Teagasc National Farm Survey 2019 Sustainability Report

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Rural Economy and Development Programme

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Teagasc
Agriculture and Food Development Authority

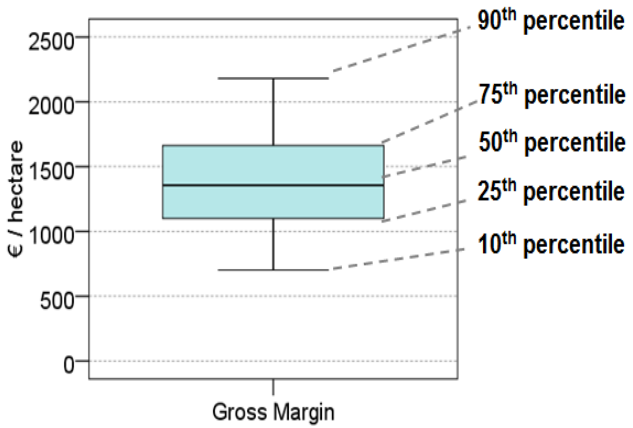
Overview

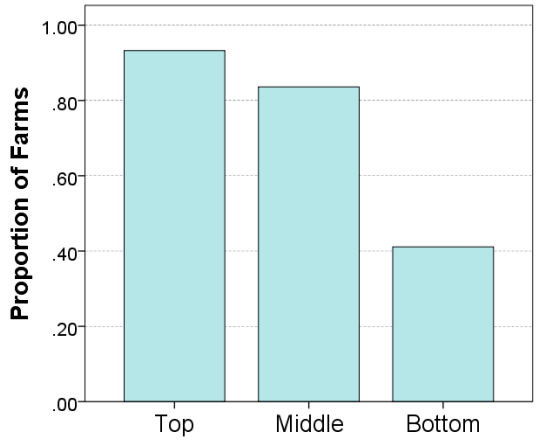
- NFS sample profile
- Methodology
- Results
- On going development of indicators
- Summary / conclusion

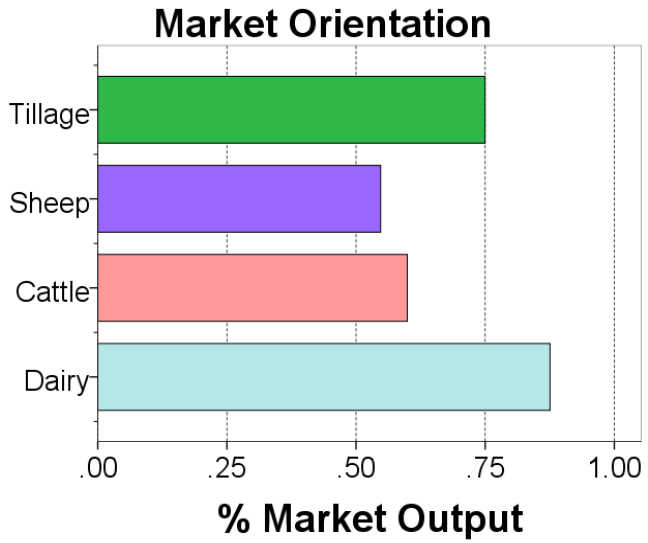
Profile of Teagasc NFS Sample - 2019

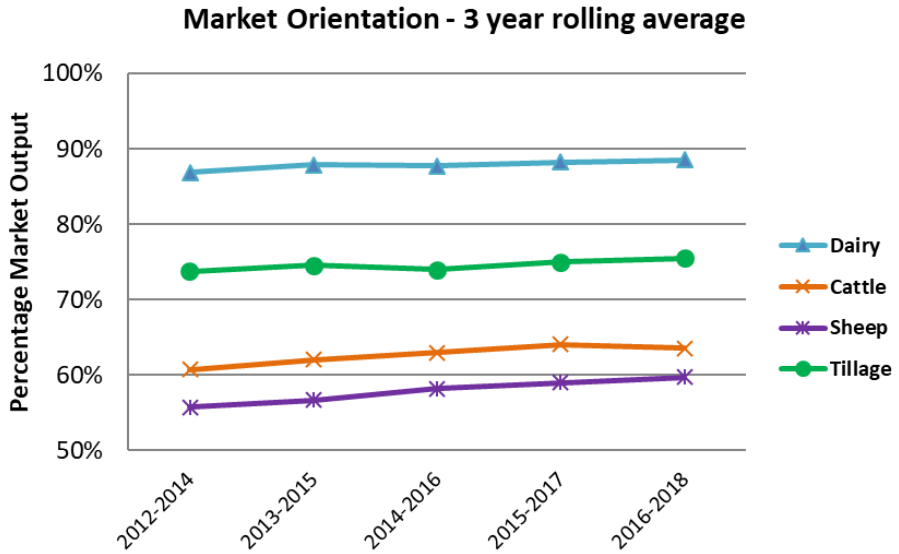
	Dairy	Cattle	Sheep	Tillage	All Farms
Sample No.	311	360	116	71	858
Population Represented	16,146	54,020	14,322	6,879	91,367
Average					
Utilisable Agricultural Area (ha^{-1})	58.9	34.1	47.1	59.2	42.4
Grassland Area (ha^{-1})	57.7	33.6	46.5	23.6	39.1
Tillage Area (ha^{-1})	1.2	0.5	0.6	35.6	3.3
Dairy Cow Livestock Units	79.4	0.0	0.0	0.0	14.0
Cattle Livestock Units	39.8	40.5	20.7	27.2	36.3
Sheep Livestock Units	0.6	1.8	31.5	5.0	6.5
Total Livestock Units	119.8	42.3	52.2	32.2	56.8
Farm Stocking Rate (LU ha^{-1})	2.0	1.3	1.3	0.5	1.4

Presentation of Results - Charts







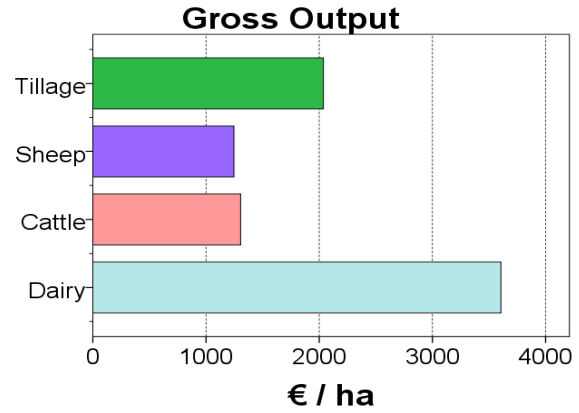


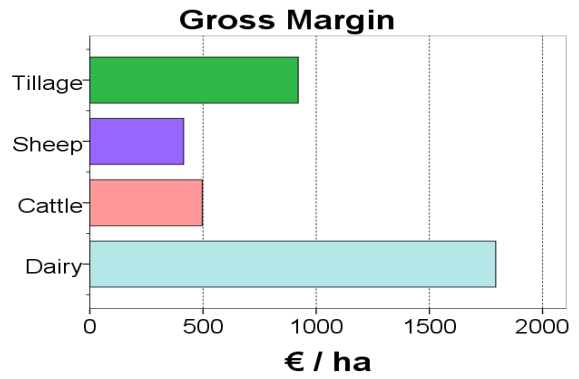
Economic Sustainability

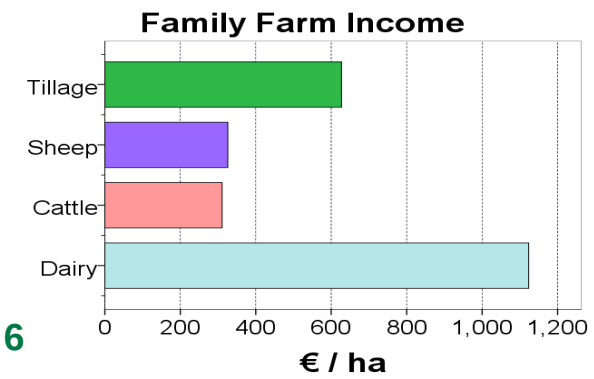
Indicator	Measure	Unit
1. Economic return to land	Gross output per hectare	€ / hectare
2. Profitability of land	Gross margin per hectare	€ / hectare
3. Family Farm Income	Returns to farm family labour, land and capital	€ / hectare
4. Market Orientation	Output derived from market rather than subsidies	%
5. Economic Viability	Economic viability of farm business – Minimum wage for labour & 5% return on non-land based assets	1=viable 0=not viable
6. Productivity of labour	Family Farm Income per unpaid labour unit	€ / unpaid labour unit

