

“Climate change mitigation and adaptation in the RDPs: assessing the scope and measuring the outcomes”



Llywodraeth Cymru  
Welsh Government

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# Case Study Wales

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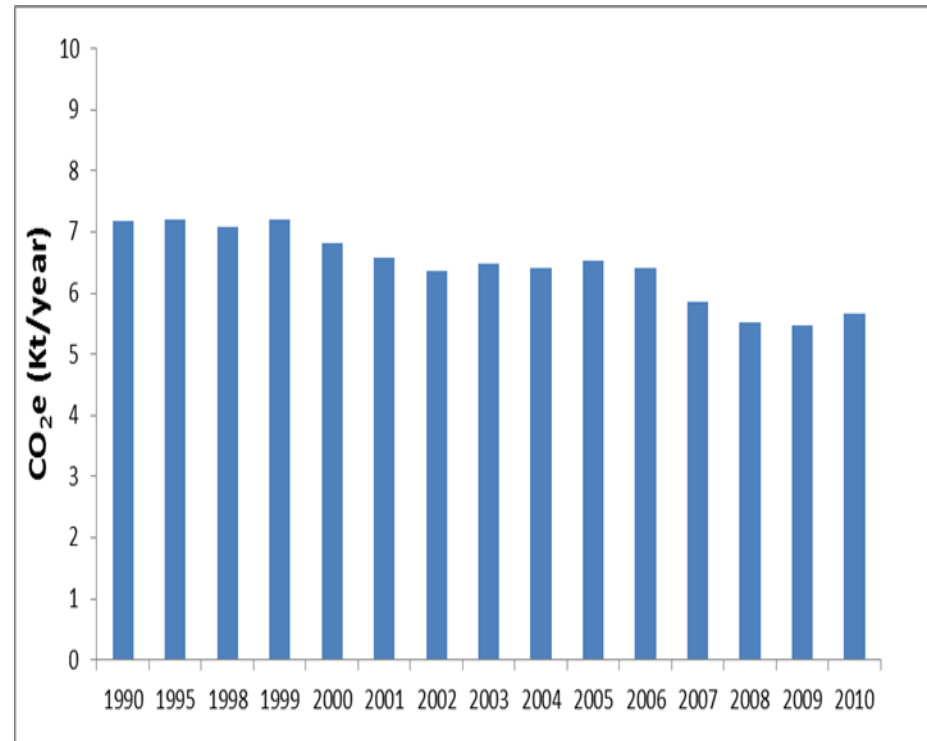
# Climate Change Mitigation through Welsh Axis II Scheme

- GHG emissions from Agriculture and policy drivers
- Axis II scheme Glastir : scheme structure and GHG mitigation measures
- Axis II scheme Glastir Monitoring and Evaluation Programme
- Approaches and methodologies for monitoring and evaluating GHG emissions / sequestration
- Challenges and evidence gaps
- Future applications

# Emissions from Welsh Agriculture

- Agriculture contributed 12% of Welsh total CO<sub>2</sub>e emissions (2010)
- 5,665 CO<sub>2</sub>e total emissions
- N<sub>2</sub>O 2,644kt CO<sub>2</sub>e 48% total
- CH<sub>4</sub> 2,469kt CO<sub>2</sub>e 44% total
- LULUCF net sink

