



PRIFYSGOL
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Effeithlonrwydd mewn amgylchedd sy'n newid
Efficiency in a changing environment

Prysor Williams
Prifysgol Bangor University

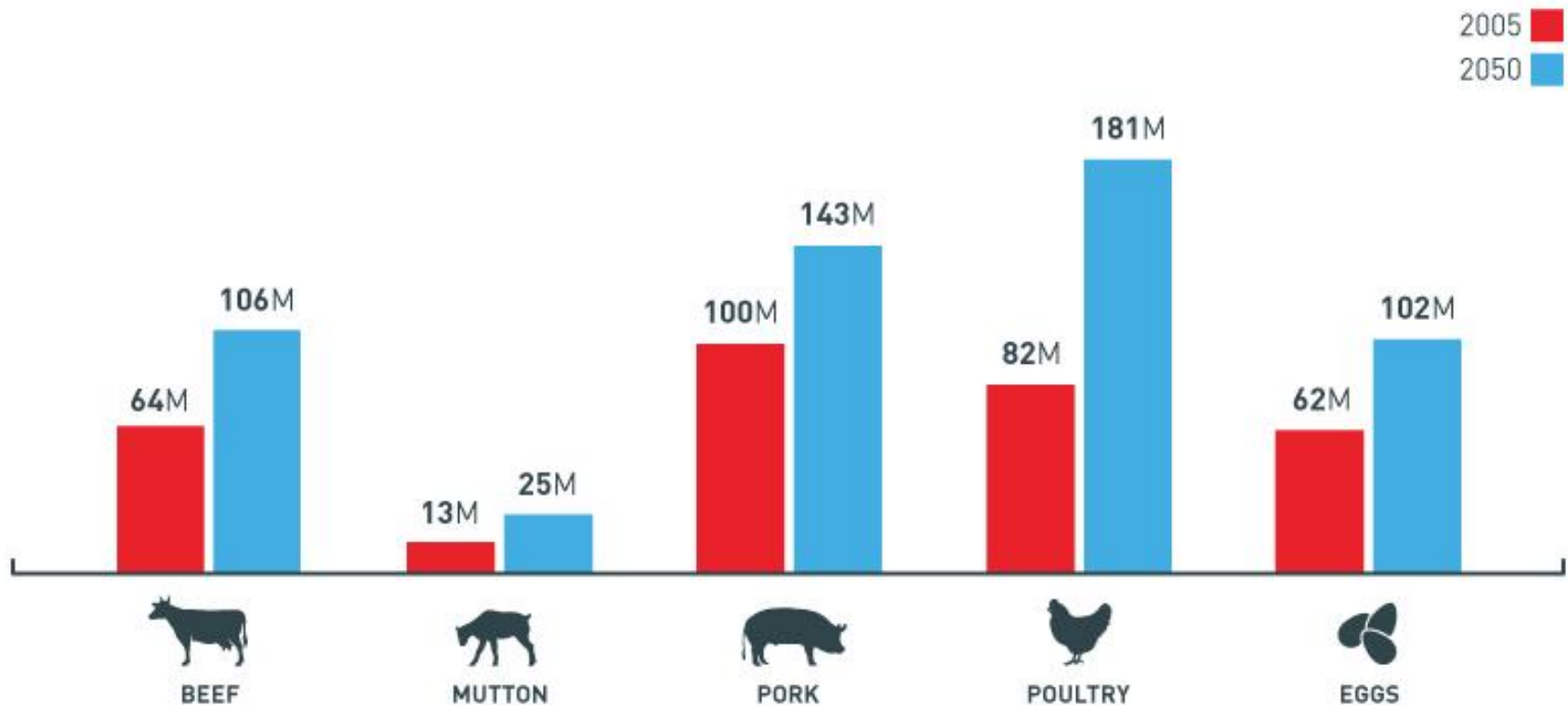
Background

- Good news & bad news...

Increasing demand for your produce

GLOBAL DEMAND FOR MEAT

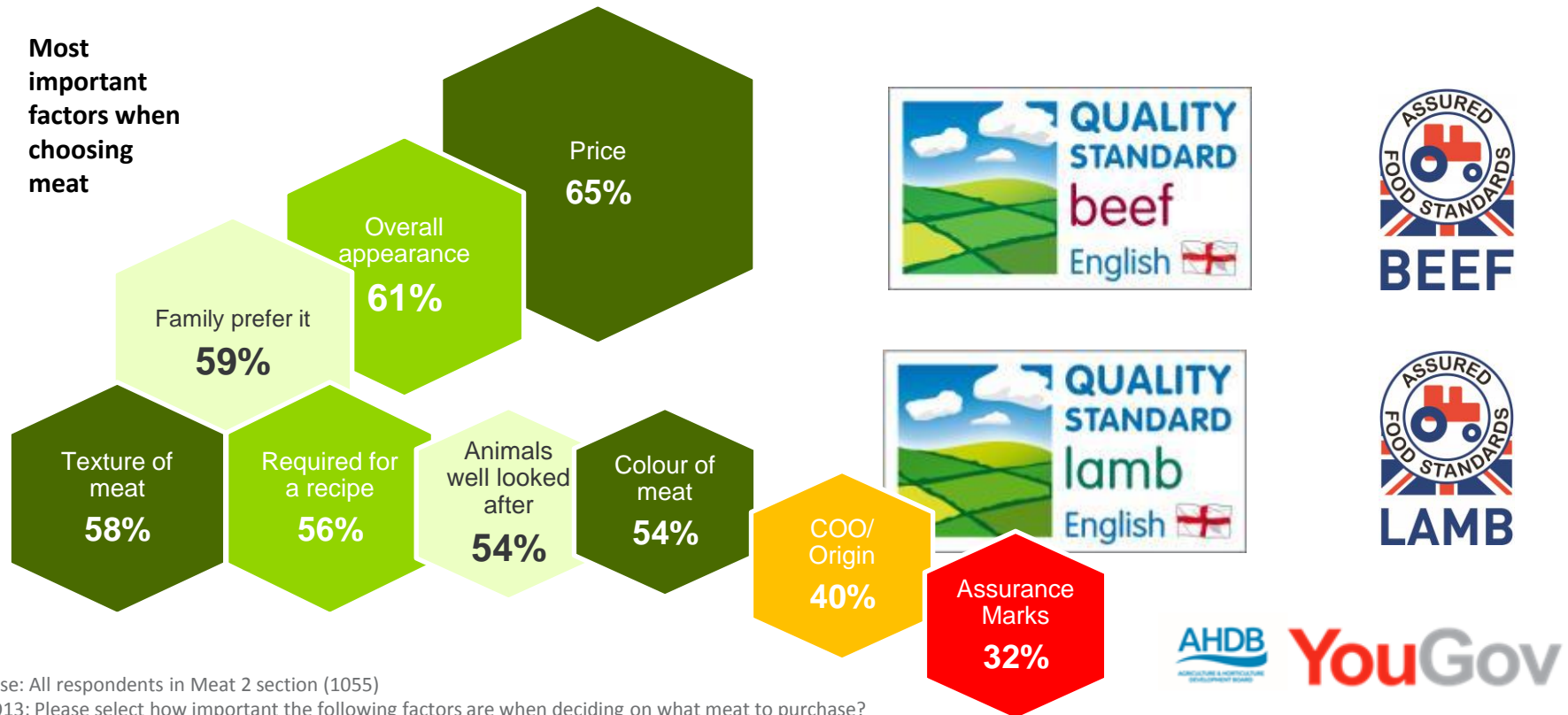
2005 vs. 2050
[in tonnes]



Source: Food and Agriculture Organization of the United Nations, ESA Working Paper No. 12-03, p. 131

Provenance and assurance

- Food assurance schemes for many act as a consumer comfort blanket – around confidence & trust
- Provenance on its own doesn't necessarily drive sales – value and good quality are key considerations



The “B word”





Brexit earthquake

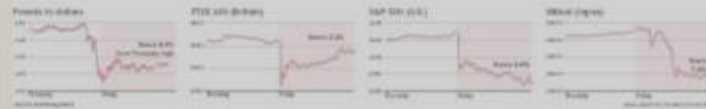
© Prime minister announces resignation © Vote to leave threatens break-up of UK

Britain breaks with Europe



Cameron quits, sterling plunges and Scotland hints at independence vote
 Rise of rage from Leave voters alienated by London and globalisation

Brits' vote to exit E.U. roils globe
 WORLD MARKETS TAKE HIT; PRIME MINISTER CAMERON TO RESIGN



Global economies lurch for long term

The global economy has been rocked by the Brexit vote. The British pound has fallen to a 30-year low, and the FTSE 100 has lost more than 10% of its value. Investors are worried about the impact of the vote on the global economy.