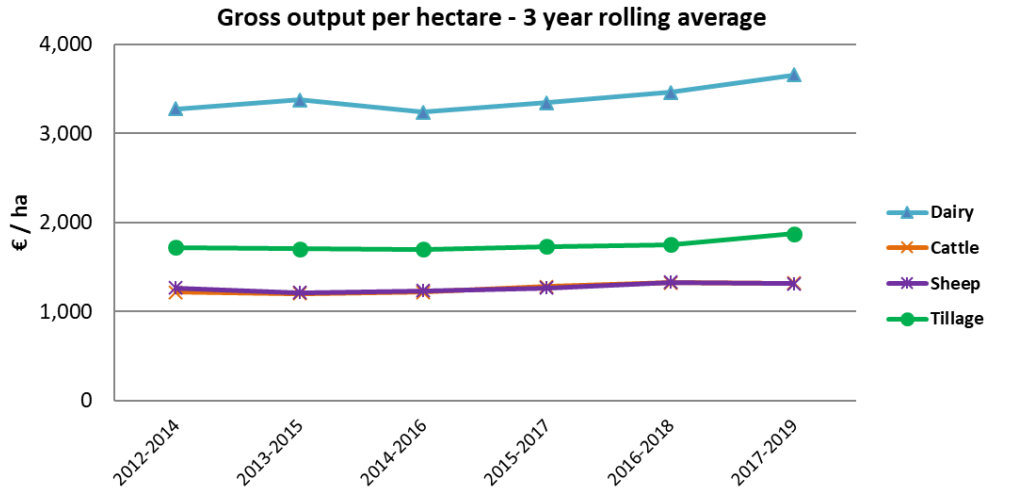
Economic Sustainability

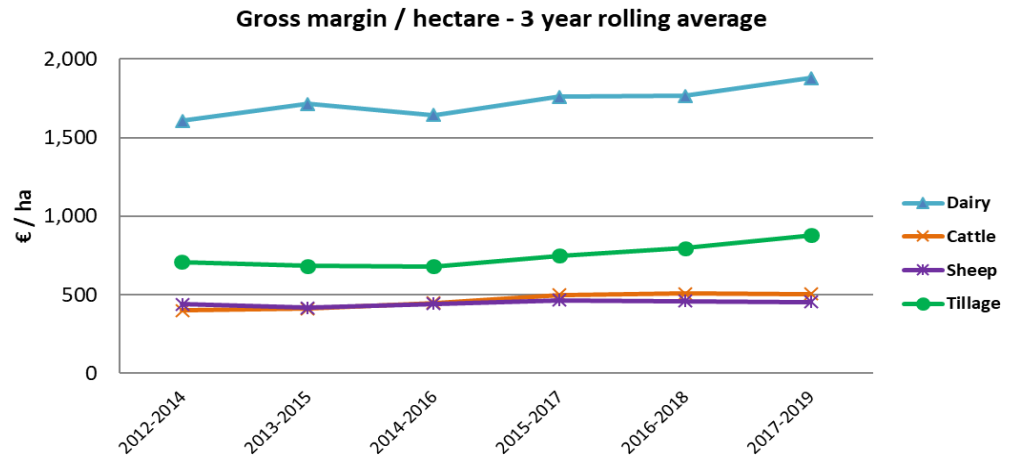
2019 Results

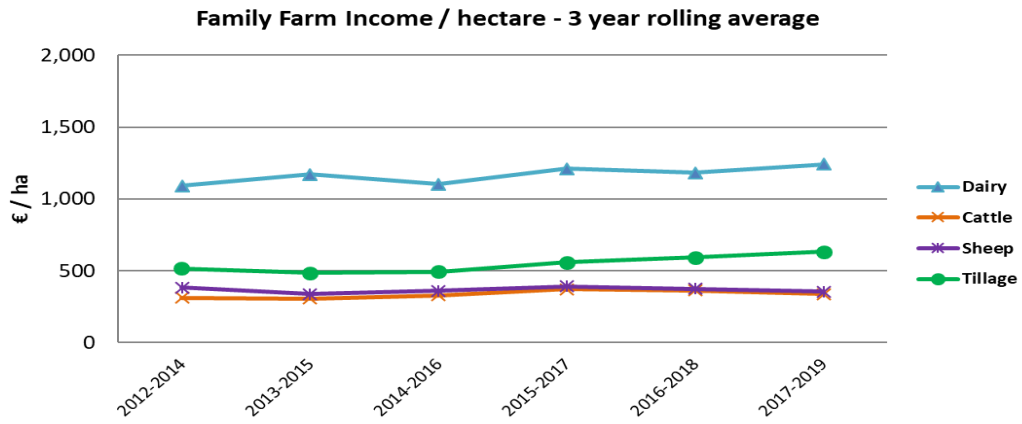






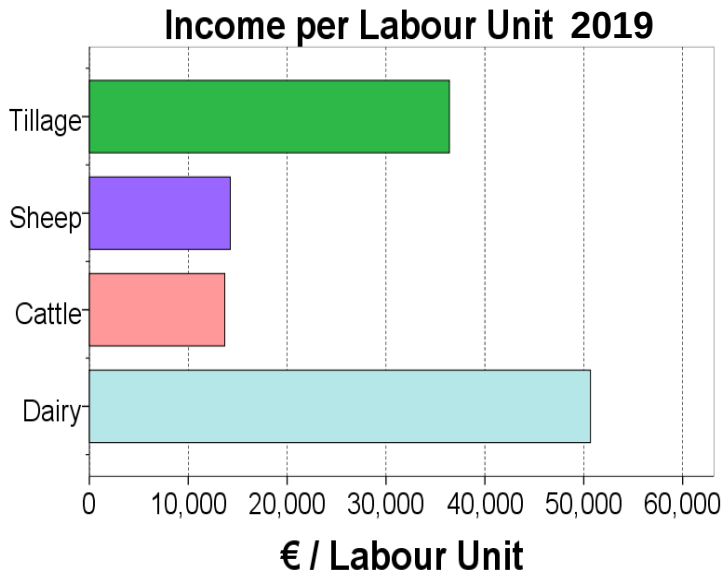


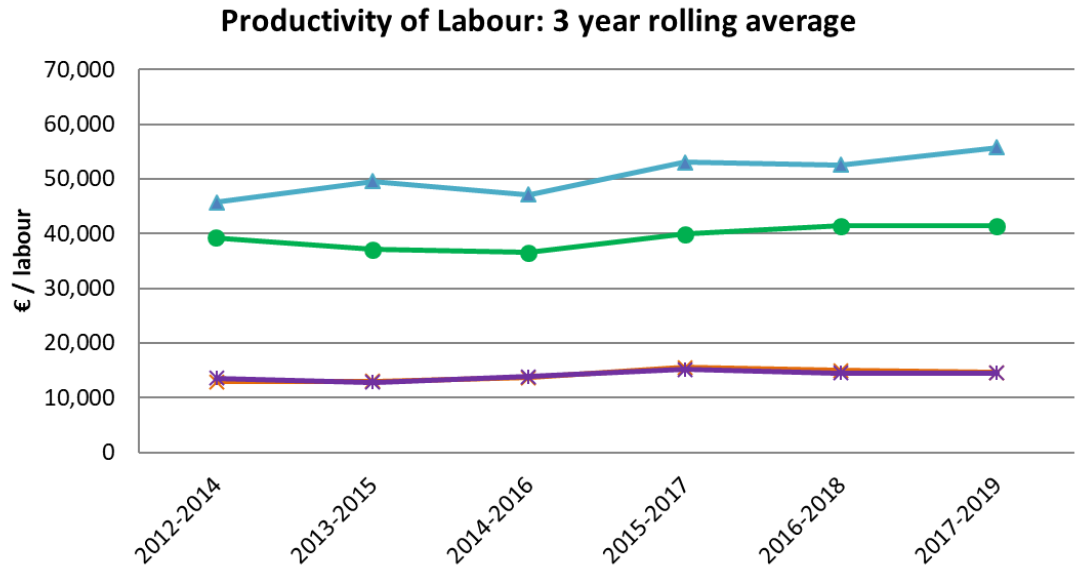


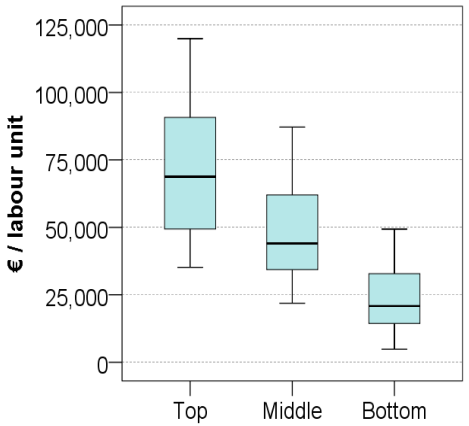


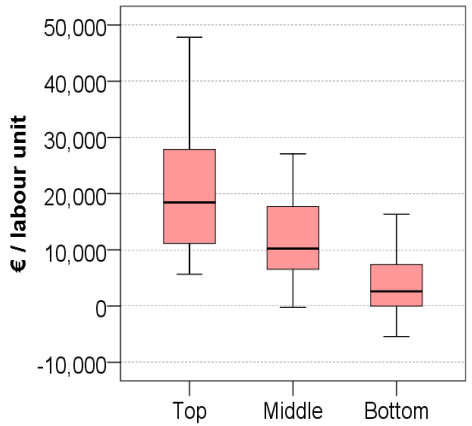
Economic Sustainability

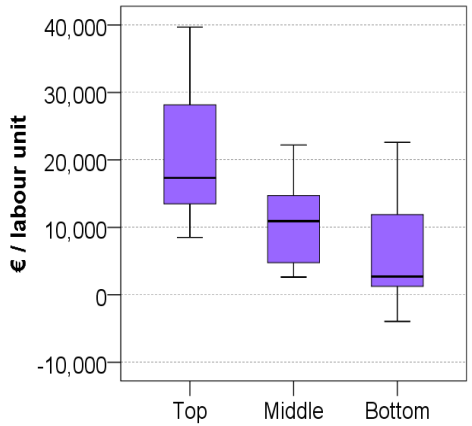
Indicator	Measure	Unit
Productivity of Labour	Family Farm Income per unpaid labour unit	€ / unpaid labour unit

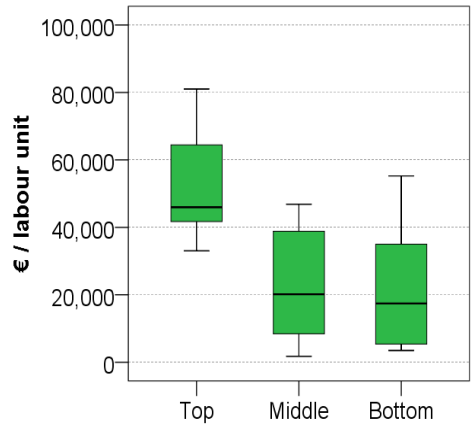






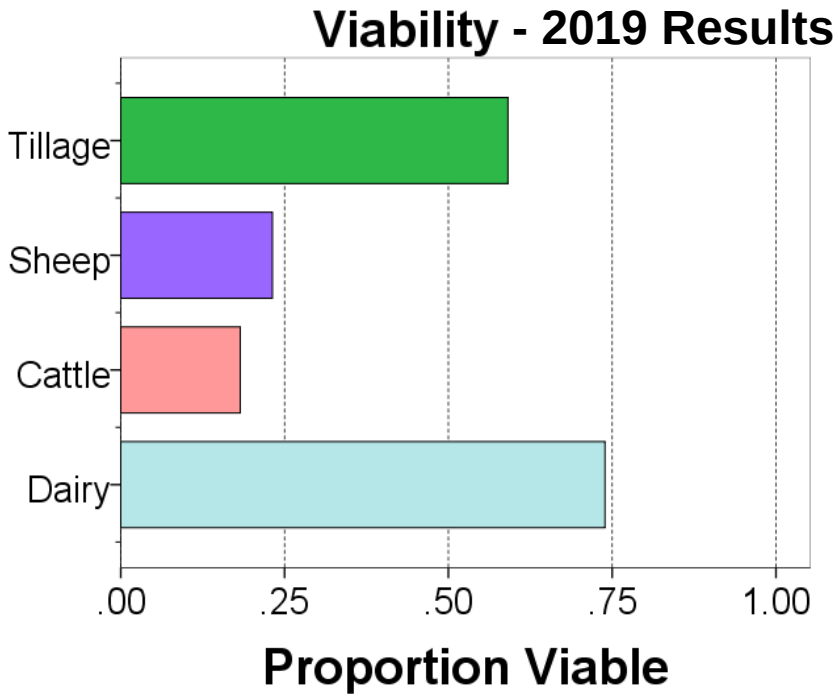


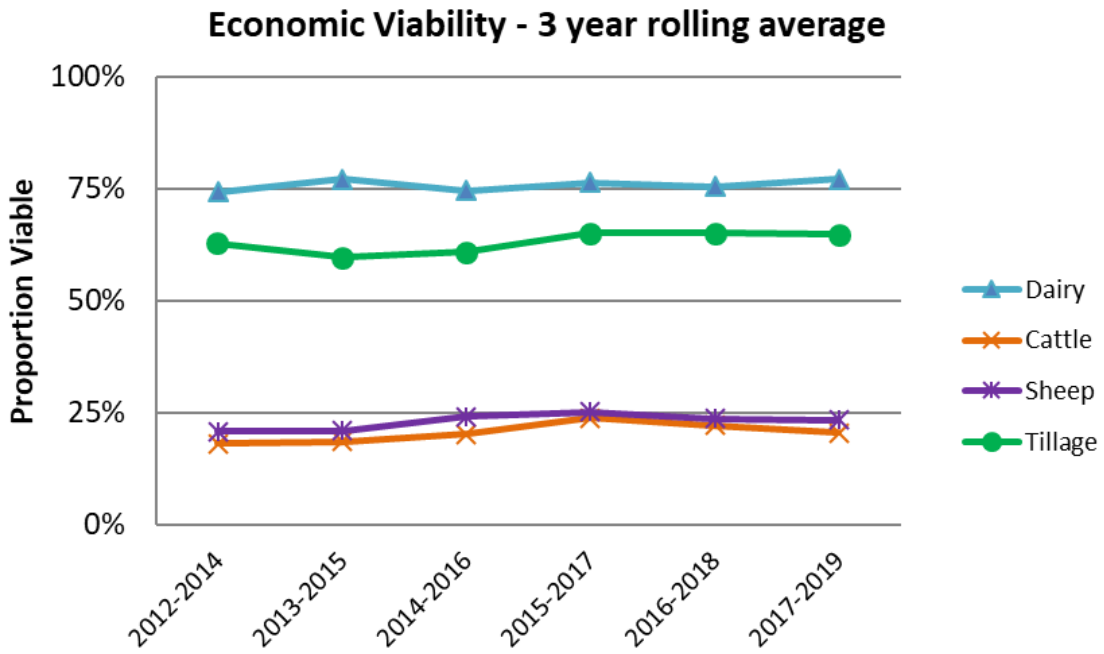




Economic Sustainability

Indicator	Measure	Unit
Economic Viability	Economic viability of farm business – Min wage for labour & 5% return on non-land based assets	1=viable 0=not viable



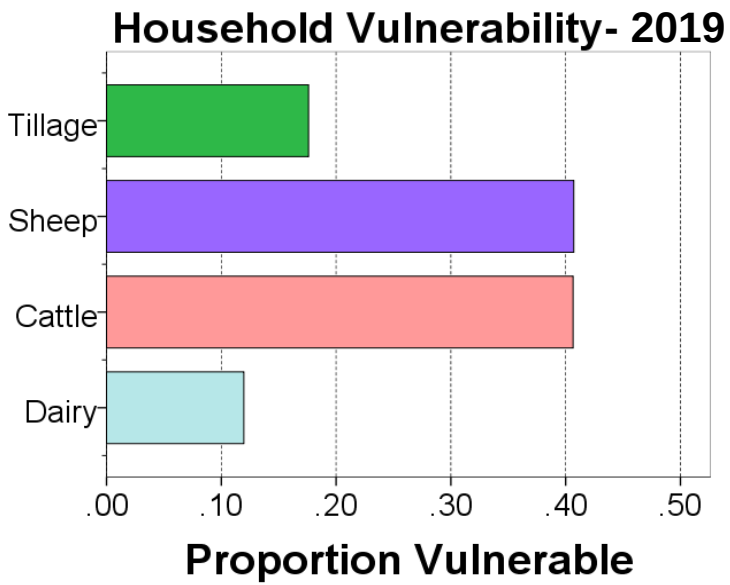


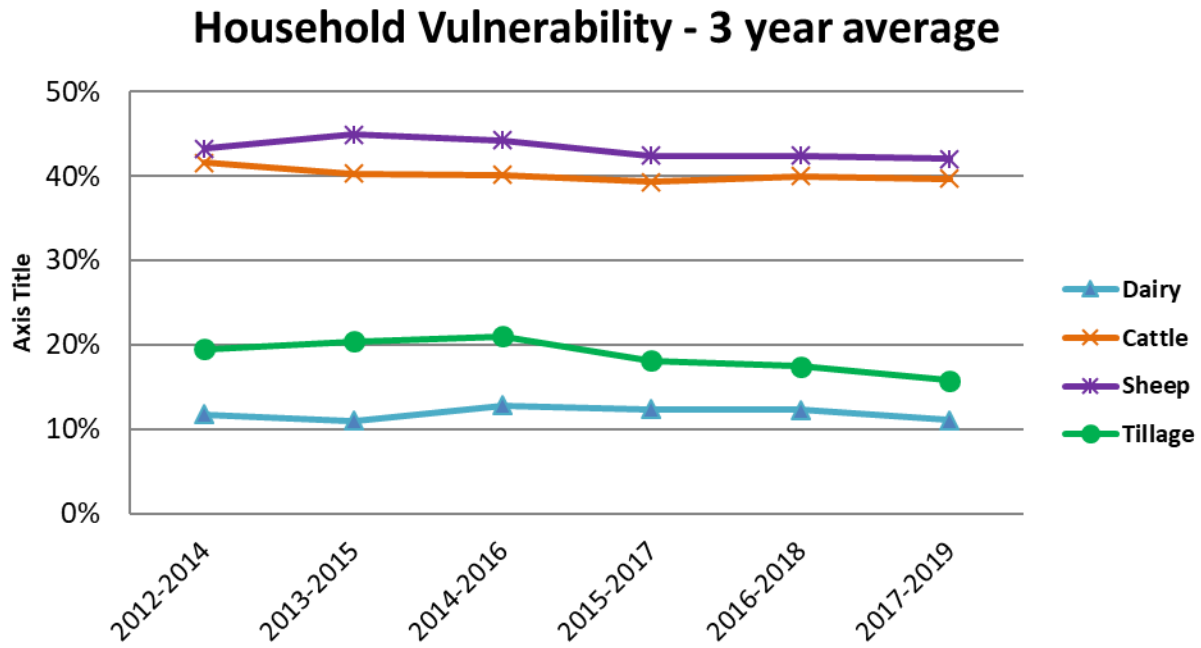
Social Sustainability

Indicator	Measure	Unit
1. Household vulnerability	Farm business is not viable and no off-farm employment	Binary variable, 1= vulnerable
2. Isolation Risk	Farmer lives alone	Binary variable 1=isolated
3. High Age Profile	Farmer is over 60 years old & no members of household under 45	Binary variable 1=high age
4. Agricultural education	Formal agricultural training received	Binary variable 1= agricultural training received
5. Hours worked on the farm	Work load on farm** (Off-farm work hours not included)	Hours worked on the farm

