



# Greenhouse Gas Emission Intensity of Irish Sheep Meat: Irish Data Component of LIFE Green Sheep Project

Lyubov Bragina, Cathal Buckley and Tim Keady

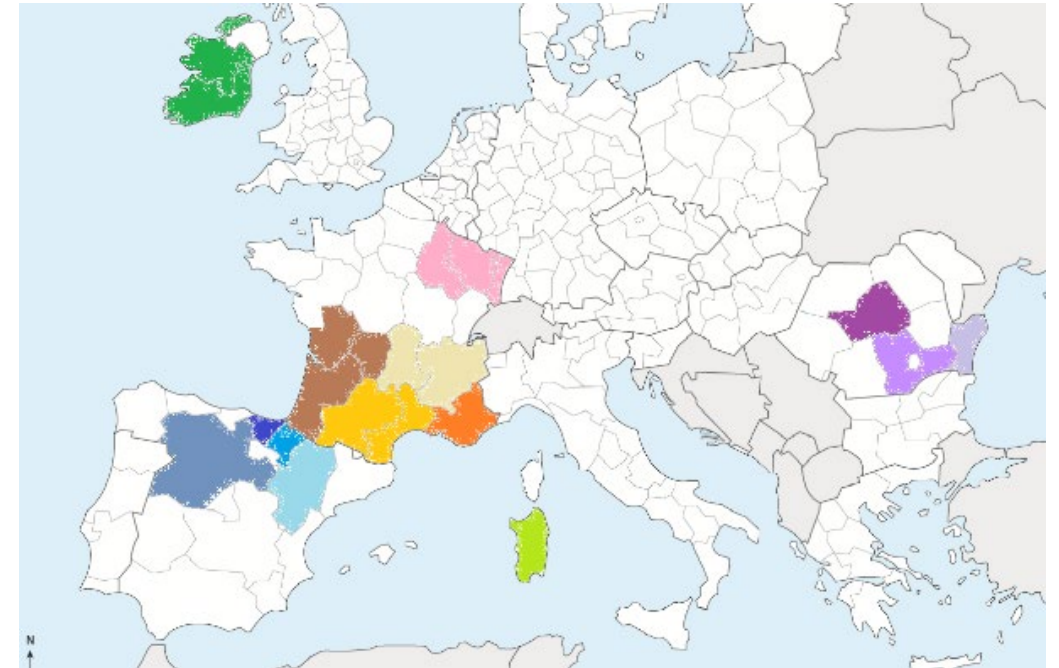
The 75<sup>th</sup> EAAP Annual Meeting, Florence, Italy



# LIFE Green Sheep Project

Small ruminant production accounts for 7.4% of Global GHG emissions.

- The project involves France, Ireland, Italy, Romania and Spain.
- These 5 countries represent 47% of the EU sheep meat and 63% of the sheep milk production.
- Aim is to reduce by 12% the carbon footprint of sheep meat and milk while ensuring farm sustainability



# Irish Sheep Sector Overview

- 2.56 m breeding ewes
- 34,519 sheep farms
- 4<sup>th</sup> largest sheep meat exporter worldwide  
the largest net exporter in the EU
- 400% self-sufficient in sheep meat production
- 80% is exported to France, UK, Germany, Sweden and Belgium
- 77,000 tonnes of sheep meat were exported  
an export value of €440 million