Consequences swirl after jarring result

The consequences of the Brexit vote are still unclear. The pound has fallen, and the FTSE 100 has lost value. Investors are worried about the impact of the vote on the global economy.

DAILY MIRROR

DAY ONE OF BREXIT BRITAIN

- » Cameron resigns and Corbyn fights mutiny in 'worst crisis since WW2'
- » World leaders stunned as shares plummet by £1.2trillion & pound falls
- » Find out what leaving Europe actually means for you and your family

So what the hell happens now?

theguardian

Over. And out

- » Britain votes for Brexit
- » Europe tells UK: leave now
- » Scotland: we'll go it alone
- » David Cameron resigns as PM
- » Pound crashes to 30-year low
- » Johnson and Gove urge calm

THE Sun £5 OFF AT Iceland

EXCLUSIVE: REASON CAM QUIT

Why should I do the hard s**t?

TEARY PM DIDN'T WANT BREXIT GRIEF

“New” pressures

- Livestock agriculture often reported as a significant source of environmental impact

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



Environment

Would eating less meat really combat climate change?

If every Briton went vegetarian, we could cut our greenhouse gas footprint by 25 per cent

Mike Berners-Lee | Sunday 29 November 2015 | 17 comments



Cows graze on grass at the Stemple Creek Ranch in Tomales, California Getty



Environmental concerns about meat

- Livestock agriculture often reported as a significant source of environmental impact



The EU Nitrates Directive

WATER

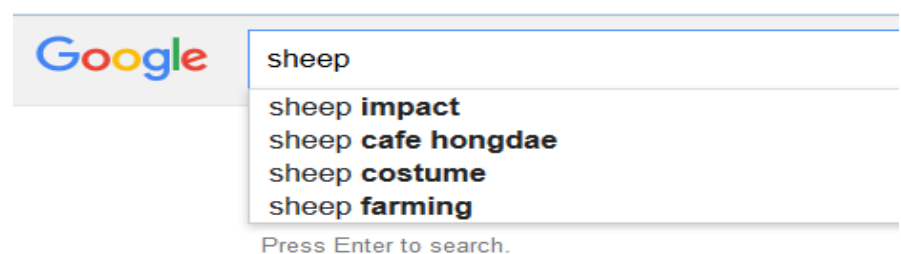
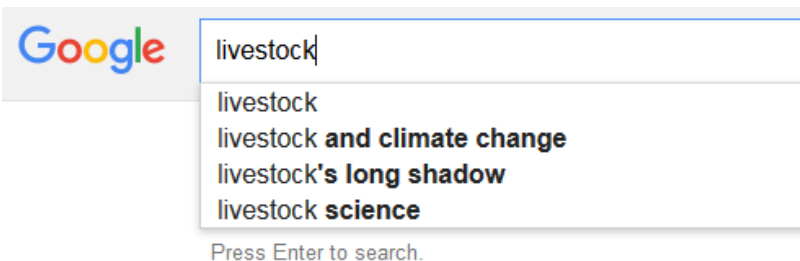
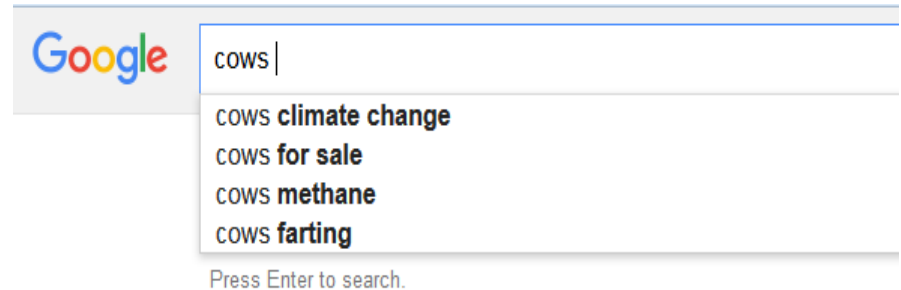
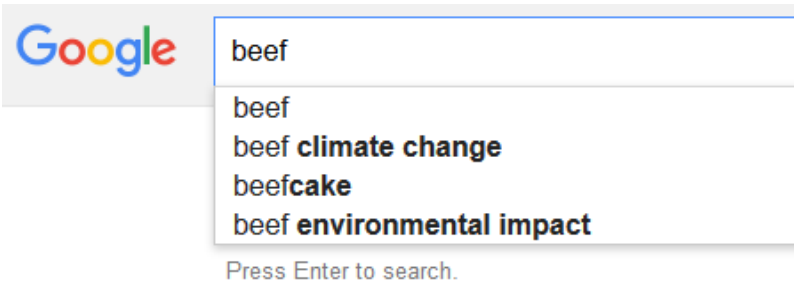
The background to the Directive

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.

Some Google searches...



5%

Population
say they are
vegetarian

35%

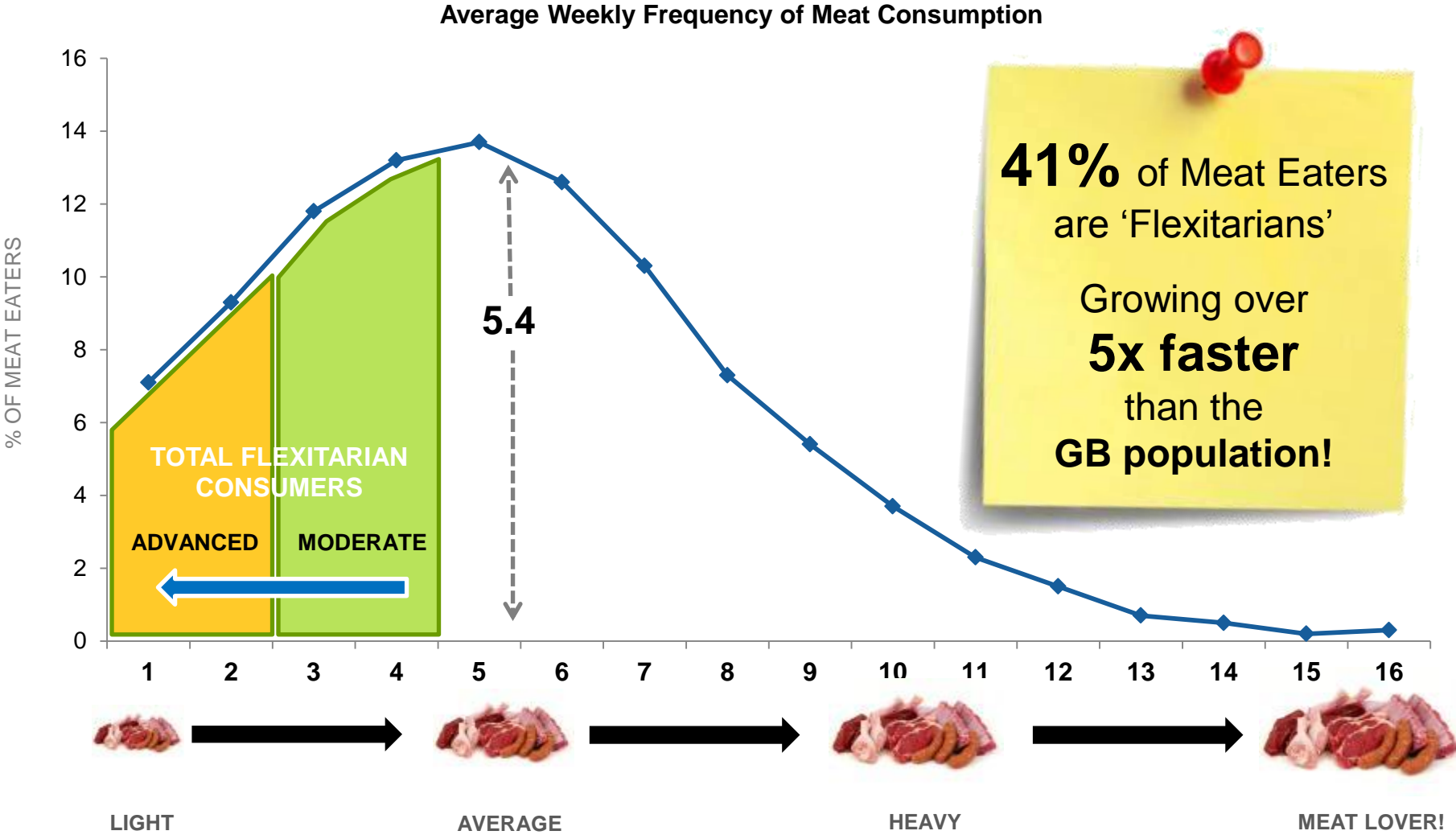
of evening
meals are
Meat Free

64%

GB HHs are
buying Meat
Free each year

Cutting down on Meat
becoming a more
important part of meals

The rise of Meat Free ...and flexitarians



Kantar Worldpanel Usage // Total in Home and Carried out Consumption // 52 we/ 31st of January 2016



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Meat free January – my veggie journey



Andy Atkins
21 January 2014

So far, so good

So, what New Year's resolutions did you make? Have you broken them yet? The only one I made was to go meat free for January – and so far, so good.