Social Sustainability

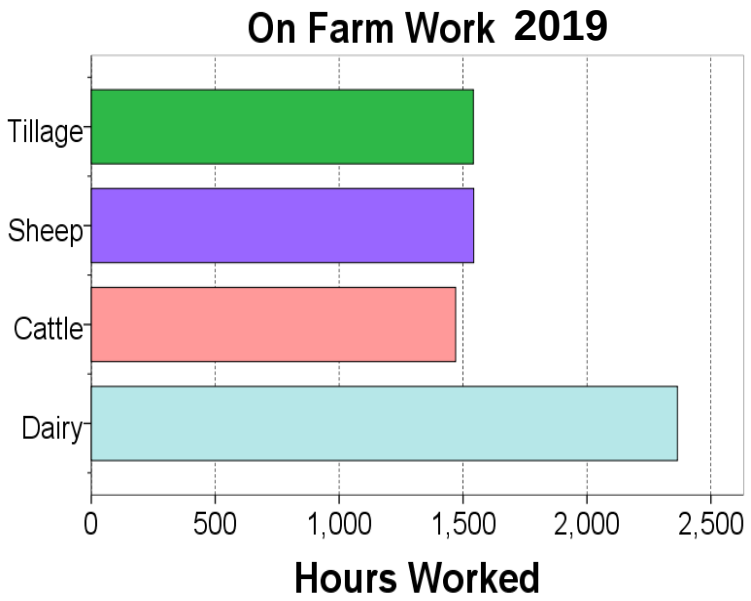
Indicator	Measure	Unit
Household vulnerability	Farm business is not viable & no off-farm employment	Binary variable 1= vulnerable 0=Non vulnerable

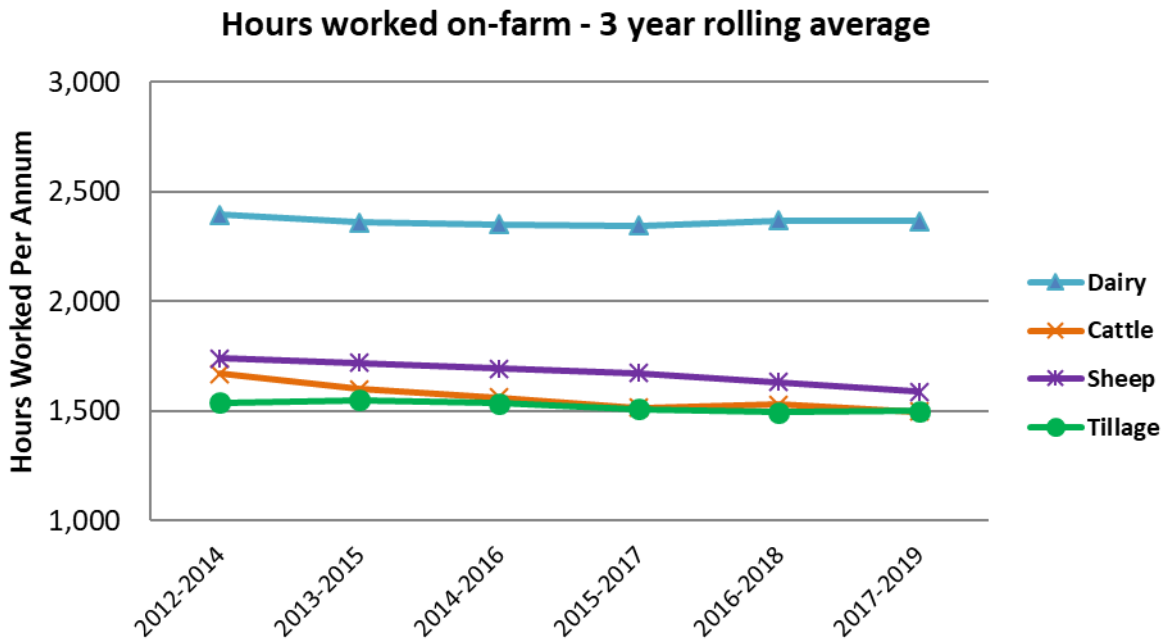




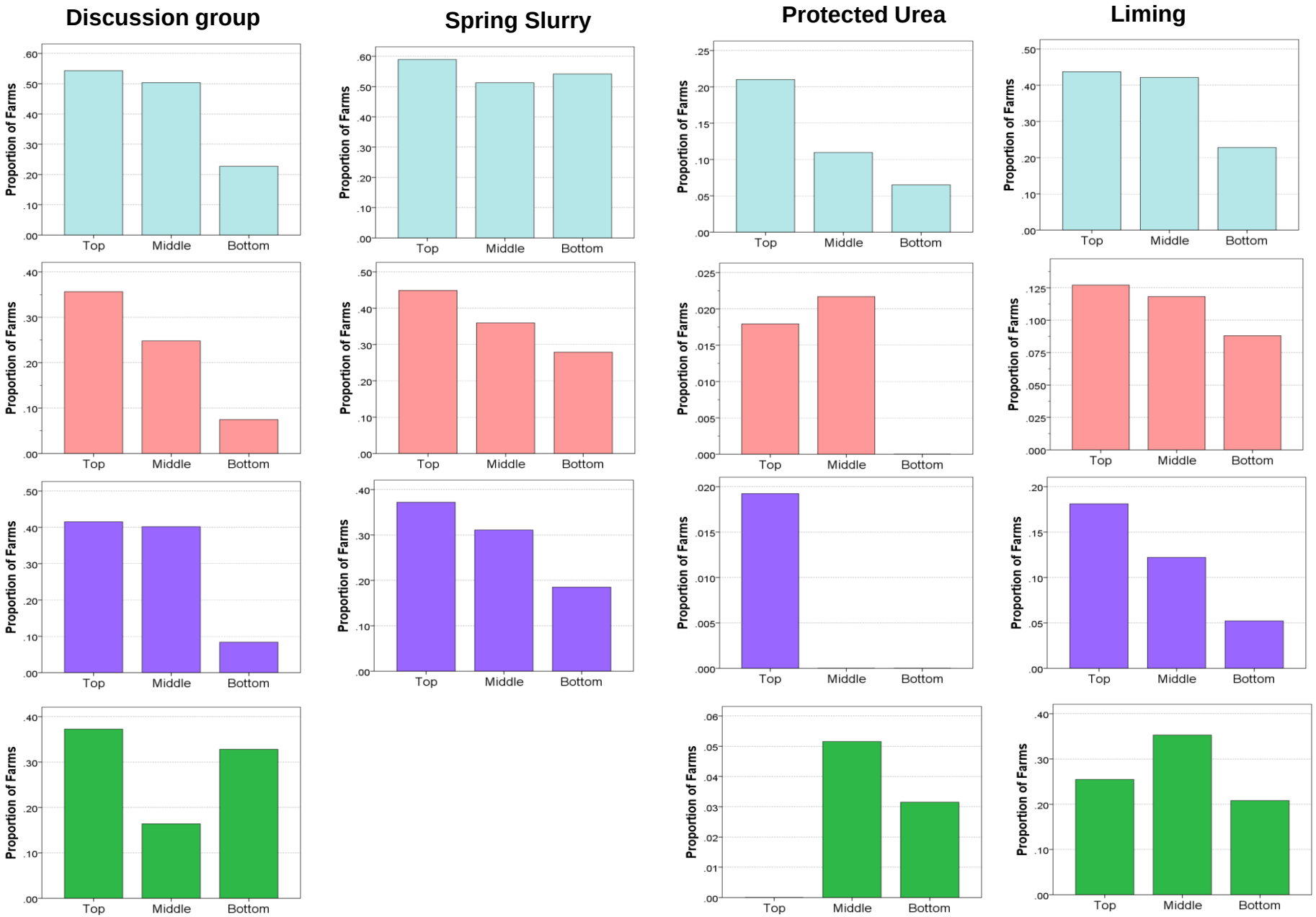
Social Sustainability

Indicator	Measure	Unit
Hours worked on farm	Work load on farm (Off-farm work hours not included)	Hours worked on the farm





Innovation - 2019

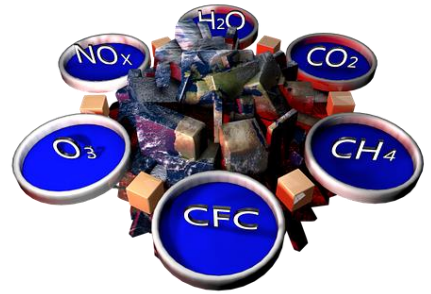


Environmental Sustainability

1. Gaseous Emissions
   - Greenhouse Gases
   - Ammonia

2. Risk to water quality
   - Use of nitrogen & phosphorus

3. Biodiversity Indicator
   - In development

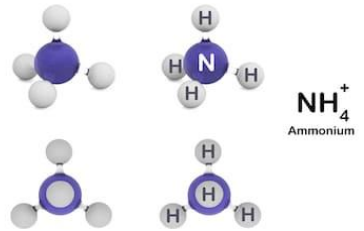


Overview of Environmental Indicators

Indicator	*Measure*	*Unit*
Ag. GHG emissions per farm	GHG emissions	Tonnes CO_2 equivalent / farm
Ag. GHG emissions per hectare	GHG emissions per hectare	Tonnes CO_2 equivalent / hectare
Ag. GHG emissions per kg of output	GHG emissions efficiency	kg CO_2 equivalent / kg output *AND* kg CO_2 e / € output
Energy GHG emissions per farm	Farm GHG energy use efficiency	kg CO_2 equivalent / kg output
Energy emissions per kg of output	Energy GHG emissions efficiency	kg CO_2 equivalent / kg output *AND* kg CO_2 e / € output
NH_3 emissions per farm	NH_3 emissions	Tonnes NH_3 equivalent / farm
NH_3 emissions per hectare	NH_3 emissions per hectare	Tonnes NH_3 equivalent / hectare
NH_3 emissions per kg of output	NH_3 emissions efficiency	kg NH_3 equivalent / kg output *AND* kg NH_3 / € output
N balance	N transfer risk	kg N surplus / ha^{-1}
N use efficiency	N retention efficiency	% N outputs / N inputs
N surplus per kg of output	N emissions efficiency	kg N surplus / kg output
P balance	P transfer risk	kg P surplus / ha^{-1}
P use efficiency	P retention efficiency	% P outputs / P inputs

Methodological approach

- Activity data from Teagasc National Farm Survey
- GHG - All in common currency of CO_2 equivalence
  1. IPCC national inventory approach for all farm types (Dillon et al., 2016, Ryan et al., 2017)
  2. Life Cycle Analysis (LCA) for Dairy (O'Brien et al, 2014)
- Ammonia
  - » National inventories approach for all farms
- Nitrogen / Phosphorus
  - » Farm gate input/output approach (Buckley et al., 2015; 2016a; 2016b)