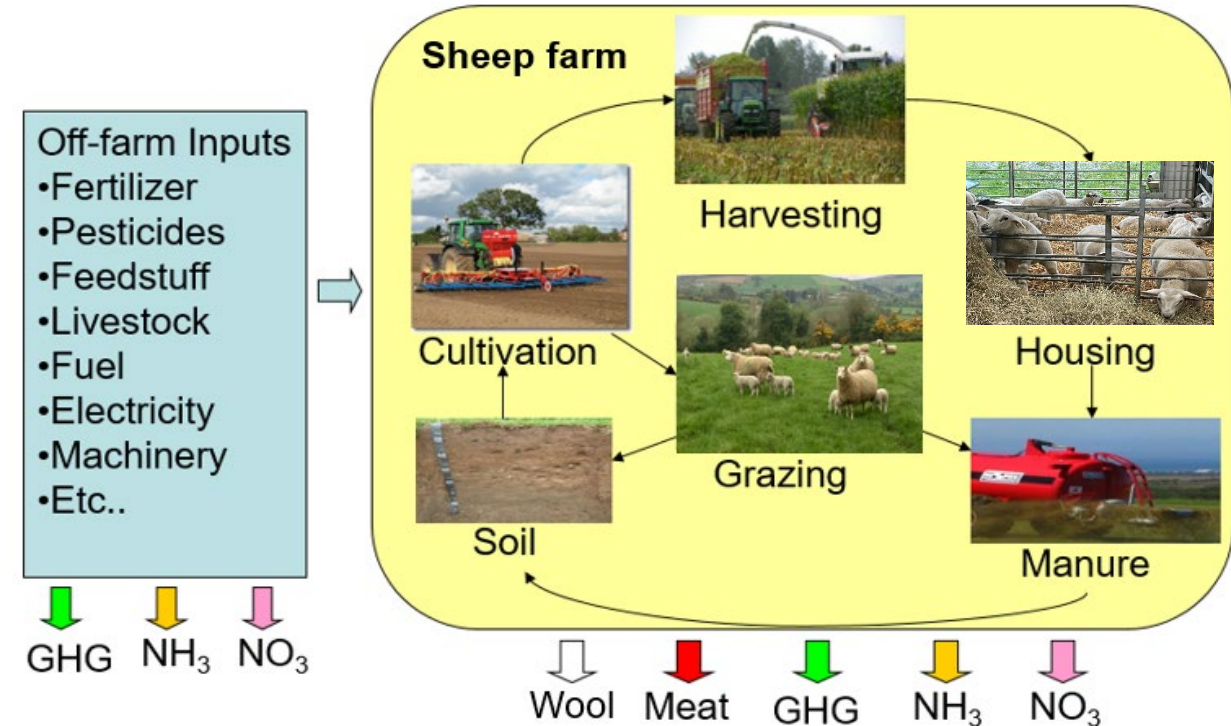
# Sheep Sector Emissions

- Ireland committed reduce the GHG emissions by 51% by 2030
- Aim is for carbon neutrality by 2050
- In 2023, Ireland emitted 55 Mt CO<sub>2</sub> eq, of which 38% came from Agriculture.
- Sheep responsible for c. 7% of agricultural emissions (enteric fermentation and manure management are main sources)
- Emissions from agriculture decreased by 4.6% in 2023



# Teagasc Irish Sheep LCA

- System boundary “cradle to farm gate”
- IPCC and Irish based equations
- Animal categories: mature ewes, lambs, hoggets and rams
- Detailed monthly data collected on:
  - on farm structure
  - animal performance and breeding
  - animal movements
  - all inputs
  - all outputs



## Functional unit

- $\text{CO}_2$  eq per 1 kg live weight, carcass weight and per ha



# Carbon Sequestration



- No approved methodology exist
- Petersen *et al.* (2013) approach
- This method considered two C fluxes:
  - 1) from the soil to the atmosphere during the decomposition of soil organic matter, and
  - 2) from the atmosphere to the soil, when atmospheric C in the form of carbon dioxide (CO<sub>2</sub>) is removed or sequestered by land

*It is estimated that 9.7% of C was added to the soil in the form of plant residues (above and below-ground), application of animal manures, and direct deposition of faecal matter and urine will be sequestered in a 100-years perspective.*

