



# Teagasc National Farm Survey 2018 Sustainability Report

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**Rural Economy and Development Programme**

# Presentation Overview

- Sustainability definition
- Sample profile
- Methodology
- Results
- On going development of indicators

# Sustainability Definition

- Farm level sustainability is intersection of:

1. Economic
2. Environmental
3. Social
4. Innovation



Success



Failure

# 2018 Teagasc Sustainability Report

- Comprehensive range of results
  - 4 Farm Systems (Dairy, Cattle, Sheep, Tillage)
  - 4 Sustainability dimension
    - » Economic, Environmental, Social & Innovation
    - » 97 indicators for 2018 (most recent year)
  - Temporal
    - » Individual year results 2013 to 2018 in appendix of report
      - 97 indicators x 6 years
    - » 3 year rolling averages 2011-2018 (longer term trend)
- Results presented today is only a small subset

# Data Source: Teagasc National Farm Survey

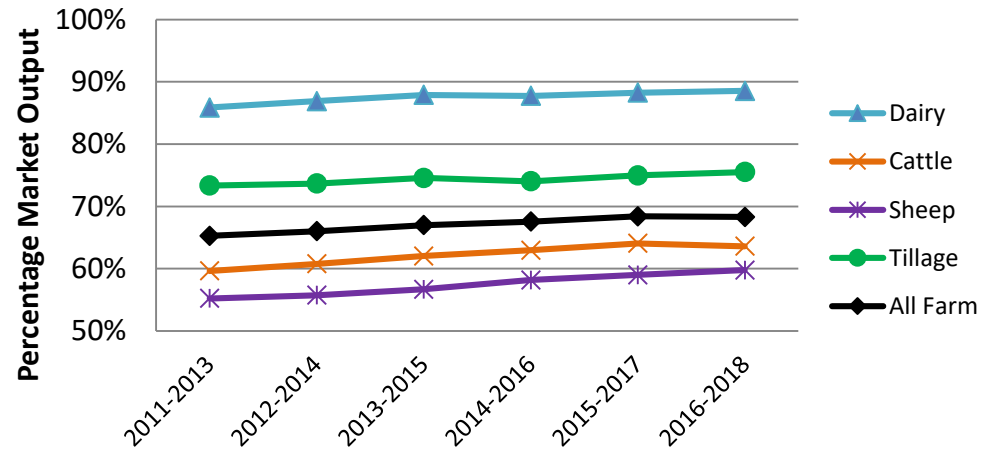
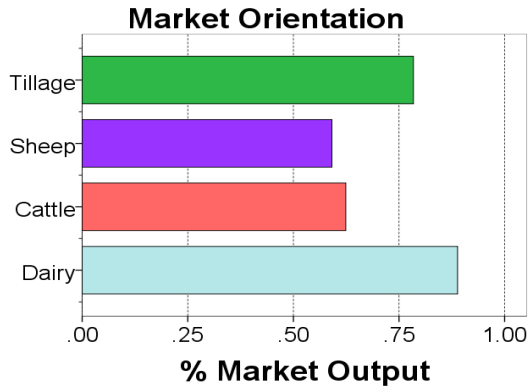
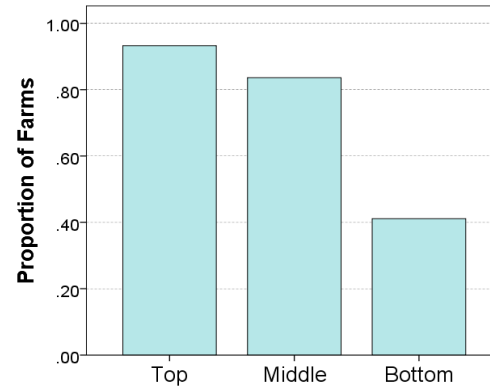
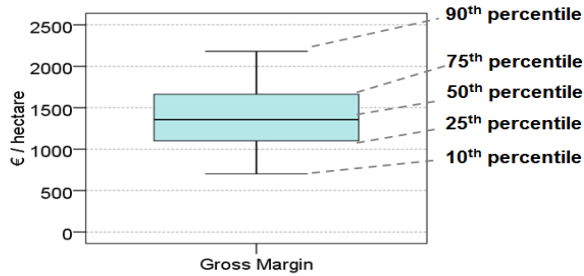
- Conducted by Teagasc on an annual basis since 1972.
- Operated as part of the EU Farm Accountancy Data Network (FADN).
  - Fulfils Ireland's statutory obligation to provide data to EU
- Teagasc as a collection agency
- EU Farm to Fork Strategy “convert its Farm Accountancy Data Network into the Farm Sustainability Data Network”
  - “with a view to also collect data on the Farm to Fork and Biodiversity Strategies’ targets and other sustainability indicators”

# Profile of Teagasc NFS Sample - 2018

	Dairy	Cattle	Sheep	Tillage	All Farms
Sample No.	310	375	124	67	876
Population Represented	16,081	53,651	14,265	6,879	90,875
<u>Average</u>					
Utilisable Agricultural Area (ha <sup>-1</sup> )	58.7	34.0	47.6	60.2	42.5
Grassland Area (ha <sup>-1</sup> )	57.6	33.5	46.8	23.2	39.1
Tillage Area (ha <sup>-1</sup> )	1.1	0.5	0.8	37	3.4
Dairy Cow Livestock Units	77.9	0.0	0.0	0.0	13.8
Cattle Livestock Units	41.2	41.2	20.9	28.1	40.0
Sheep Livestock Units	0.5	1.8	32.2	4.1	6.5
Total Livestock Units	119.6	43.0	53.1	32.2	57.3
Farm Stocking Rate (LU ha <sup>-1</sup> )	2.0	1.3	1.2	0.5	1.4

# Presentation of Results

## Charts



# Economic Sustainability

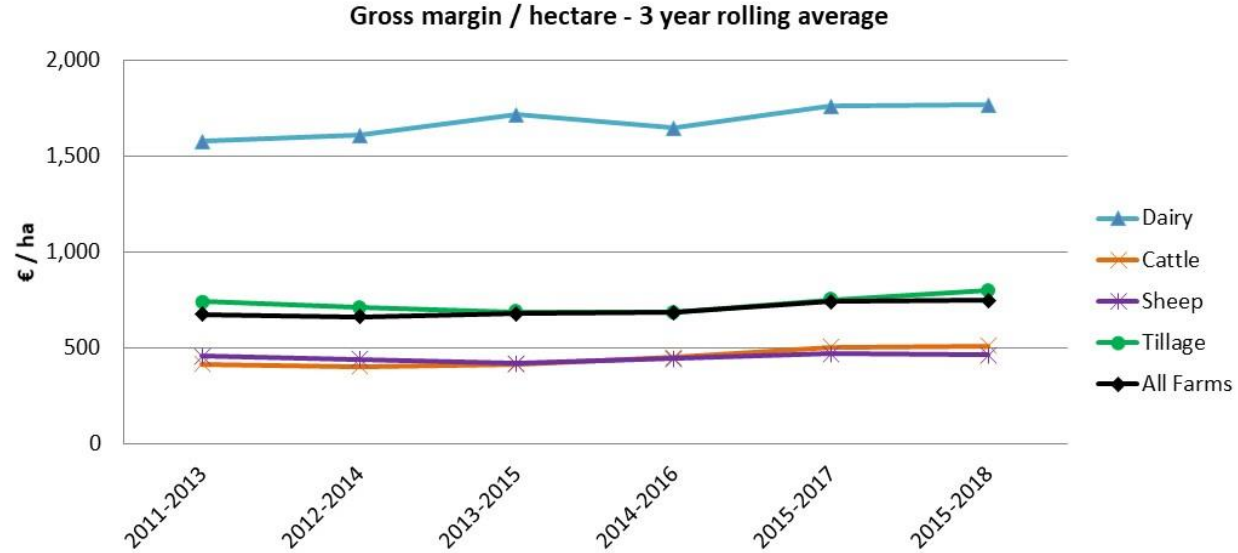
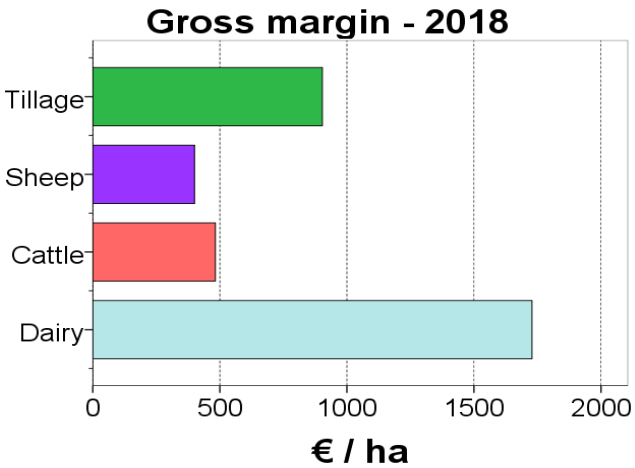
Indicator	Measure	Unit
1. Economic return to land	Gross output per hectare	€ / hectare
2. Profitability of land	Gross margin per hectare	€ / hectare
3. Market Orientation	Output derived from market rather than subsidies	%
4. Economic Viability	Economic viability of farm business – Minimum wage for labour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





# Economic Sustainability

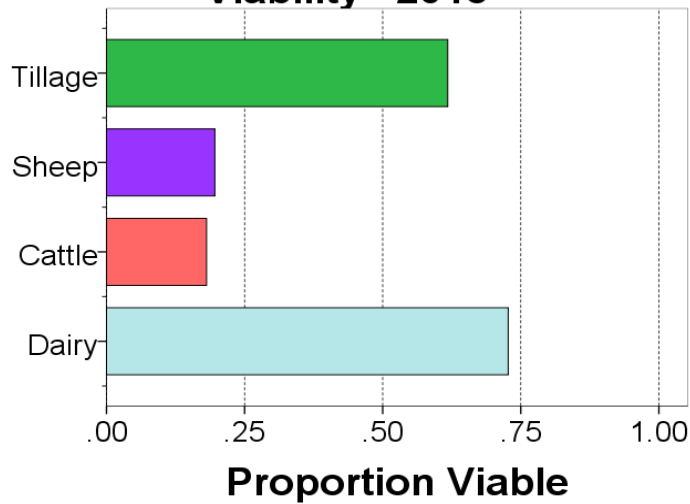
Indicator	Measure	Unit
Profitability of land	Gross margin per hectare	€ / hectare



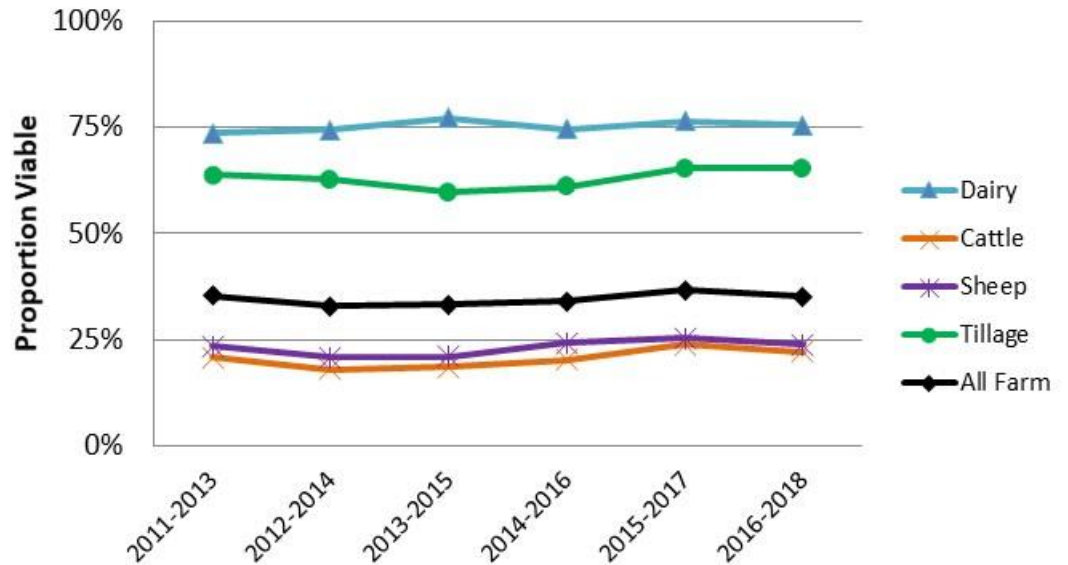
# Economic Sustainability

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

**Viability - 2018**



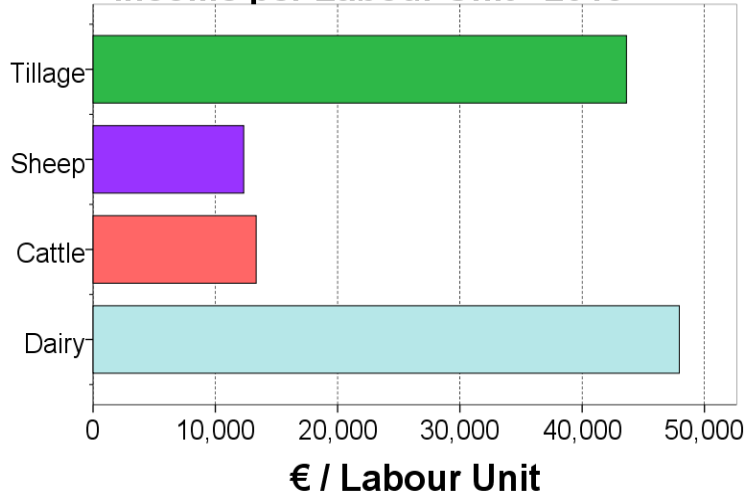
**Economic Viability - 3 year rolling average**