Livestock production is responsible for 14.5% of greenhouse gases emitted worldwide each year, as well as water degradation, pollution and wildlife loss. We need to start thinking more sustainably when it comes to the things we eat.

That's why we'll be asking our meat and fish-eating supporters to take part in **Meat Free May** later this year. We'll be inviting you to cut meat out of your diet for a month, to help you kickstart a longer term **flexitarian** diet – eating less, but better quality meat – which **benefits you and the planet**.

I'm not the world's biggest carnivore, so when **Young Friends of the Earth** and our **Land, Food and Water team** asked me to give it a test run in January, I could hardly say no.



© Think

Get email updates

Sign up to find out how you can get involved in our work to protect the planet

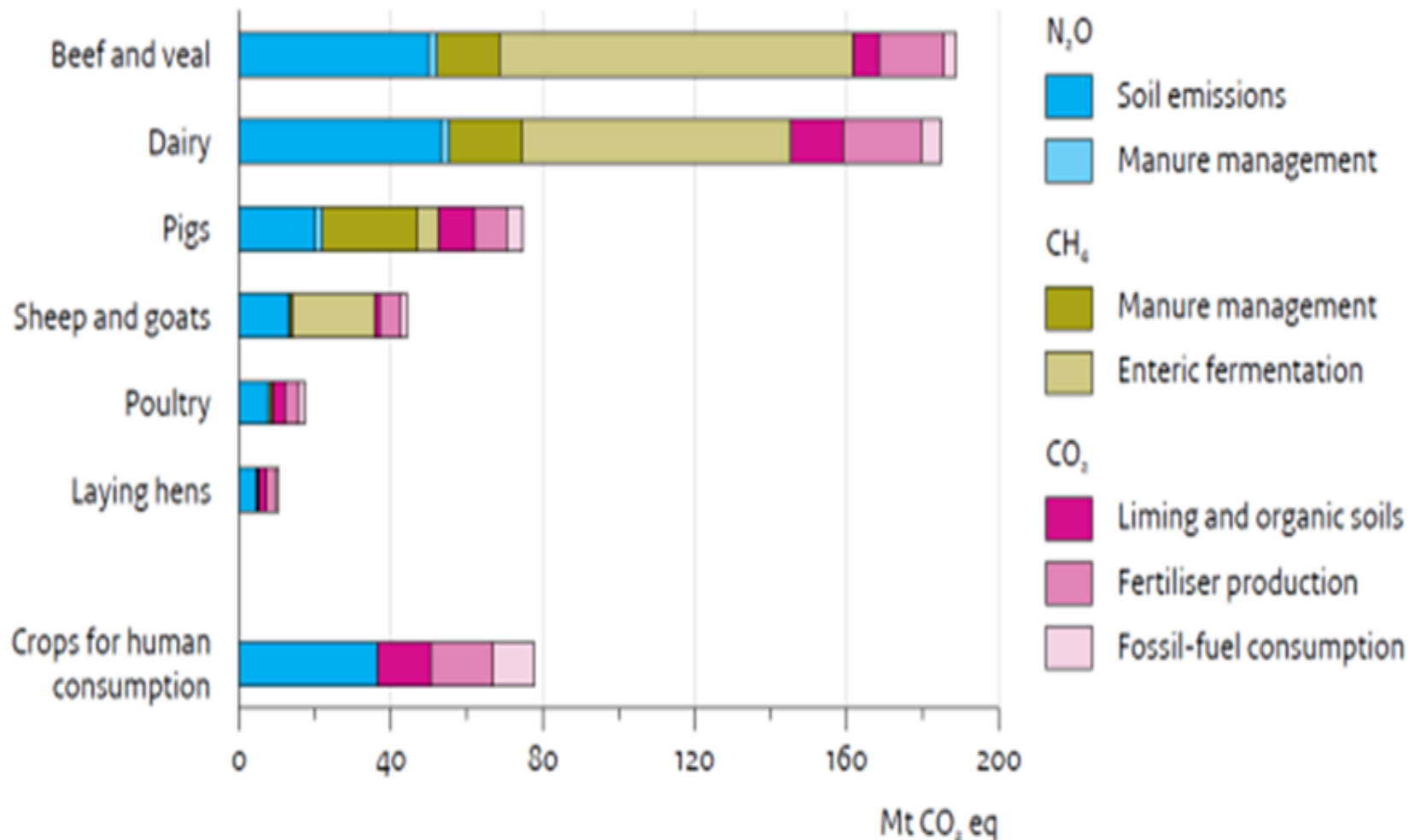
First Name

Surname

Email

Sign up now

So what's the beef with meat and the environment?



Where do we go from here?

- UK Climate Change Act target to cut GHG emissions 80% by 2050
 - All sectors will be under the spotlight
 - Each has to play its part
- In short: agriculture will need to stand up to the challenge



The roadmap



Turning a negative into a positive

- Our competitors have latched onto this



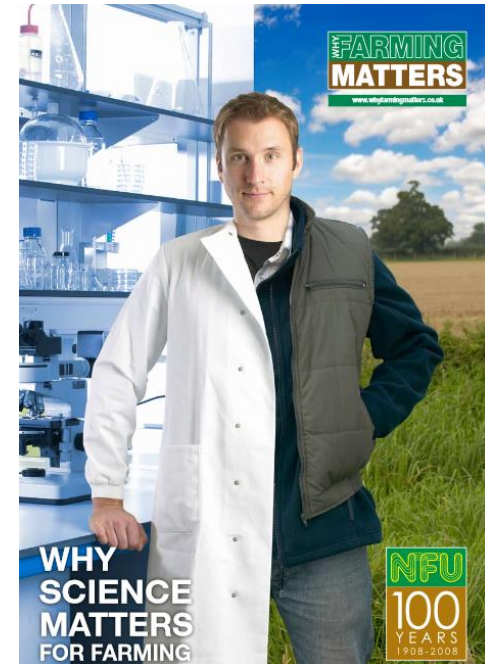
Upping our game

- We can't pretend that there is no room for improvement
- Need to be more efficient across all areas
 - Inputs vs. outputs
- *But how do we get there?*