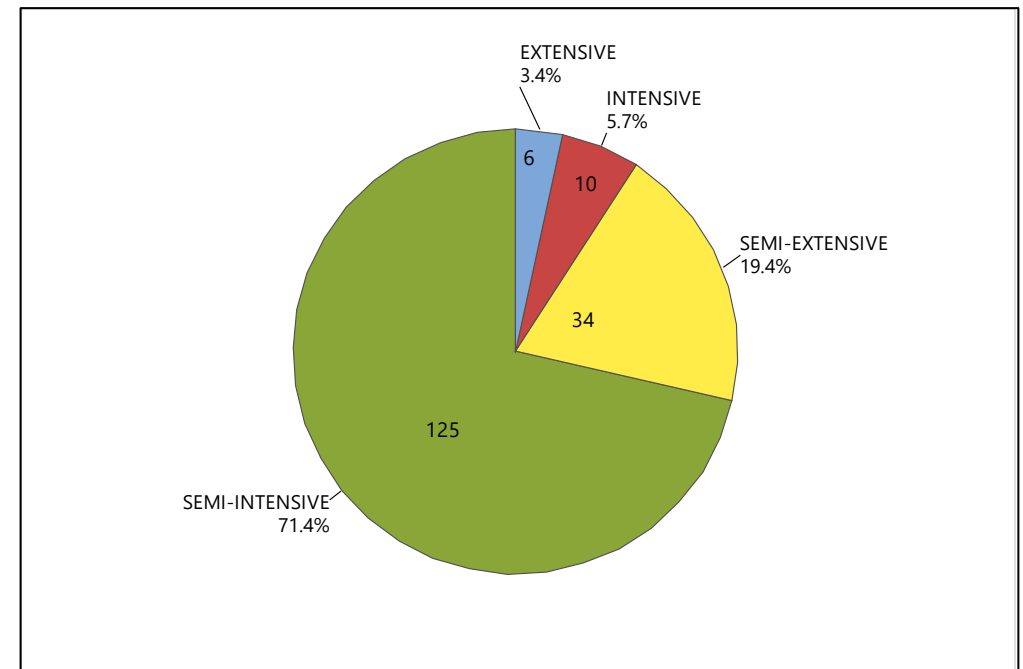
# Irish Sheep farms sample

- Sample of 175 specialist sheep farms, which are population weighted to represent 21037 sheep farms on a national basis

## EU classification of sheep meat farms

|                                                                       |
|-----------------------------------------------------------------------|
| <b>Shepherded:</b> Continuous presence of the shepherd with the sheep |
| <b>Extensive:</b> <1 ewe/ha                                           |
| <b>Semi-Extensive:</b> 2-4 ewes/ha                                    |
| <b>Semi-Intensive:</b> 5-11 ewes/ha                                   |
| <b>Intensive:</b> >12 ewes/ha                                         |