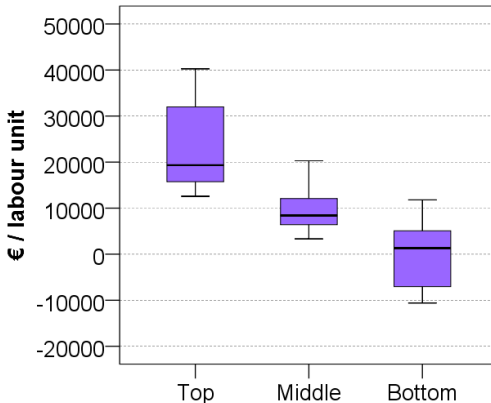
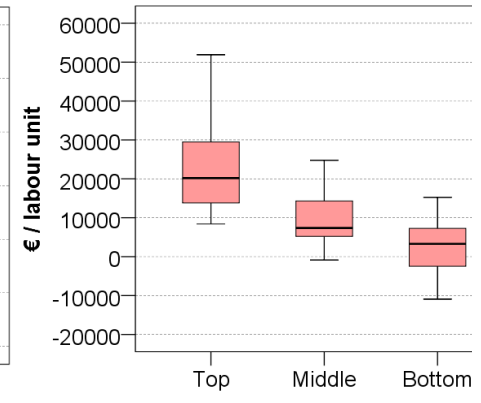
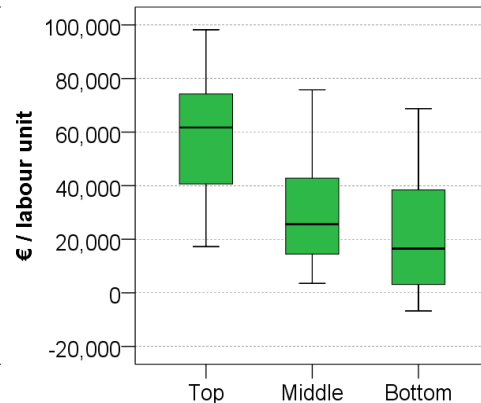
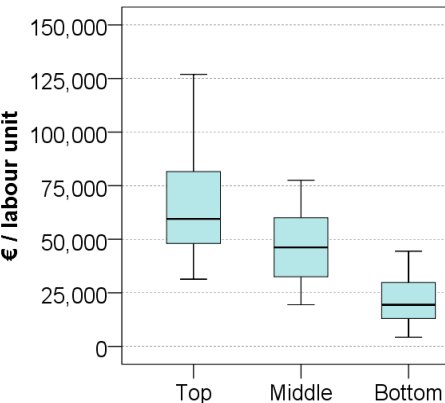
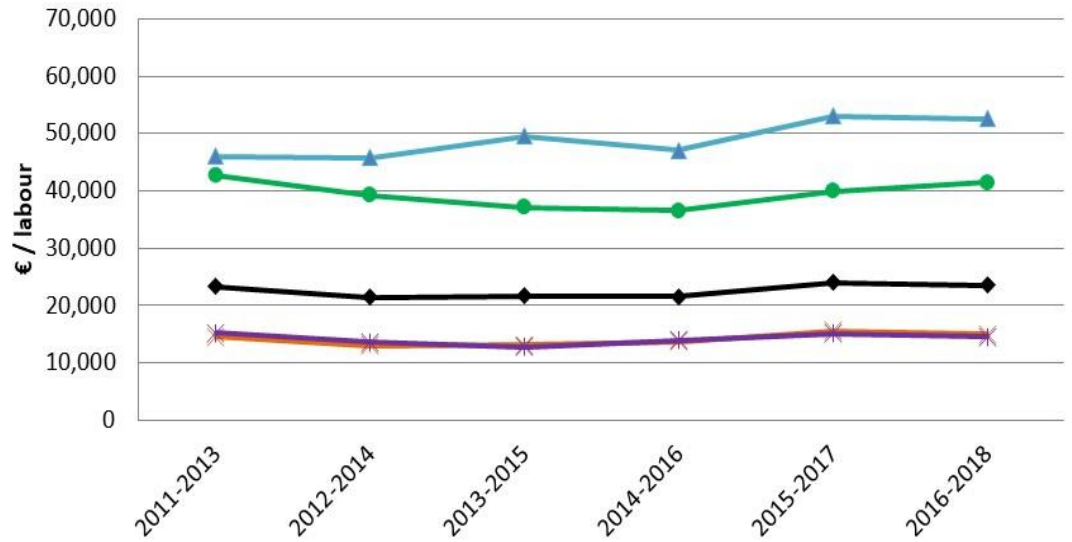
# Economic Sustainability

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

**Income per Labour Unit - 2018**



**Productivity of Labour: 3 year rolling average 2013-2018**



# Social Sustainability

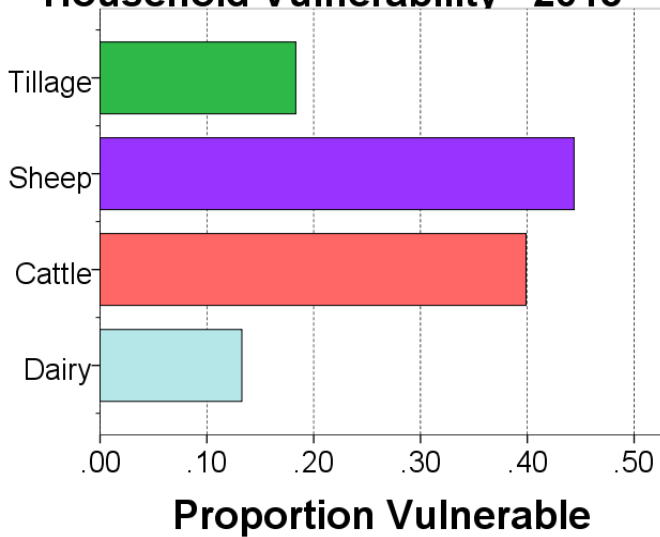
Indicator	Measure	Unit
1. Household vulnerability	Farm business is not viable and no off-farm employment	Binary variable, 1= vulnerable
2. Isolation Risk	Farmer lives alone	Binary variable 1=isolated
3. High Age Profile	Farmer is over 60 years old & no members of household under 45	Binary variable 1=high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



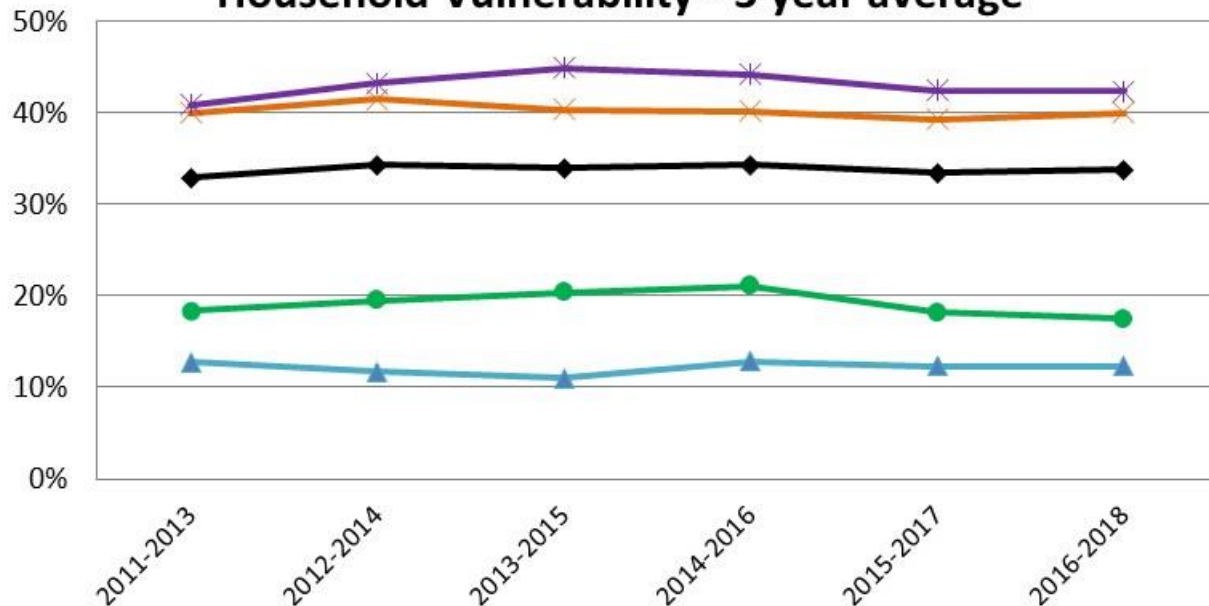
# Social Sustainability

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

Household Vulnerability - 2018



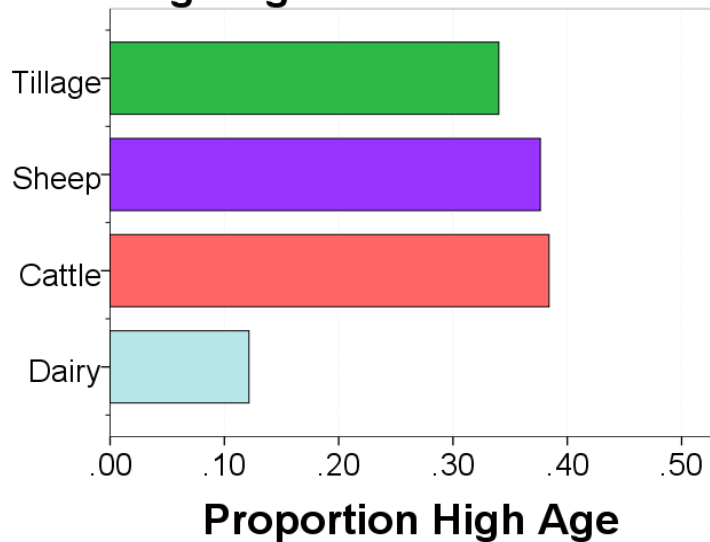
Household Vulnerability - 3 year average



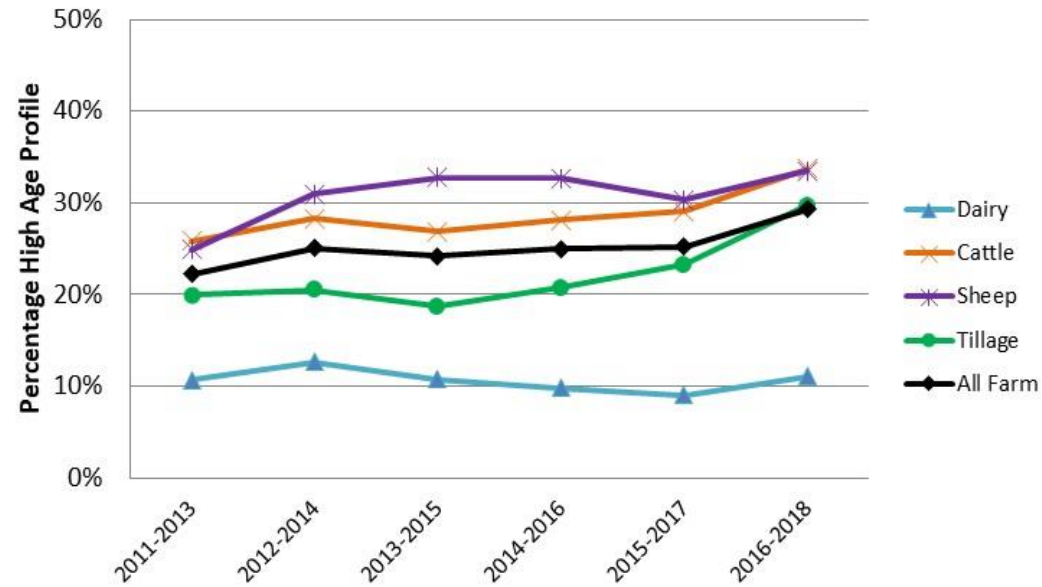
# Social Sustainability

Indicator	Measure	Unit
High Age Profile	Farmer is over 60 years old & no members of household under 45 years	Binary variable 1=High age profile 0=Not high age profile

