NOVEMBER 28TH 2023

REVIEW OF 2023-Environmental Sustainability

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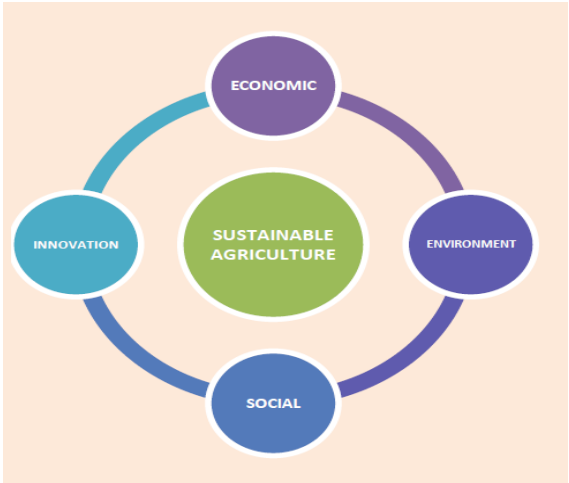
teagasc

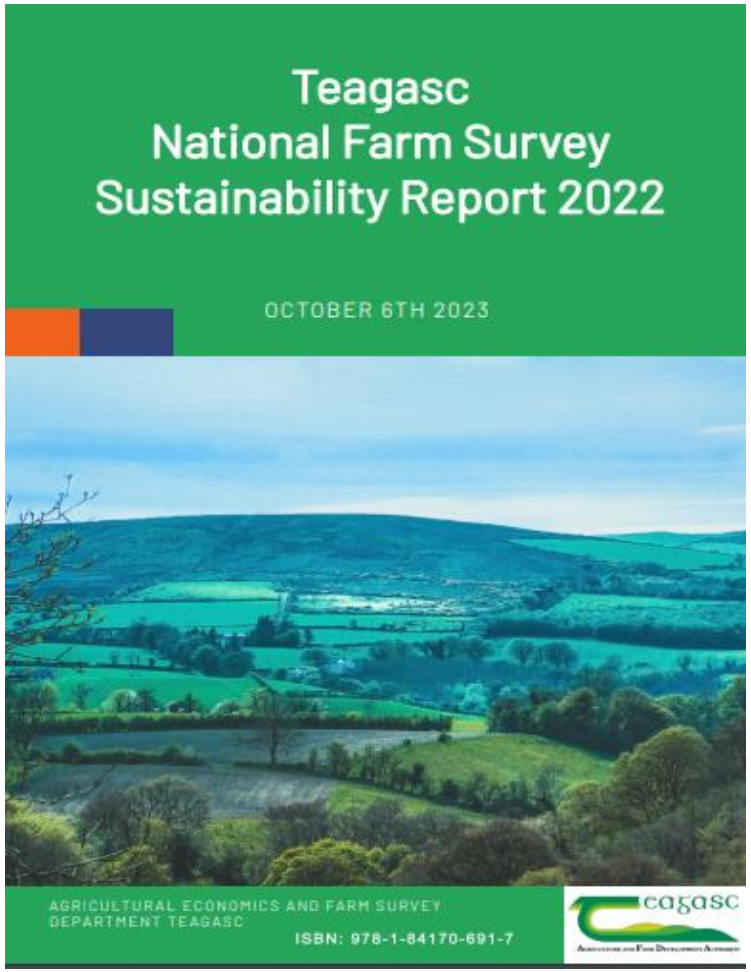
Overview

- Sustainability conceptual framework
- Methodological approach used for projecting for 2023
- Projections results for 2023
- Summary / conclusion

Teagasc NFS Sustainability Report

- Farm level sustainability is intersection of:
  1. Economic
  2. Environmental
  3. Social
  4. Innovation





- The 2022 Teagasc Sustainability Report
  - Published 6th of October 2023
  - 8th report since 2013

https://www.teagasc.ie/media/website/publications/2023/SustainabilityReport2022.pdf

