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Department for Environment
Food and Rural Affairs

The Agricultural Greenhouse Gas Research and Development Platform 2010 -2015

*Accounting for greenhouse gases from
agriculture*

Toby Mottram 26/11/2011

Agricultural greenhouse gases

- **Nitrous oxide from croplands**
- **Enteric Methane from ruminants**
- **Methane from manures**
- **Approximately 8% of national eCO₂ annual emissions**

- **£12.6 m platform commissioned in 2010**
- **Aims to bring UK agricultural greenhouse gas inventory up to Tier 2 & Tier 3 standards**

WHAT are the GHG Inventory projects ?

- **AC0114 Inventory Tool Building**
- **AC0115 Methane Emissions from Livestock**
- **AC0116 The *InveN₂Ory* project : nitrous oxide**

- **AC0114 Inventory Tool Building/Data Mining**
- **Aim: improve the UK's greenhouse gas inventory by replacing generic IPCC emission factors with british factors linked to new data sources**

Building



LIVESTOCK

TOTAL CAT

Dairy herd To

Beef herd To

Dairy heifers

SUMMARY:		AGRICULTURAL METHANE EMISSIONS								
		YEAR	2009							
COUNTRY		Total	England	Wales	Scotland	N Ireland	Total			
Agricultural CH4										
Total CH4		892.37	480	115	142	115	852.18	1008	2009	
Enteric CH4, (ruminants)		749.14	392.04	103.52	125.44	97.44	718.44	477	5,484,083	
Waste CH4, (manure)		143.24	88.28	11.41	16.25	17.79	133.73	218	1,129,968	
Burning CH4		0.00	0.00	0.00	0.00	0.00	0.00	749	1,812,405	
[Difference x-check CH4, kt]		0.00	0.00	0.00	0.00	0.00	0.00	541	1,599,025	
[Total x-check CH4, kt]		892.37	480.32	114.92	141.69	115.24	852.18	985	10,025,481	
NE _m MJ d ⁻¹								260	187,361	
NE _f MJ d ⁻¹								247	284,698	
NE _p MJ d ⁻¹								345	1,856,863	
NE _m /DE								785	735,399	
NE _f /DE								519	182,564	
GE MJ d ⁻¹								175	450,817	
DM Intake as % body wt								363	256,776	
EF kg CH ₄ head ⁻¹ yr ⁻¹								142	1,625,556	
Agricultural N2O kt										
Total N2O		92.37	56.41	7.03	12.26	6.87	82.56	360	254,114	
Animals N2O, kt		7.41	4.18	0.51	0.90	0.85	6.44	443	52,972	
Direct N2O, (from crops)		55.32	34.83	4.06	7.27	3.69	49.85	327	40,335	
Indirect N2O, (ammonia)		29.12	17.09	2.36	3.97	2.27	25.69	272	62,489	
Bio fix by improv grass N2O		0.52	0.32	0.09	0.11	0.06	0.58	302	409,910	
Burning N2O		0.00	0.00	0.00	0.00	0.00	0.00			
[difference x-check N2O, kt]		0.00	0.00	0.00	0.00	0.00	0.00			
[Total x-check N2O, kt]		92.37	56.41	7.03	12.26	6.87	82.56			

- How it will be remade
 - New sources of data
 - Breed society records?
 - Farm Business Survey ?
 - others
 - New Emission Factors
 - literature search
 - AC0115
 - AC0116

Methane EFs

Nitrous Oxide



- **Outputs**
 - **A data archive**
 - **A new inventory tool**
 - **Spatially disaggregated data**
 - **Mitigation strategies**

Methane Emissions – the missing data ?

- **AC0115 Methane Emissions**
- **Aim: improve the accuracy and reliability of the UK's methane inventory**

Agricultural Greenhouse Gas Research Platform – missing data

Table 5. An approximate representation of knowledge of methane emissions from cattle and sheep under UK-relevant conditions, where 0 = no information, + to ++++ = some to lots of information, ? = unknown, NA = not applicable.

Diet/System	Dairy cows	Dairy young-stock	Beef cows	Growing/finishing beef cattle	Sheep	Weaned lambs
<u>Housed</u>						
Grass silage	++++	+	++	++	+	+
Maize silage	++++	?	++	++	+	0
Straw and by-product based	++	?	?	?	?	0
High concentrate inputs	++++	+	+	+	?	?/NA
<u>Grazing</u>						
Improved grass grazing	+	?	0	0	?	+
Mixed swards	?	?	0	0	0	0
Permanent pasture grazing	?	?	0	0	0	0
Rough grazing	NA	NA	0	0	0	0
Moorland	NA	NA	0/NA	0	0	0

- **Measuring methane emissions**
 - **Beef Cows**
 - **Sheep**
 - **Grazing dairy cows**