## Farms distribution



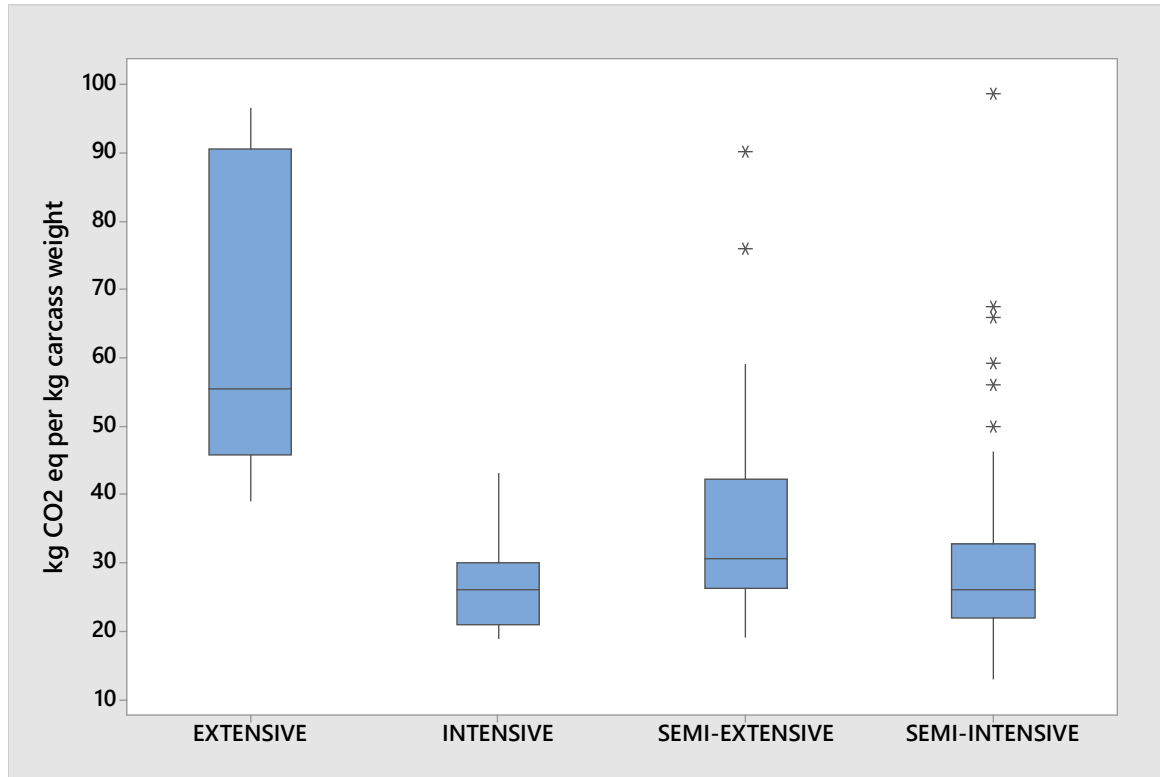
# Technical Farm Performance Indicators

| Variable                               | Extensive Farms | Semi-Extensive Farms | Semi-Intensive Farms | Intensive Farms | <i>P-Value</i> |
|----------------------------------------|-----------------|----------------------|----------------------|-----------------|----------------|
| Farm size, ha                          | 127             | 33                   | 20                   | 24              | 0.000          |
| Stocking rate, ewes ha <sup>-1</sup>   | 1.05            | 3.30                 | 7.18                 | 13.29           | 0.000          |
| Lambs reared ewe joined, n             | 0.97            | 1.39                 | 1.44                 | 1.50            | 0.017          |
| CW sold, kg ha <sup>-1</sup>           | 13              | 90                   | 216                  | 385             | 0.000          |
| Concentrates fed, kg ewe <sup>-1</sup> | 53              | 126                  | 98                   | 74              | NS             |
| Inorganic N input, kg ha <sup>-1</sup> | 18              | 29                   | 66                   | 93              | 0.000          |
| Farm fuel, L ha <sup>-1</sup>          | 15              | 47                   | 122                  | 162             | 0.016          |
| Electricity, kwh ha <sup>-1</sup>      | 13              | 140                  | 233                  | 321             | 0.020          |