High Age Profile - 2018



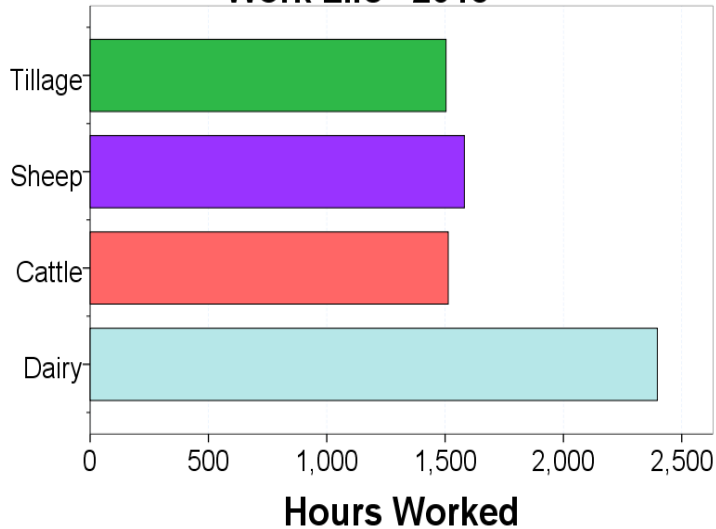
High Age Profile - 3 year rolling average



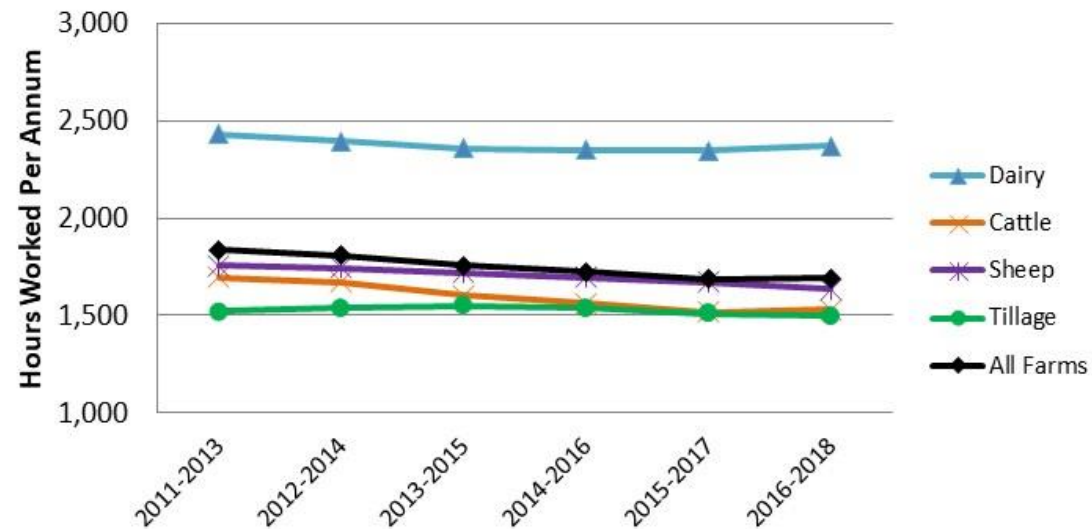
# Social Sustainability

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

Work Life - 2018

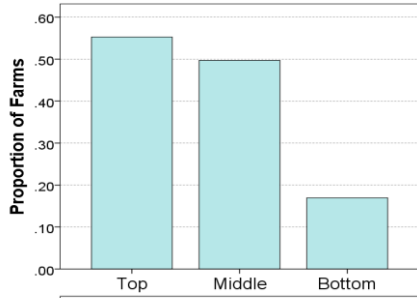


Hours worked on-farm - 3 year rolling average

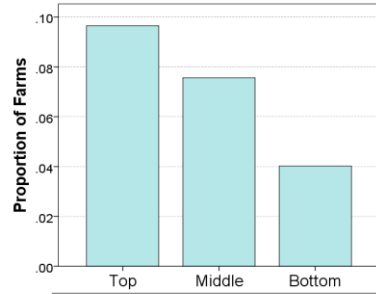


# Innovation

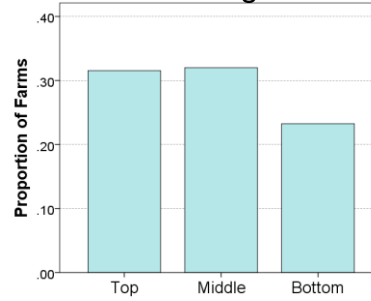
Discussion group



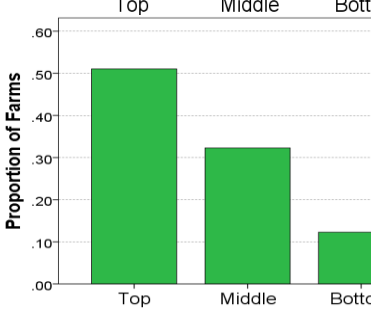
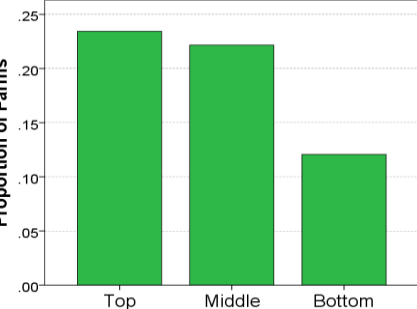
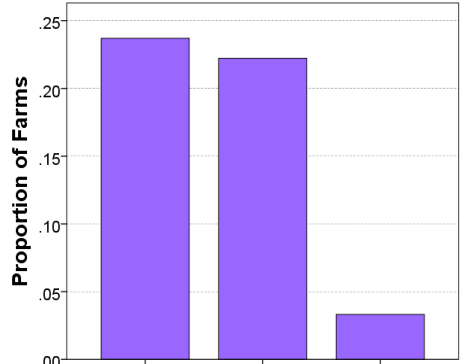
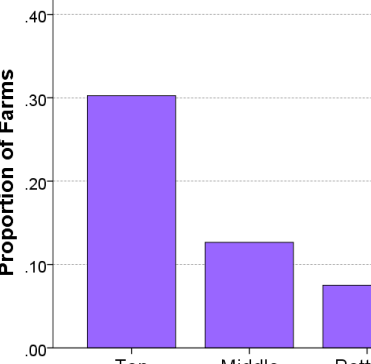
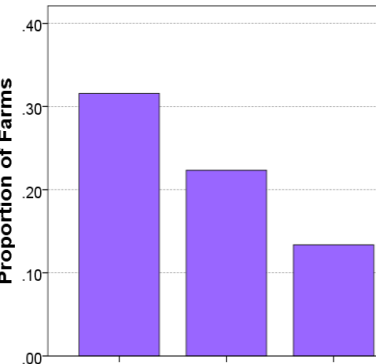
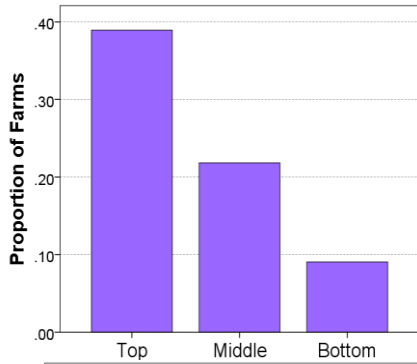
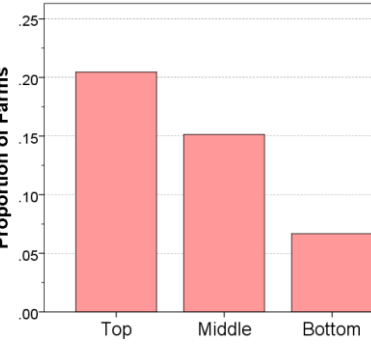
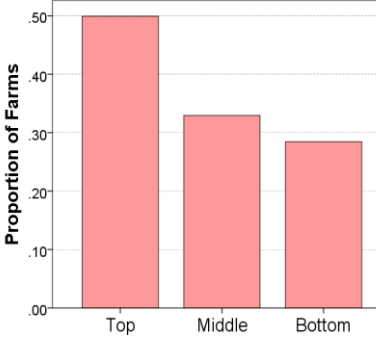
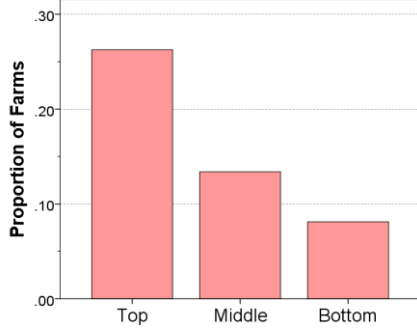
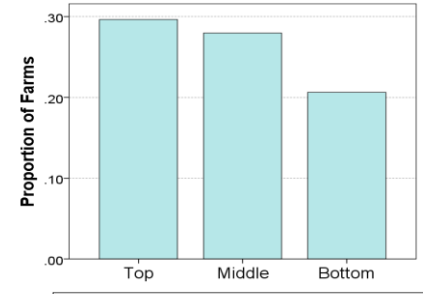
Spring Slurry



Liming



Reseeding





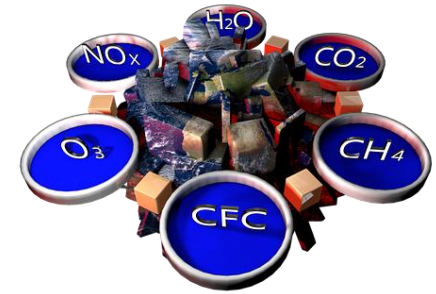
# Overview of Environmental Indicators

<i>Indicator</i>	<i>Measure</i>	<i>Unit</i>
Ag. GHG emissions per farm	GHG emissions	Tonnes CO <sub>2</sub> equivalent / farm
Ag. GHG emissions per hectare	GHG emissions per hectare	Tonnes CO <sub>2</sub> equivalent / hectare
Ag. GHG emissions per kg of output	GHG emissions efficiency	kg CO <sub>2</sub> equivalent / kg output AND kg CO <sub>2</sub> e / € output
Energy GHG emissions per farm	Farm GHG energy use efficiency	kg CO <sub>2</sub> equivalent / kg output
Energy emissions per kg of output	Energy GHG emissions efficiency	kg CO <sub>2</sub> equivalent / kg output AND kg CO <sub>2</sub> e / € output
Ammonia emissions per farm	NH <sub>3</sub> emissions	Tonnes NH <sub>3</sub> equivalent / farm
Ammonia emissions per hectare	NH <sub>3</sub> emissions per hectare	Tonnes NH <sub>3</sub> equivalent / hectare
Ammonia emissions per kg of output	NH <sub>3</sub> emissions efficiency	kg NH <sub>3</sub> equivalent / kg output AND kg NH <sub>3</sub> / € output
Nitrogen (N) balance	N transfer risk	kg N surplus / ha <sup>-1</sup>
Nitrogen (N) use efficiency	N application efficiency	% N outputs / N inputs
N surplus per kg of output	N emissions efficiency	kg N surplus / kg output
Phosphorus (P) balance	P transfer risk	kg P surplus / ha <sup>-1</sup>
Phosphorus (P) use efficiency	P application efficiency	% P outputs / P inputs

