The Irish Agriculture and Food Development Authority

The challenge of sustainability for Irish Agriculture

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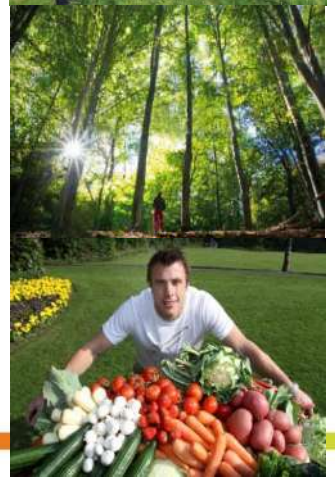
A.S.A. Johnstown Castle

16 January 2019

teagasc
Agriculture and Food Development Authority

Presentation Overview

- Introduction to Johnstown Castle
- Ireland's GHG/NH_3 challenge
- Scenarios for future emissions (without mitigation)
- Mitigation pathways
  - GHG
  - NH3
- Water quality challenge
  - ACP highlights
  - New Ag. Sustainability Support & Advisory Prog.



Environment, Soils and Land-Use Research Programme

Strategic Vision: To underpin the economic & environmental sustainability of Irish agriculture.

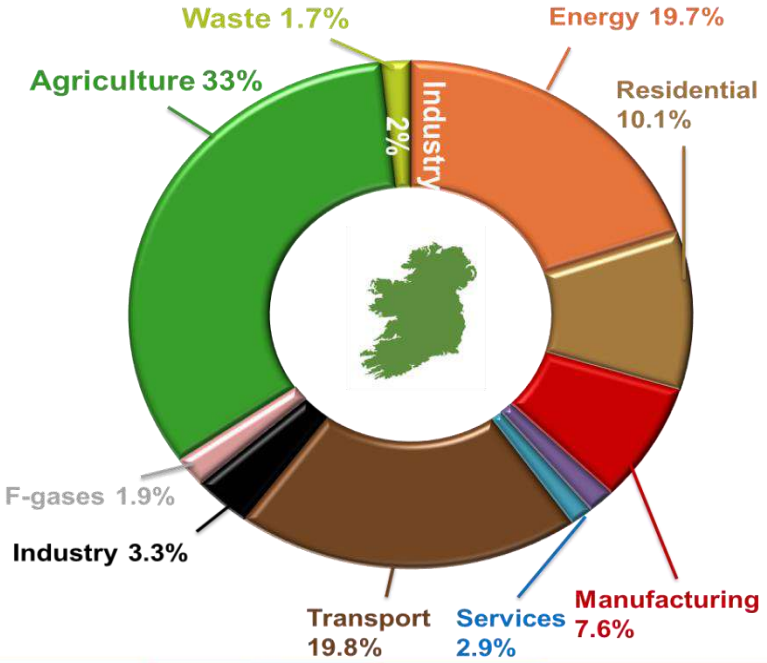
Department Objective: Develop technologies &management strategies to achieve economic & environmental sustainability.

Sub-Program Objectives

- To improve nutrient efficiency and soil fertility on farms.
- To reduce the impact of agriculture on water quality.
- To reduce greenhouse gas & ammonia emissions and improve the carbon footprint of Irish Agriculture produce.
- To maintain and enhance biodiversity in Irish agricultural systems.

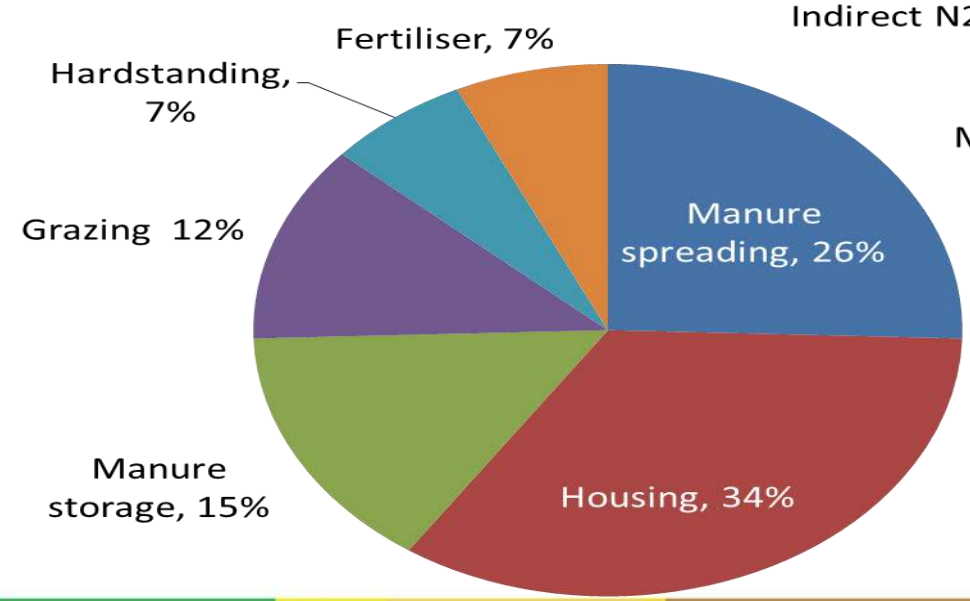
Background

- Irish agriculture comprises
  - 33% of Irish GHG emissions
  - 45% of Irish non-ETS GHG
- GHG targets
  - 20% emissions reduction by 2020
  - 30% non-ETS reduction by 2030 (2030 Effort Sharing)
- NH_3 Targets
  - Agriculture 98% emissions
  - Reduction targets= -1% (2020) -5% (2030) compared to 2005
  - Ireland got one of the lowest targets in the EU