AC0115 – led by IBERS

- **Beef sucklers**
 - **Effect of breed/genotype**
- **Beef growing and finishing**
 - **Genotype**
 - **Pasture (improved v rough grazing)**
 - **Housed diets and chamber studies**
- **Sheep**
 - **Effect of body size**
 - **Effect of within breed genotype**
 - **Effect of crossbred genotype**

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AFBI calorimeter chamber

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SF6 technique based on bolus and sampling device

- **Deliverables**
 - **Better emission factors for the inventory**
 - **Systems information for improved future emissions**
 - **Policy inputs by identifying optimal mitigation strategies**

- **Improved EFs for Nitrous Oxide emissions**
- **Identifying UK mitigation techniques**

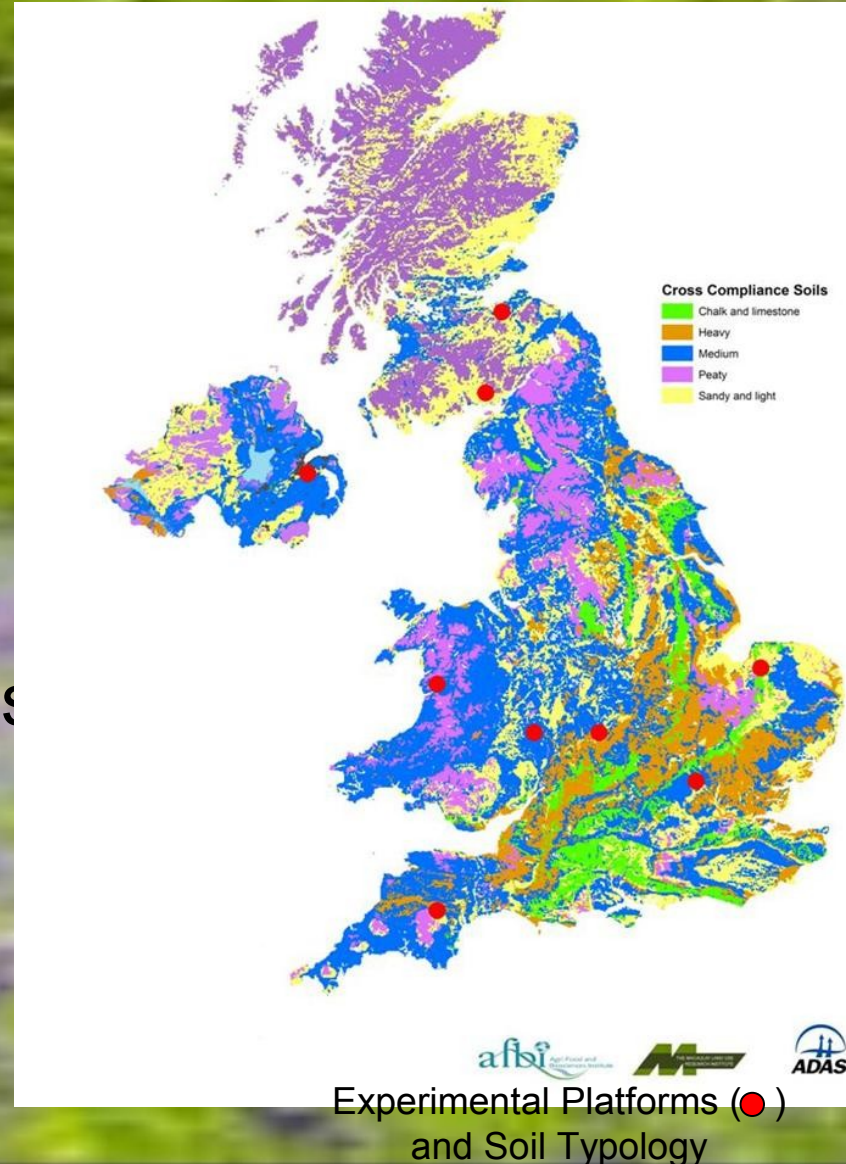
- **Field measurements**
 - **Mineral and organic sources of N**
- **Building/improving models**
 - **DNDC**
 - **DailyDayCent**
- **Close links to emissions to water**

AC0116 – measurement sites



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- Land areas under soil type rainfall zones
- Ranking of N sources (Tier 1 assumptions)
- Modelling sensitivities of soil, Climate, N source combinations
- Previous and current studies delivering EFs and model validation data