# Environmental Sustainability

## 1. Gaseous Emissions

- Greenhouse Gases
- Ammonia



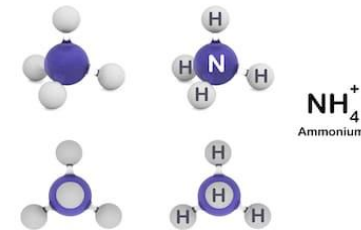
## 2. Risk to water quality

- Nitrogen & phosphorus



# Methodological approach

- Activity data from Teagasc National Farm Survey
- GHG - All in common currency of CO<sub>2</sub> 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)



# GHG National Inventory Accounts

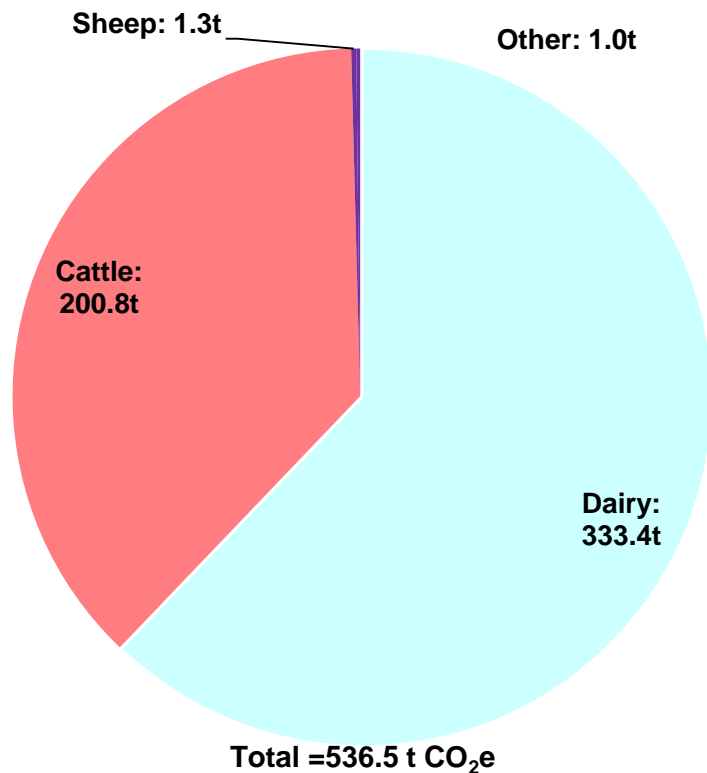
<b>3. Agriculture (CO2 eq)</b>	<b>National Emission Profile IPCC Approach (% by Gas CO2 eqv)</b>	<b>% Teagasc NFS - 2018 Profile (% by Gas CO2 eqv)</b>
3.A Enteric Fermentation (CH4)	58%	57%
3.B Manure Management (CH4 & N2O)	10%	11%
3.C Rice Cultivation	-	-
3.D Agricultural Soils (N2O)	30%	30%
3.E Prescribed Burning of Savannas	-	-
3.F Field Burning of Agricultural Residues	-	-
3.G Liming	2%	2%
3.H Urea Application	0%	0%
3.I Other Carbon-containing fertilizers	-	-
3.J Other	-	-
<b>Total Emissions</b>	<b>100%</b>	<b>100%</b>

# Environmental Sustainability – GHG Emissions

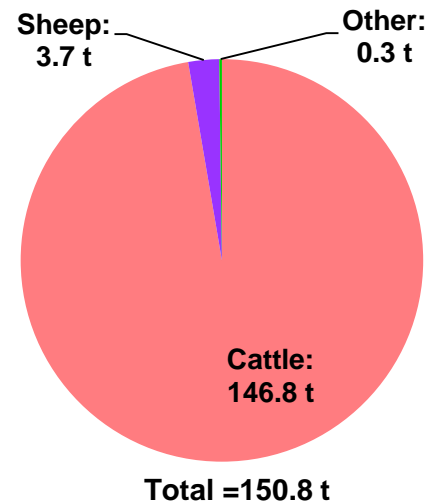
Indicator	Measure	Unit
Ag. GHG emissions per farm*	Absolute Ag. GHG emissions (IPCC methodology)	Tonnes CO <sub>2</sub> equivalent/farm
Ag. GHG emissions per hectare*	Ag. GHG emissions per hectare farmed (IPCC methodology)	kg CO <sub>2</sub> equivalent / hectare
Ag. GHG emissions per kg of output*	Ag. GHG emissions efficiency (IPCC methodology)	kg CO <sub>2</sub> equivalent / kg output
Ag. GHG Emissions per € output*	Ag. GHG emissions efficiency (IPCC methodology)	kg CO <sub>2</sub> equivalent / € output

\* Methodological update from previous report

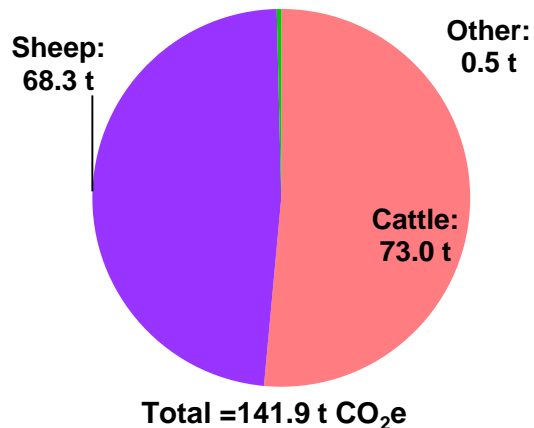
**Farm level Ag. GHG Emissions - Dairy Farms 2018**



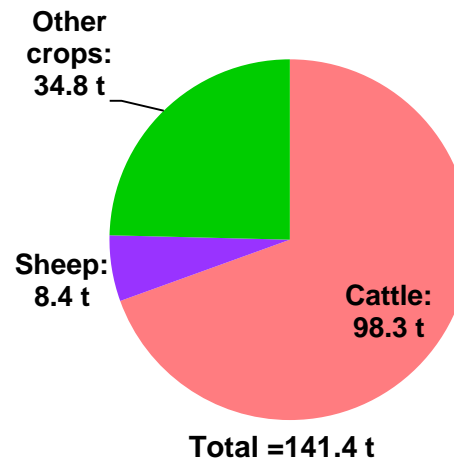
**Farm level Ag. GHG Emissions - Cattle Farms 2018**



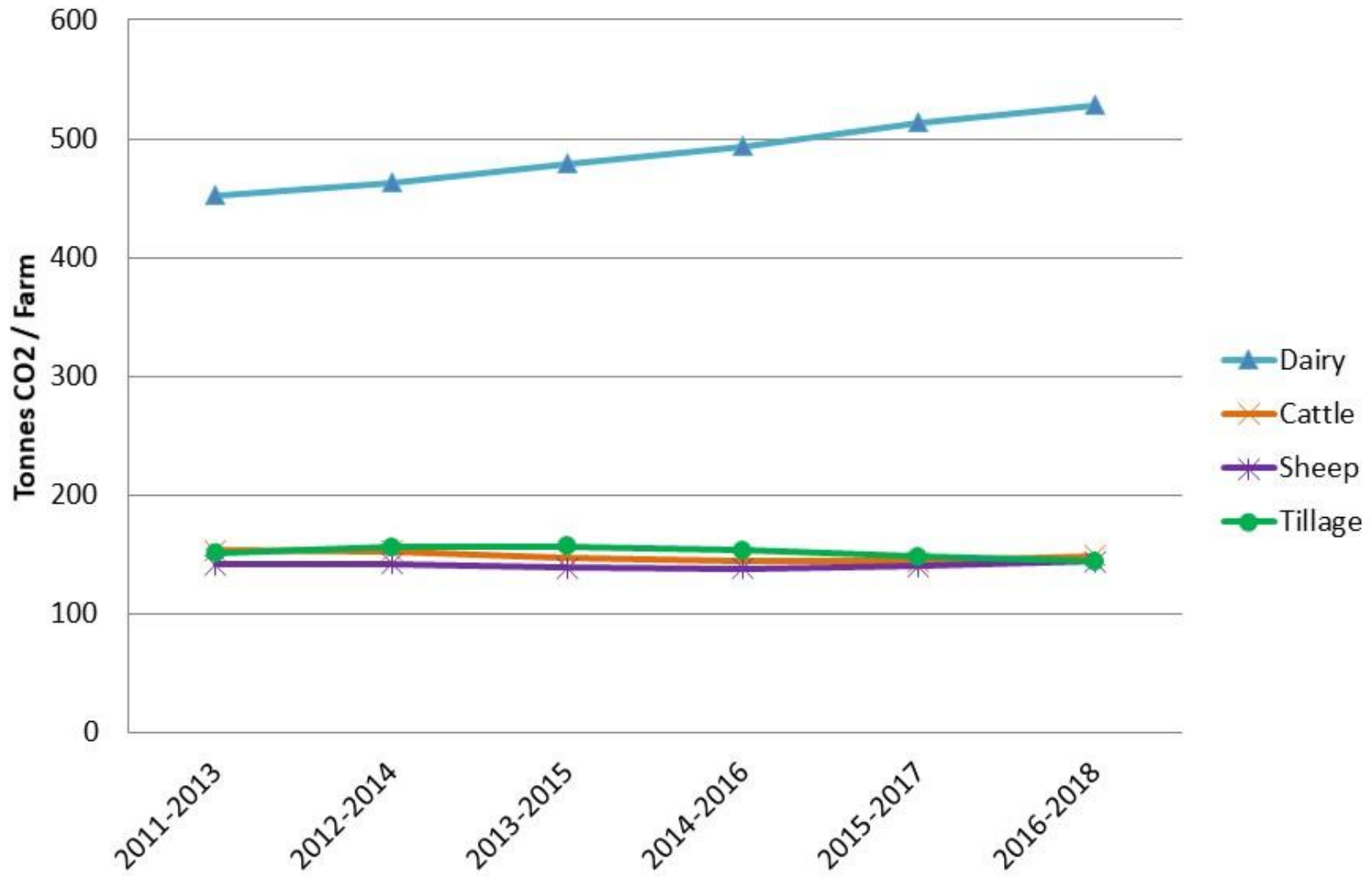
**Farm level Ag. GHG Emissions - Sheep Farms 2018**