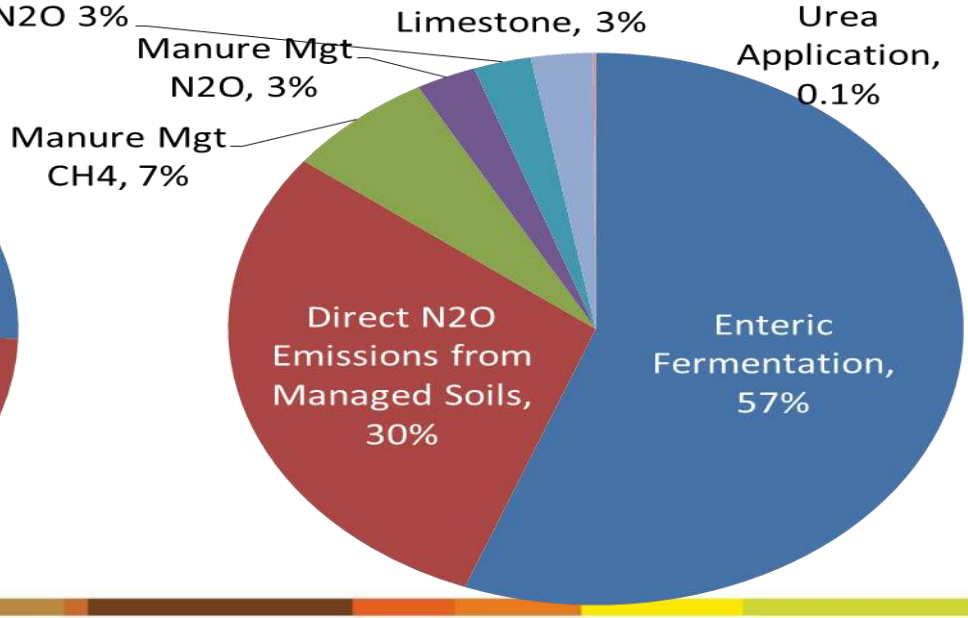


Ammonia and GHG emissions profile

Ammonia

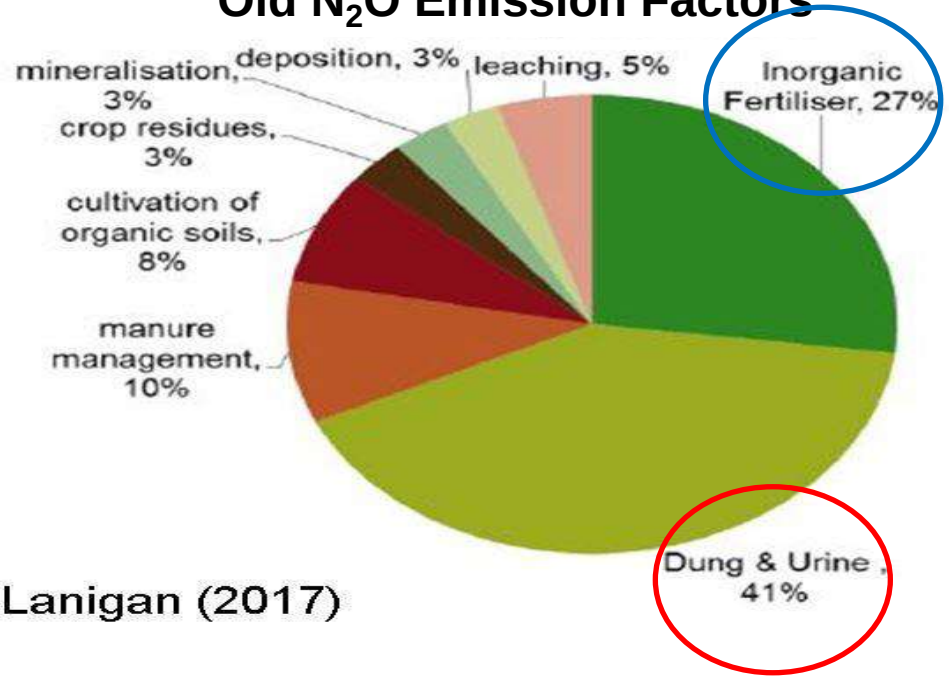


GHG



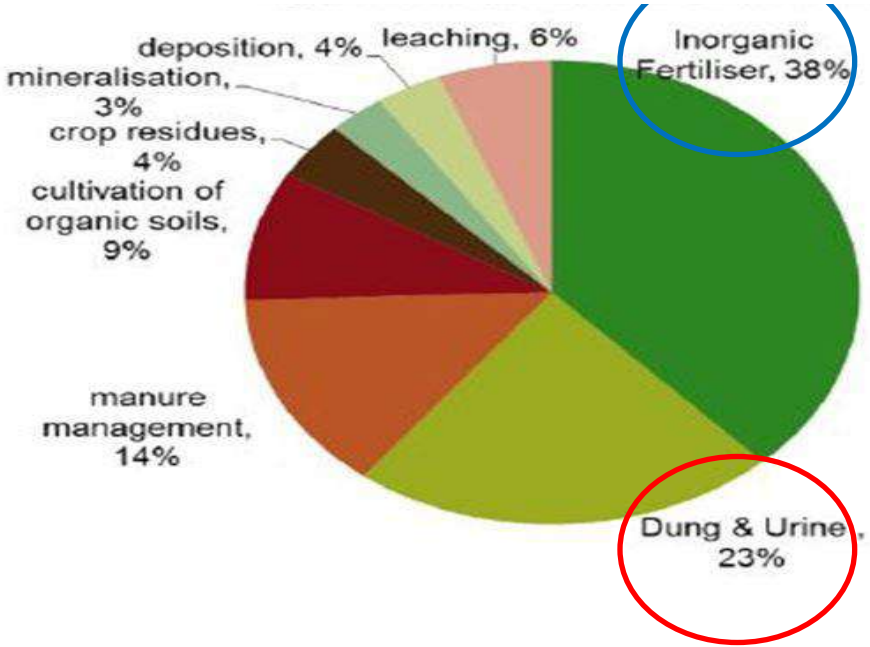
Revised national inventory - new EFs

Old N_2O Emission Factors



Lanigan (2017)