Total emissions from Agriculture



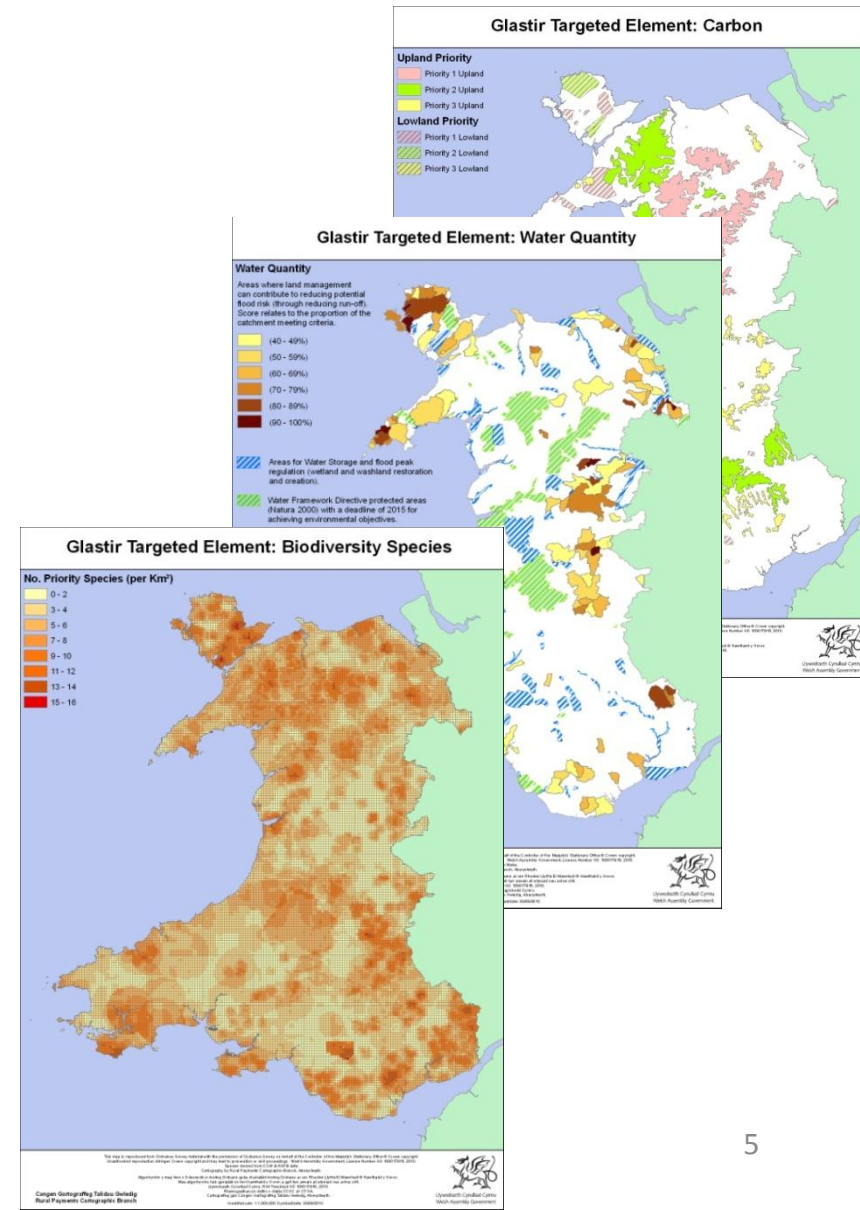
# Welsh Policy Drivers and Mechanisms

- The Welsh Government has an annual 3% reduction target across all sectors of devolved competence, including agriculture
- Reductions baseline average emissions between 2006 and 2010
- The Climate Change Strategy for Wales (2010) identified potential savings of 600 kt CO<sub>2</sub>e by 2020 through
  1. Woodland creation and management
  2. Axis II scheme
  3. Knowledge transfer
  4. Sector roadmaps

# Welsh Axis II Scheme 'Glastir'

- 5 year whole farm Axis II scheme
- 4 elements
  - All Wales Element
  - Advanced Element
  - Woodlands Element
  - Commons Element
  - Efficiency Grants

Key Feature -spatial targeting of measures where benefit will be greatest



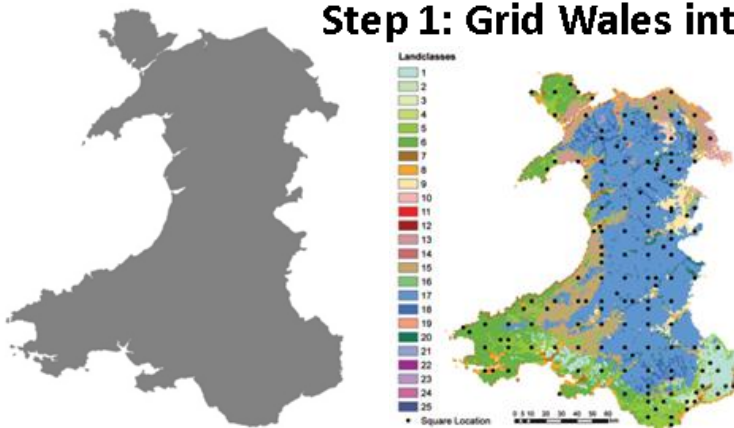
# Axis II scheme 'Glastir' climate change mitigation measures

- Stock reduction
- Soil management
- Fertilizer management
- Manure / slurry management
- Woodland expansion and management
- Infrastructure investment