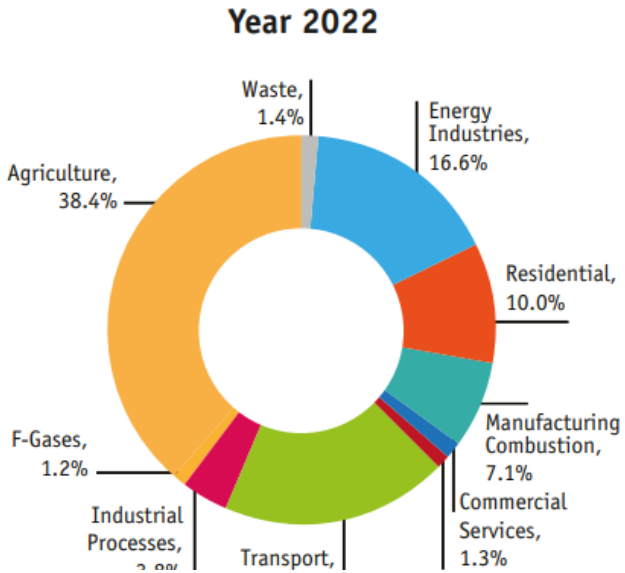
Environmental Sustainability

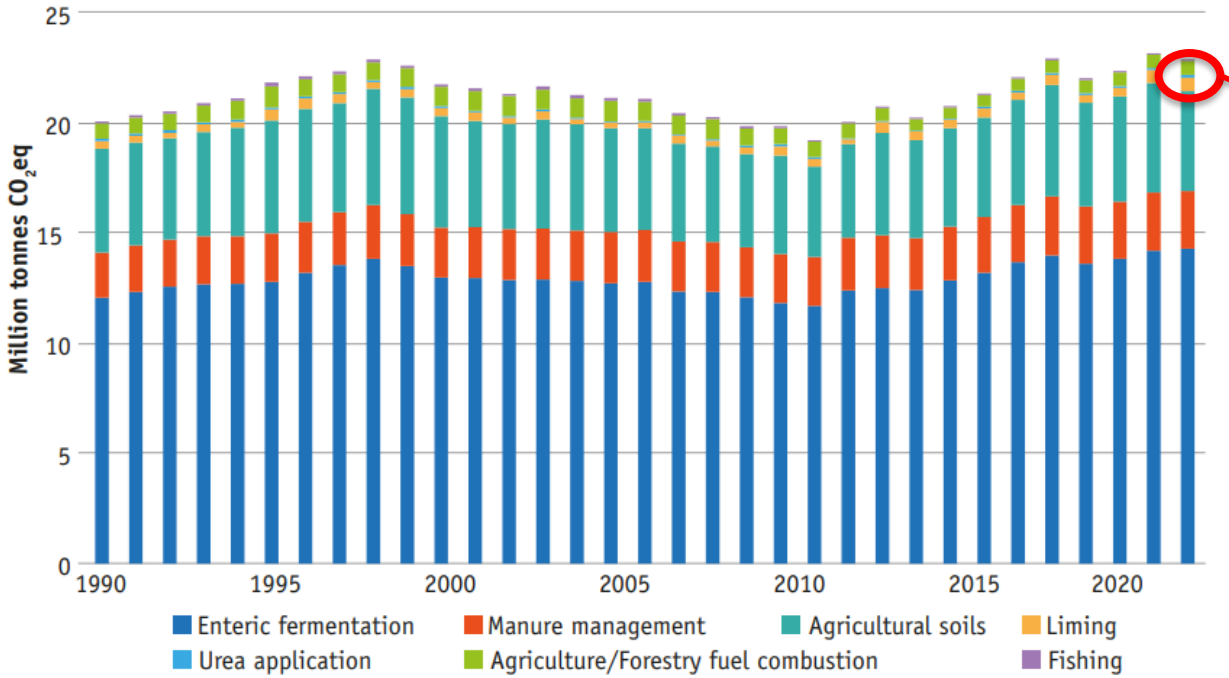
1. Gaseous Emissions
   - Greenhouse Gases
   - Ammonia

2. Risk to water quality

3. Biodiversity Indicator

Gaseous Emissions - Agriculture





Source: EPA, 2023

Climate Action Plan 2021: GHGs

- Sectoral GHG reduction targets for 2030 (compared to 2018)
  - Agriculture: 25%