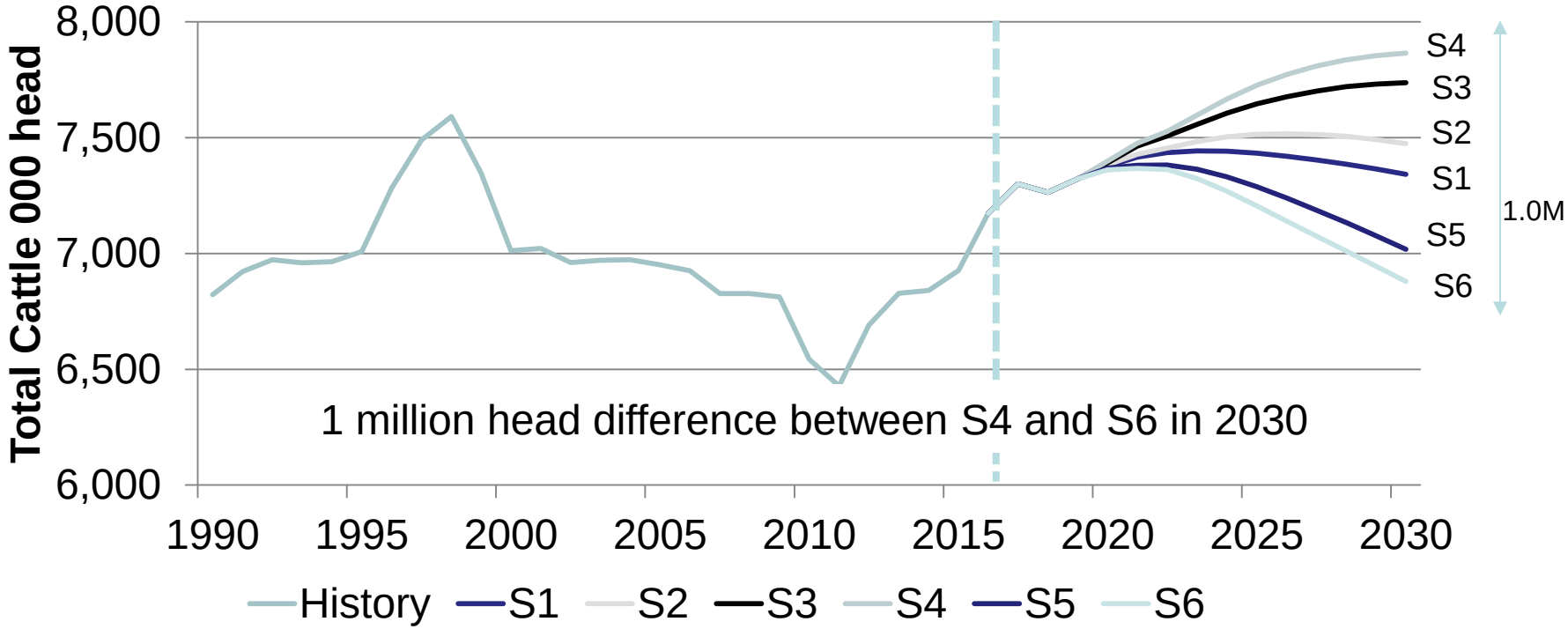
New N_2O Emission Factors



Future Ag Scenarios (FAPRI)

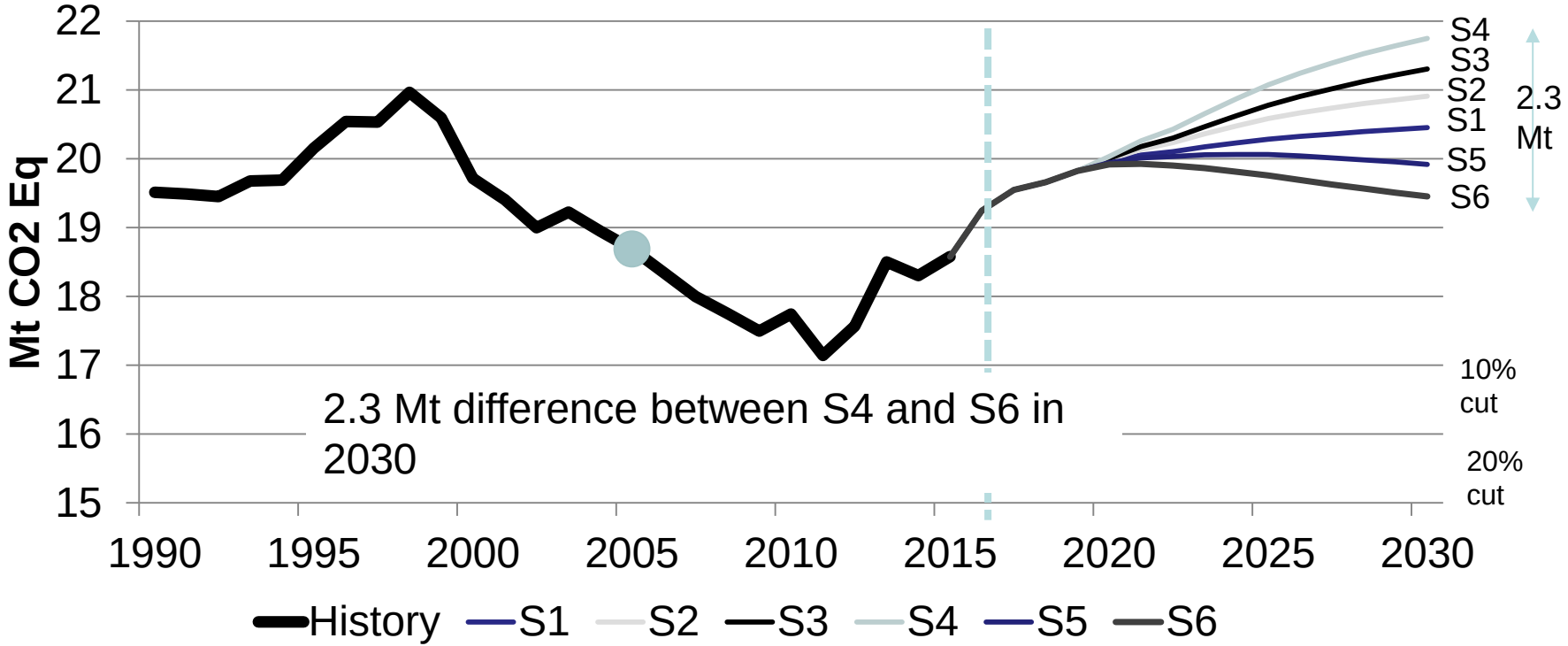
- Impossible to know future level of activity with certainty
- Depends on
  - international supply/demand -> commodity and farm prices
  - policy (Mercosur, CAP Reform, Brexit)
- Look at 6 activity scenarios
- Based largely around how cow population could evolve
  - in the dairy and beef herd
- Scenarios move along different paths **from 2020 onwards**
- Look at impact on:
  - Total Cattle Population
  - Other agricultural activities
  - Nitrogen Use
  - Determine associated GHG emissions (without mitigation)