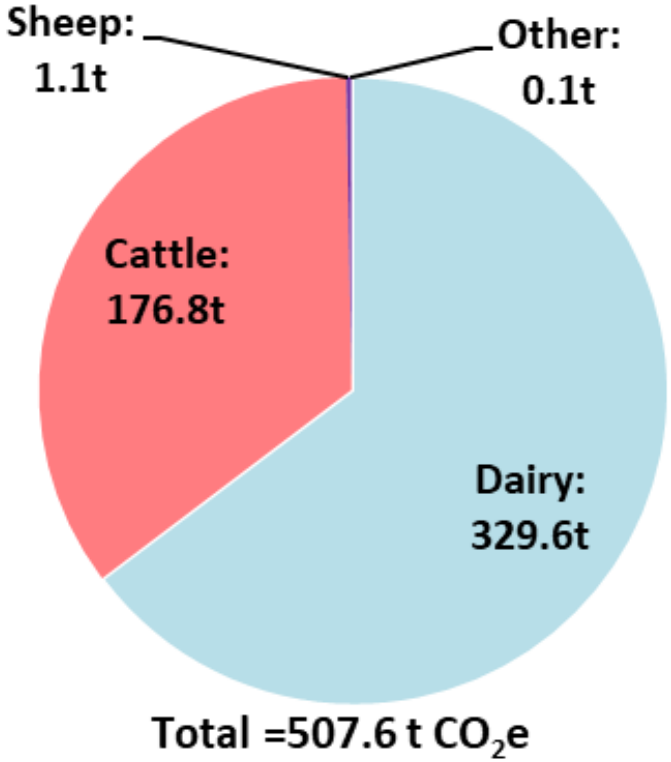


Environmental Sustainability – GHG Emissions

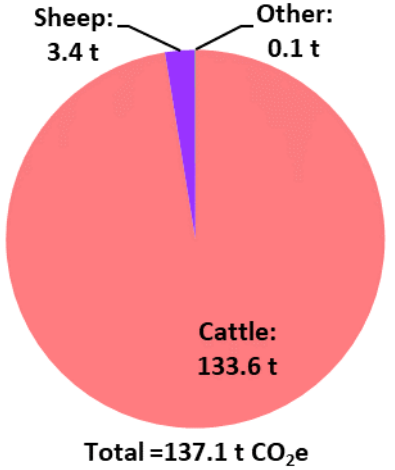
Ag GHG emissions	Measure	Unit
per farm*	Absolute Ag. GHG emissions (IPCC methodology)	Tonnes CO_2 equivalent/farm
per hectare*	Ag. GHG emissions per hectare farmed (IPCC methodology)	kg CO_2 equivalent / hectare
per kg of output*	Ag. GHG emissions efficiency (IPCC methodology)	kg CO_2 equivalent / kg output
per € output*	Ag. GHG emissions efficiency (IPCC methodology)	kg CO_2 equivalent / € output

* Methodological update from previous report

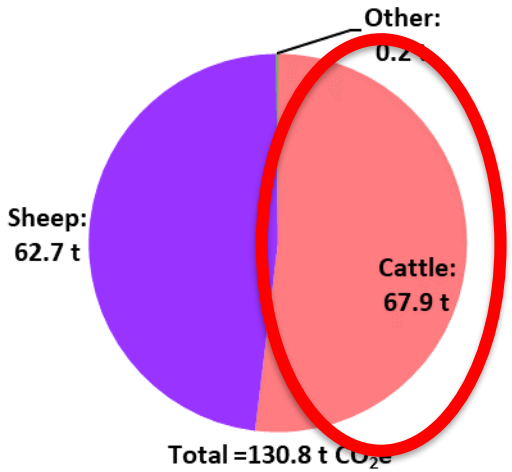
Farm level Ag. GHG Emissions - Dairy Farms 2019



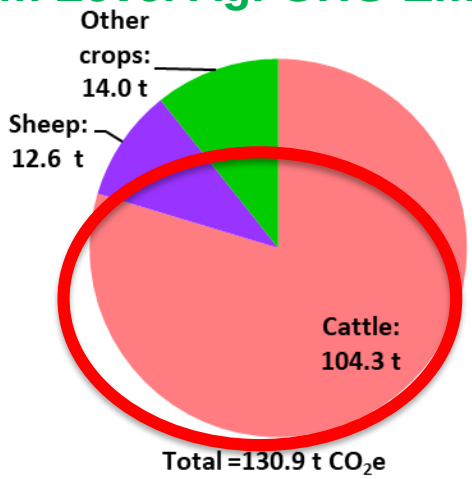
Farm level Ag. GHG Emissions - Cattle Farms 2019

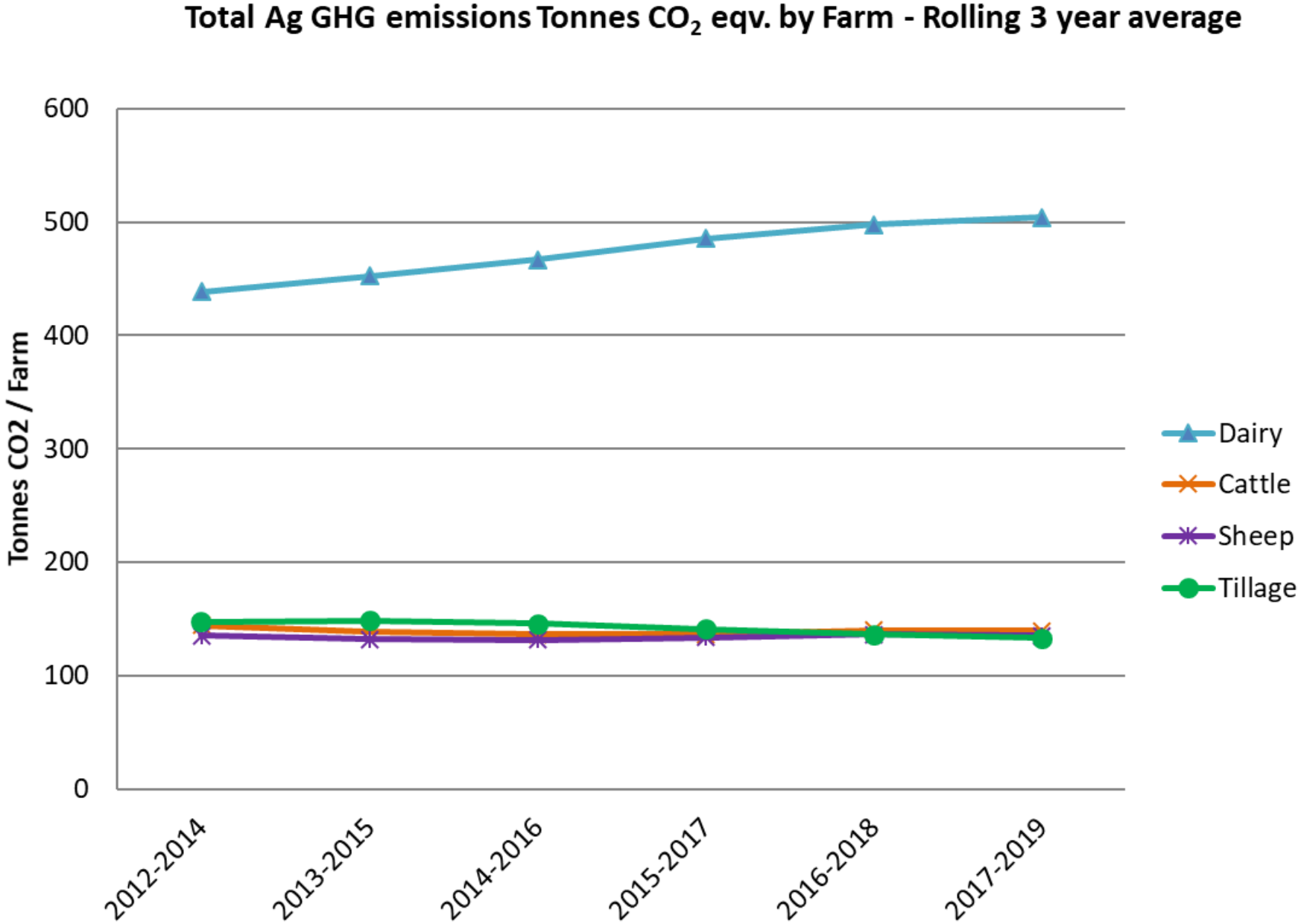


Farm level Ag. GHG Emissions - Sheep Farms 2019

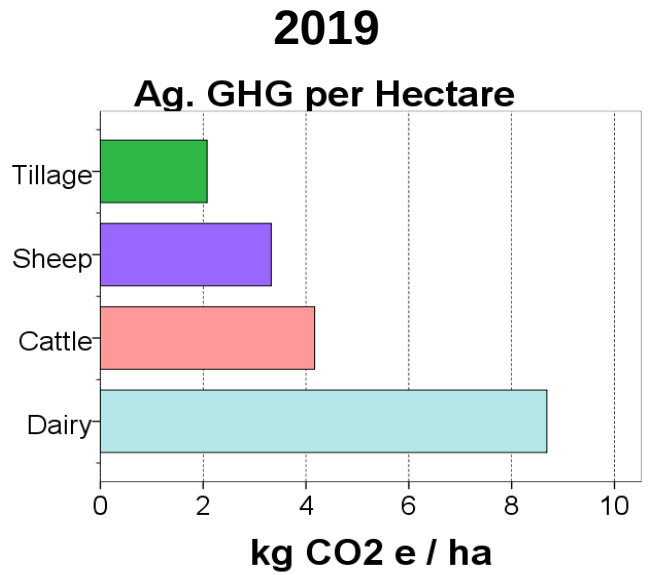


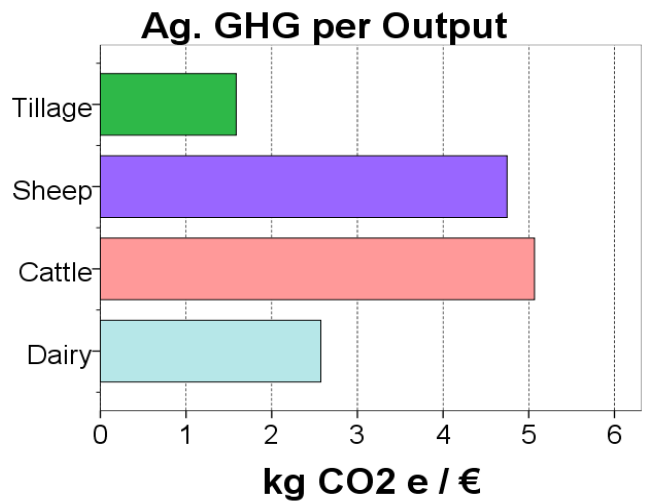
Farm Level Ag. GHG Emissions - Tillage Farms 2019