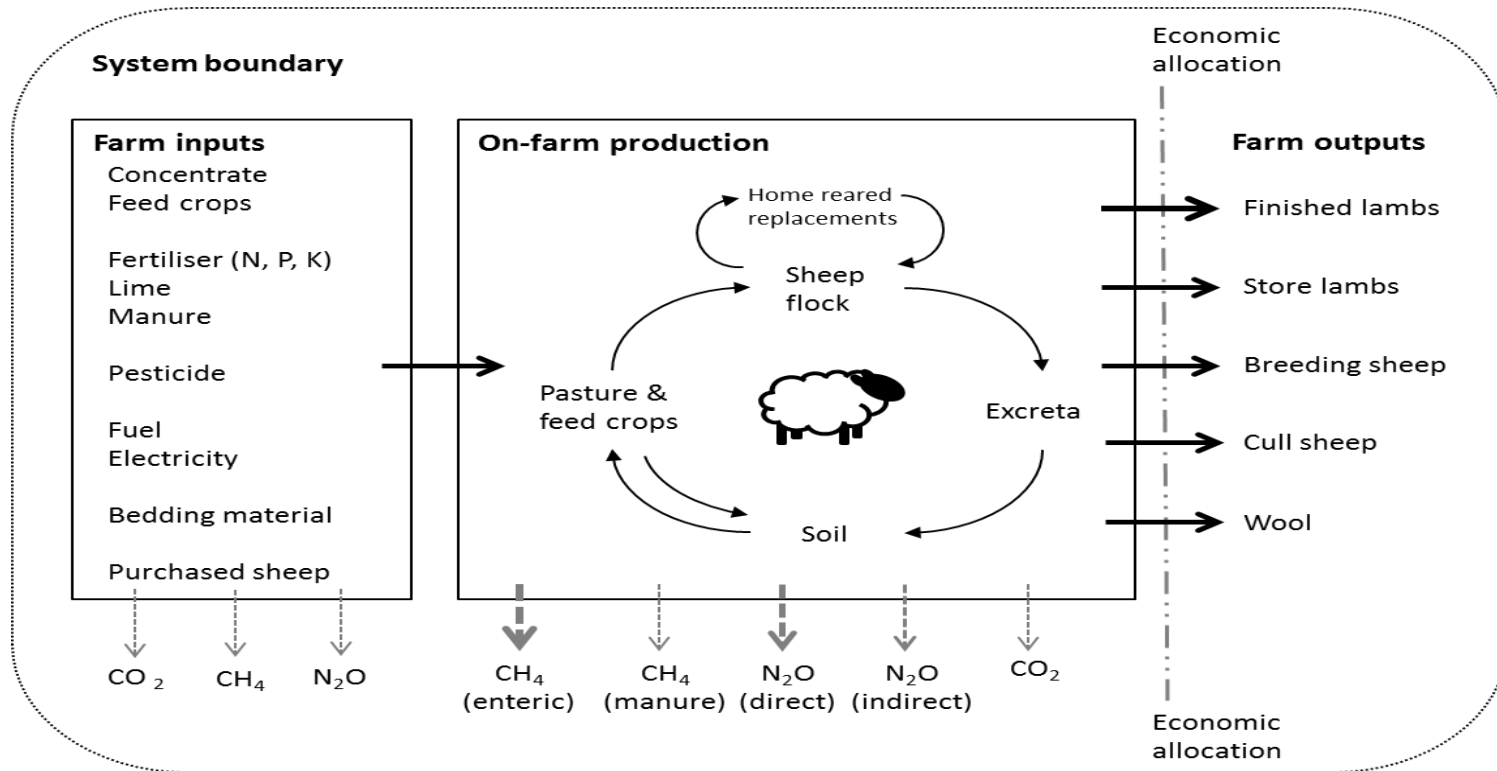


Research and agriculture: where we're at

- Any progressive industry invests in research
- Agriculture should be no different
 - Farmers need to engage with researchers and vice versa
 - “bottom-up” and “top-down”
- HCC have sponsored a number of relevant projects at Bangor University



1. Starting point: carbon footprints



Carbon footprint method

- Face to face questionnaires on 60 sheep farms:
 - Inputs: feeds, fertilisers, pesticides, bedding, fuel
 - Stock numbers and movements throughout the year
 - Outputs: produce
- Emissions calculations:
 - Intergovernmental Panel on Climate Change equations
 - Emission factors from standard databases

Results

- Means (kg CO₂equivalents/kg lamb):

Emission source	Lowland	Upland	Hill
Inputs (direct and indirect emissions)	2.18	2.70	2.98
Enteric CH ₄	4.62	5.59	8.61
Excreta CH ₄	0.11	0.13	0.20
N ₂ O from soils (direct and indirect emissions)	3.79	4.21	5.91
N ₂ O from manure storage (direct and indirect emissions)	0.14	0.23	0.16
	10.85	12.85	17.86

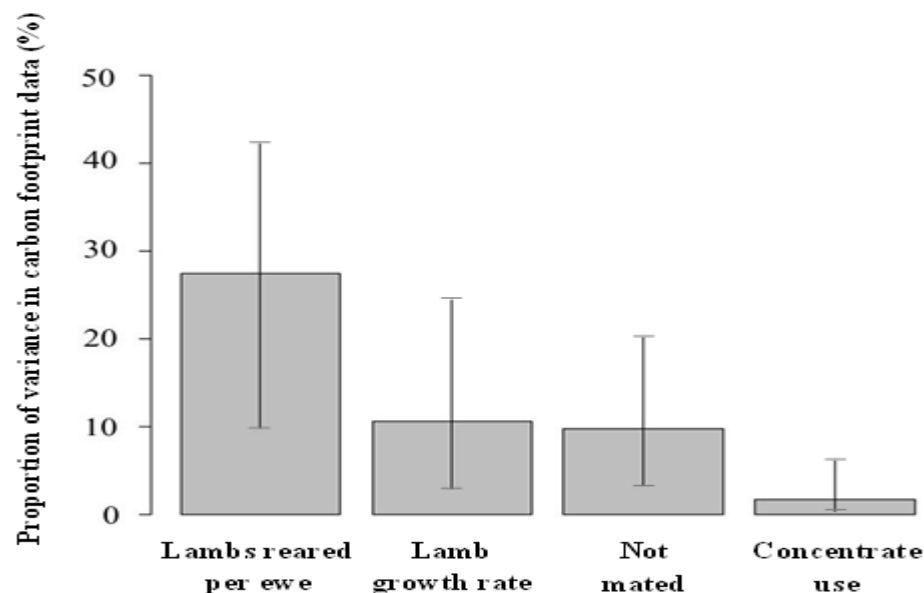
- Carbon footprints ranged from:
 - 5.4 to 21.5 kg CO₂e/kg lamb – lowland farms
 - 8.3 to 18.3 kg CO₂e/kg lamb – upland farms
 - 8.8 to 33.3 kg CO₂e/kg – hill farms
- Other studies have found C-footprints to range by a factor of 15 times

Impact of management

Regression analysis showed that:

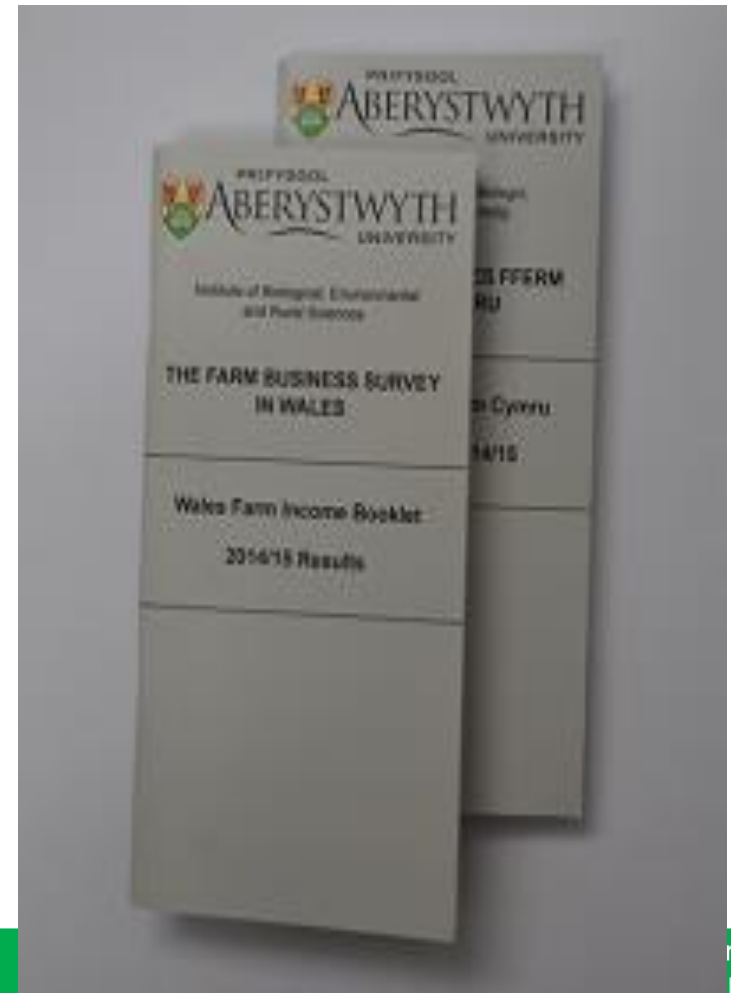
- 1) Concentrate use (kg/LSU)
- 2) Number of lambs reared per ewe (head/ewe)
- 3) Lamb growth rate (g/day)
- 4) Percentage of ewe and replacement ewe flock not mated (%)

Dominance analysis results:



Implications for farmers

- Importance of productivity and efficiency
 - Maximising output per unit input
- Number of lambs reared per ewe
 - Breeding for ewe productivity
 - Lamb survival
 - Nutritional management
- Closing the productivity gap