**Farm Level Ag. GHG Emissions - Tillage Farms 2018**

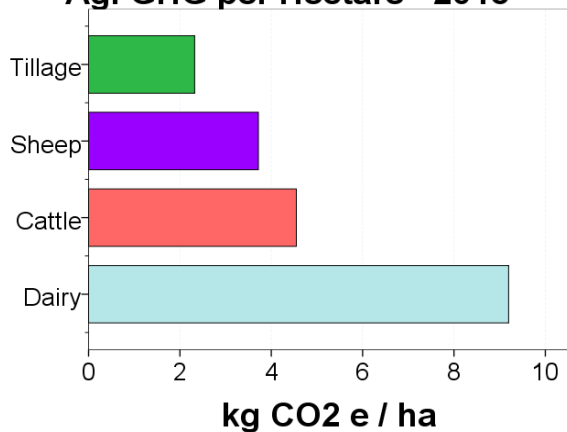


## Total Ag GHG emissions Tonnes CO<sub>2</sub> eqv. by Farm - Rolling 3 year average

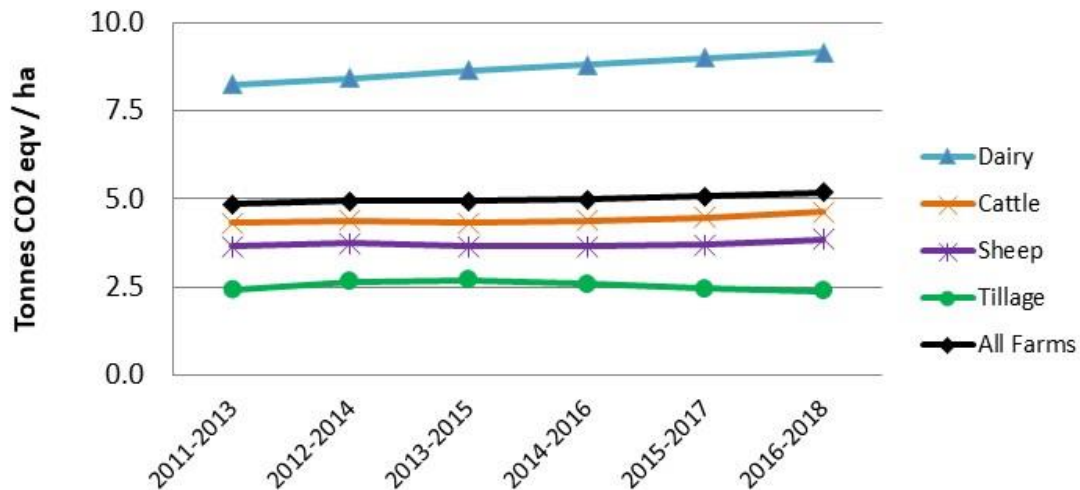


# Absolute & Emissions Intensity – Ag. GHG

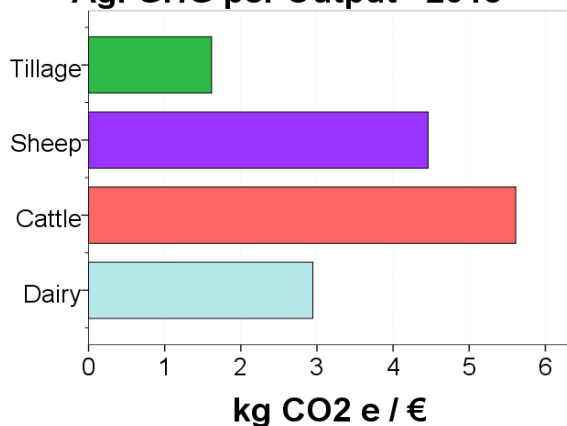
### Ag. GHG per Hectare - 2018



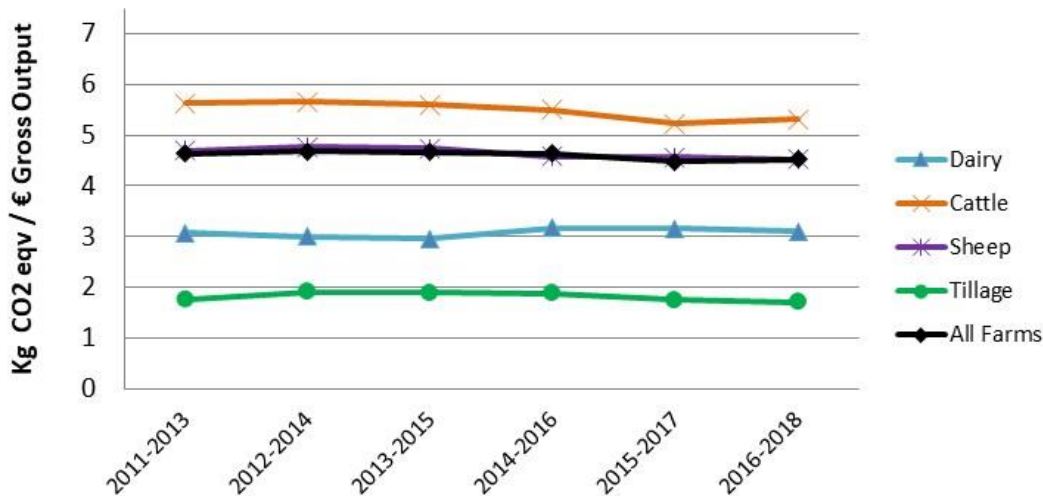
### Ag. based Co2eq ha - 3 year rolling average



### Ag. GHG per Output - 2018



### kg Co2 eqv emitted per € output



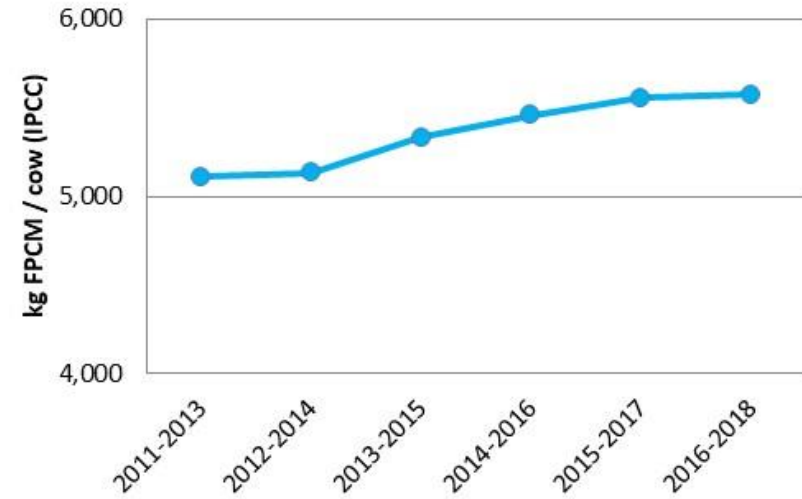


# Dairy based Ag. GHG emissions - Components

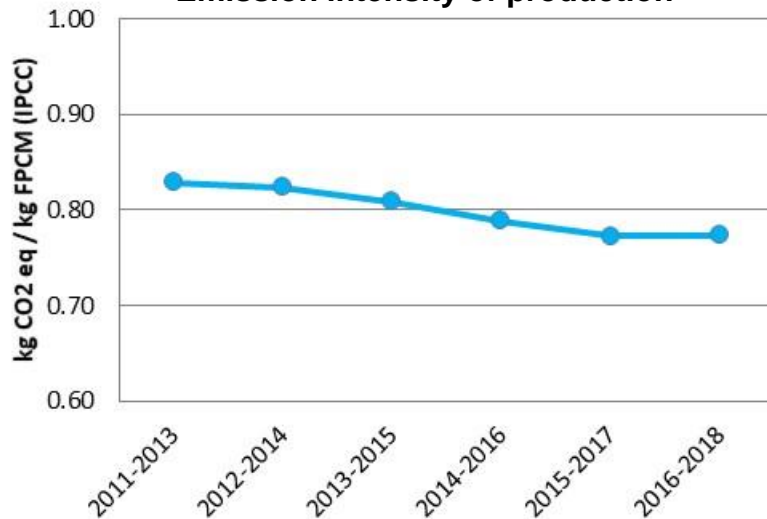
Dairy absolute emissions = kg of milk produced per cow \* CO<sub>2</sub>e per kg of milk \* No. of cows

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

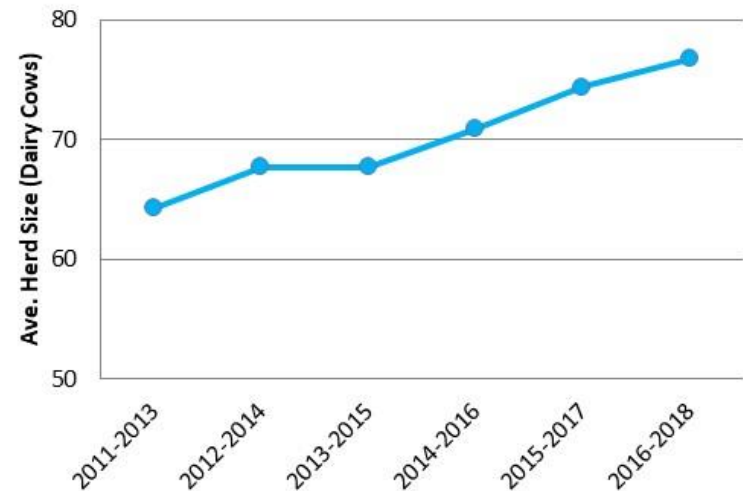
kg FPCM / cow - 3 year rolling average



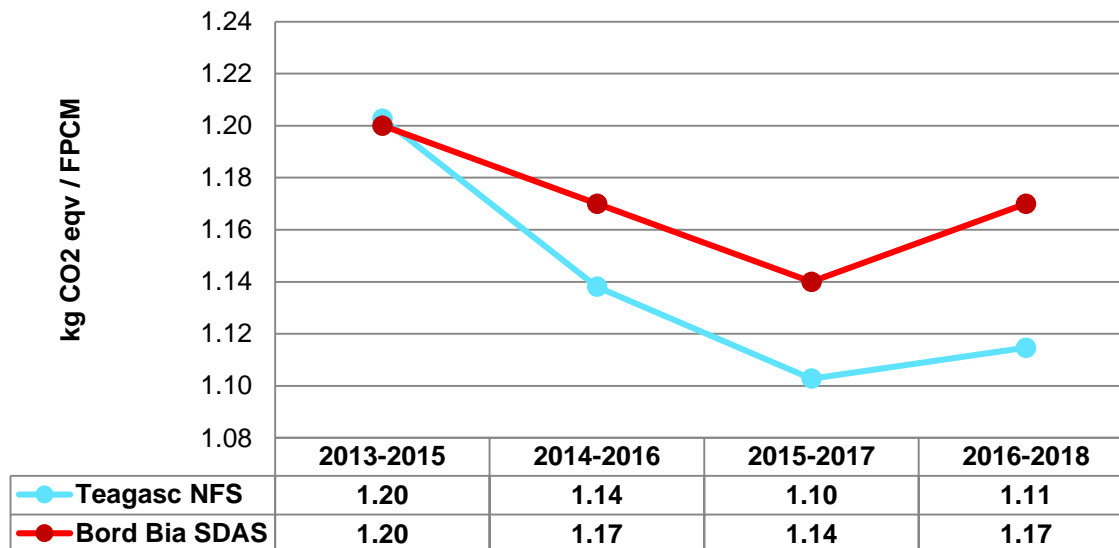
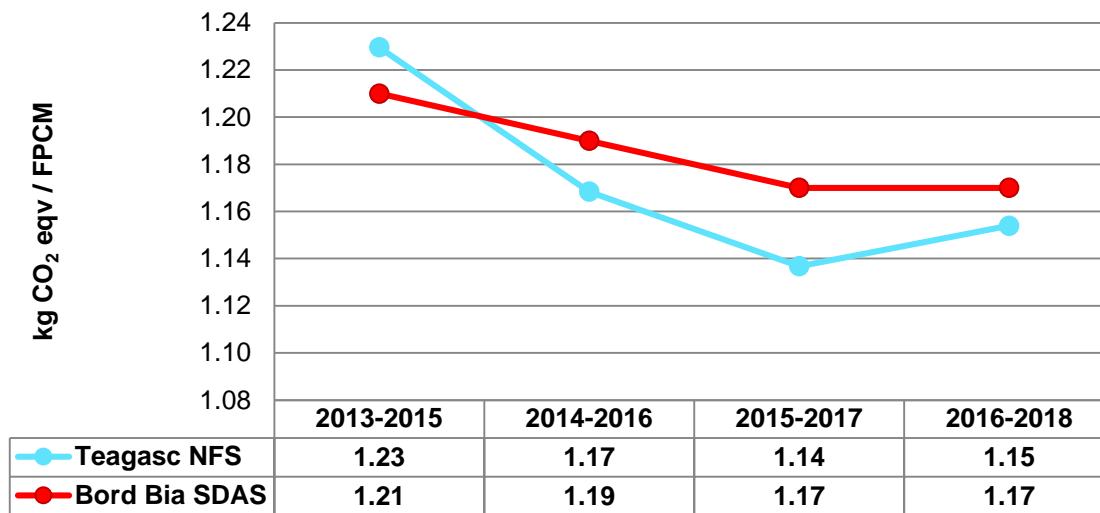
Emission intensity of production