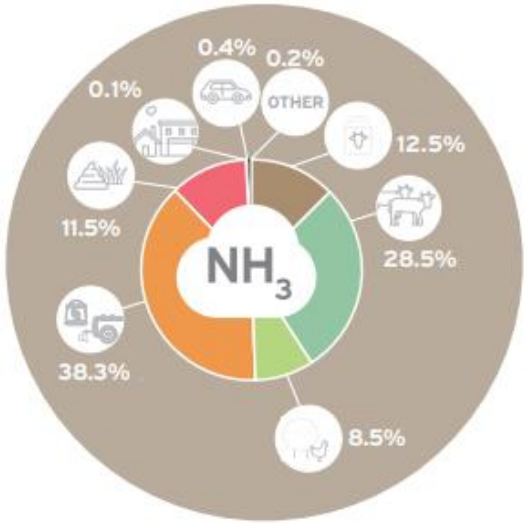
22.4 Mt in 2018 to 16.8Mt in 2030

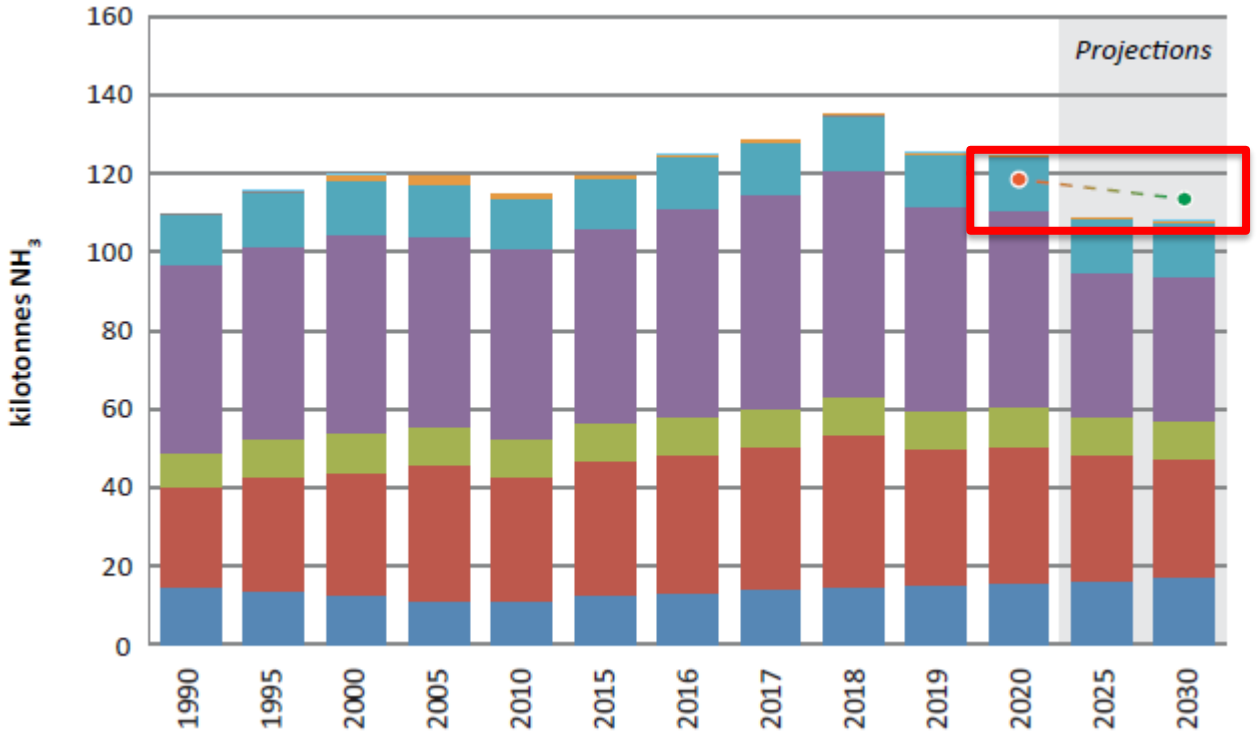
- Carbon neutrality by 2050

Agriculture and Food Development Authority

Gaseous Emissions - Ammonia

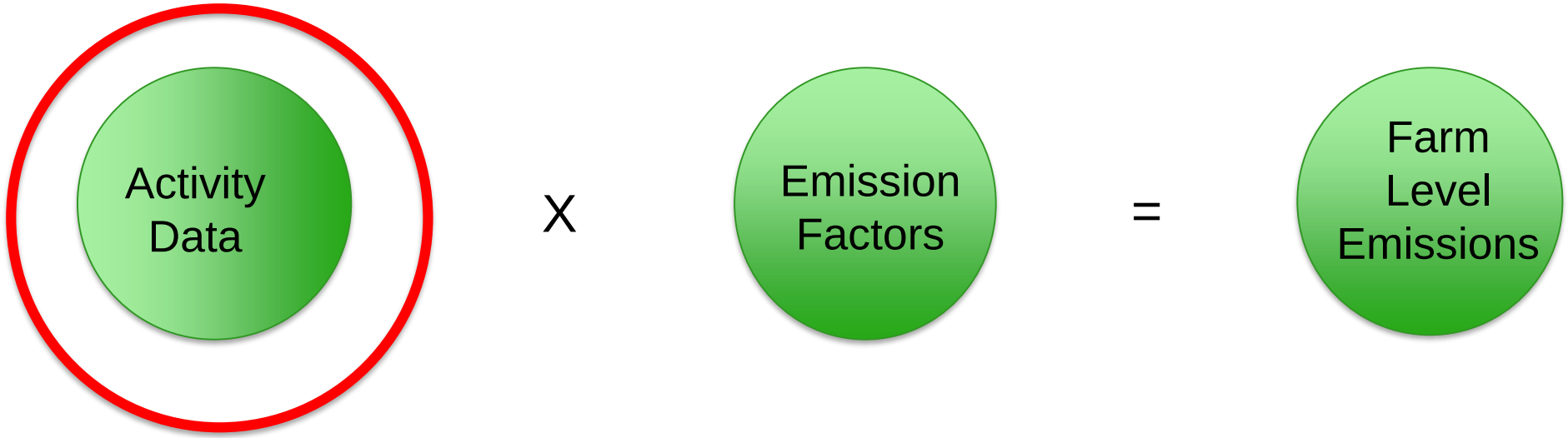
99.4% of Ammonia Emissions generated from Agriculture (EPA, 2023)





Source: EPA, 2022

Emissions – How are they calculated

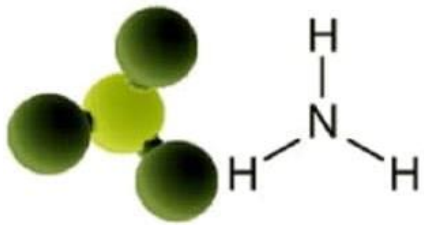


- Activity Data
  - Farm Practice (e.g. animal numbers, chemical fertilisers & manure management)
- Emission Factors
  - Scientific evidence from lab/field experiments, national level if possible (peer reviewed)

Methodological approach – Emission Factors

- GHG - All in common currency of CO_2 equivalence
  - » IPCC based national inventory approach for all farm types
  - » Replicating approach used by EPA at national level
  - » CO_2 equivalent in the base gas (1=1)
    - Methane (CH_4) 1 tonne = 28 tonnes of CO_2 equivalent
    - Nitrous Oxide (N_2O)1 tonne = 265 tonnes of CO_2 equivalent

- Ammonia (NH_3)
  - » National inventories approach for all farms
  - » Replicating approach used by EPA at national level for reporting under the EU NEC Directive



Methodological approach – Activity Data

- Activity data from Teagasc National Farm Survey
- NFS conducted by Teagasc since 1972 (part of EU Farm Accountancy Data Network)
  - Sample of 793 farms in 2022 representing over 85,951 nationally
  - Reports on main land based systems – Dairy, Cattle, Sheep & Tillage
- Data captureD for environmental modelling
  - Animal numbers by category (e.g. Dairy Cows)
  - Crops grown (e.g. barley, wheat, oats)
  - Fertilisers applieD (e.g. CAN, urea, protected urea)
  - Lime applied
  - Manure management practices (housing, storage, landspreading)
  - Technology Adoption

Activity Data Projections / Assumptions – 2023

- Animal Numbers & Chemical Fertilisers applied are key parameters – Type and quantity