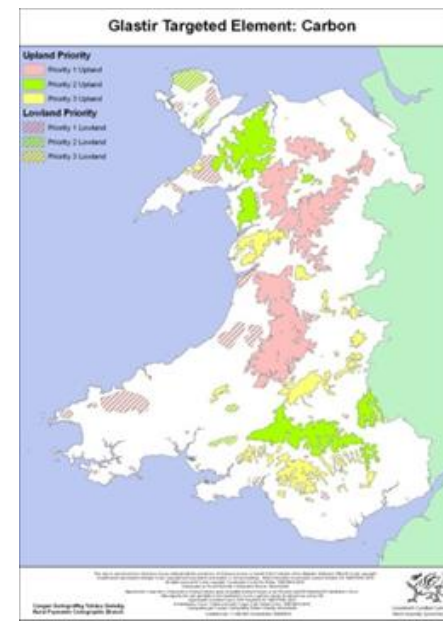
# Axis II scheme 'Glastir' Monitoring and Evaluation six steps

**Step 1: Grid Wales into 1km squares**



**Step 2: Select 45 1km x 1km squares every year using stratified approach ('Wider Wales Survey'). Provides resources to identify populations of locations for land in and out of the scheme**

**Step 3: Select another 45 squares to insure enough squares in the scheme for measures of priority ('Targetted survey')**



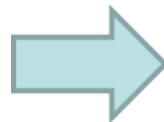
# Axis II scheme 'Glastir' Monitoring and Evaluation six steps



**Step 4: Send surveyors out to both following a whole ecosystem approach**

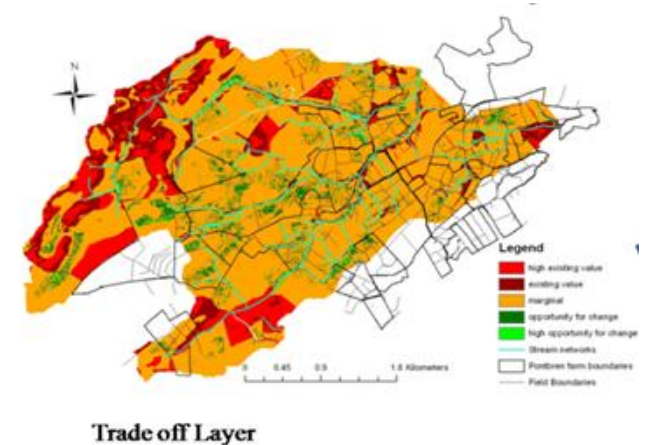


**Step 5: Additional measurements to ensure causal relationship to specific measures e.g. £300k of new GHG and moisture kit ('Measures specific')**



**Step 6: Annual reporting**

- 1. National trend reporting for natural capital and ecosystem services**
- 2. Impact of payments for specific measures on the stock of natural capital and delivery of ecosystem services**
- 3. Modelling and trade-off scenarios testing using LUCI tool**





# Step Six 6 Modelling the impact of the Axis II scheme 'Glastir'

- Model framework ensemble approach
- Multiple models across wide range of parameters; water quality, biodiversity, water quality and quantity and climate change mitigation
- Predictive analytics provide early policy feedback
- Test potential measures / interventions
- Assist in spatial targeting