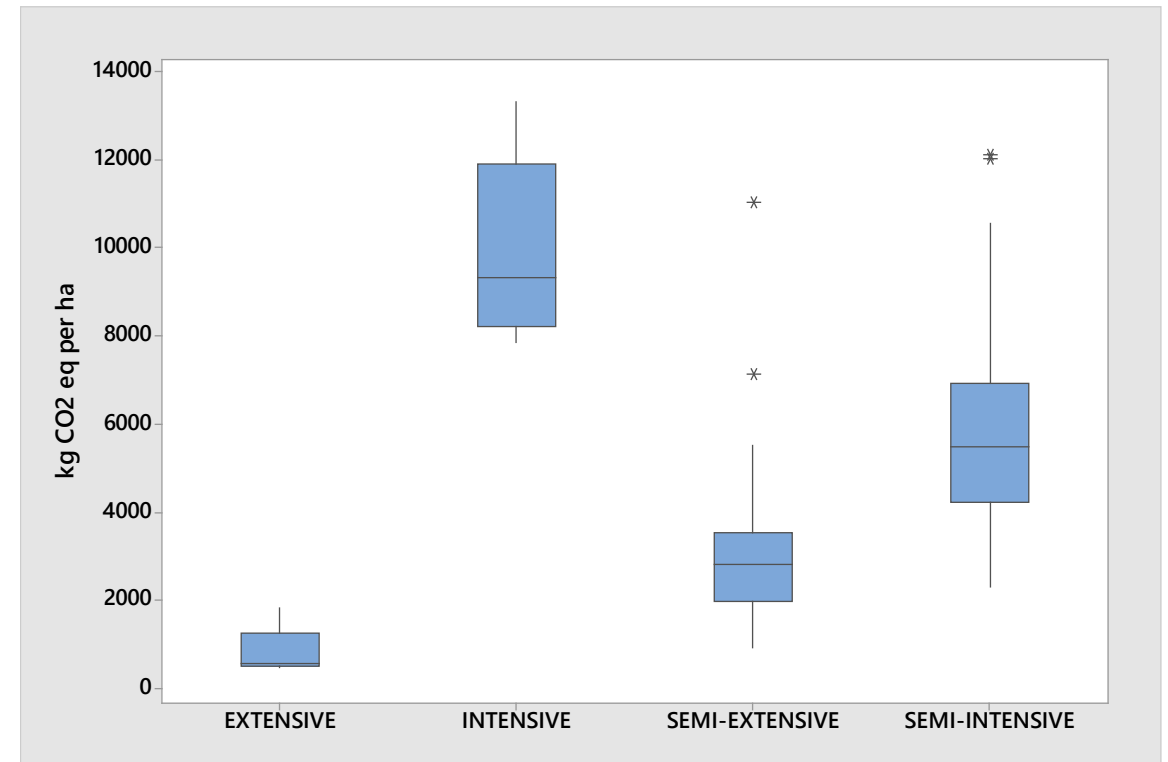




# GHG Emissions Distribution Between Farm Systems

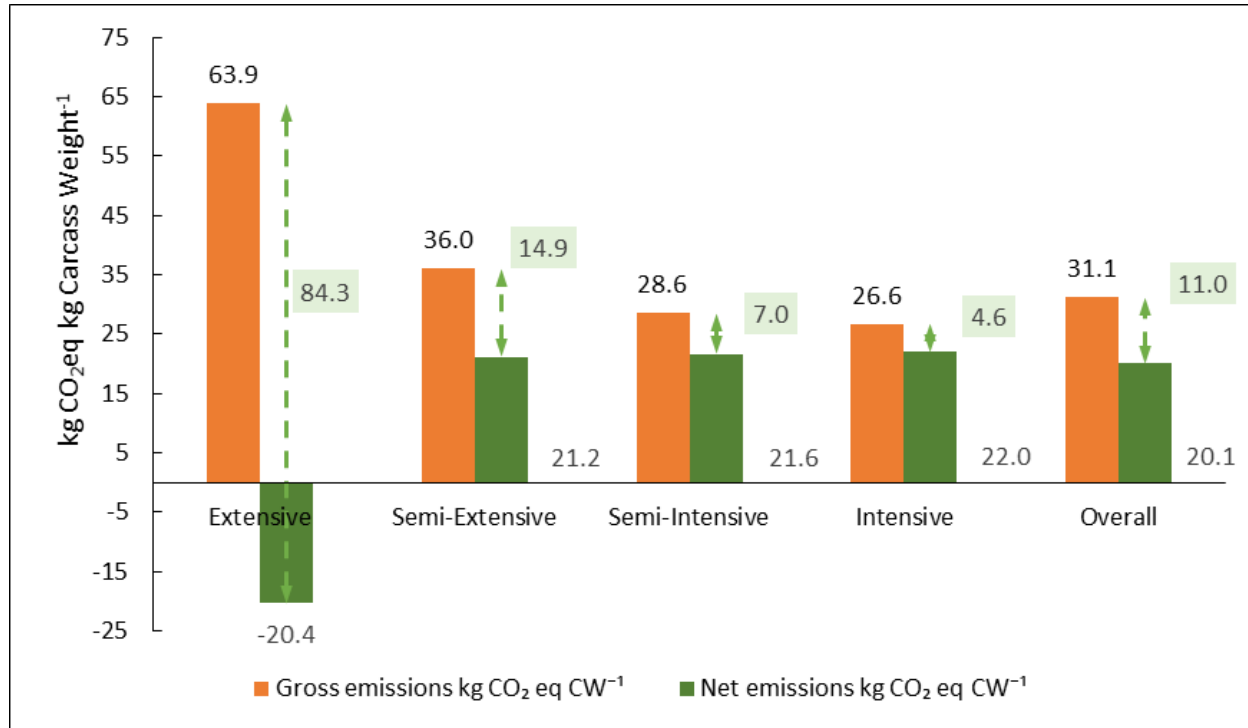


Distribution of GHG emissions per kg of product across sheep farm systems, kg CO<sub>2</sub> eq kg CW<sup>-1</sup> (min 13.0 and max 98.6)

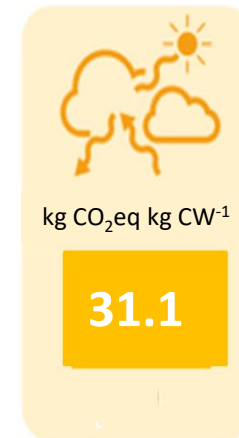


Distribution of GHG emissions per hectare across sheep farm systems, kg CO<sub>2</sub> eq ha<sup>-1</sup> (min 457 and max 13291)

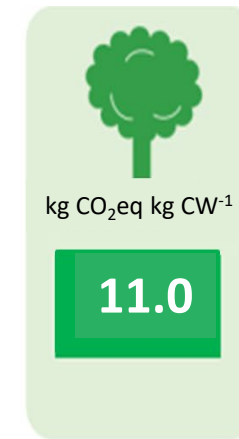
# GHG Emissions per Carcass Weight (Carbon Footprint per kg product)