Total Cattle Population: Scenarios



Source: FAPRI-Ireland Model

GHG emissions (no mitigation)



Source: FAPRI-Ireland Model

Implications for GHG emissions in 2030 NB: excludes mitigation actions

	2005	2016	2030	2030 vs 2005	2030 vs 2016
	Mt CO_2 eq			% change	% change
Historical	18.69	19.24			
S1			20.45	9%	6%
S2			20.91	12%	9%
S3			21.31	14%	11%
S4			21.75	16%	13%
S5			19.92	7%	4%
S6			19.45	4%	1%

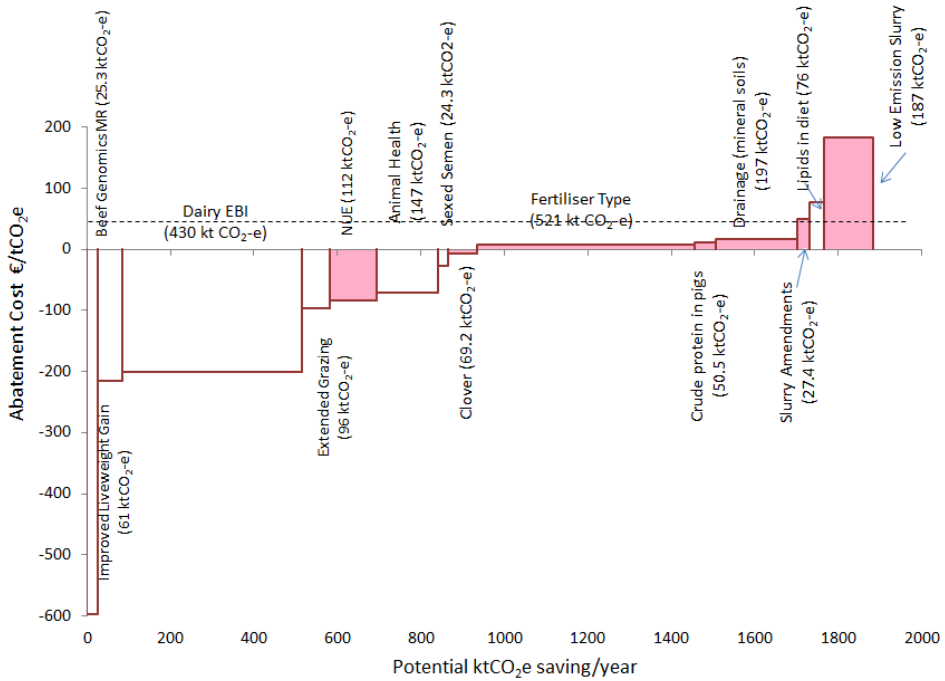
E
NB: excludes mitigation actions

Source: FAPRI-Ireland Model

Three Mitigation Pathways

1. Reduce Agricultural Methane and Nitrous Oxide
   - lower emissions from animals, animal waste and fertiliser
2. Sequester Carbon (LULUCF)
   - Via land use change and forestry
3. Energy efficiency & biofuels and bioenergy production
   - to reduce overall energy usage on farms
   - to displace fossil fuel emissions