# Our Climate Change Modelling Framework

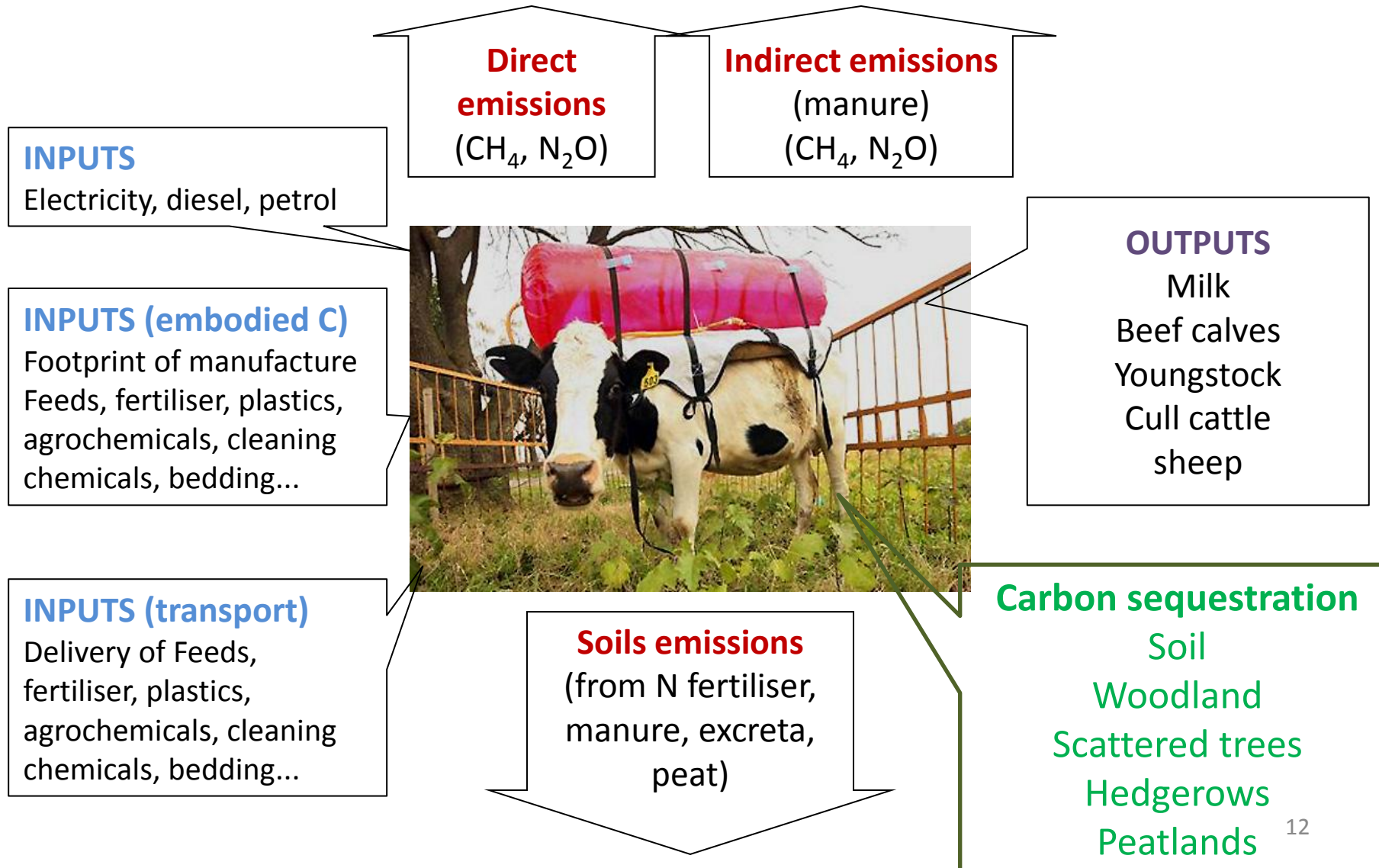
IPCC Tier level	Methane	Nitrous oxide	Carbon Dioxide	Carbon stocks
Tier 1 (some Tier 2)	<b>Bangor University Carbon Footprinting Tool</b>			
	Ruminant and manure	Direct and indirect + embedded	CO <sub>2</sub> energy, incl. embedded losses	Soil and vegetation
Tier 1/Tier 3	<b>ADAS Tool</b>			
	Ruminant and manure	Direct and indirect	CO <sub>2</sub> energy	
Tier 1	<b>LULUCF and Forestry</b>			
	Soil	Direct	Soil respiration	Soil and vegetation
Tier2/Tier 3	<b>ECOSSE</b>			
	Soil	Direct and indirect	Soil respiration	Soil and vegetation

# What is a Carbon Footprint & What are the boundaries

- Farm gate is the system boundary
- Embedded & process emissions included
- Expressed as CO<sub>2</sub>e ha & kg product
- Farm surveys, standard default figures and field survey data



# Bangor University Carbon Footprinting tool



# Proof of concept Footprint method

## *activity data*

					Farm level use (kg)				Sheep numbers		Beef numbers		Dairy numbers	
Farm Type <sup>1</sup>	Previous Scheme <sup>2</sup>	area (ha)	peat (ha)	Altitude (m asl)	N	P	K	Lime	Summer	Winter	Summer	Winter	Summer	Winter
<b>Beef</b>														
7	OR	96	10	290	0	0	0	8000	0	0	151	152	0	0
32	TC	140	0	220	10682	2350	1270	10836	678	410	266	232	0	0
38	TG	90	0	70	5520	1104	1380	92000	329	328	78	36	0	0
53	TC	279	64	240	31140	7110	9810	210000	961	848	465	461	0	0
62	TG	460	168	350	11575	10050	3150	200000	3630	1928	153	153	0	0
<b>Dairy</b>														
20	TC	182	1	100	34354	0	3229	50177	0	0	0	0	371	336
23	TG	188	0	125	13296	840	840	25000	0	0	0	0	528	582
30	TC	70	42	266	5098	85	284	7800	500	274	0	0	123	126
56	NS	340	0	50	33037	9952	11988	94680	0	0	0	0	413	472
<b>Mixed</b>														
19	TC	214	0	175	18500	1500	14000	100000			248	246	286	311
34	NS	108	0	60	8599	2824	3183	1489	390	226	46	51	64	70
51	TG	158	0	215	0	0	0	60000	1025	410	0	0	213	177
<b>Sheep</b>														
43	NS	39	10	300	0	0	0	0	230	0	0	0	0	0
54	TG	143	68	100	2764	1053	1448	0	1401	804	0	0	0	0
61	TG	69	0	60	0	0	0	0	424	483	0	0	0	0
64	TG	117	40	310	500	250	250	0	254	123	0	0	0	0