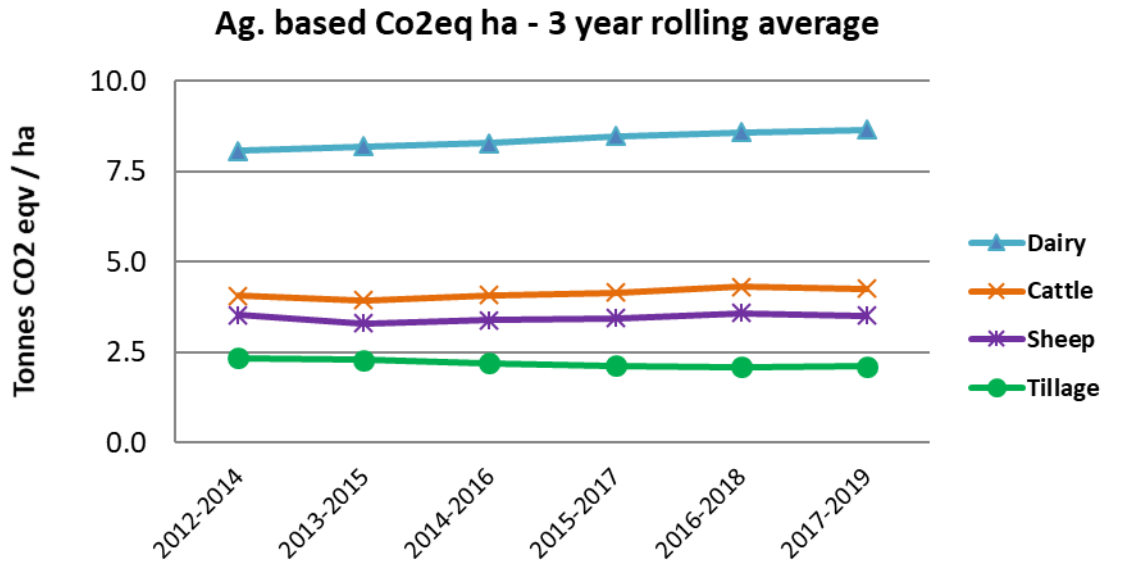


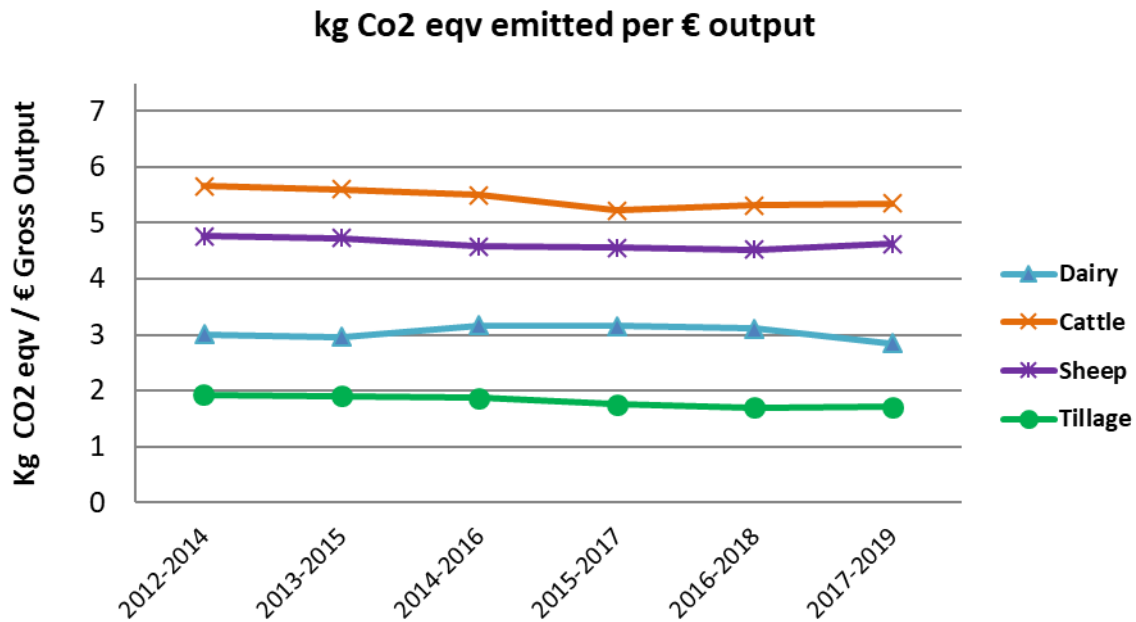


Absolute & Emissions Intensity – Ag. GHG









Dairy based Ag. GHG emissions - Components

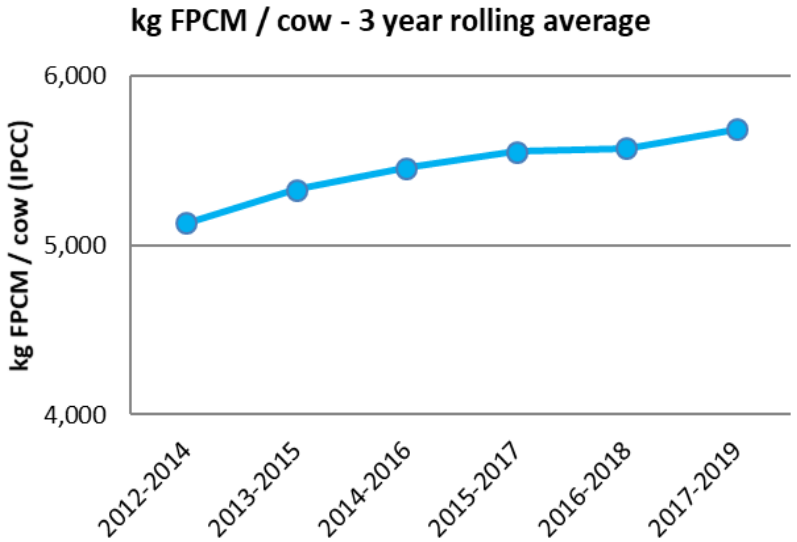
Dairy absolute GHG emissions equation = 3 Components

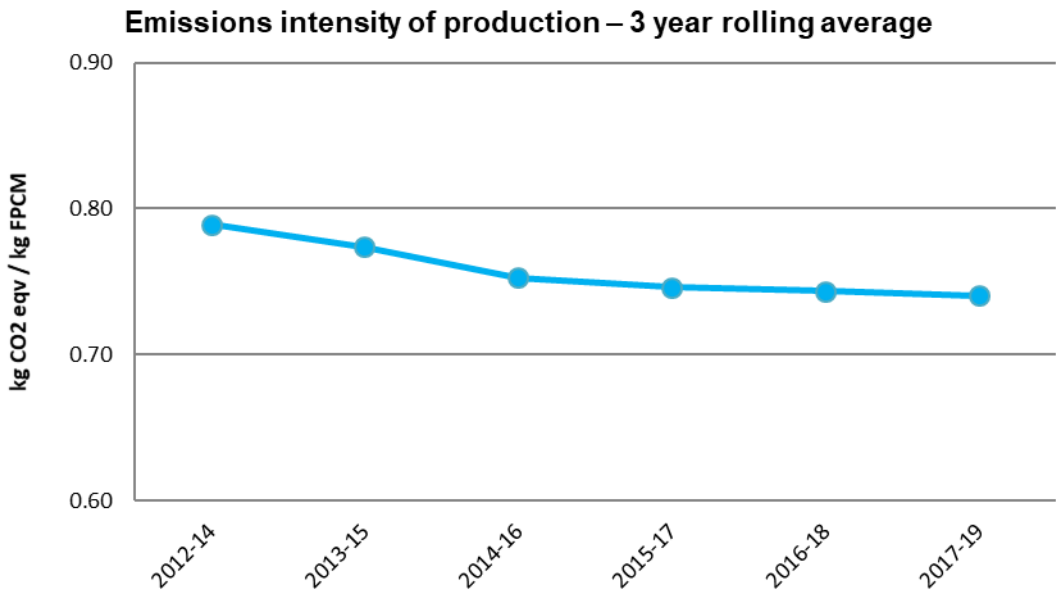
(1) kg of milk produced per cow *

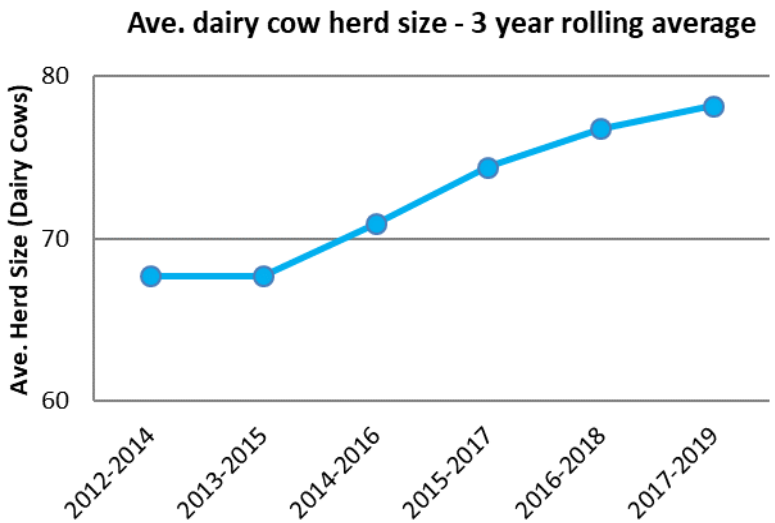
(2) CO_2e per kg of milk *

(3) No. of cows

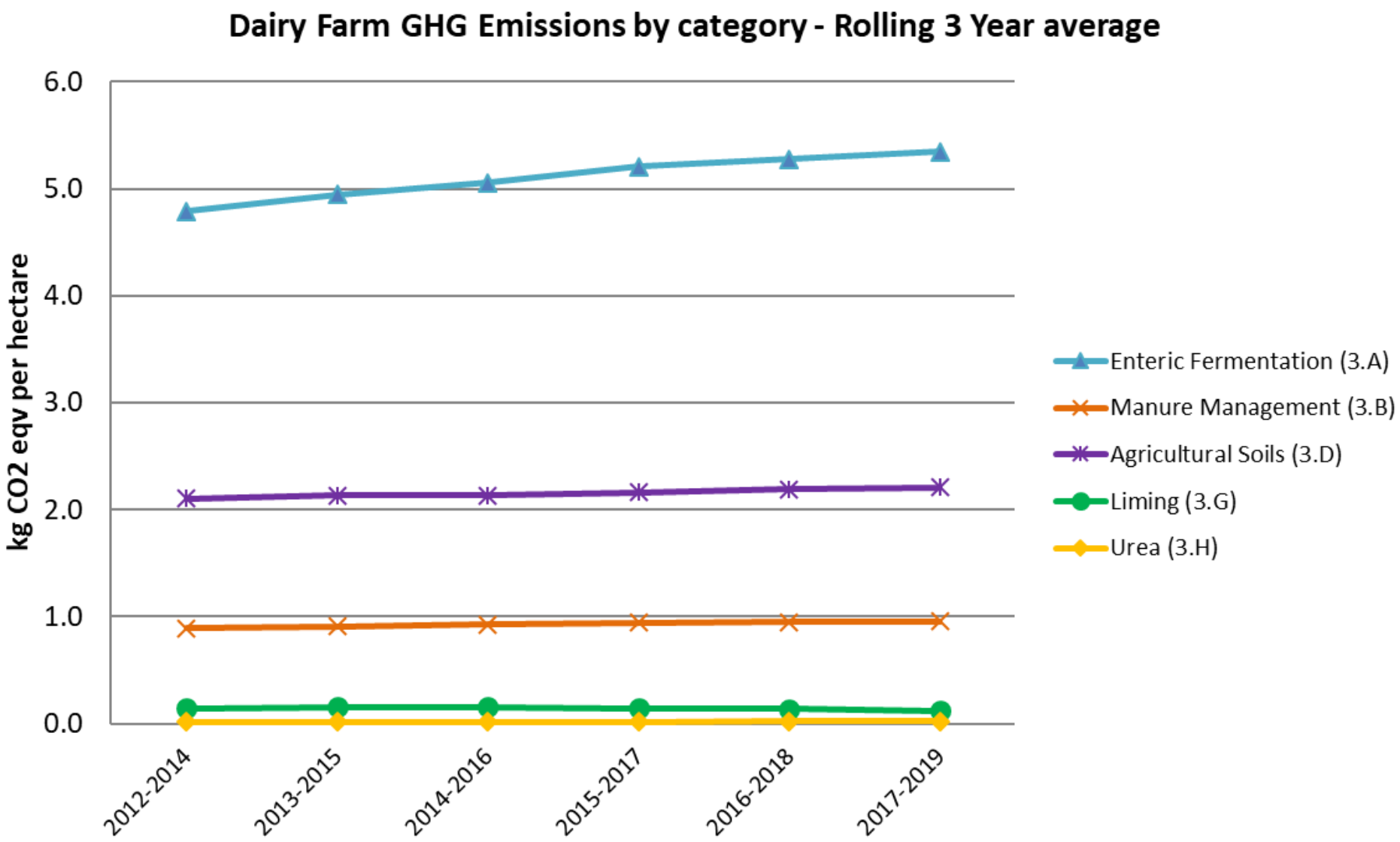
- Kg of Fat & Protein Corrected Milk (FPCM) milk = Standardized to 4% fat and 3.3% protein.







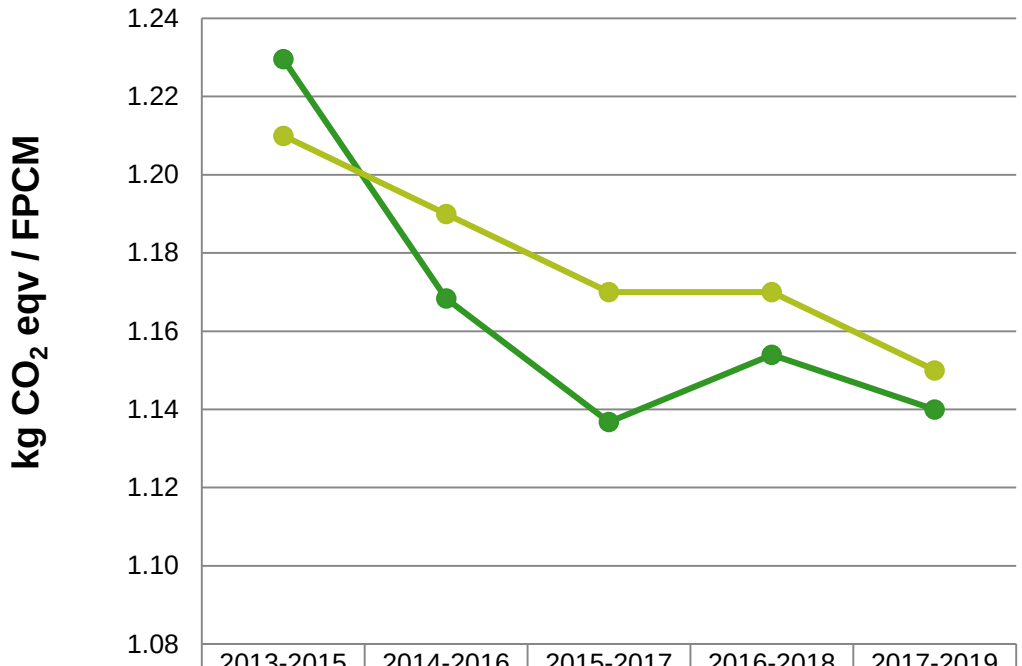
Dairy based Ag. GHG emissions - Components



Carbon Footprint of Milk Production

National Cross Validation of LCA Approach (O'Brien et al., 2014)

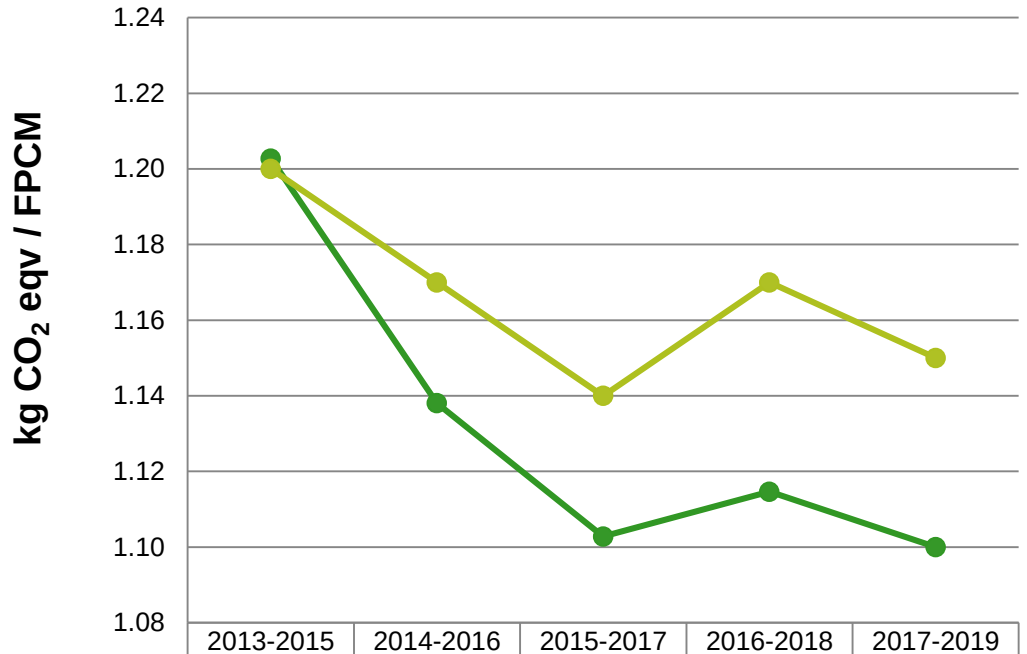
Farm Average



	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
Teagasc NFS	1.23	1.17	1.14	1.15	1.14
Bord Bia SDAS*	1.21	1.19	1.17	1.17	1.15