Gross emissions



Storage



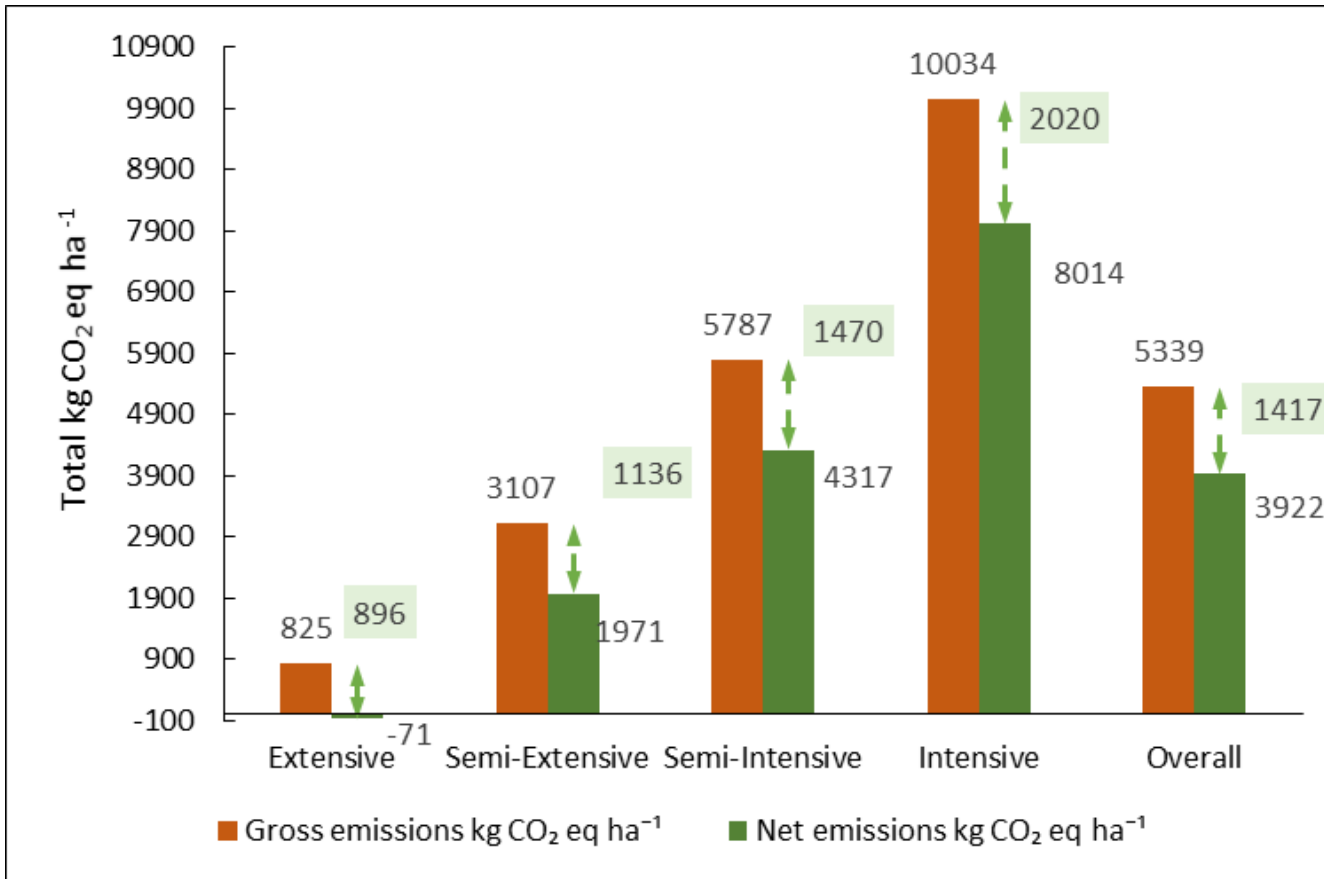
Net emissions



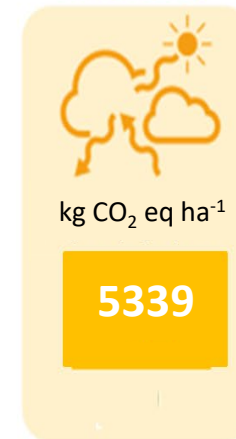
Mean GHG emission per kg carcass weight is 31.1 kg CO<sub>2</sub> eq (20.1 kg CO<sub>2</sub> eq if include CO<sub>2</sub> sequestration)