# Proof of concept Footprint method *emissions and sequestration data*

Farm ID		Total Farm C footprint (emission)	Embedded GHG emissions (upstream)					Livestock manure and excreta	Direct N <sub>2</sub> O – N fert.	Direct N <sub>2</sub> O crop resid	Indirect soils N <sub>2</sub> O	Enteric methane	Manure methane	LUC	Total C seq
			fertiliser manuf.	Feed Concent	Bedding	Bought in stock									
<b>Beef</b>															
7	OR	418983	0	6320	1368	0	61001	0	0	23724	281037	9190	0	80589	
32	TC	992016	73397	51583	1163	19999	163800	50681	1232	67470	494809	17520	0	412123	
38	TG	1810291	35888	17443	1259	1337323	65659	25676	341	27428	156669	4751	1915	140780	
53	TC	2345931	203925	192022	5434	5258	251981	144845	7683	145726	1055708	33222	0	204105	
62	TG	2658992	89666	317	0	1132134	236037	53840	7397	127477	650526	18072	114848	434125	
<b>Dairy</b>															
20	TC	2332422	221285	523429	3255	47903	204967	159794	0	104522	728574	138005	0	437043	
23	TG	2188313	86633	201418	5654	0	278217	61845	826	101741	1097842	206120	0	192830	
30	TC	805478	32588	182841	922	0	96512	23711	0	48212	313835	50489	0	124846	
56	NS	2327227	239950	309086	4707	18925	167269	153668	20410	115921	879758	167342	0	225106	
<b>Mixed</b>															
19	TC	2261067	125020	202240	0	0	267486	86051	1392	99570	1072042	126598	0	136381	
34	NS	634268	62872	9067	4543	31518	80416	39999	2167	37309	289321	31995	0	118630	
51	TG	1272893	0	228784	7466	14294	170132	0	2746	64902	539976	80867	0	152699	
<b>Sheep</b>															
43	NS	61543	0	17867	0	711	7294	0	0	4205	28509	417	0	40834	
54	TG	335975	21104	16634	472	10964	58935	12855	0	37792	155701	3567	0	146528	
61	TG	130080	0	6320	1368	0	35285	0	0	15622	62867	1601	0	69500	
64	TG	66049	3865	1896	137	0	11009	2326	0	10996	22440	533	0	165042	

# Proof of concept applying modelling framework to historic Axis II schemes

- Entry level < 3% emissions & > 27% sequestration
- Higher level <11% emissions & > 23% sequestration
- Organic Farm Scheme <18% > 10% sequestration
- National impact 5.2% reduction in emissions & 12.2% increase in sequestration (agri sector)



# Challenges include Evidence Gaps and assumptions

- IPCC default emissions factors
- Soil GHG flux dynamics
- Ruminant emissions
- Resource management
- Embedded emissions
- System boundaries
- CMEF impact indicators





# Addressing Evidence Gaps Soil GHG flux dynamics

- Deployment of Eddy co variance flux towers
- Real time GHG flux dynamics from grasslands
- Simultaneous CO<sub>2</sub>, CH<sub>4</sub> & N<sub>2</sub>O
- In future feed model simulations



# Addressing Evidence Gaps Peatland Carbon dynamics

- Welsh peatlands hold significant stock of carbon
- Poor evidence base sink or source & impact of intervention
- Development of novel cost effective method
- Remote sensing technologies
- In future feed model simulation



# Future Applications

- Address evidence gaps and assumptions
- Enhance power of model framework
- Apply model framework to current Axis II scheme Glastir
- Run simulations including potential policy interventions future RDP
- Incorporate wider environmental objectives
- Run trade off and synergies simulations actively seek optimal intervention



# Thank you

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