2. Doing something about it

- Options need to be
 - Practical
 - Cost-effective
 - Effective

2. Doing something about it

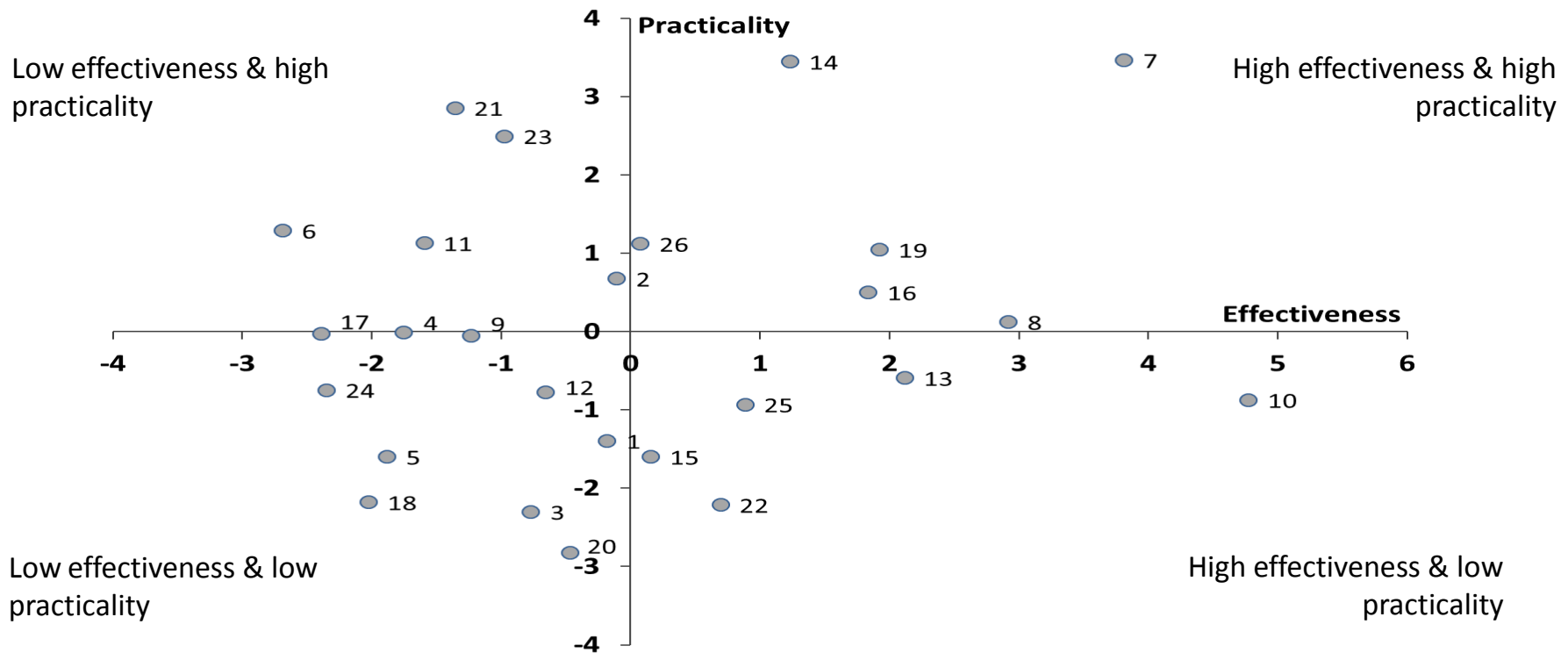
Number	Mitigation Measure
1	Use a fertiliser recommendation system
2	Improve timing of fertiliser applications
3	Improve precision of fertiliser applications in soil
4	Avoid feeding excess nitrogen to minimise nitrogen losses in excreta
5	Analyse manure prior to application
6	Calibrate & maintain spreader equipment
7	Include legumes in pasture reseed mix e.g. clover
8	Increase lamb growth rates for earlier finishing
9	Feed a diet balanced in energy & protein
10	Increase the number of lambs born per ewe
11	Increase pasture productivity to enhance carbon storage
12	Performance recording & selective breeding for improved feed conversion efficiency
13	Increase ewe longevity
14	Improve ewe nutrition in late gestation to increase lamb survival
15	Increase diet digestibility
16	Reduce mineral fertiliser use
17	Split fertiliser applications
18	Improve drainage (non-organic soils only)
19	Lamb as yearlings
20	Performance recording & selective breeding for reduced enteric CH ₄ /kg dry matter intake
21	Improve hygiene & supervision at lambing
22	Avoid conversion of peatlands
23	Select pasture plants bred for improved nitrogen conversion efficiency
24	Avoid fertiliser applications prior to pasture renovation
25	Avoid conversion of woodlands to pasture / crops
26	Select pasture plants bred to minimise dietary nitrogen losses e.g. high sugar grasses

Best-Worst Scaling method

- Best-Worst Scaling surveys to identify practical and effective mitigation measures

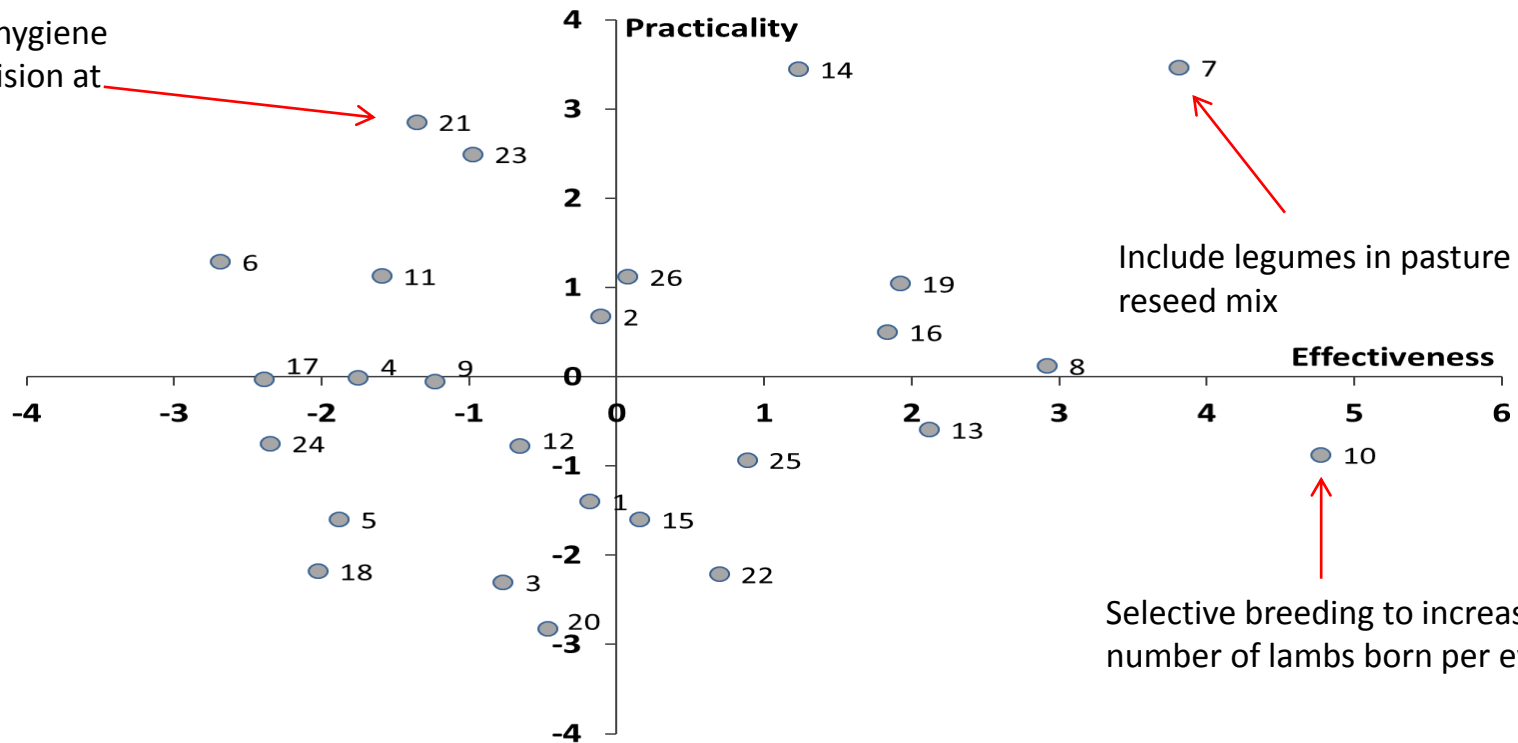
Most Practical		Least Practical
<input type="radio"/>	Use a fertiliser recommendation system	<input type="radio"/>
<input type="radio"/>	Selective breeding to increase ewe longevity	<input type="radio"/>
<input checked="" type="radio"/>	Improve hygiene & supervision at lambing	<input type="radio"/>
<input type="radio"/>	Lamb as yearlings	<input checked="" type="radio"/>
<input type="radio"/>	Include legumes in pasture reseed mix	<input type="radio"/>

Expert and farmer opinion results



Expert and farmer opinion results

Improve hygiene
& supervision at
lambing



These were then costed and their effectiveness modelled

Clover: A practical measure

- Determine N₂O emissions from Ryegrass-Clover systems vs. Ryegrass-fertiliser
 - High/low N input
 - Dry matter yield