**35 % offset by carbon storage**

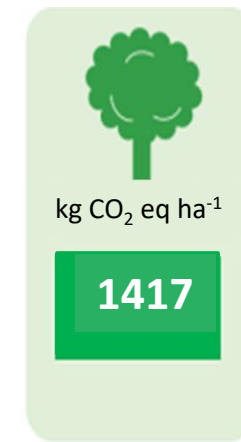
# GHG Emissions per ha



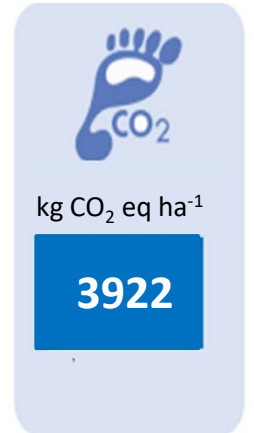
Gross emissions



Storage



Net emissions



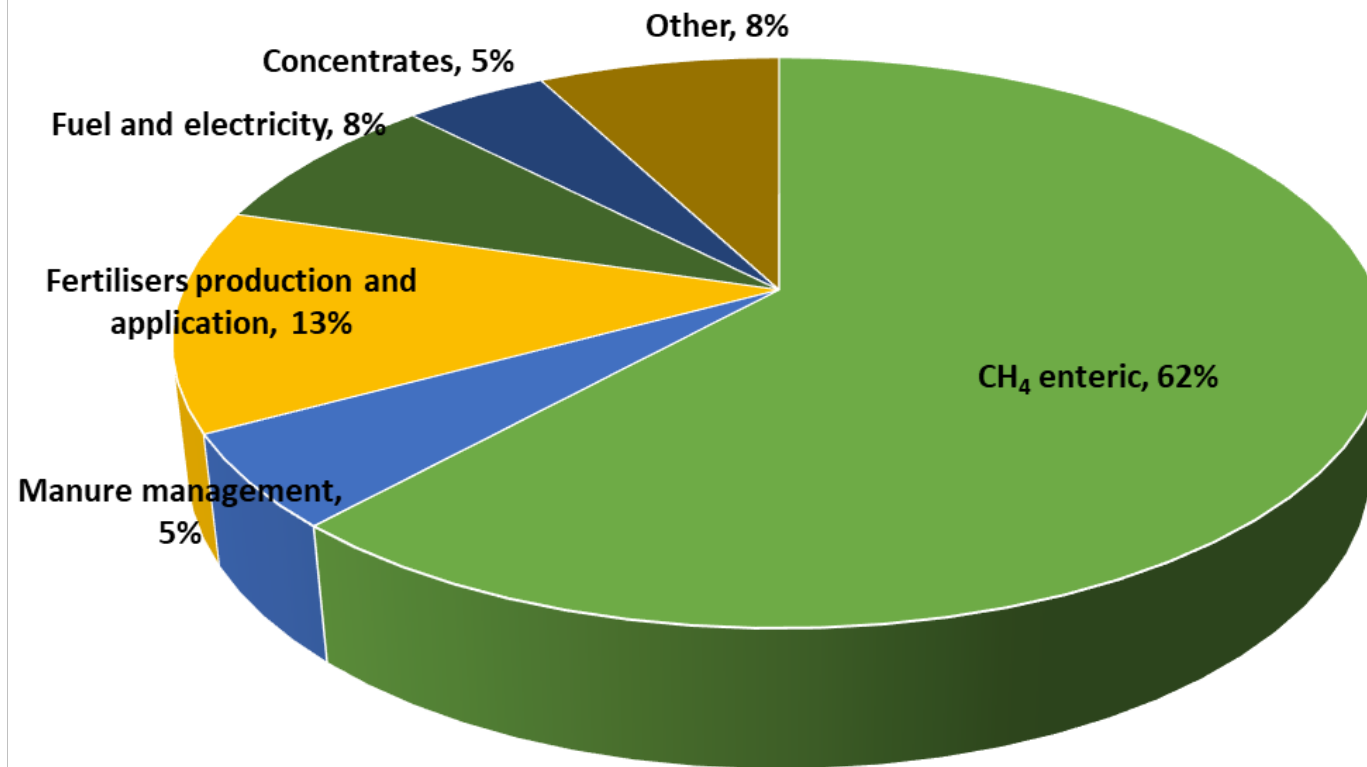
**27 % offset by carbon storage**

Mean GHG emission per kg ha of sheep forage area is 5339 kg CO<sub>2</sub> eq (3922 kg CO<sub>2</sub> eq if include CO<sub>2</sub> sequestration)



# GHG Emissions Sources

GHG emissions sources





# Conclusions

- Mean GHG emission is 31.1 kg CO<sub>2</sub> eq per kg of lamb carcass produced
- Significant heterogeneity of GHG emissions between the farm systems and within each individual farm system
- Intensive farms produce less GHG emissions per kg of sheep meat
- Extensive farms produce less GHG emissions per ha
- Trade-offs between productivity and environmental sustainability
- Improving farm efficiency and adopting low-emission technologies can reduce the GHG intensity of sheep meat



Thank you

lyubov.bragina@teagasc.ie  
<https://life-green-sheep.eu/>



# GHG Mitigation Practices

- 1) Grassland management (protected urea, grass clover swards, optimal soil pH, P and K levels)
- 2) Manure management (using LESS)
- 3) Animal feeding and nutrition (optimise feed formulation)
- 4) Animal health and welfare (improved health, reduced stress, extended animal longevity)
- 5) Animal genetics and breeding