Mitigation Strategies

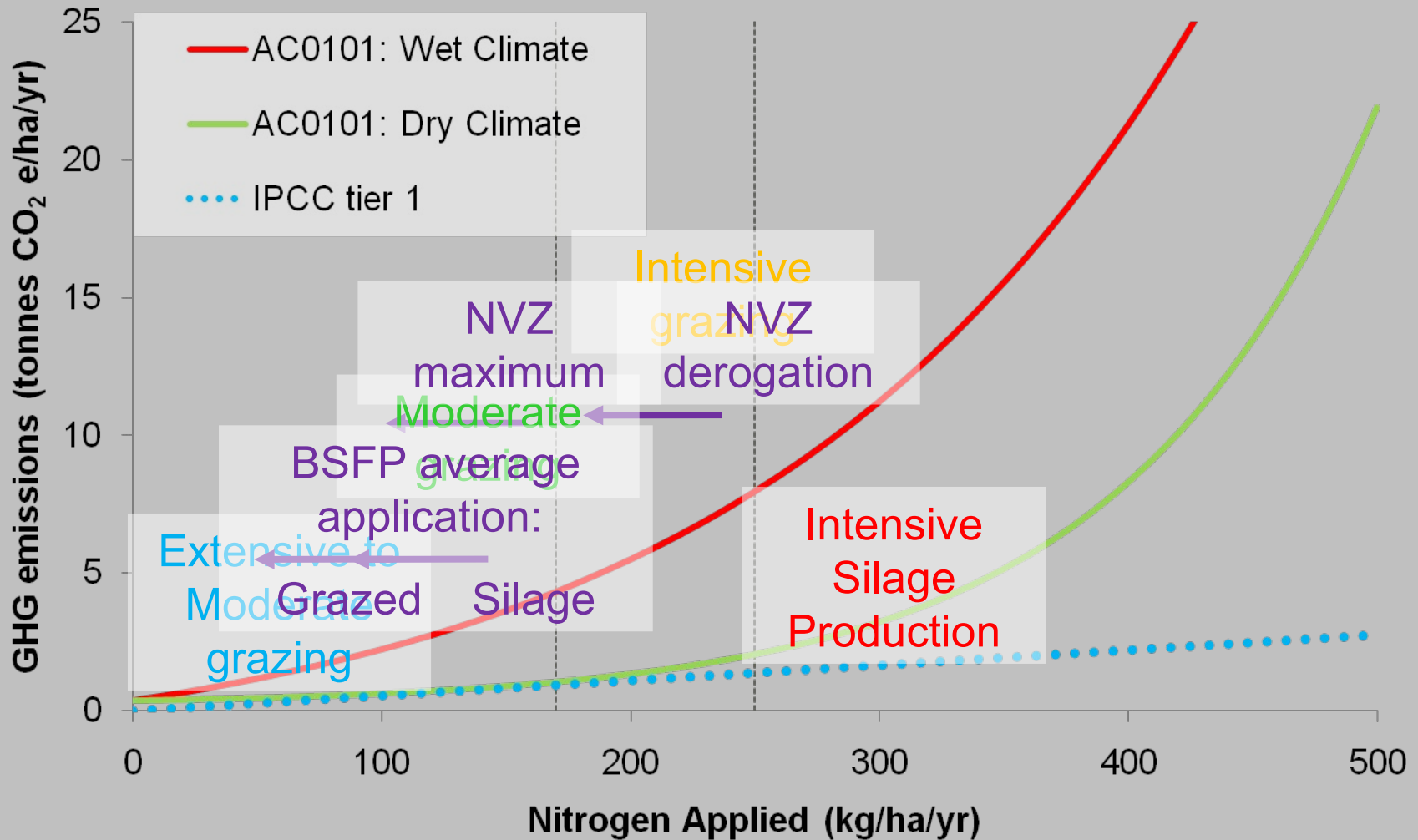
- **Better fertility management**
 - **Reduces productive cows culled**
 - **Reduces followers**
 - **Could cut methane emissions by 15%**
- **Reduce production and infectious disease**
- **Breeding ?**
- **Nutritional strategies for reduced emissions**

- **Proposed Strategies**
 - **Supplements**
 - Tannins, oils
 - Nitrate
 - **Higher milk yields**
 - Less methane per litre

Nitrous Oxide Emissions Factors



Estimated Grassland Emission Rates



But.....

- **Beware of adverse tradeoffs**
- **Intensification of cropping = more cultivation**
- **Which can mean more Nitrous Oxide**

Agricultural Greenhouse Gas Research Platform Communications

- **Via AC0112 to Defra to DECC and the annual inventory**
- **Reports and refereed papers**
- **A platform website**
- **Annual Workshops with stakeholders**
- **Direct KT and KT via the Levy Boards**
- **Global Research Alliance**

Global Research Alliance

- **Hosted by NZ**
- **Three Groups**
 - **Croplands**
 - **Livestock**
 - **Paddy Rice**
- **UK fully committed**

Agricultural Greenhouse Gas Research Platform

- **More information at**
- <http://www.ghgplatform.org.uk/>
- **Thank You**