1. Animal Inventories
   - CSO June survey 2022 vs 2023

2. Chemical Fertiliser & Lime Sales
   - Sales data DAFM Sept 2022 - June 2023**
   - Lime Sales January – June 2023**

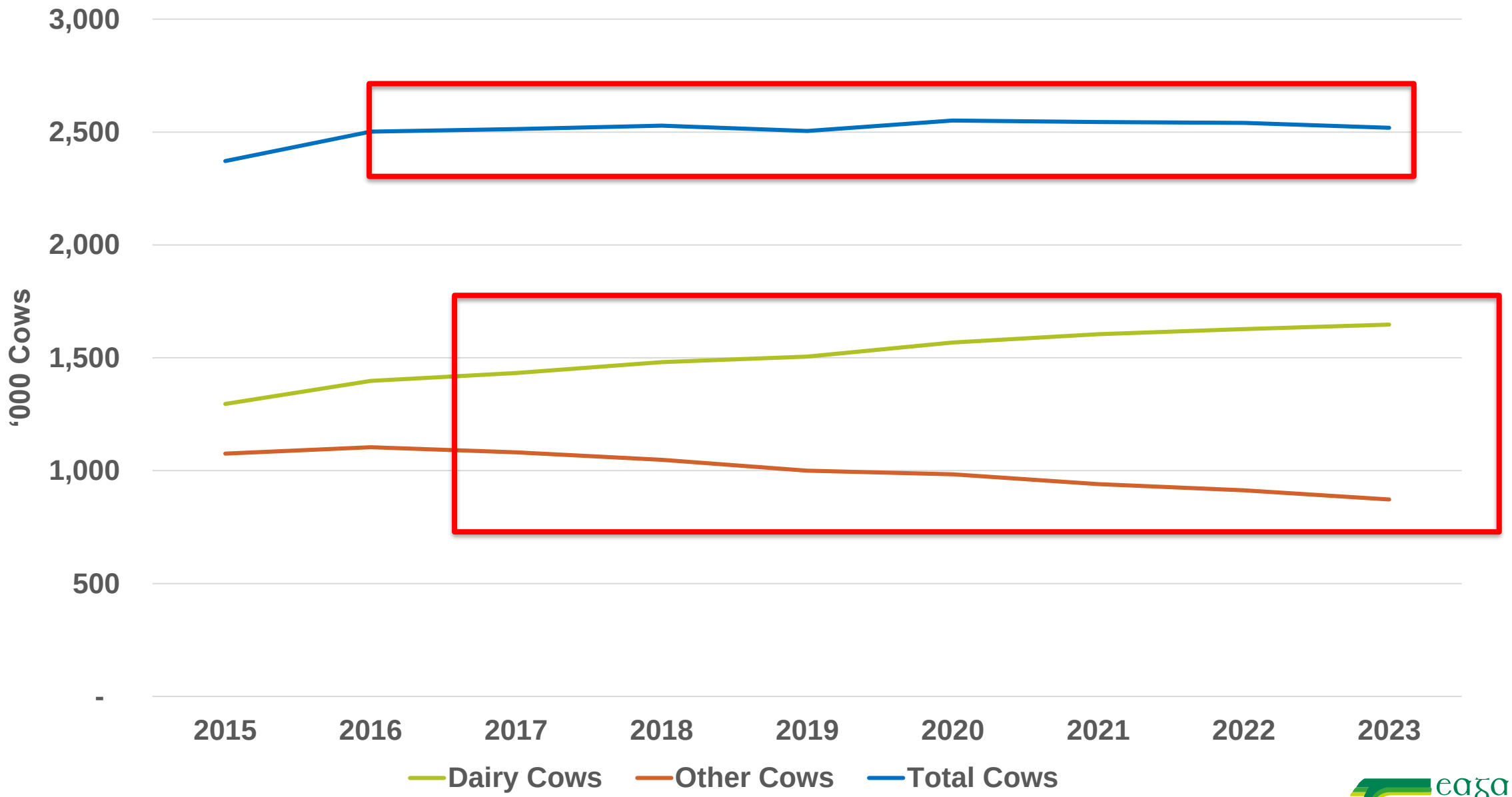
3. Technology adoption
   - Gaseous Emissions Mitigation
     - » LESS use to increase in line with historical trends

- Apply these changes to farms with the Teagasc NFS
  - Using 2022 as the base year

Cattle Numbers June 2021 vs 2022

Animal inventories	2022 vs 2023	% Pop 2023
Total cattle	-0.74%	100%
Dairy cows	+1.19%	22%
Other cows	-4.50%	12%
Bulls	-3.73%	1%
Cattle: 2 years and over	+7.63%	11%
Cattle: 1-2 years	-1.39%	26%
Cattle: under 1 year	-2.82%	28%

Cow Population



Enteric Fermentation EF Co-efficients	2021
Animal Category	
Dairy cows	120.19
Beef cows (Suckler Cows)	72.27
Dairy heifers	53.60
Beef heifers	57.10
Cattle <I year	33.23
Cattle < 1 yrs - male	34.70
Cattle < 1 yrs - female	31.88
Cattle 1 - 2 yrs	55.02
Cattle 1 - 2 yrs - male	58.09
Cattle 1 - 2 yrs - female	51.41
Cattle > 2 yrs	28.72
Cattle > 2 yrs - male	33.97
Cattle > 2 yrs - female	20.28
Bulls for breeding	91.38

Sheep Numbers June 2022 vs 2023

Animal inventories	2022 vs 2023
Total sheep	+0.27%
Ewes	-3.05%
Rams	+4.67%
Other sheep	+3.52%

Chemical Fertiliser – Nitrogen (September to June*)

	2022*	2023*	% change
Total	274,935	227,398	-17.3%
Straight CAN	84,909	58,128	-31.5%
Straight Urea	41,909	33,332	-20.5%
Protected Urea	26,032	25,766	-1.0%
NK Compounds	1,831	1,412	-22.9%
NP Compounds	1,554	983	-36.7%
NPK Compounds	114,846	103,299	-10.1%
Other N Fertilisers	3,854	4,478	16.2%

STOCKS FROM 2022?

* September to June (DAFM,2023)