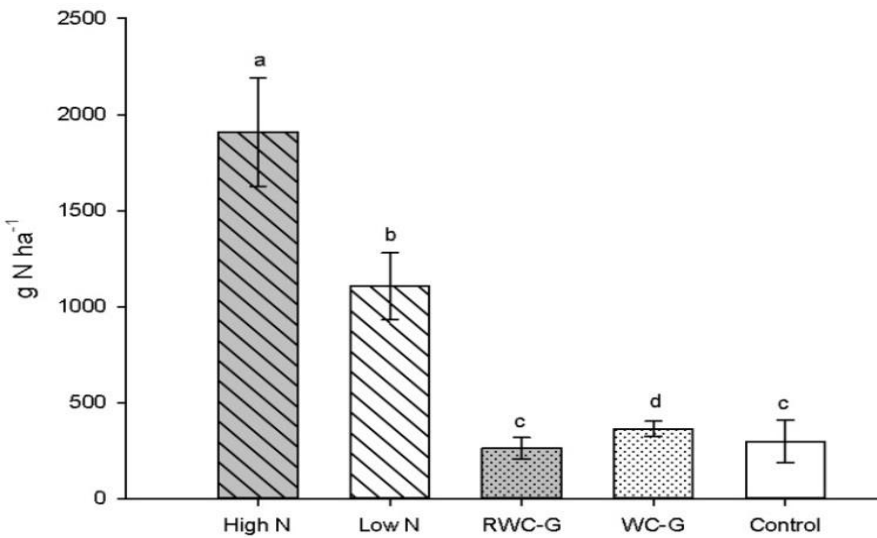


Clover: A practical measure

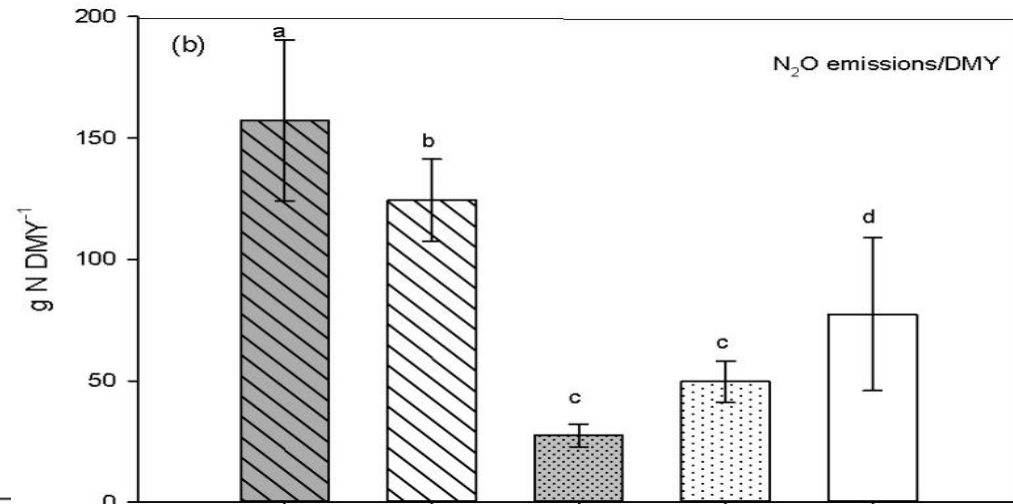
- Determine N₂O emissions from Ryegrass-Clover systems vs. Ryegrass-fertiliser
 - High/low N input
 - Dry matter yield



Results



Mean cumulative emissions per treatment



Mean N₂O emissions per harvested DMY (t)

Monitoring soil N levels

- Development of electrodes and probes
- Field-testing
- Generate fertiliser recommendations from real-time data
 - Targeted applications

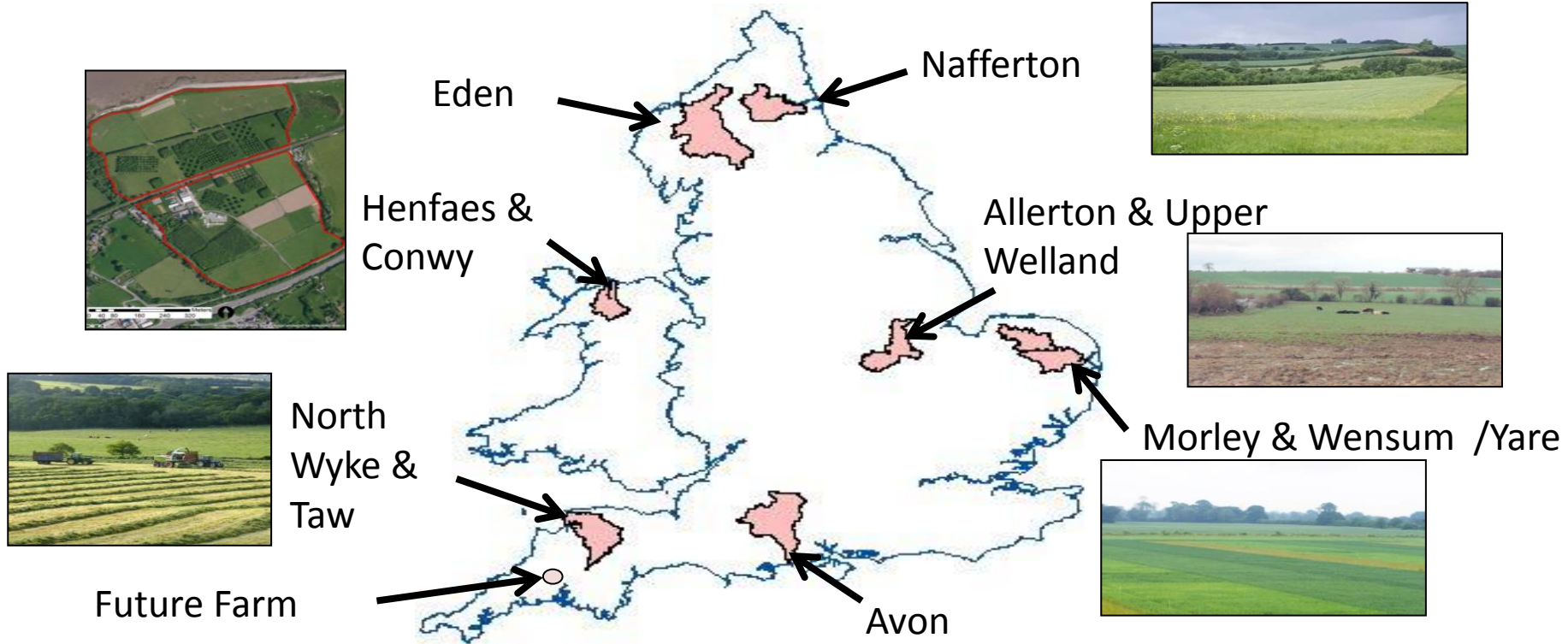


Other activities

- “Sustainable intensification”
- Shorthand definition: 'producing more food with less negative impact'
- Involves many disciplines and topics



SIP Study Farm and Area Locations





Henfaes: the Uplands Sustainable Intensification Platform

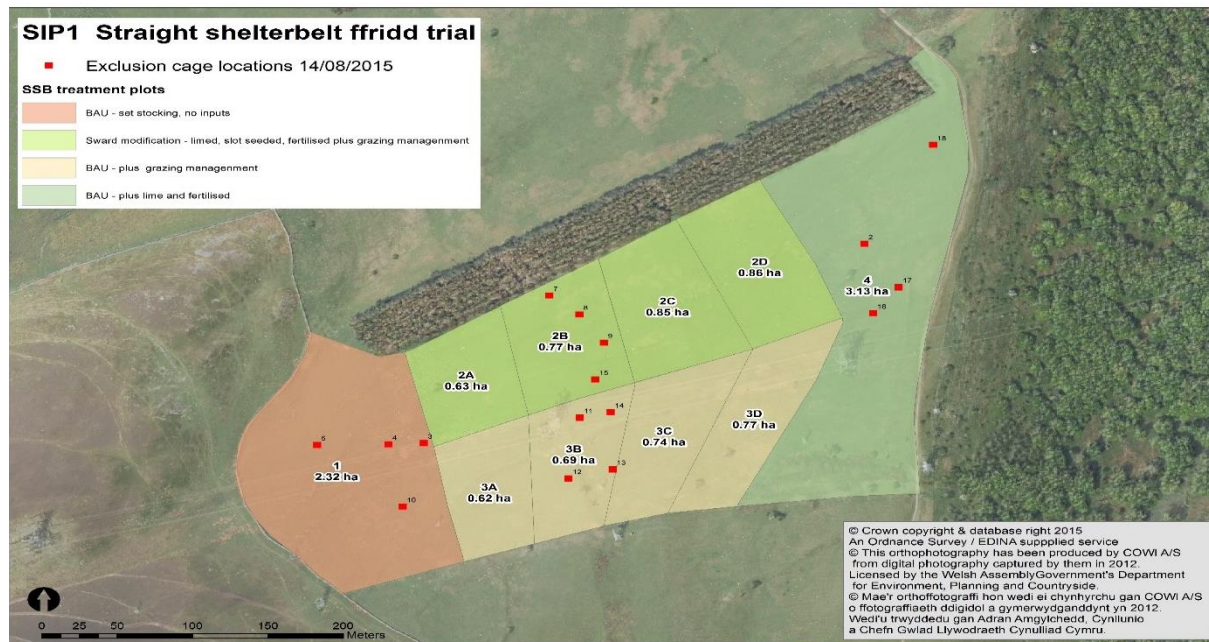
Henfaes: SI strategy

- *Aim: to increase grassland productivity through optimised soil, nutrient and grazing management*
- How to better utilise grass as the base of lamb production systems



