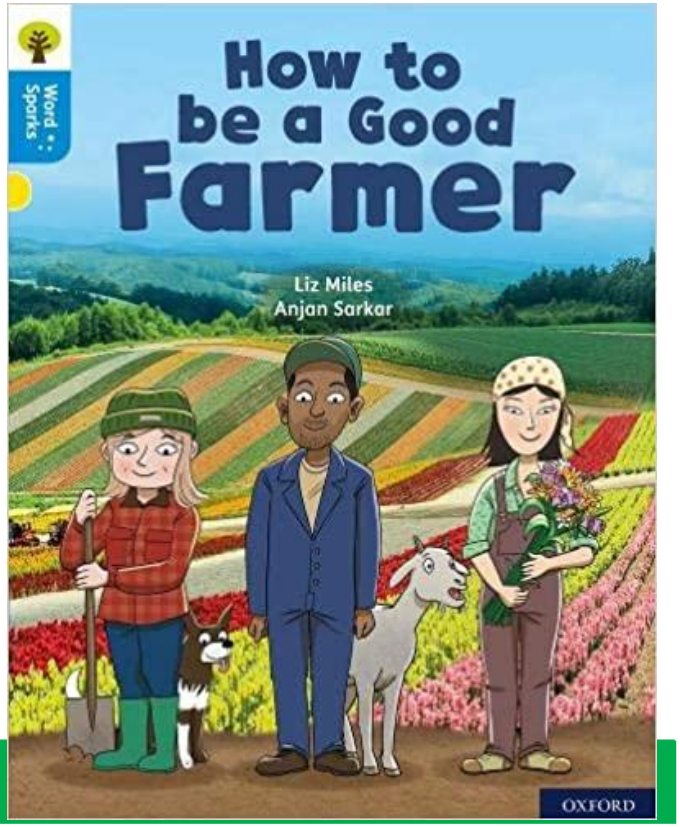


Changing perspectives?

- Farmer's job description, 2014:
  - Food producer
- Farmer's job description, 2034:
  - Food producer
  - Conservationist
  - Flood defence manager
  - Climate change mitigator
  - Clean water provider
  - Etc., etc.
  - ??
  - Notion of "land manager"…

Changing perspectives?

- What is a “good farmer”? Is this notion changing?
- Wheeler et al. (2018) argued that sound environmental management is increasingly considered an attribute of being a “good farmer”



Farmer's views on climate change and the environment

- Four distinct clusters
  - The Countryside Steward
  - The Productivist
  - The Environmentalist
  - The Dejected
- Tailoring messages to the audience
- Appreciation of differences

Agric Hum Values (2016) 33:323–339
DOI 10.1007/s10460-015-9608-9

Farmers' perceptions of climate change: identifying types

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Abstract Ambitious targets to reduce greenhouse gas (GHG) emissions from agriculture have been set by both national governments and their respective livestock sectors. We hypothesize that farmer self-identity influences their assessment of climate change and their willingness to implement measures which address the issue. Perceptions of climate change were determined from 286 beef/sheep farmers and evaluated using principal component analysis (PCA). The analysis elicits two components which evaluate identity (productivism and environmental responsibility), and two components which evaluate behavioral capacity to adopt mitigation and adaptation measures (awareness and risk perception). Subsequent Cluster Analyses reveal four farmer types based on the PCA scores. 'The Productivist' and 'The Countryside Steward' portray low levels of awareness of climate change, but differ in their motivation to adopt pro-environmental behavior. Conversely, both 'The Environmentalist' and 'The Dejected' score higher in their awareness of the issue. In addition, 'The Dejected' holds a high sense of perceived risk; however, their awareness is not conflated with an explicit understanding of agricultural GHG sources. With the exception of 'The Environmentalist', there is an evident disconnect between perceptions of agricultural emission sources and their contribution towards GHG emissions amongst all types. If such linkages are not conceptualized, it is unlikely that behavioral capacities will be realized. Effective communication channels which encourage action should target farmers based on the groupings depicted. Therefore, understanding farmer types through the constructs used in this study can facilitate effective and tailored policy development and implementation.