*Preliminary results for 2019

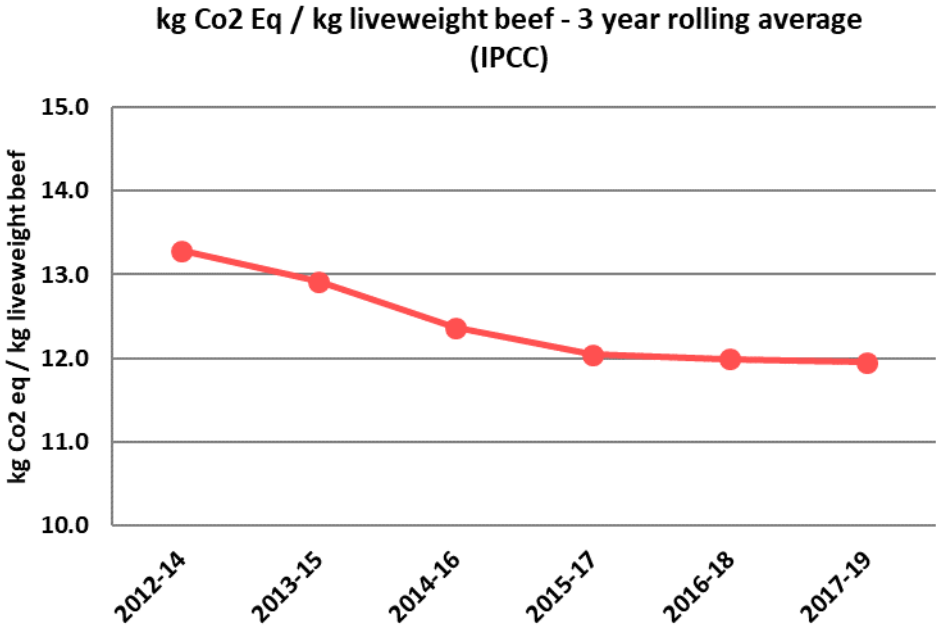
Aggregate average – Milk supply weighted

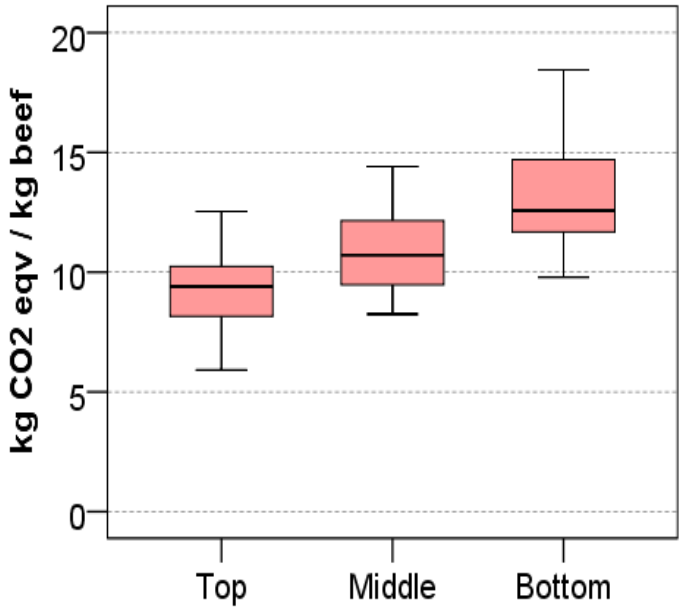


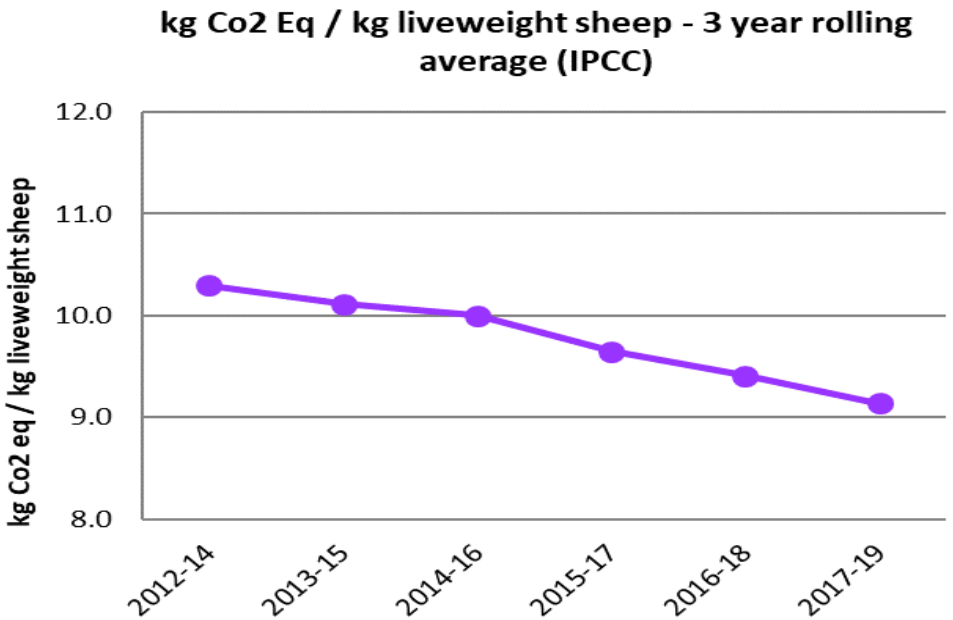
	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
Teagasc NFS	1.20	1.14	1.10	1.11	1.10
Bord Bia SDAS*	1.20	1.17	1.14	1.17	1.15

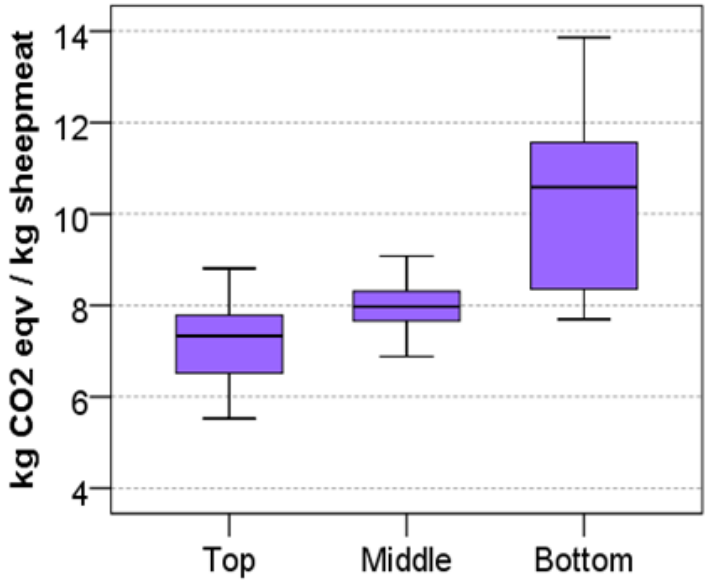
*Preliminary results for 2019

Ag. Emissions intensity – Cattle & Sheep





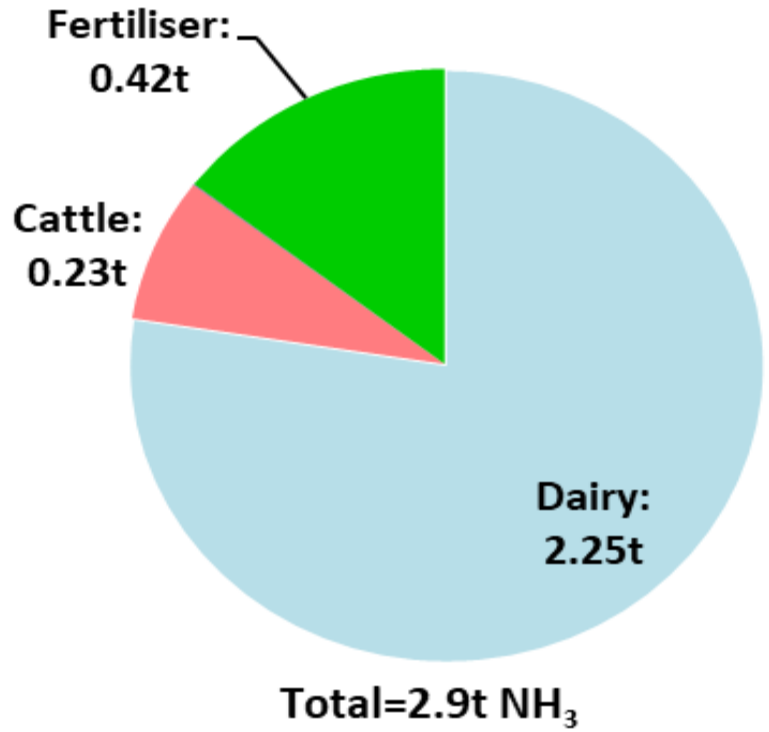




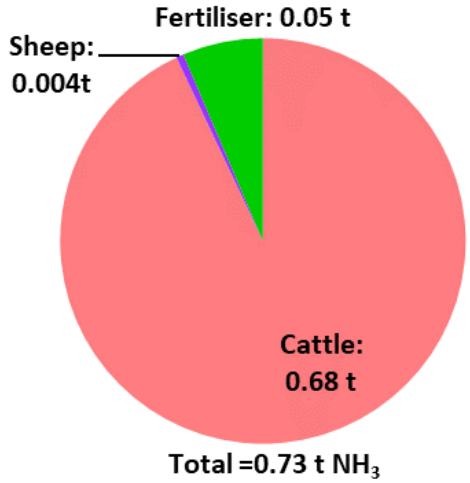
Ammonia Emissions

Ammonia emissions Indicators	Measure	Unit
per farm	NH_3 emissions	Tonnes NH_3 equivalent / farm
per hectare	NH_3 emissions per hectare farmed	kg NH_3 equivalent / hectare
per kg of output	NH3 emissions efficiency on a kg of product basis	kg NH3 / kg output
per € of output	NH_3 emissions efficiency on a Euro of output generated basis	kg NH_3 / € output

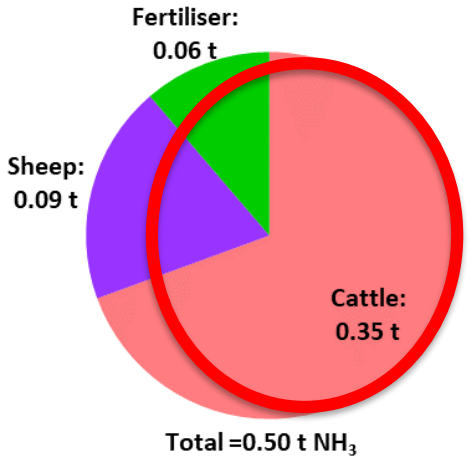
Farm level NH_3 Emissions - Dairy Farms 2019



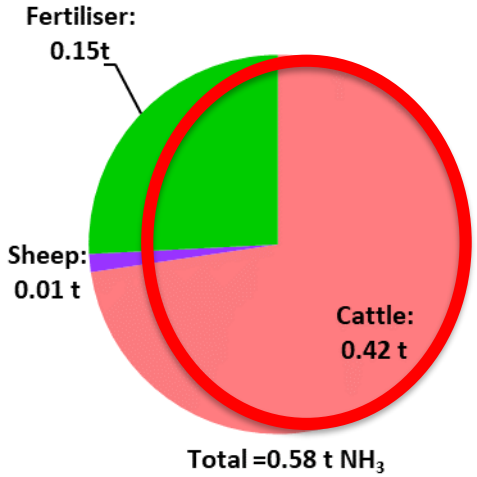
Farm level NH_3 Emissions - Cattle Farms 2019