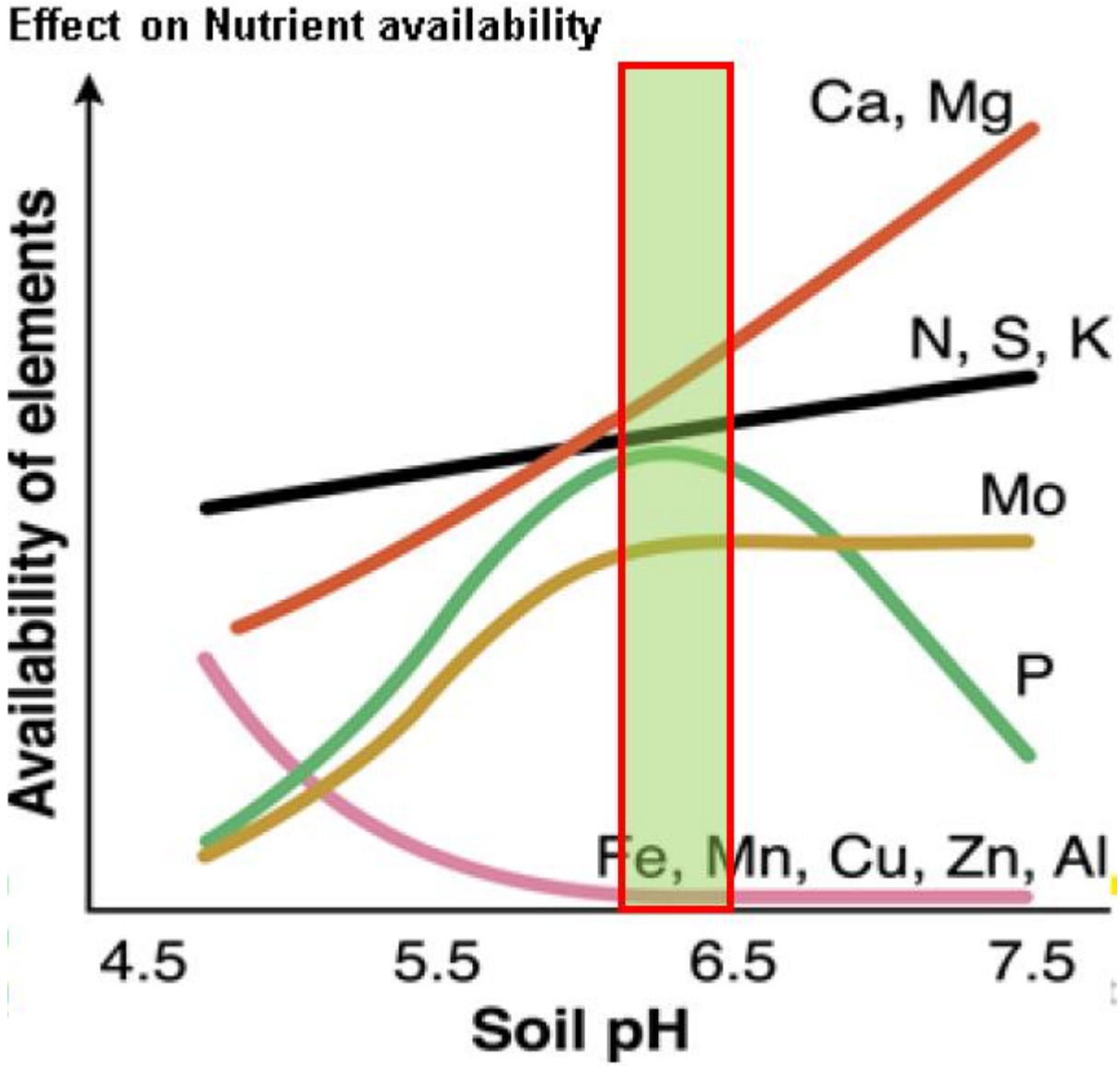
Chemical Nitrogen GHG Emission Factors

GHG linked Emission factors	(kgN2O-N/Nkg)	EF Multiple
CAN	0.0140	1.0
Straight Urea	0.0025	5.6
Protected Urea	0.0040	3.5

Source: EPA, 2022

Liming Rates

- Optimum pH required for nutrient use efficiency and maximum crop yield
  - Natural release from soils
- Lime sales also decreased by circa 16% between 2022 and 2023 January to June (DAFM, 2023)
- Liming has a once off pulse of CO_2 in year it is applied
  - 12% Carbon in Lime – 120kg of CO_2 per tonne of Lime



Source: Wall et al., 2015

Low Emissions Slurry Spreading

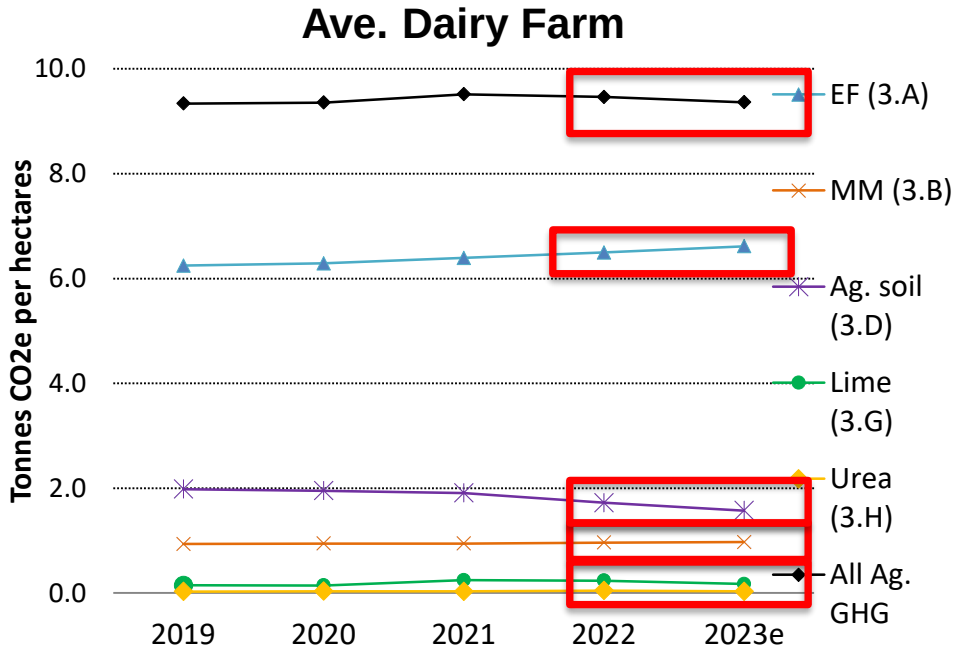
- Aggregate slurry spread by LESS
  - 48% in 2021
  - 59% in 2022
  - 65% in 2023?