Ave. dairy cow herd size - 3 year rolling average

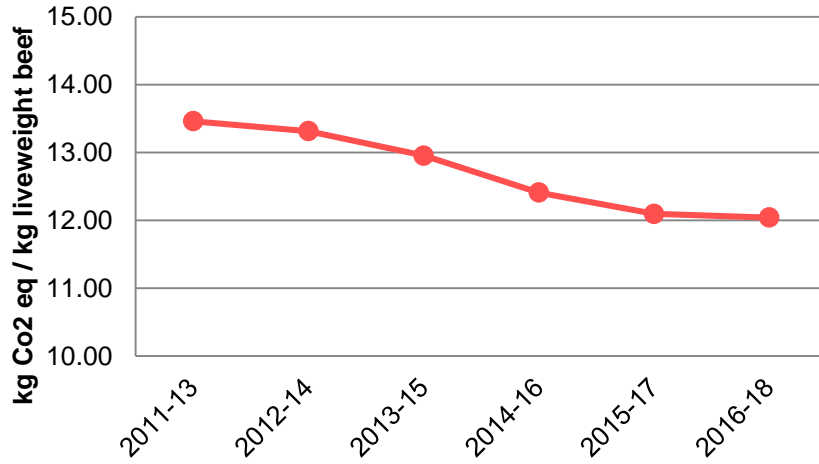


# National Cross Validation on Carbon Footprint of Milk Production – LCA Approach (O'Brien et al., 2014)

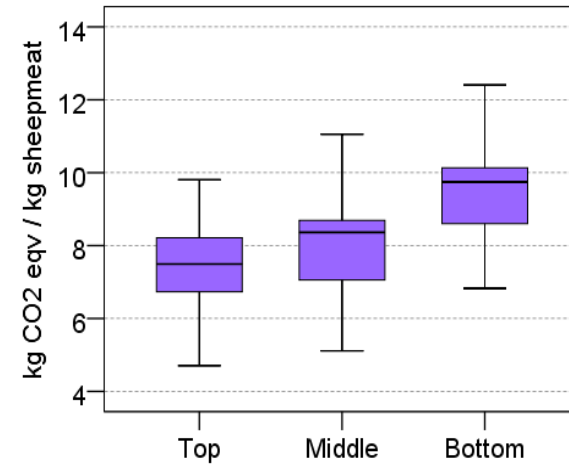
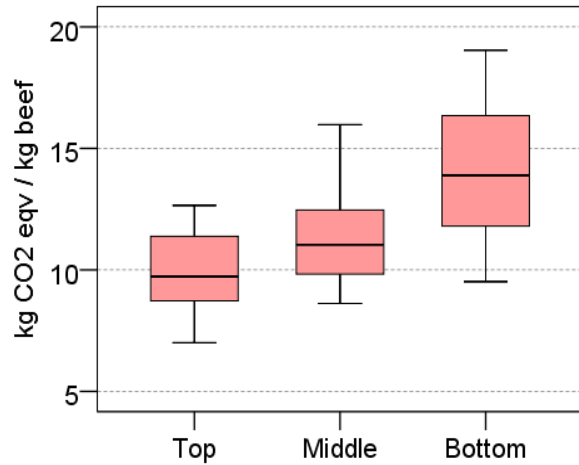
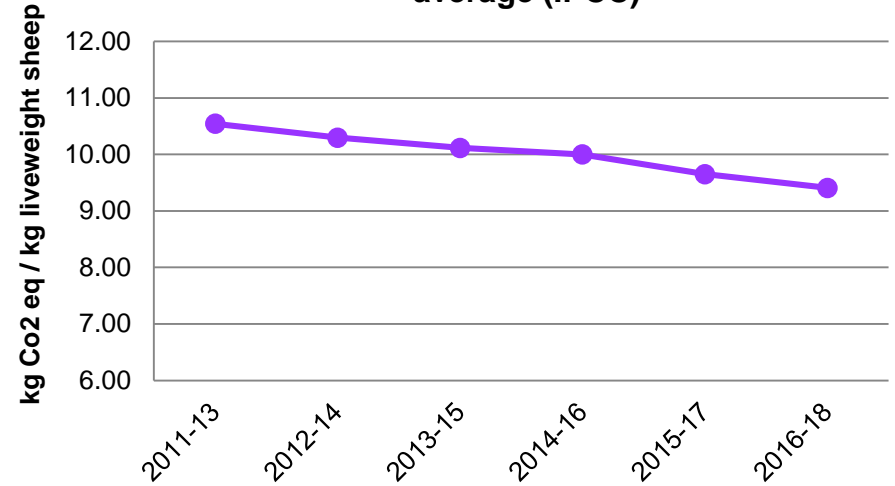


# Ag. Emissions intensity – Cattle & Sheep

kg Co2 Eq / kg liveweight beef - 3 year rolling average (IPCC)



kg Co2 Eq / kg liveweight sheep - 3 year rolling average (IPCC)

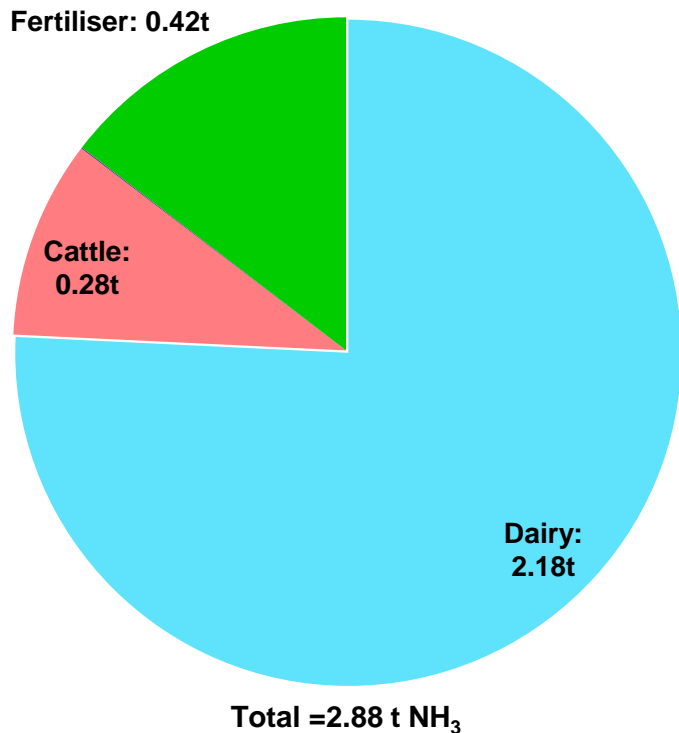


# Ammonia Emissions

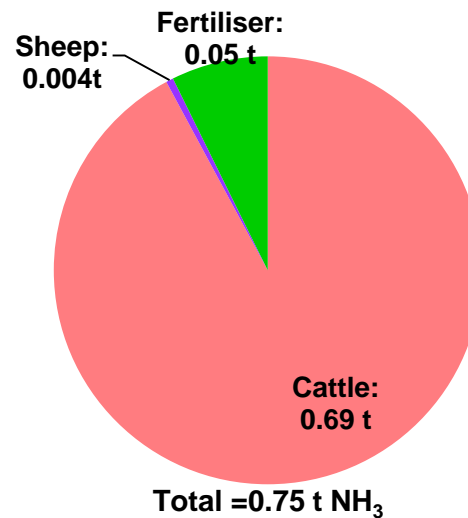
Indicator	Measure	Unit
Ammonia emissions per farm	NH <sub>3</sub> emissions	Tonnes NH <sub>3</sub> equivalent / farm
Ammonia emissions per hectare	NH <sub>3</sub> emissions per hectare farmed	kg NH <sub>3</sub> equivalent / hectare
Ammonia emissions per kg of output	NH <sub>3</sub> emissions efficiency on a kg of product basis	kg NH <sub>3</sub> / kg output
Ammonia emissions per € of output	NH <sub>3</sub> emissions efficiency on Euro of output generate basis	kg NH <sub>3</sub> / € output



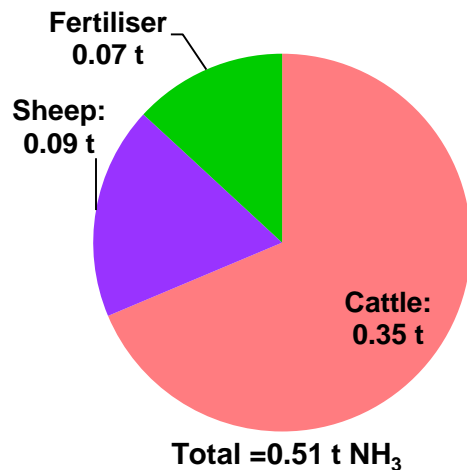
### Farm level NH<sub>3</sub> Emissions - Dairy Farms 2018



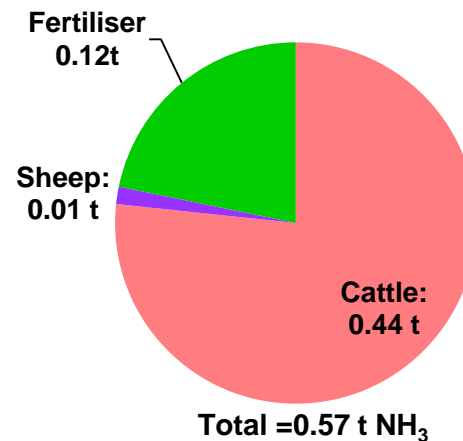
### Farm level NH<sub>3</sub> Emissions - Cattle Farms 2018



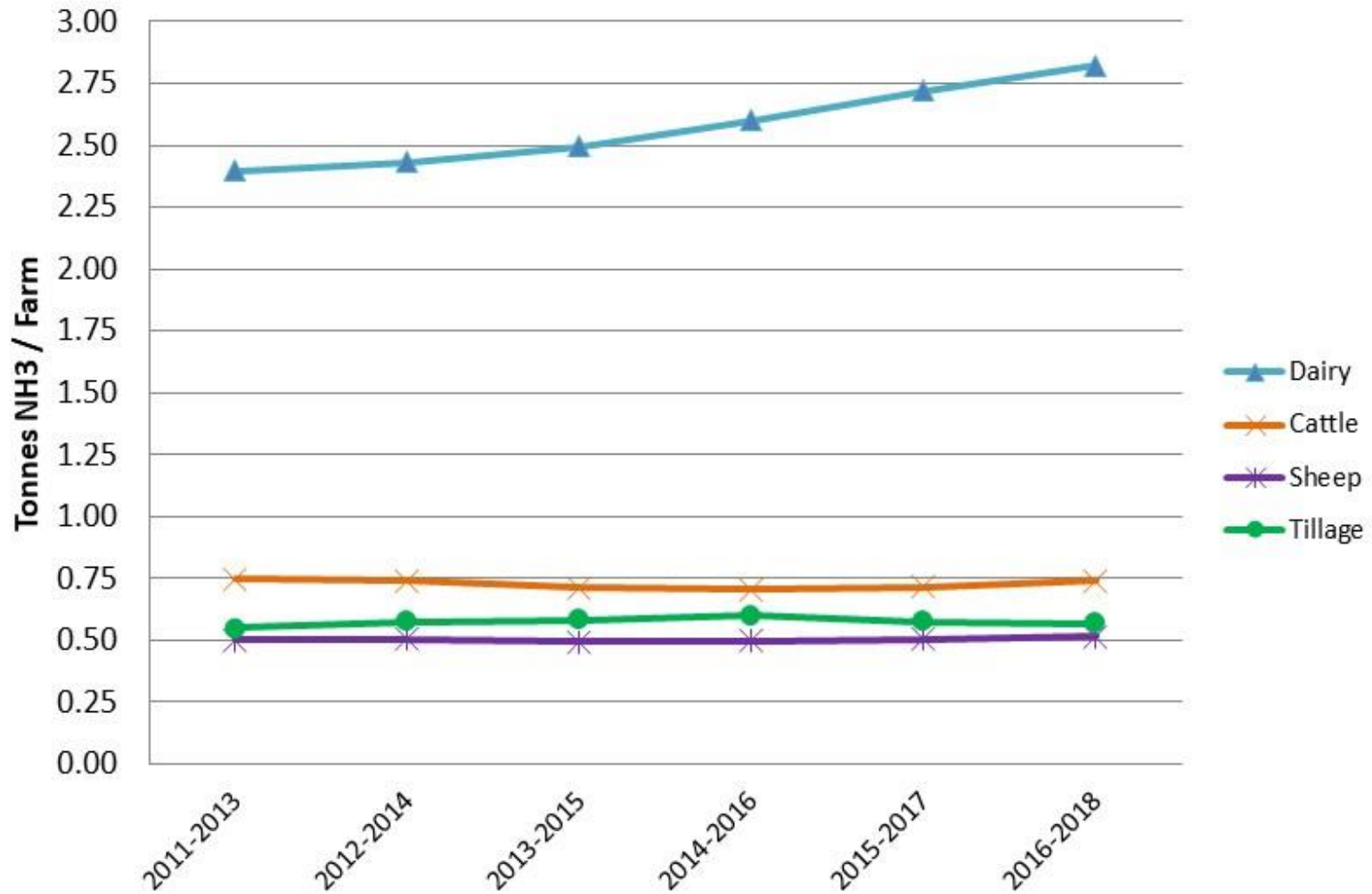
### Farm level NH<sub>3</sub> Emissions - Sheep Farms 2018