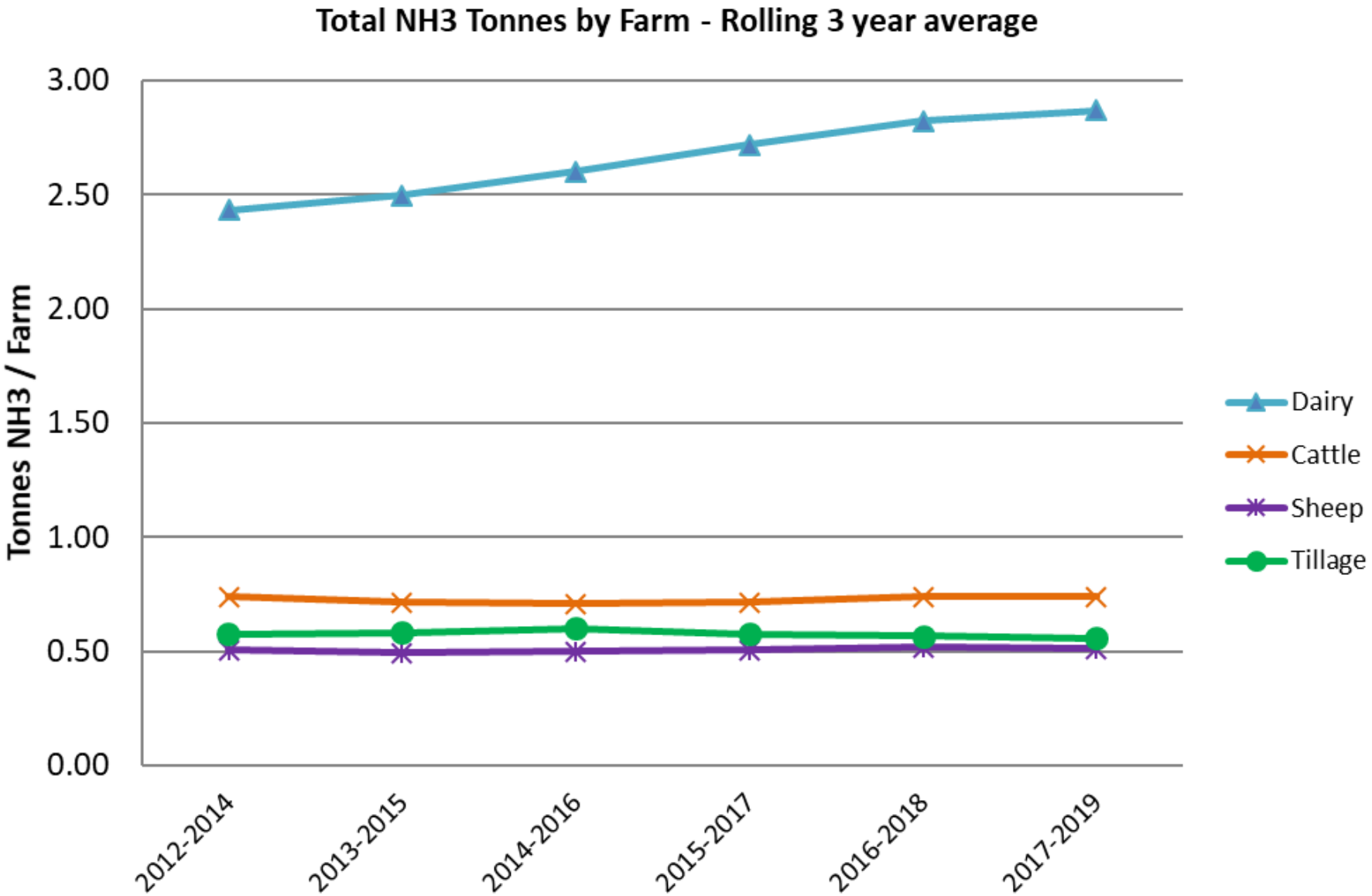


Farm level NH_3 Emissions - Sheep Farms 2019

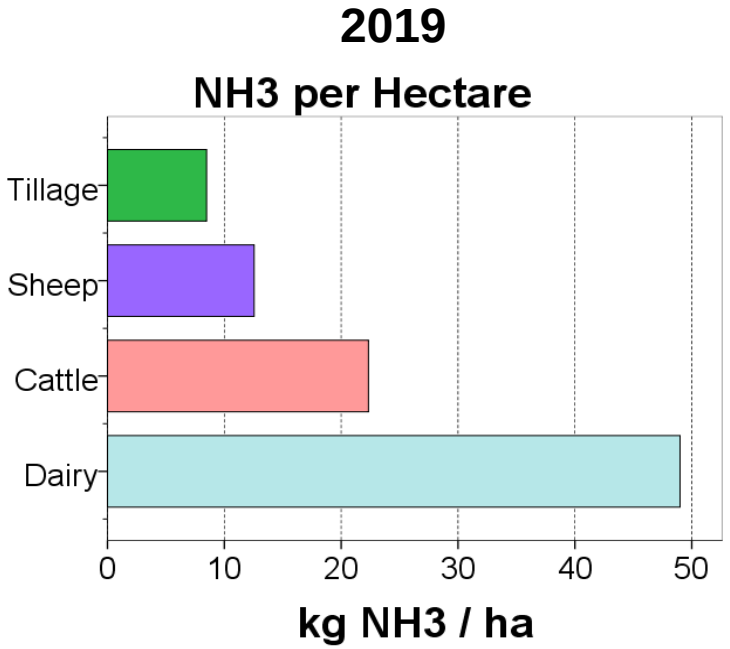


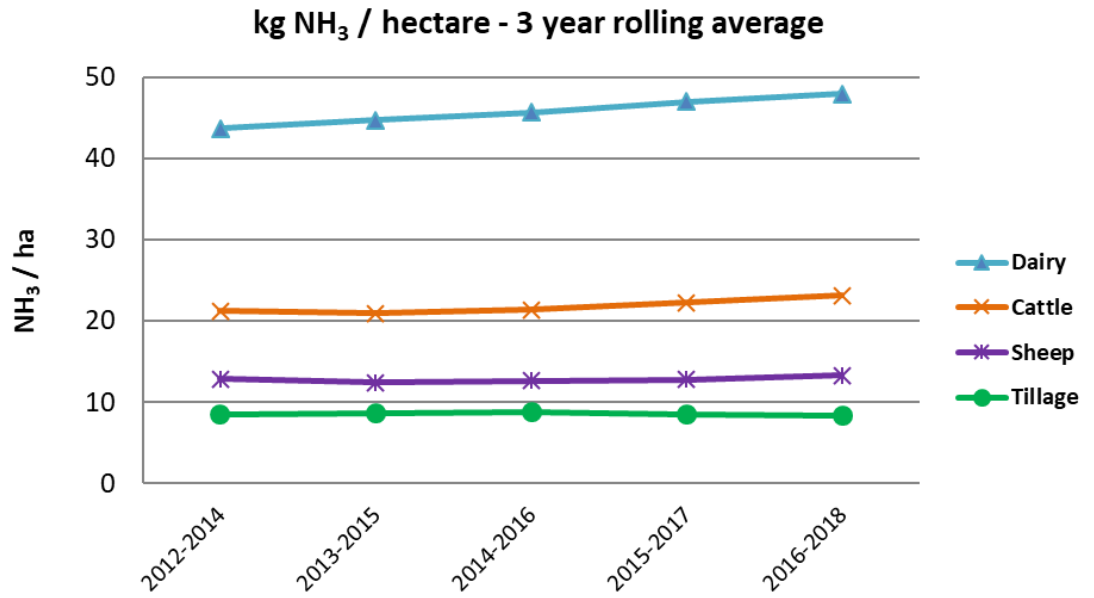
Farm level NH_3 Emissions - Tillage Farms 2019

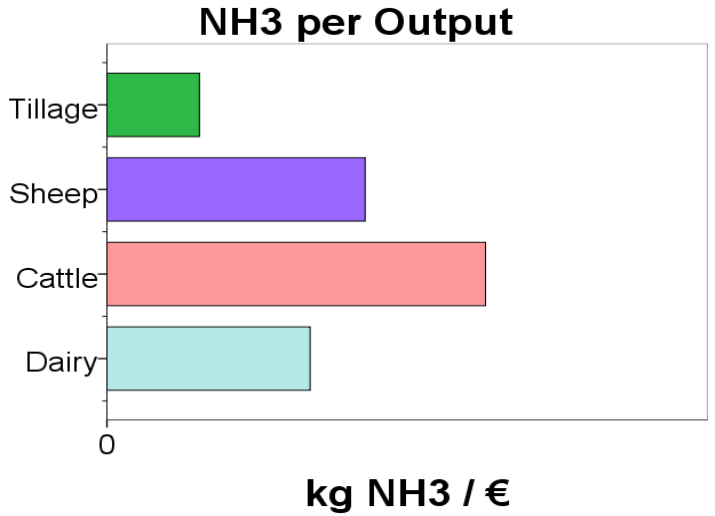


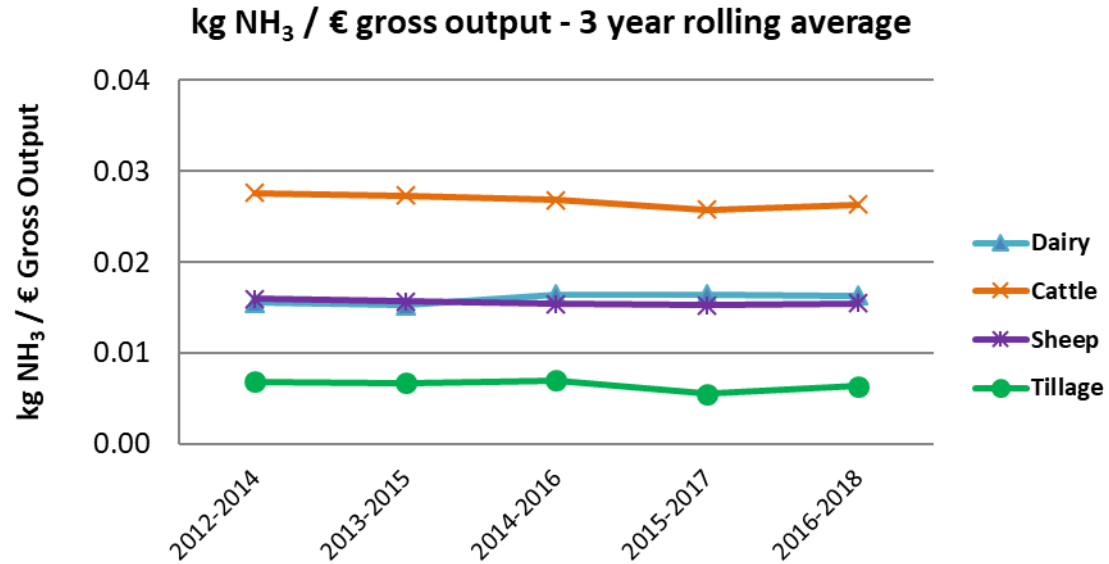


Absolute & Emissions Intensity – NH_3



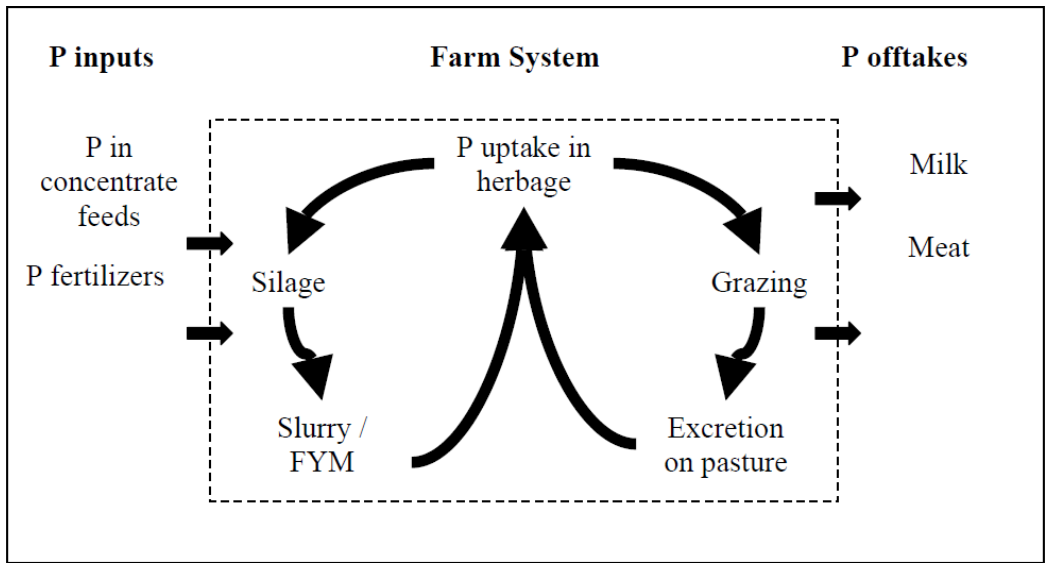






Environmental Sustainability – Risk to Water Quality

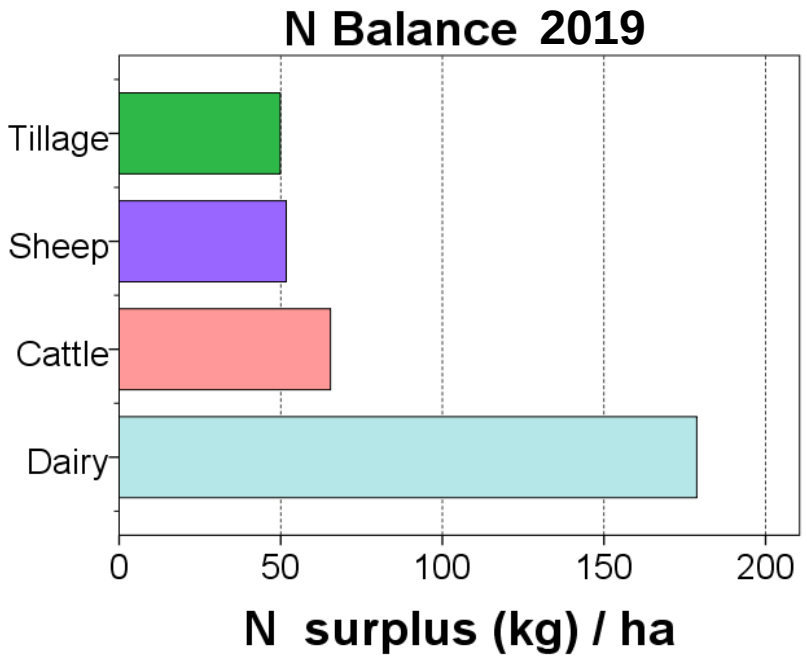
Indicator	*Measure*	*Unit*
Nitrogen (N) balance	N loss risk (Farm gate level)	kg N surplus/hectare
Phosphorus (P) balance	P loss risk (Farm gate level)	kg P surplus/hectare
Nitrogen (N) use efficiency	N application efficiency	% N outputs / N inputs
Phosphorus (P) use efficiency	P application efficiency	% P outputs / P inputs
N surplus per kg of output	N emissions efficiency	kg output / kg N surplus