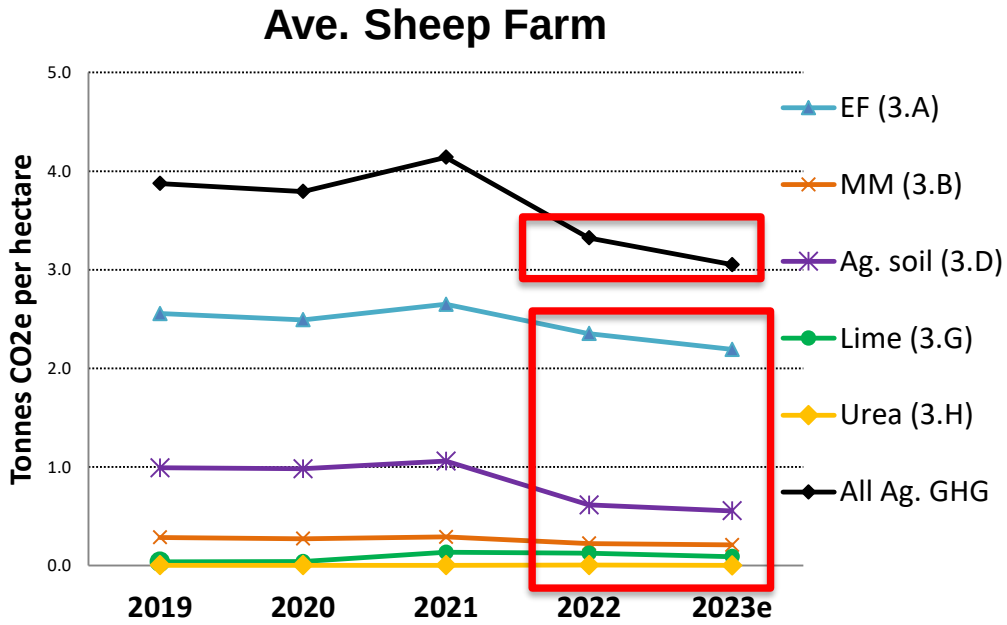
GHG emissions profile for Agriculture in ROI 2021

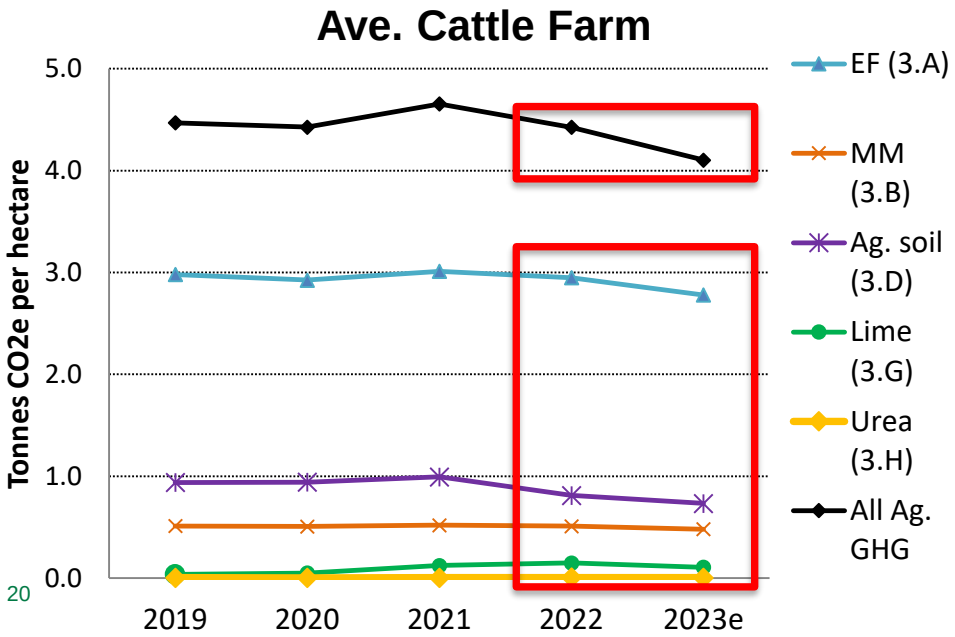
3. Agriculture (Mt CO2 eq)	2021	%
3.A Enteric Fermentation (CH_4)	14.49	63.1%
3.B Manure Management (CH_4 & N_2O)	2.70	11.8%
3.C Rice Cultivation	-	-
3.D Agricultural Soils (N_2O)	5.06	22.1%
3.E Prescribed Burning of Savannas	-	-
3.F Field Burning of Agricultural Residues	-	-
3.G Liming (CO_2)	0.60	2.6%
3.H Urea Application (CO_2)	0.10	0.4%
3.I Other Carbon-containing fertilizers	-	-
3.J Other	-	-
Total Emissions (kt CO_2 eq)	22.95	100%

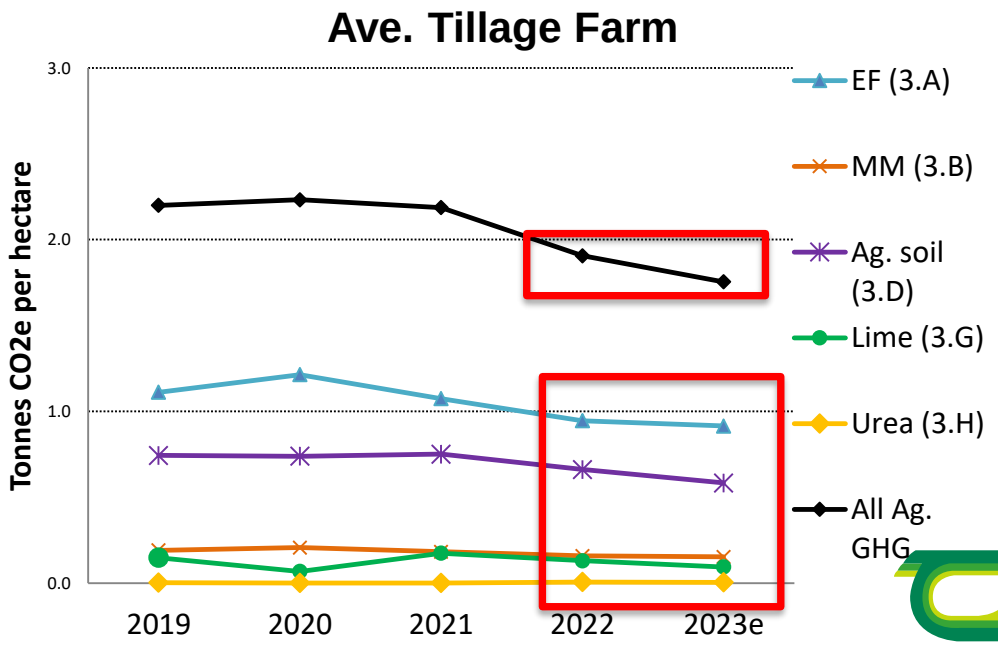
Source: EPA, 2023

Projections for 2023 for GHG emissions tonnes per hectare NFS Farms – IPCC Category