MACC – Agricultural Abatement

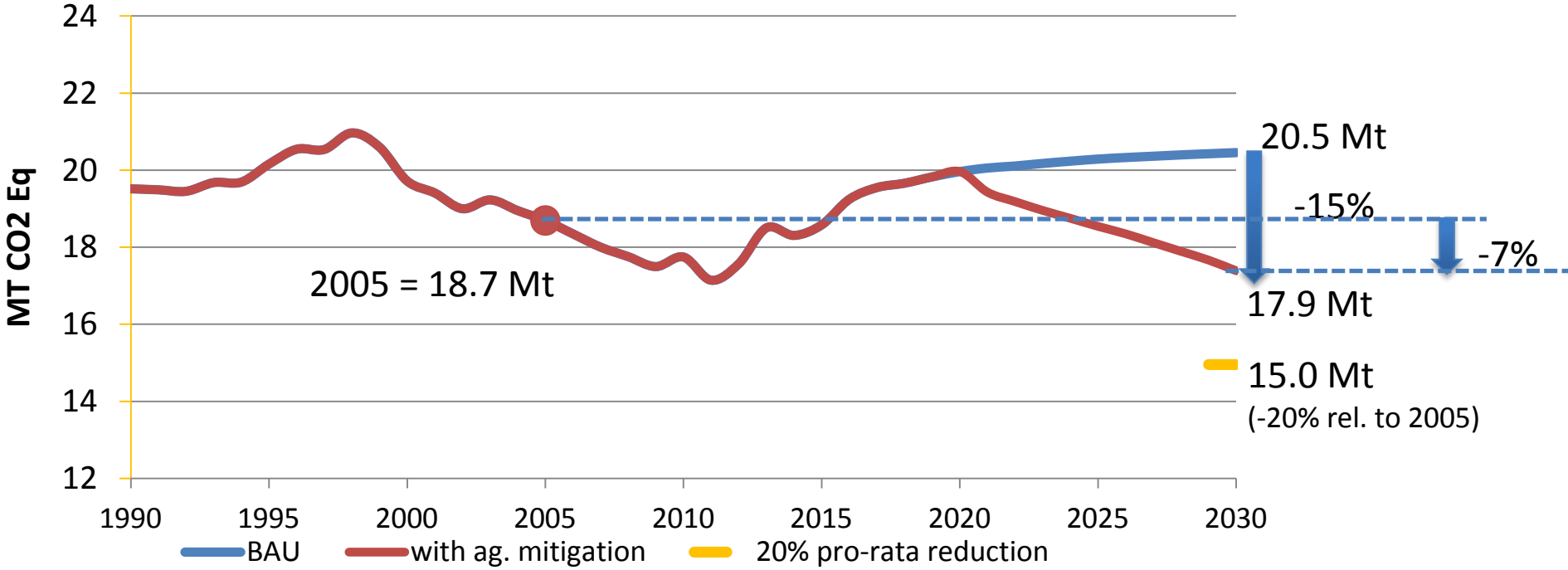


Marginal Abatement Cost Curve for agriculture for 2021-2030

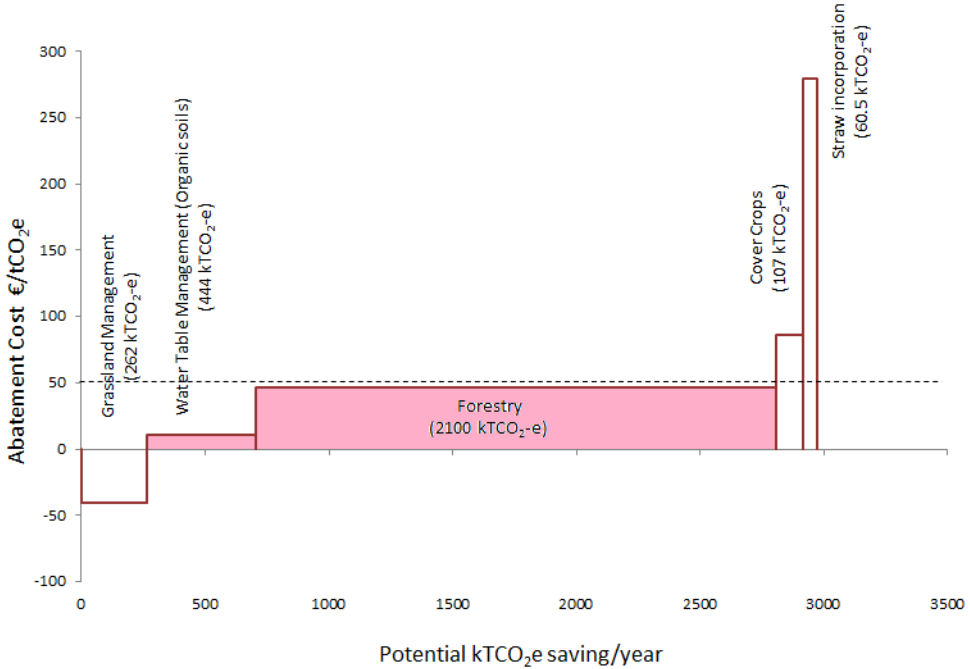
1.	Improved Beef Maternal Traits	0.03 Mt
2.	Beef Genetics: Optimised live-weight gain	0.06 Mt
3.	**Dairy EBI**	**0.43 Mt**
4.	Extended grazing	0.07 Mt
5.	**Nitrogen-use efficiency**	**0.1 Mt**
6.	**Improved animal health**	**0.1 Mt**
7.	Sexed Semen	0.02 Mt
8.	Inclusion of Clover in pasture swards	0.07 Mt
9.	**Fertiliser Type (Reducing N emissions)**	**0.52 Mt**
10.	Reduced crude protein in pigs	0.05 Mt
11.	**Draining wet mineral soils**	**0.2 Mt**
12.	Slurry amendments	0.03 Mt
13.	Adding Fatty Acids to dairy diets	0.03 Mt
14.	**Low-emission slurry spreading***	**0.12 Mt**

* Double dividend as it also reduces ammonia emissions

Impacts on 2030 GHG targets
S1 Scenario with mitigation



MACC - Land-Use Sequestration



15. Grassland Management 0.26 Mt
16. Water table mgt of organic soils 0.44 Mt
17. **Forestry** **2.1 Mt**
18. Tillage Mgt – Cover crops 0.1 Mt
19. Tillage Mgt – Straw incorp. 0.06 Mt