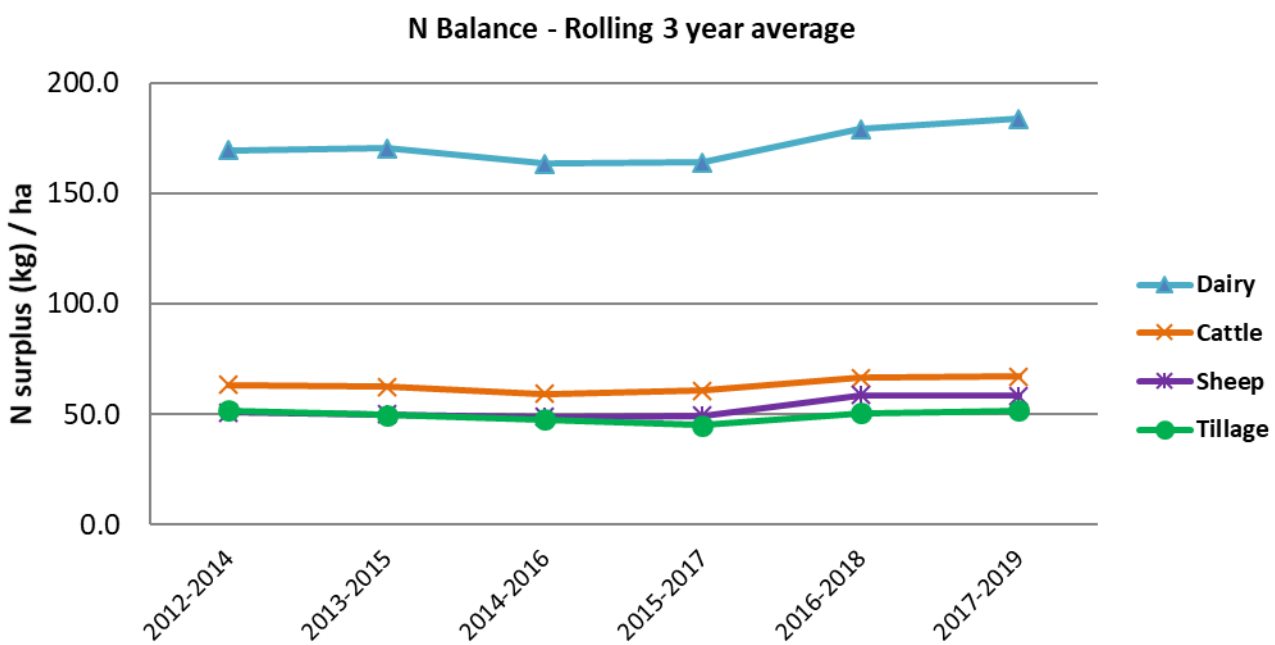


Source: Lalor and Coulter 2009

Nitrogen Balance

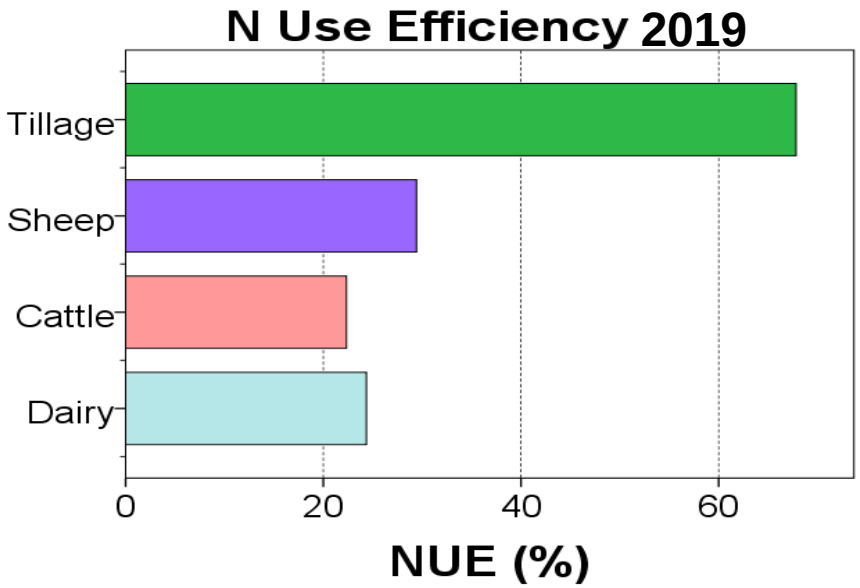
- N inputs – N outputs (farm-gate level), per hectare basis

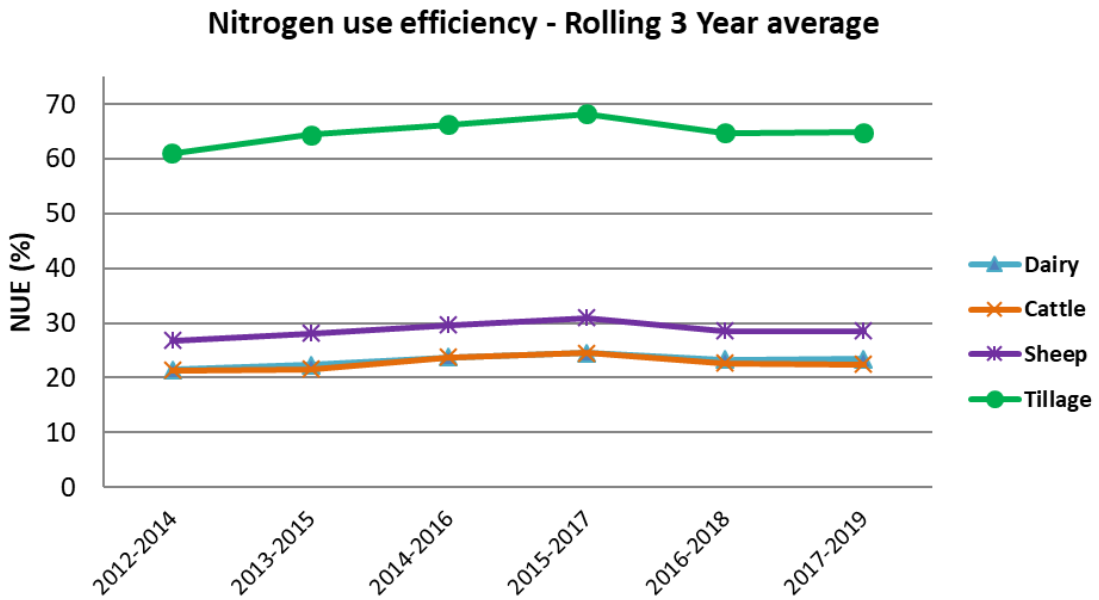




Nitrogen use efficiency

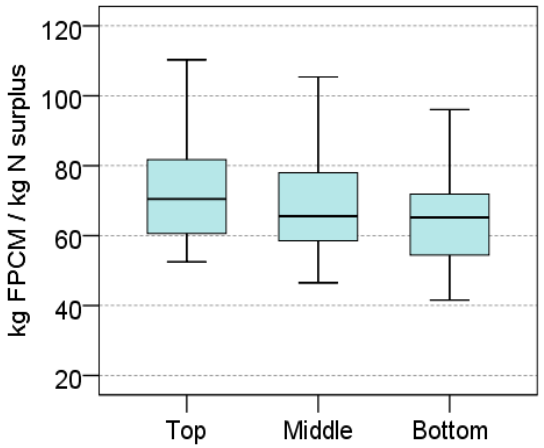
- Retention of N in farm system in % terms

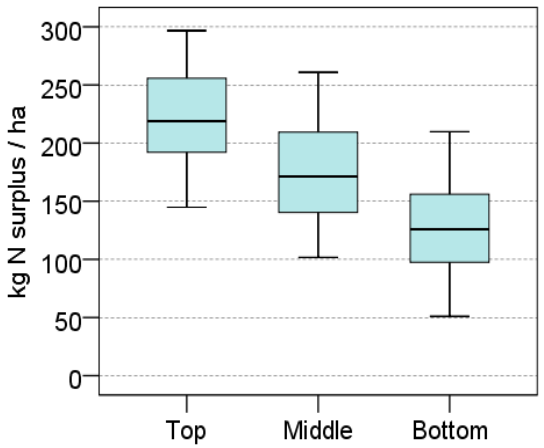




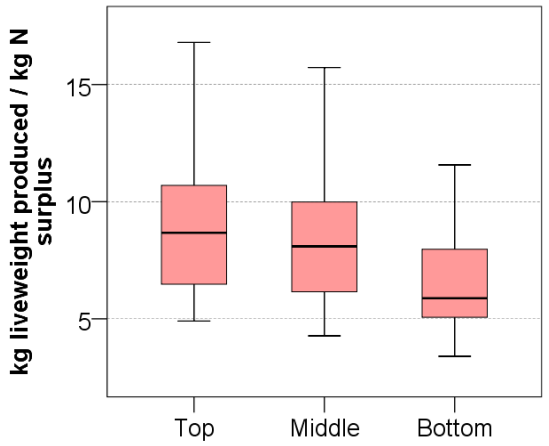
Emissions intensity vs Absolute Emissions

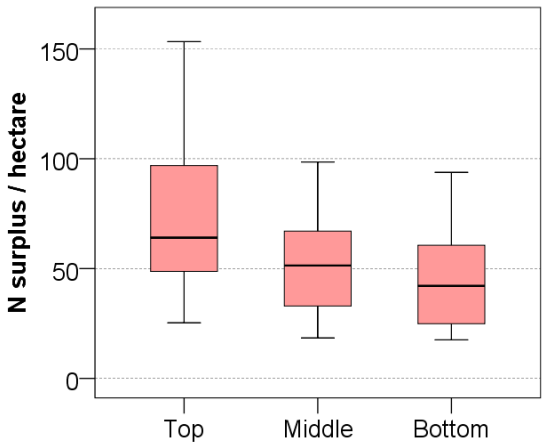
Dairy farms - 2019



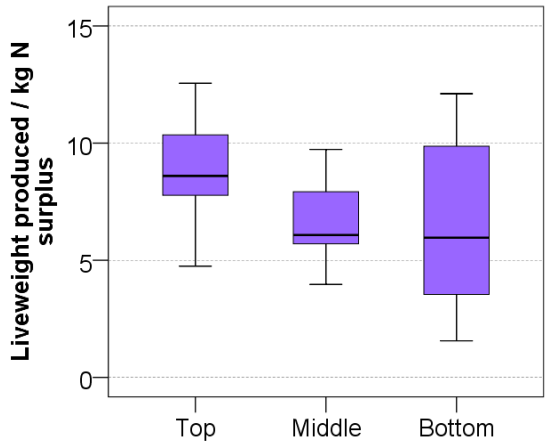


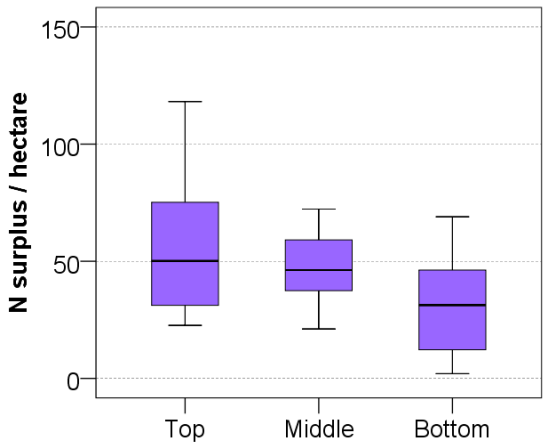
Cattle farms - 2019





Sheep farms - 2019





On going Work

- Life cycle analysis Beef Model

- Biodiversity indicators
  - EU Smart Agri Hubs Project
  - 300 farm reports via LPIS & aerial imagery
  - 30 Farm ground truthing halted – Covid 19

Summary / Conclusion

- **Economic & Social Metrics: Dairy** performs **strongest**
- **Environmental Metrics: 2019 results reverted back to 2017 levels**
  - weather affected results in 2018 (drought)
- **Absolute GHG & NH3 Emissions in 2019:**
  - continued to increase on dairy farms (compared to preceding years)
  - other farm systems static or in decline (cattle, sheep, tillage)
- **Emissions intensity of production:**
  - GHG / NH3 per kg Product (milk & meat) is generally improving.
- **Dairy farm emissions continue to increase:**
  - driven by increased herd sizes
  - emission intensity improved
  - output per cow increasing
- **Innovation Metrics:**
  - now include use of **protected urea** and **low emissions slurry spreading**