Keywords Environmental impact · Farmer engagement · Livestock · Red meat · Sustainable intensification

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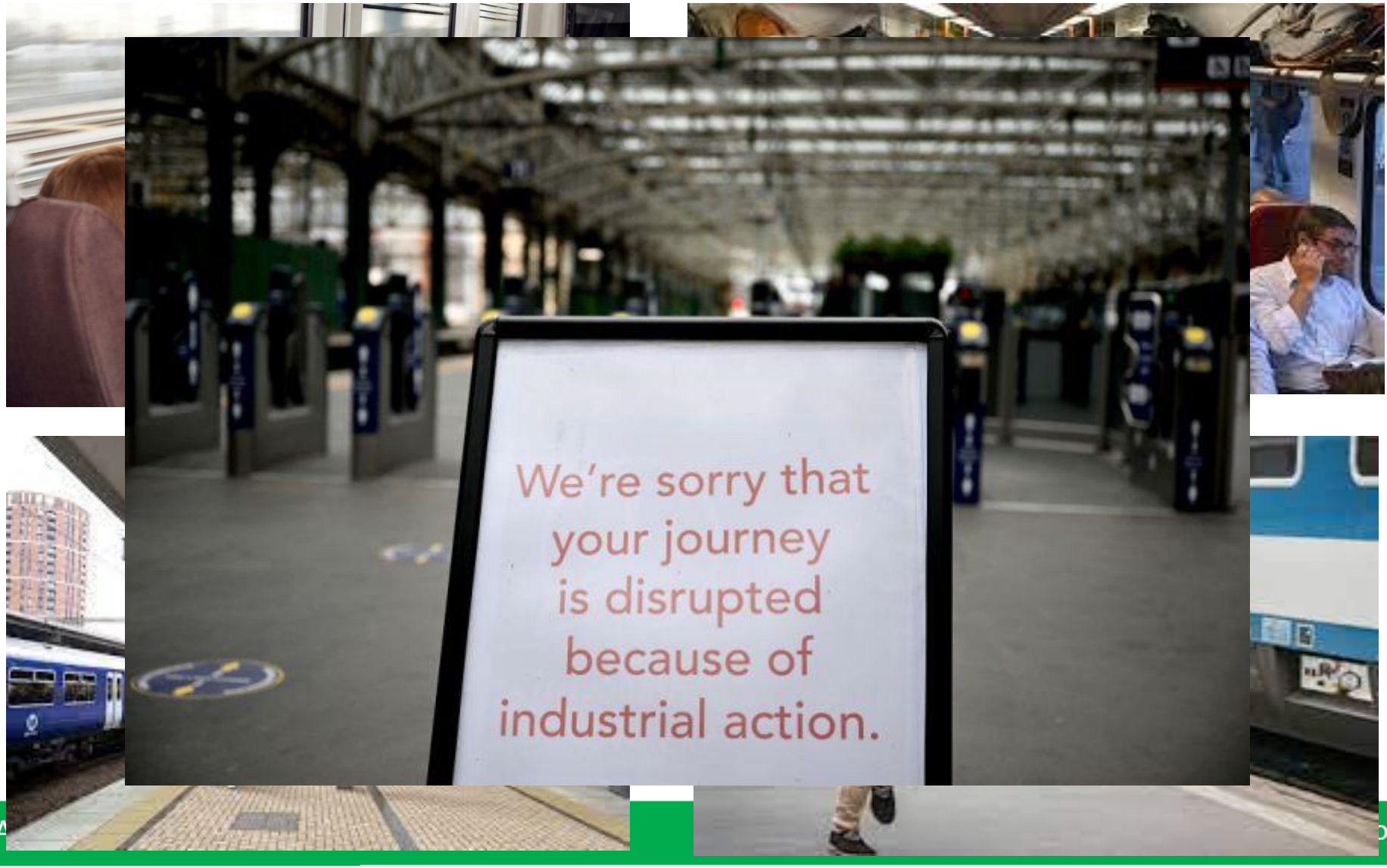
Catching the Net Zero train: the industry is at different places



Summary

- Farmers increasingly realise the need to act on environmental challenges won't disappear
  - Public and the government *expects* this
  - Competitors are also at it
  - **Welsh livestock systems have much to offer**
  - There are opportunities in the challenge
- Benefits to industry
  - Efficiency gains
  - Happier consumers
  - Happier regulators
  - Payments?

- But it's not all easy, and Net Zero is not achievable everywhere

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Diolch yn fawr / Many thanks

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