Three Mitigation Pathways

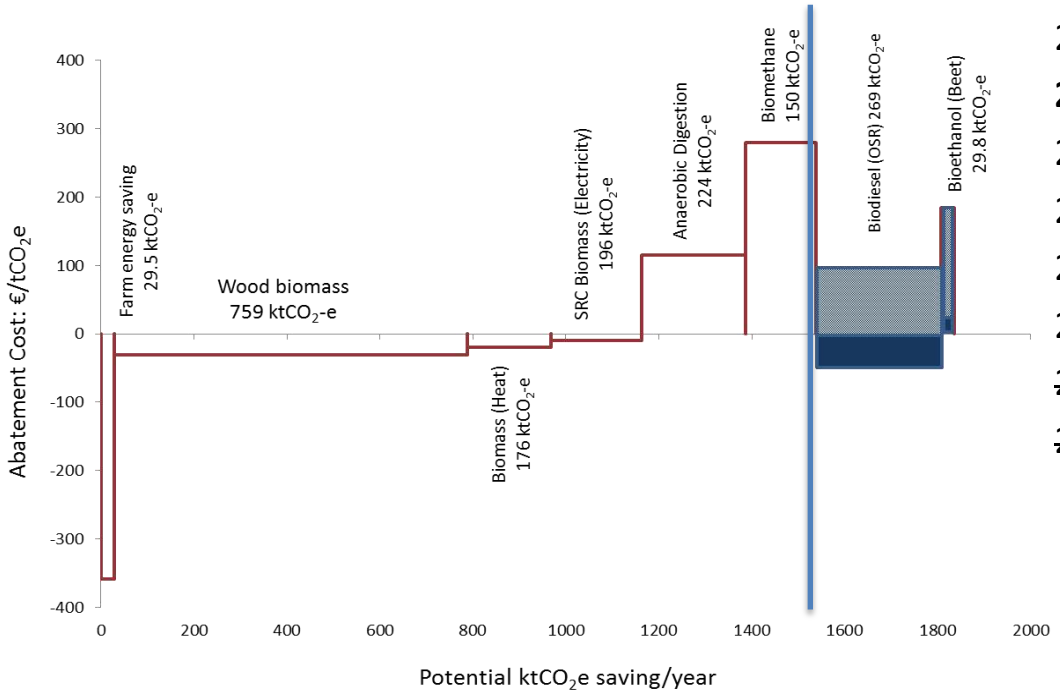
Under flexibilities

- 26.8 M tonnes CO_2 can be banked

Scope in Ireland to elect more sequestration

- particularly in ‘organic soils’ category
- but also in grassland and croplands

MACC - Energy Efficiency, Bioenergy and Biofuels



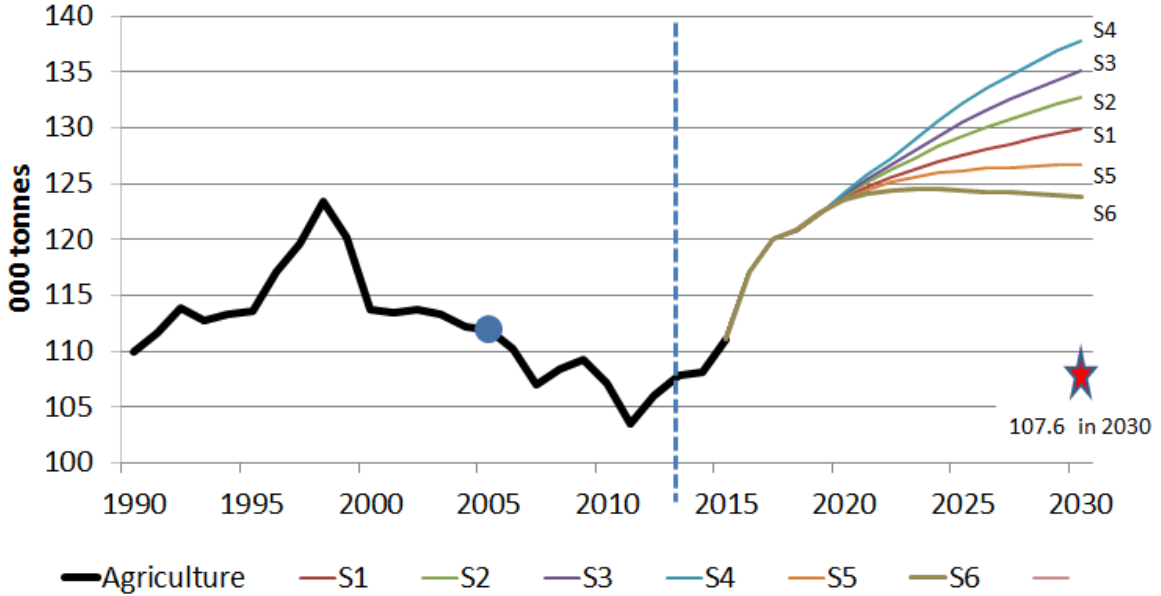
20.	Energy efficiency on farm	0.03 Mt
21.	**Wood Biomass for energy**	**0.76 Mt**
22.	SRC & Miscanthus for Heat	0.18 Mt
23.	SRC for Electricity	0.19 Mt
24.	Anaerobic Digestion	0.22 Mt
25.	Biomethane	0.15 Mt
~~26.~~	~~Oil Seed Rape for Biodiesel~~	~~0.18 Mt~~
~~27.~~	~~Sugar beet for Bioethanol~~	~~0.03 Mt~~

Summary of Emissions and Mitigation

	Historical emissions (Mt CO_2-e yr^{-1})			Projected Emissions	
	1990	2005	2016	Mean 2021-2030	2030
				Emissions without Mitigation	
Total Agriculture emissions (ex. Fuel)	19.51	18.69	19.24	20.28	20.45
				Mitigation	
Cost effective Agriculture mitigation				1.73	2.89
Cost effective LULUCF offsets*				2.80	3.50
Cost effective energy mitigation				0.99	1.31
Total Mitigation				5.52	7.70

Summary: Ammonia emissions

(NB: excludes mitigation actions)