NH_3 National Inventory Accounts

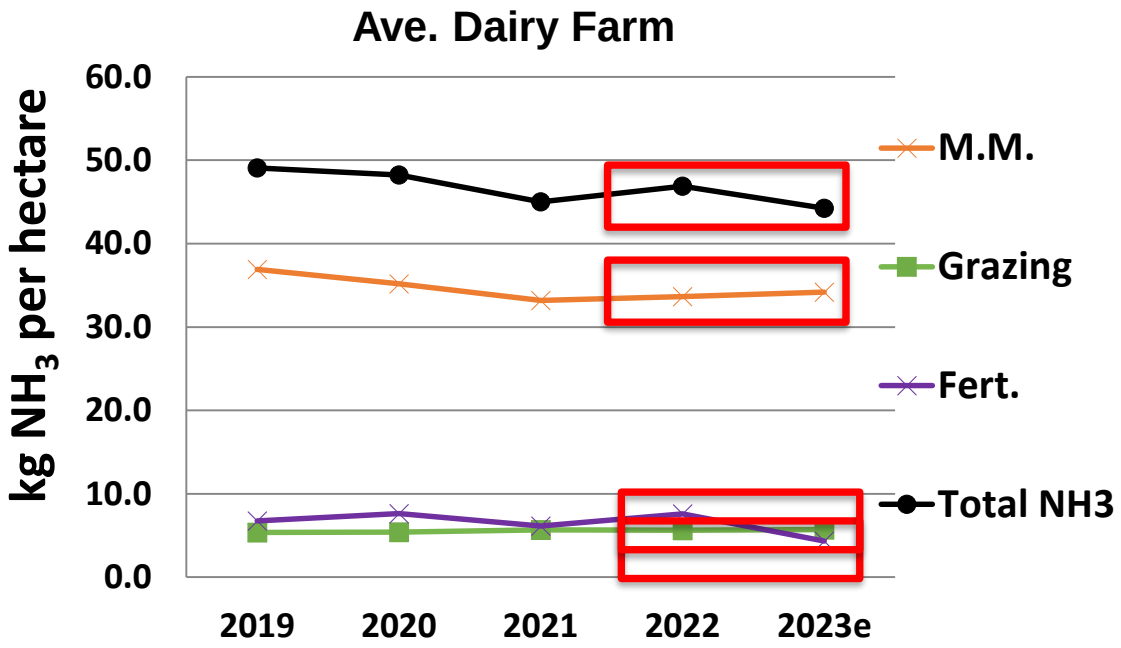
Total NH_3 emissions (kilotonnes NH_3)	2021	%
Cattle (Manure Management + Grazing)	95.8	77.3%
Pigs	6.4	5.2%
Sheep (Manure Management + Grazing)	3.3	2.6%
Poultry	5.0	4.1%
Horses	1.7	1.4%
Mules	0.1	0.1%
Goats	0.0	0.0%
Chemical Fertilizer	11.1	9.0%
Other	0.3	0.3%
National Total	123.9	100.0%