### Farm level NH<sub>3</sub> Emissions - Tillage Farms 2018

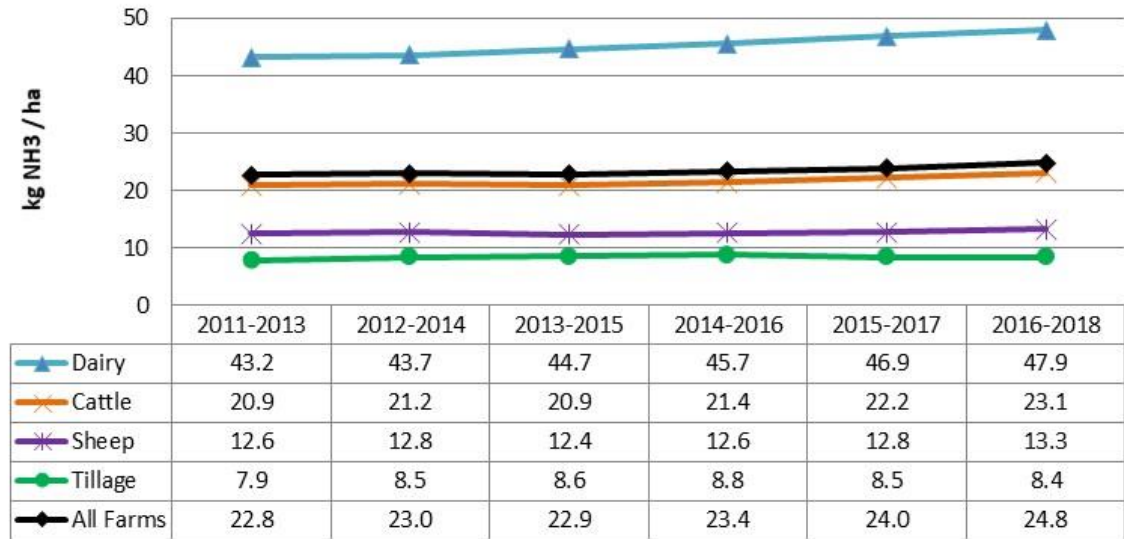
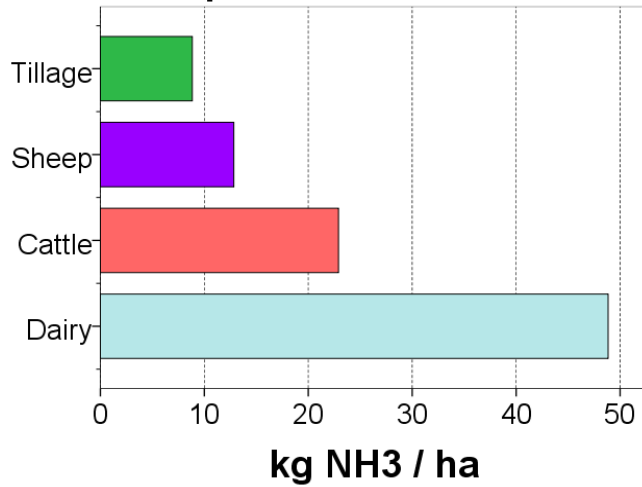


### Total NH3 Tonnes by Farm - Rolling 3 year average

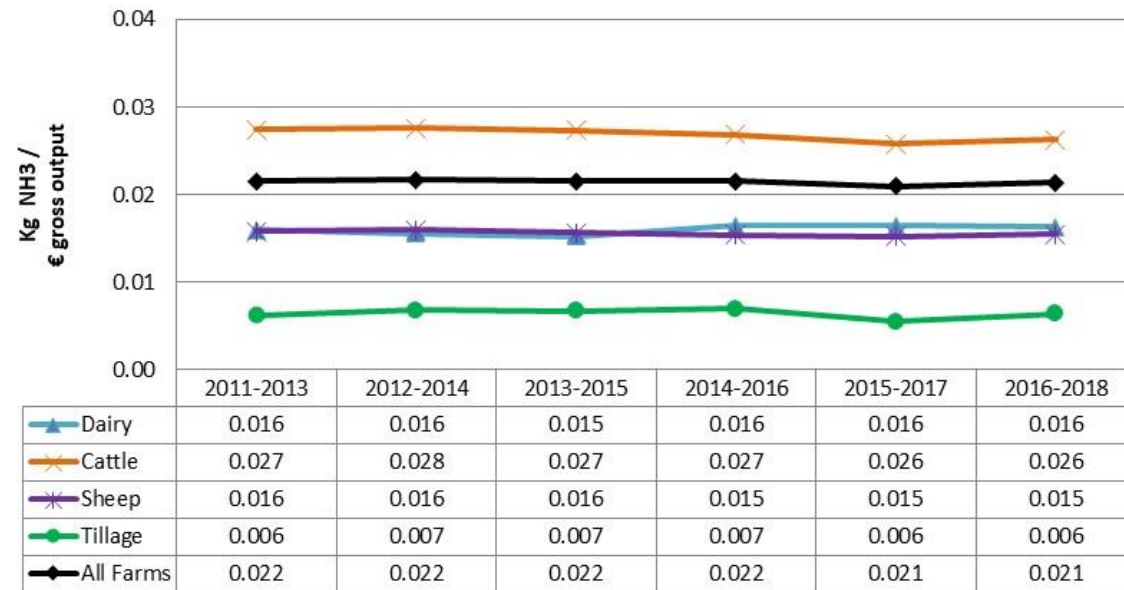
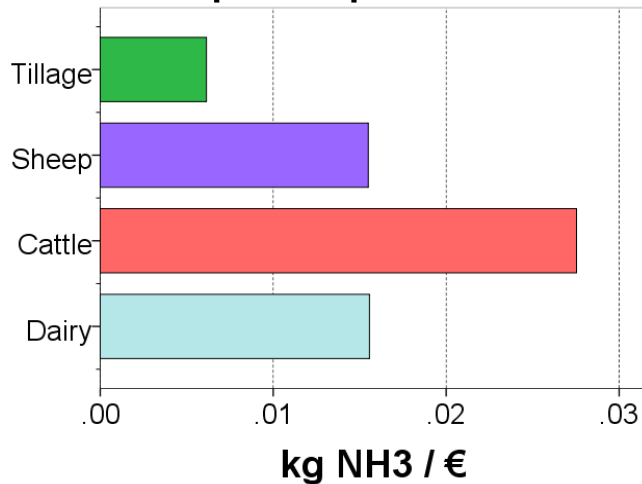


# Absolute & Emissions Intensity – NH<sub>3</sub>

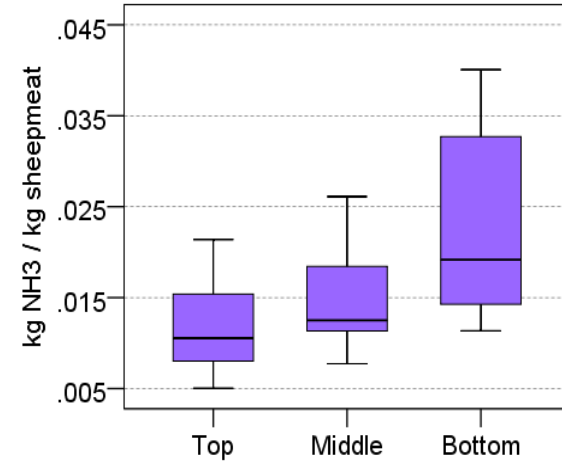
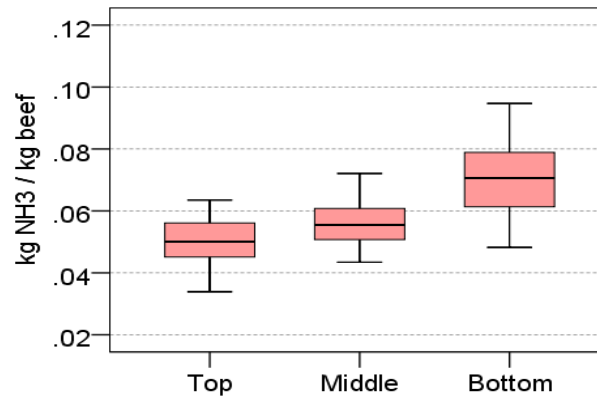
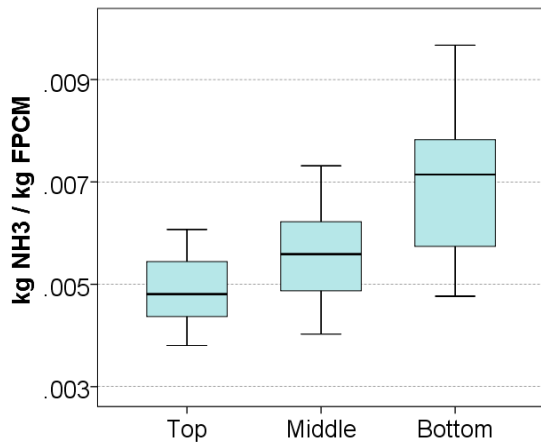
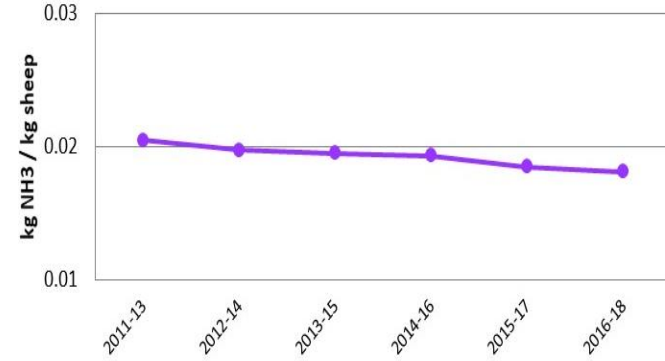
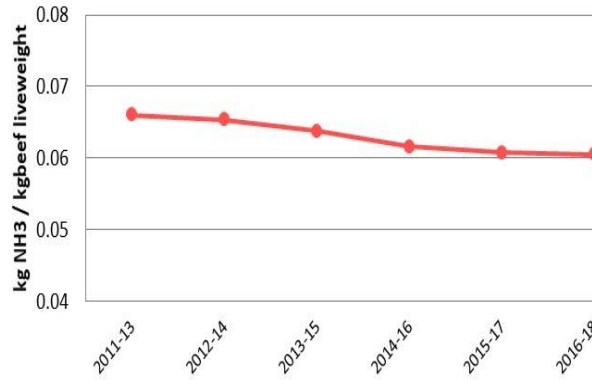
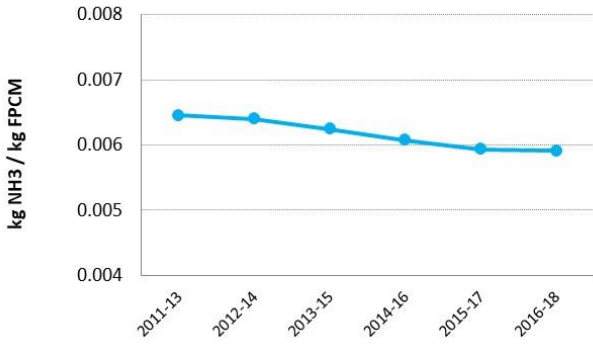
## NH<sub>3</sub> per Hectare - 2018



## NH<sub>3</sub> per Output - 2018



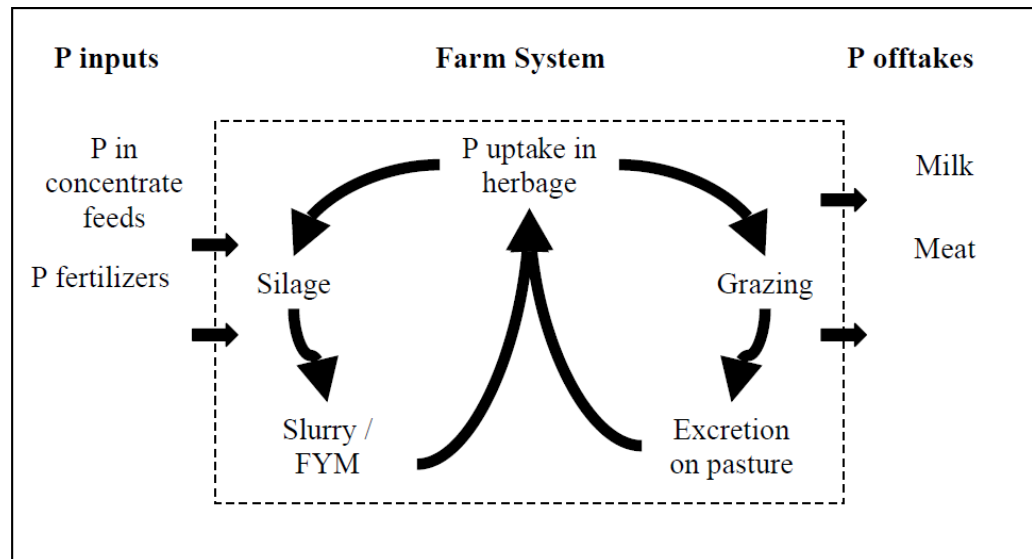
# NH<sub>3</sub> Emissions intensity – Cattle & Sheep