Source: FAPRI-Ireland Model

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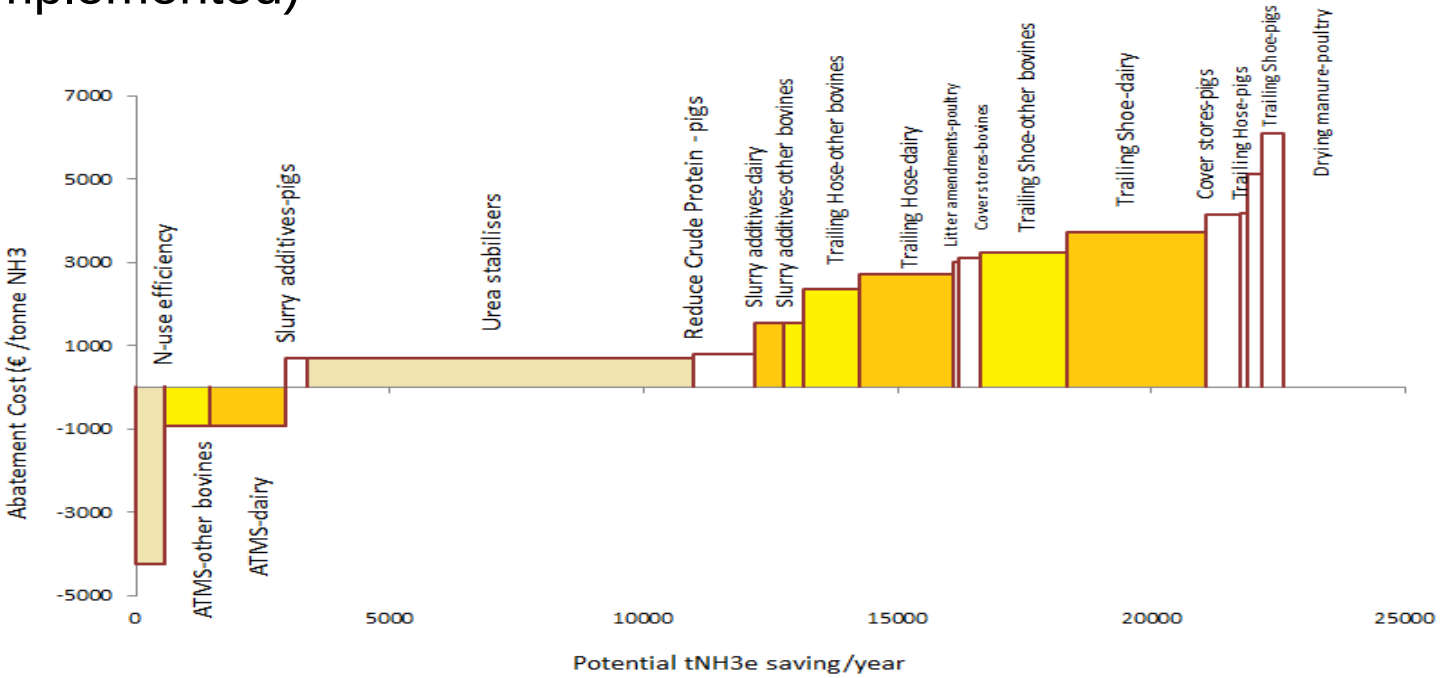
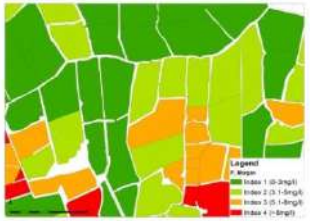
Ammonia MACC (2018)

- Measures additive, reduction range S1 = 17.3 to 19.7 kT NH_3
- Cost €41-78M/yr (? landspreading measures implemented)



Most Promising NH_3 Measures

	kT NH_3 abated
▪ Stabilised urea	**7.7**
▪ Trailing shoe dairy	**2.7**
▪ Trailing shoe non dairy	**1.7**
▪ Alt. time manure dairy	**1.5**
▪ Crude protein pigs	**1.3**
▪ Alt. time manure non dairy	**0.91**
▪ Cover stores pigs	**0.68**
▪ Increase NUE	**0.57**
▪ Slurry additives dairy or pigs	**0.57**



New Ammonia Legislation

- National Emission Ceiling Directive (NECD) being implemented in 2019
- Feb 2019 public consultation - Draft Code of Good Agricultural Practice for reducing Ammonia Emissions
- April 2019 National Plan for reducing ammonia emissions to be submitted to EU
- Ireland currently in breach of NECD targets and going exceed them again in 2018
- Ireland likely to face prosecution for failing to achieve NH_3 targets

Irish emissions of three key air pollutants getting worse – EPA

Pollutants hit air quality, cause respiratory problems, and pollute soil and surface water

Thu, Mar 29, 2018, 16:04 | Updated: Thu, Mar 29, 2018, 16:05

Kevin O'Sullivan Environment & Science Editor

EPA figures show Ireland's level of sulphur dioxide (SO2) continues to be well below EU emission limits. The main sources of SO2 are power generation, industrial activity and residential activity, including solid fuel burning. File photograph: Getty Images

Irish Examiner

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Creed says emissions targets are big challenge

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Thursday, April 26, 2018 - 12:00 AM