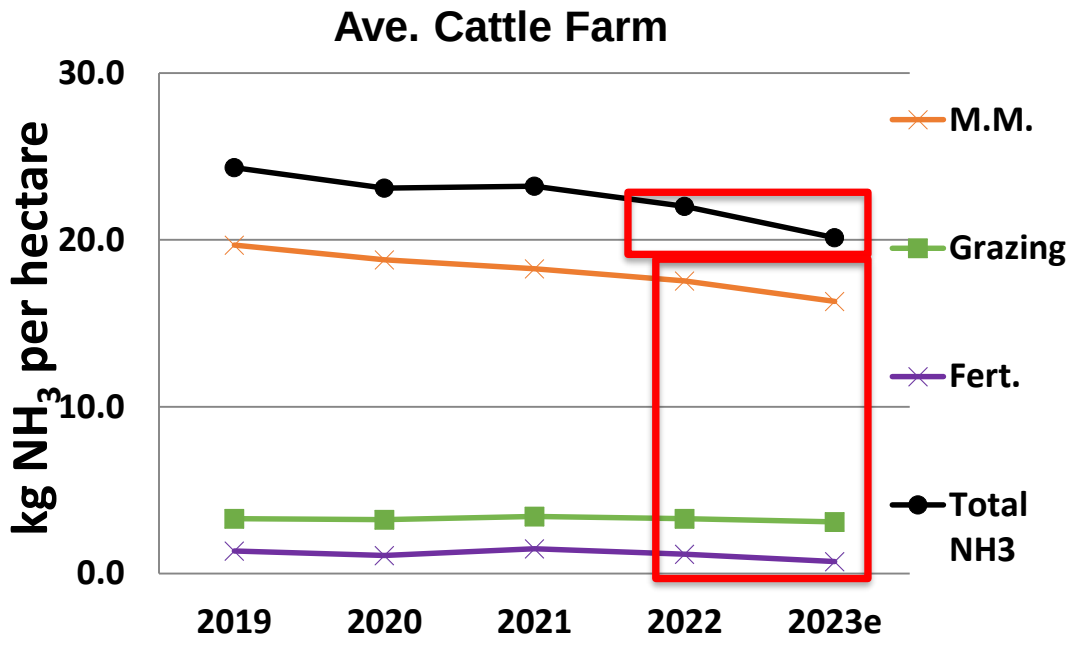
NH_3 Emission Factors

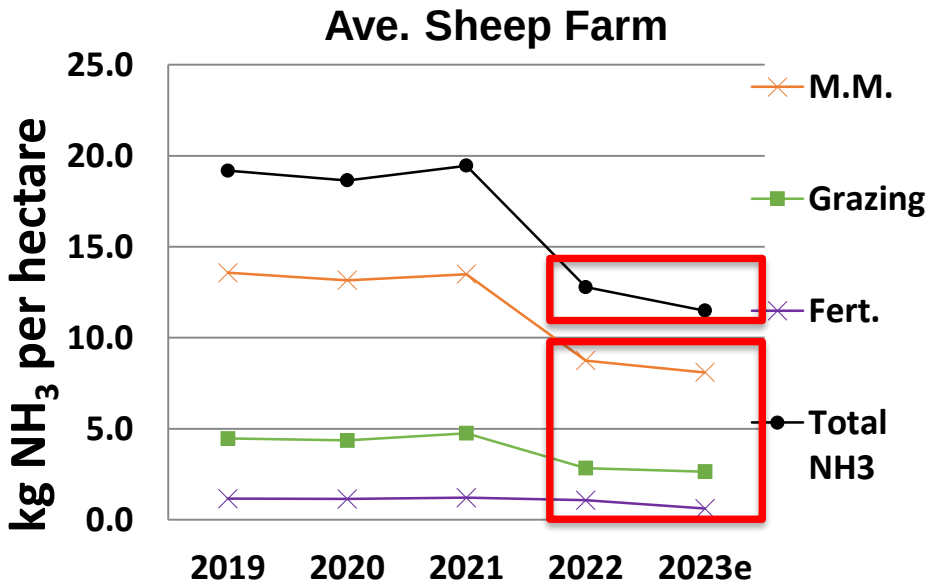
N Excretion Rates (kg/head/yr)	2021
Animal Category	
DairyCows	110.22
Cows Excluding Dairy Cows	75.04
Dairy Heifers	72.44
Other Heifers	76.58
Cattle 0 - 1 yrs male	35.03
Cattle 0 - 1 yrs female	32.42
Cattle 1 - 2 yrs male	73.72
Cattle 1 - 2 yrs female	69.77
Cattle > 2 yrs male	46.07
Cattle > 2 yrs female	44.57
Bulls	86.68
Ewes Lowland	12.573
Ewes Upland	9.374
Rams - lowland	11.383
Rams - upland	9.769
Other Sheep>1 - lowland	12.893
Other Sheep>1 - upland	9.916
Lambs - lowland	3.675
Lambs - upland	4.322

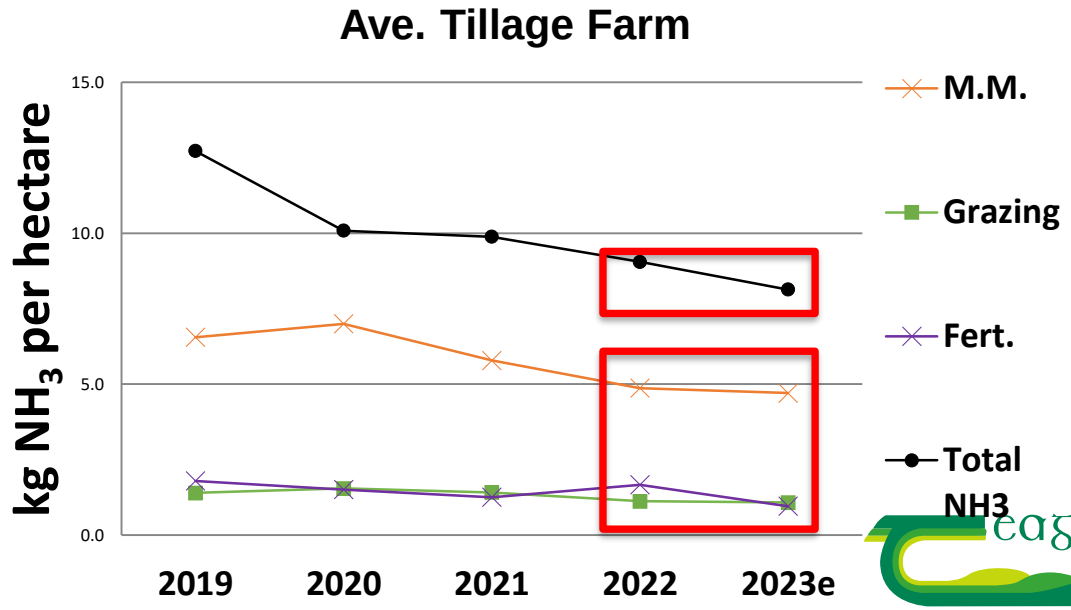
Ammonia Emission factors - Chemical N fertiliser	(NH3 - g per kg)	EF Multiple
Straight Urea	155	1.0
CAN	8	19.4
Protected Urea	33	4.7

NH_3 emissions kg per hectare by Farm System









Summary / Conclusion

- **Lower animal activity levels in 2023 but not across all categories**
  - June cattle number -0.7%
    - » Dairy Cows +1.19%
  - Sheep numbers +0.27
    - » Ewes -3.05%

- **Reduction in the quantity of chemical N fertilisers applied in 2023**
  - Chemical N sales (Sept-June) down by 17%
    - » Double digit % reduction in all categories except protected urea (-1%)
    - » Overhang of STOCKS from 2022? – Big Caveat

- **Lime projected to decline by 16%**
  - Reduced pulse of direct GHG emissions in short run

- **Other measures**
  - » Straw incorporation, legumes / protein crops?

Summary / Conclusion

- **Estimates - Absolute per hectare GHG Emissions in 2023**
  - ↓1% on Dairy Farms,↓7-8% on Non-Dairy Farms

- **Estimates - Absolute NH_3 Emissions in 2023**
  - ↓5% on Dairy Farms,↓9-10% Non-Dairy Farms
  - Level Technology adoption - Caveat

NOVEMBER 28TH 2023

THANK YOU

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