Henfaes: approach

- Upland 'ffridd'
 - ± lime/fert, ± re-seed, ± rotational grazing



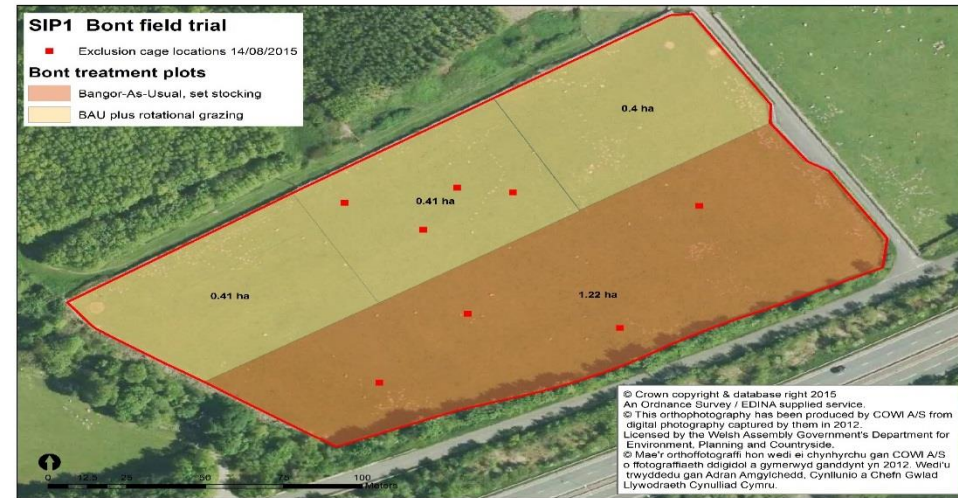
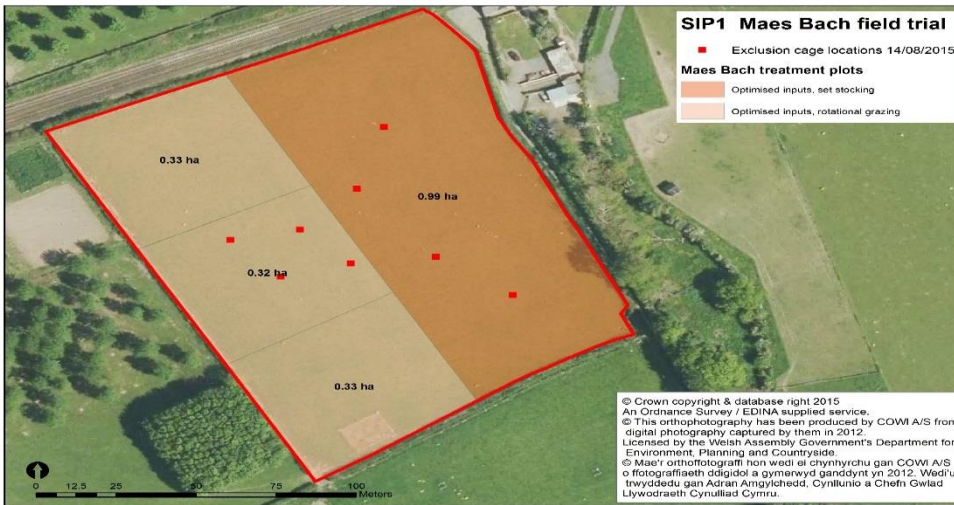
Henfaes: approach

- Upland 'ffridd'
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Henfaes: approach

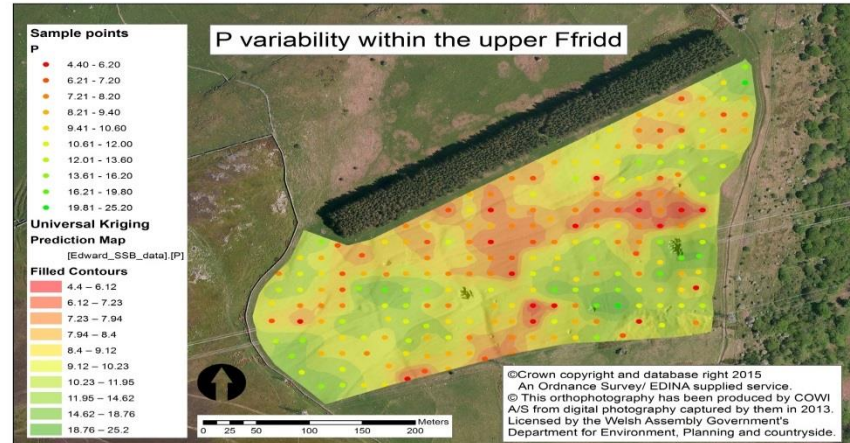
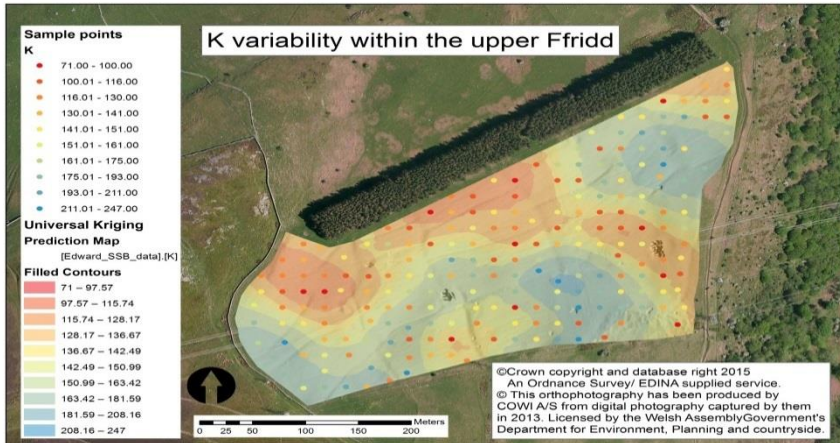
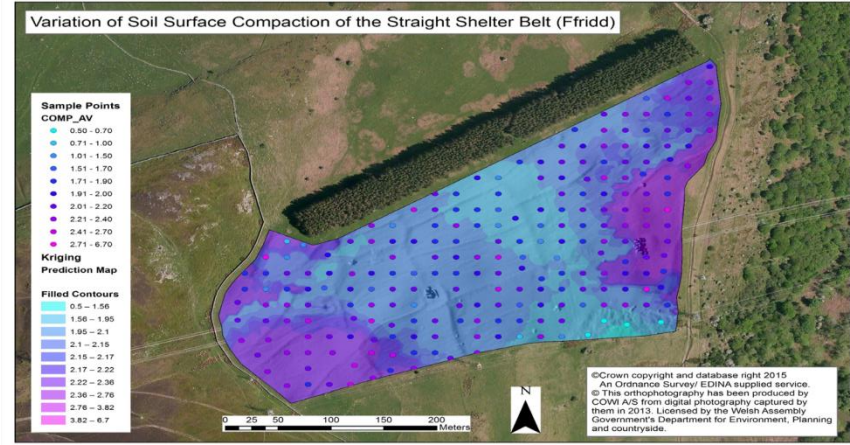
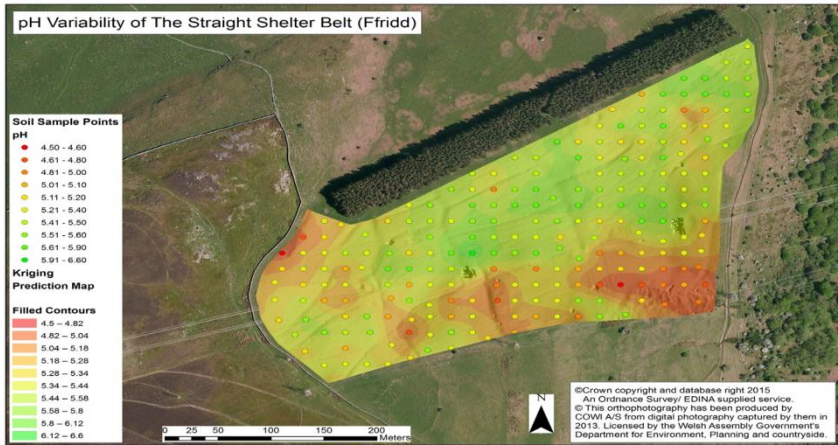
- Lowland fields
 - \pm lime/fert, \pm re-seed, \pm rotational grazing