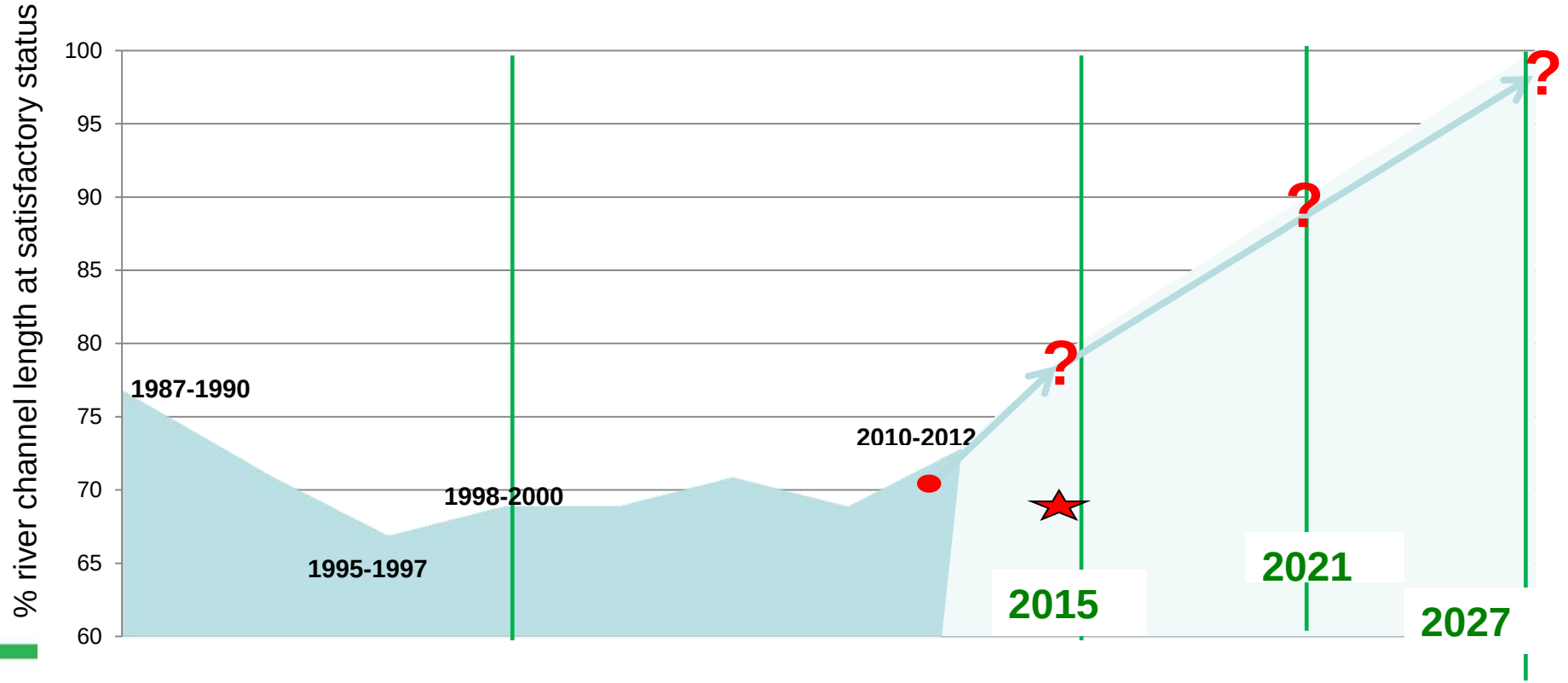
By Stephen Cadogan

Achieving required ammonia reduction targets is a significant challenge, Minister for Agriculture, Food and the Marine Michael Creed has warned.

Emissions of ammonia have been increasing since 2011 and were above the specified EU emission limit in 2016 for the first time, according to the Environmental Protection Agency, and the agriculture sector accounts for 99% of ammonia emissions in Ireland.

The EPA says ammonia emissions in Ireland come from he 40 million tonnes of animal manures are used annually and the 300,000 tonnes of nitrogen in fertilisers.

River Water Quality, past, now, future?



ACP Summary

Catchment	Phosphorus		Nitrate-N		Ecology	
	Mean [mg/L]	EPA EQS	Mean [mg/L]	EPA EQS	Macro-invert Spring	Fall
Arable B	0.112	X	4.9	√	X	X
Grassland B	0.076	X	2.5	√	X	X
Grassland A	0.063	X	5.8	√	X	X
Arable A	0.029	√	7.0	√	√	X
Grassland C	0.029	√	1.1	√	√	X
Grassland D	0.017	√	1.3	√	√	√

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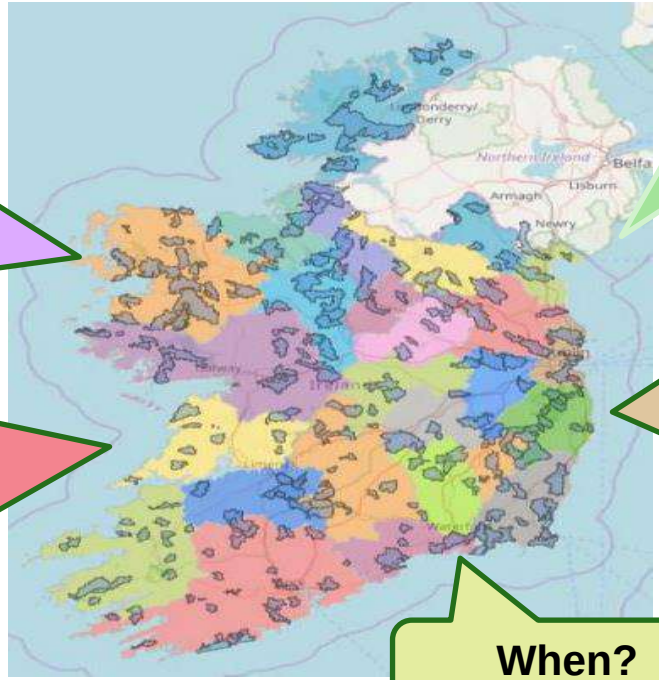
Ag. Sustainability Support & Advisory Prog.

What?

- 30 advisors from Teagasc & Co-ops
- Voluntary
- Free advisory service
- Support farmers
- Practical Advice



Where?

- 190 Areas for Action
- Located all over Ireland
- Find your local Area for Action at www.catchments.ie

Why?

- Need to Improve Water Quality for everyone's benefit
- Important for Nitrates derogation and future development of Irish agriculture

How?

- Reduce nutrient loss by 'breaking the pathway'
- On Farm tailored advice
- Farmyard Improvement
- Nutrient Management
- Land Management

When?

- 2018 - 2021

ASSASP service provided by: Teagasc Agriculture and Food Development Authority; Dairy Industry Ireland Ibec

Supported By: Department of Agriculture, Food and the Marine, An Roinn Talmhaíochta, Bia agus Mara; An Roinn Tithíochta, Pleanála, Pobail agus Rialtais Áitiúil, Department of Housing, Planning, Community and Local Government

Origin Green Ireland

Conclusions

- Without mitigation Agricultural GHG & NH_3 emissions are likely to continue to increase
  - Mainly due to increased dairy production
- Significant mitigation potential exists
  - But these exist on paper only
  - Significant communication and action required
  - Particularly at farm level to realise these emissions reductions
  - Behavioural change a significant challenge
- New Agricultural Sustainability Support & Advisory Prog.
  - 30 dedicated advisors focus
  - Increase farmer adoption initially WQ but expand to include GHG and NH_3

Further Reading

- Gary J. Lanigan & Trevor Donnellan (eds.) *An Analysis of Abatement Potential of Greenhouse Gas Emissions in Irish Agriculture 2021-2030*. *Teagasc, Oak Park, Carlow. June 2018*

- Donnellan, T., Hanrahan, K and Lanigan G.J. *Future Scenarios for Irish Agriculture: Implications for Greenhouse Gas and Ammonia Emissions*. *Teagasc, Athenry. June 2018*