# 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

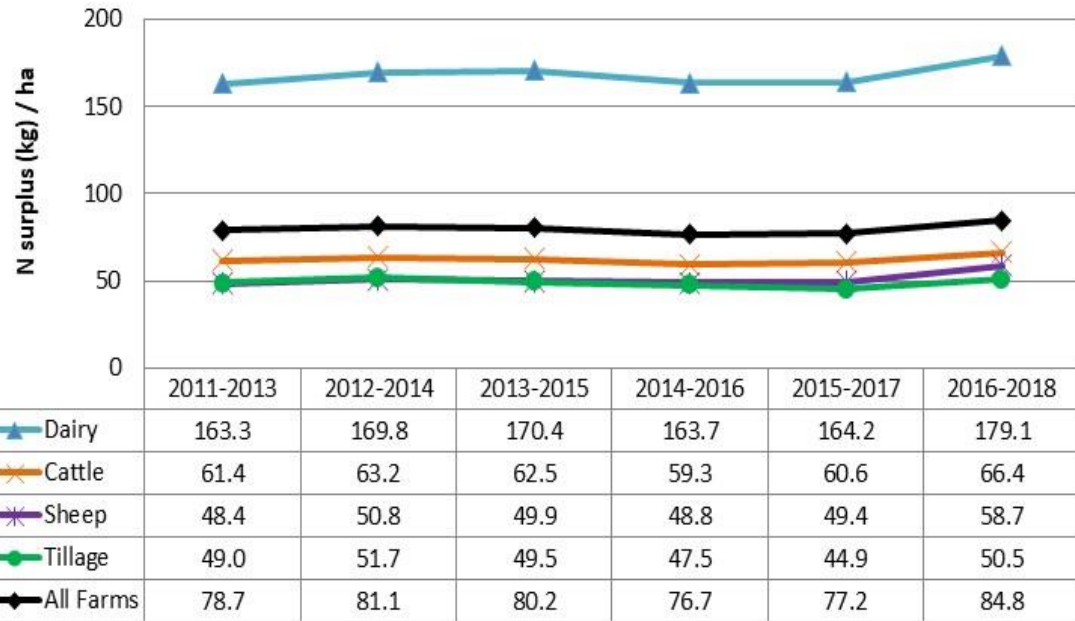
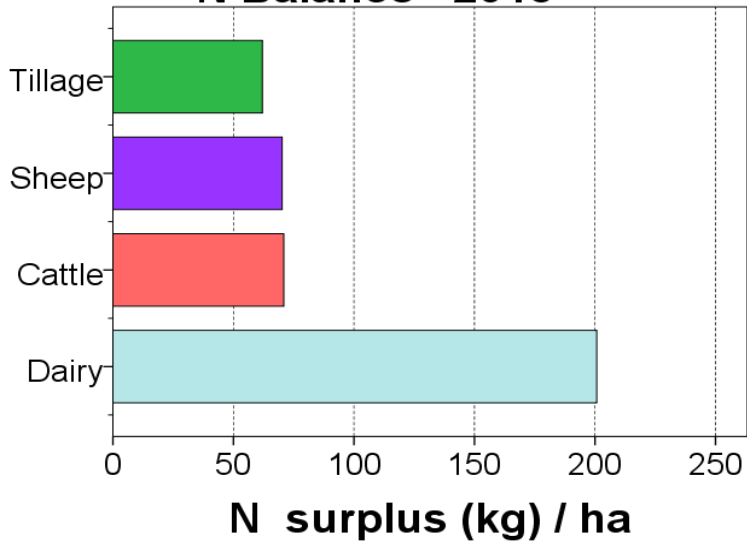


Source: Lalor and Coulter 2009

# Nitrogen Balance

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

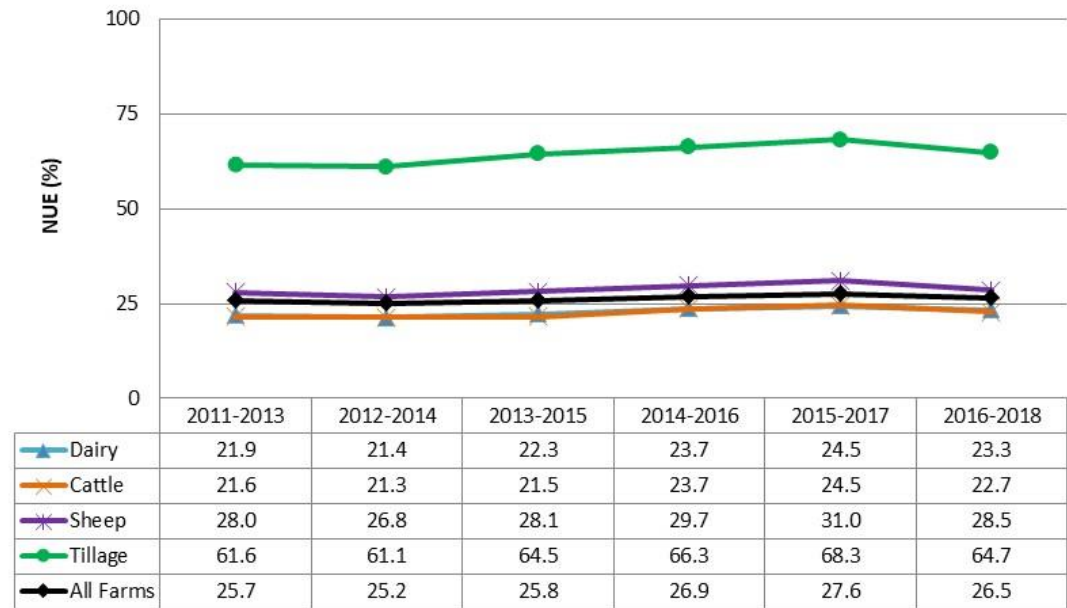
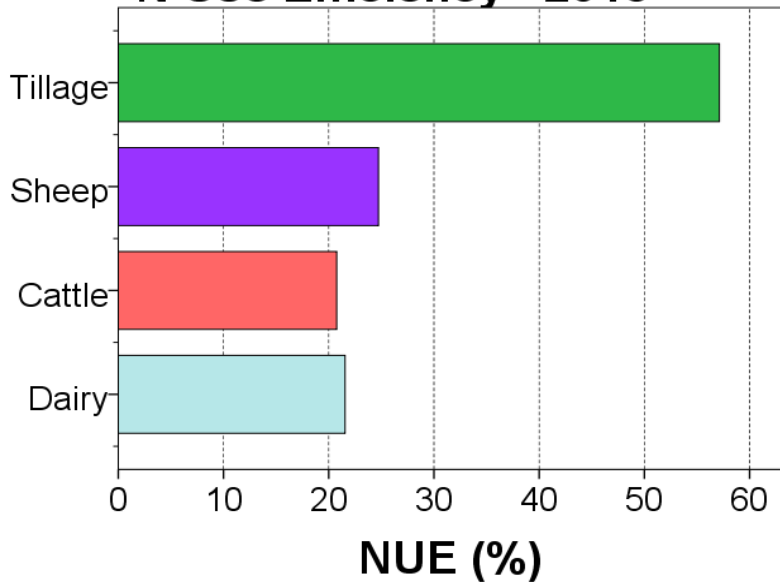
**N Balance - 2018**



# Nitrogen use efficiency

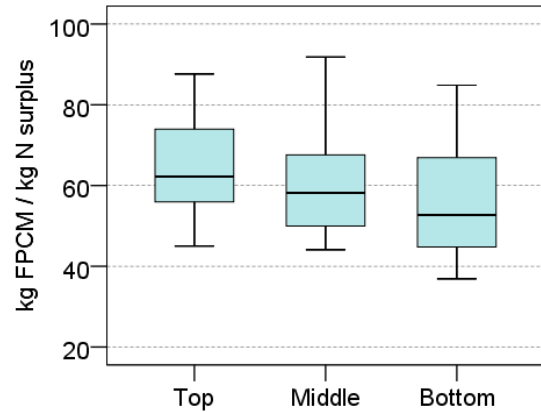
- $(N \text{ outputs} - N \text{ inputs}) * 100$
- Retention of N in farm system

**N Use Efficiency - 2018**

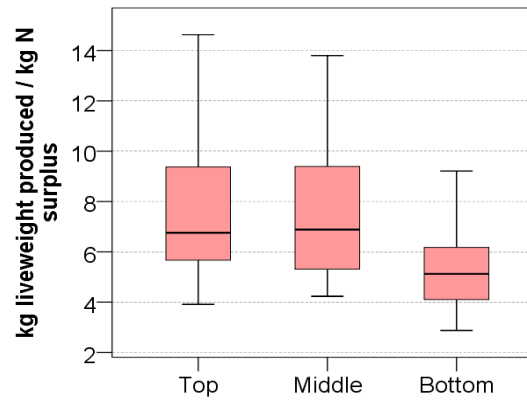


# Emissions intensity vs Absolute Emissions

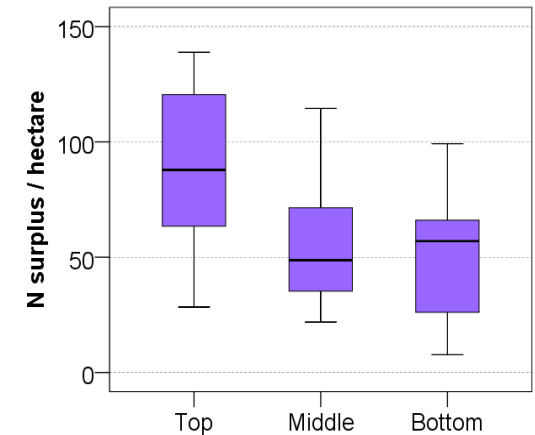
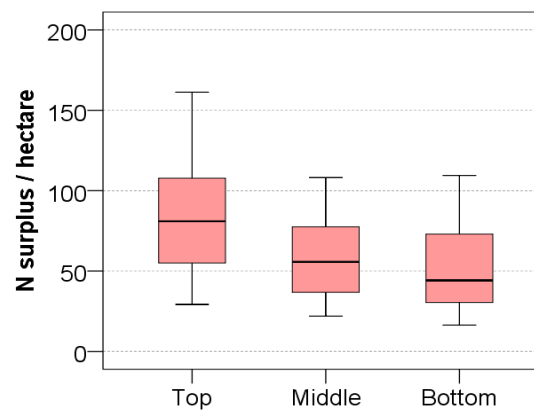
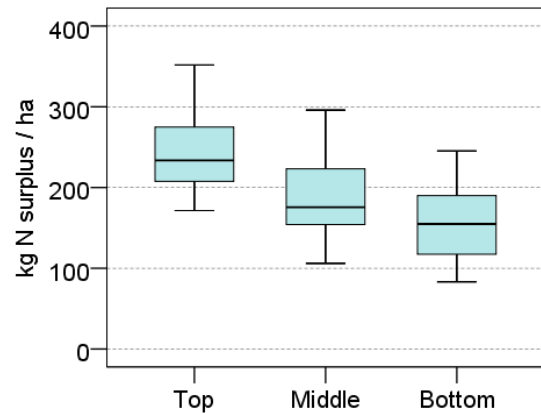
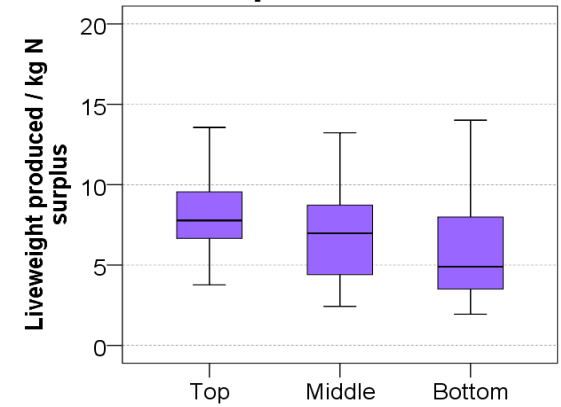
## Dairy farms - 2018



## Cattle farms - 2018



## Sheep farms - 2018



# On going work

- Life cycle analysis Beef Model
- Biodiversity indicators