Henfaes: approach

- Lowland fields
 - ± lime/fert, ± re-seed, ± rotational grazing





- Drilling (with HSG, clover + timothy)



- Introduced sheep + lambs
 - Condition-scored and weighed



- Grassland quality and quantity



Sward sample weights (Ffridd): 9th Sept 2015

Sample ID	Date of collection	Processing time	Bag wt (g)	Field FW (g)	FW s/s (g)	FW remainder (g)	Reweigh DW + bag (g)	Reweigh DW (g)
P1 G1	09/09/15	15:30	7.40	81.74	81.74	0	34.67	27.27
P1 G2	09/09/15	15:30	7.38	133.11	133.11	0	46.65	39.27
P1 G3	09/09/15	15:30	7.28	107.38	107.38	0	40.84	33.56
P1 G4	09/09/15	15:30	7.31	112.27	112.27	0	44.46	37.15
P2B G1	09/09/15	15:30	7.30	463.71	183.25	280.46	45.27	37.97
P2B G2 (bag 1)	09/09/15	15:30	7.29	337.68				
P2B G2 (bag 2)	09/09/15	15:30		411.23	183.79	565.12	53.63	46.34
P2B G3	09/09/15	15:30	7.27	340.99	192.74	148.25	57.07	49.80
P2B G4	09/09/15	15:30	7.30	706.79	152.31	554.48	42.55	35.25
P3B G1	09/09/15	15:30	7.39	139.41	139.41	0	45.91	38.52
P3B G2	09/09/15	15:30	7.31	102.62	102.62	0	38.78	31.47
P3B G3	09/09/15	15:30	7.36	160.74	160.74	0	55.47	48.11
P3B G4	09/09/15	15:30	7.39	128.91	128.91	0	44.44	37.05
P4 G1	09/09/15	15:30	7.35	222.44	222.44	0	49.21	41.86
P4 G2	09/09/15	15:30	7.36	364.89	166.47	198.42	40.21	32.85
P4 G3	09/09/15	15:30	7.42	113.43	113.43	0	37.62	30.20
P4 G4	09/09/15	15:30	7.36	206.12	206.12	0	55.87	48.51

Hay/Haylage Analysis

Advisory Contact
Eloes Hughes
Prifysgol Bangor University
Aber Gwynnogyn, Llanfairfechan
Gwynedd, LL55 2L8
Customer Code: 5056


Sample Details
Lab Reference: FBGrsang4b Description: Date Cut:
Sample Type: Hay/Haylage Cut Number: Additive: Sample Received: 09/09/2015

Parameter	Analysis	Low	Standard	High
Dry Matter (%)	944	800	900	950
Crude Protein (%)	180	150	180	200
Oil-B (%)	30	10	20	30
Ash (%)	71	15	25	35
NDF (%)	591	500	600	650
ADF (%)	295	200	300	350
Sugar (%)	109	10	20	30

Metabolisable Energy

Parameter	Analysis	Low	Standard	High
D Value (%)	57	50	60	65
ME (MJ/kg)	9.1	8.0	9.0	10.0

Farm
Kgalb
Originator Reference Number: NW 46



- Stock carrying capacity and performance
 - Expressed in two ways
 - kg /ha over time
 - DLWG (kg /lamb and kg /ha)



- Greenhouse gas emissions
 - Ffridd



- Greenhouse gas emissions
 - Lowland



SIP: summary

- Grass utilisation is critical
- Other factors that affect growth rates and performance

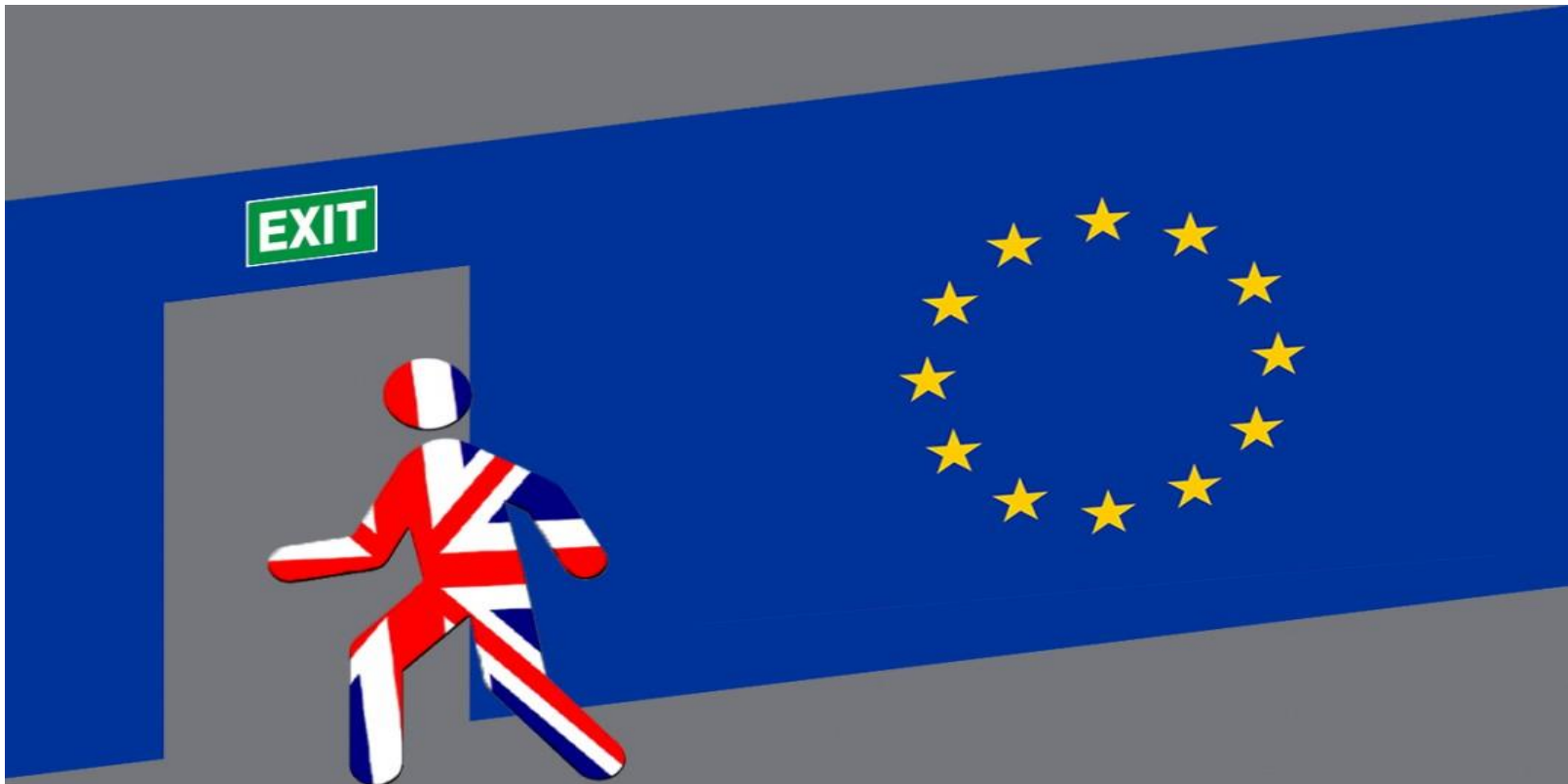


So, where are we...?



Implications in a changing environment

- Brexit will probably change much, but the core principles remain





Implications in a changing environment

- Brexit will probably change much, but the core principles remain
 - People want value and quality
 - Competition not disappearing
 - Pressure on the livestock sector
 - Increasing demand for ‘sustainably produced’ meat
 - Costs and scale
 - Efficiency is key: good business and environmental sense

Efficiency in a changing environment

- Measures that can reduce environmental impact without compromising production, e.g.
 - Clover
 - N-sensors
 - Sustainable intensification
- Doing the basics right
- Industry is engaged and pro-active – asking the questions
- Getting message across



Implications in a changing environment

- All industries need to invest in R & D
- Genetics, technology, soils, animal health, environment, etc. etc.
- Profitable, efficient, modern industry
 - Huge potential
- Often win-win scenarios
- Welsh livestock sector has much to offer



Diolch yn fawr / Many thanks

