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Environmental study of dairy sheep production system in the region of Basilicata (Italy)

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Introduction

- Livestock production is a main global source of greenhouse gas emissions (GHG)

- The impact of the small ruminants area to GHG emission is equal to 474 million tones CO_2-eq. (Opio et al., 2013)

- The main GHG emissions attributed by the International Panel of Climate Changes (IPCC) to the agricultural sector are methane (CH_4) and nitrous oxide (N_2O)

Introduction

- Animal industry are liable for the production of GHG from enteric fermentations
- Life Cycle Assessment (LCA) is one of the most common approaches for estimating the environmental impacts
- Several studies on the impacts of livestock sector were based on the application of LCA.

Introduction

- Most of the studies on the LCA of milk and dairy products were conducted on cattle

- However, ovine milk plays an important economic role in the Mediterranean area, including southern Italy

- In Basilicata region 291,000 sheep for meat and dairy production (ISTAT, 2017)

Aim

Estimate the major environmental impact on dairy sheep farming systems in Basilicata using a LCA approach

Materials and methods

Source: Google Hearth

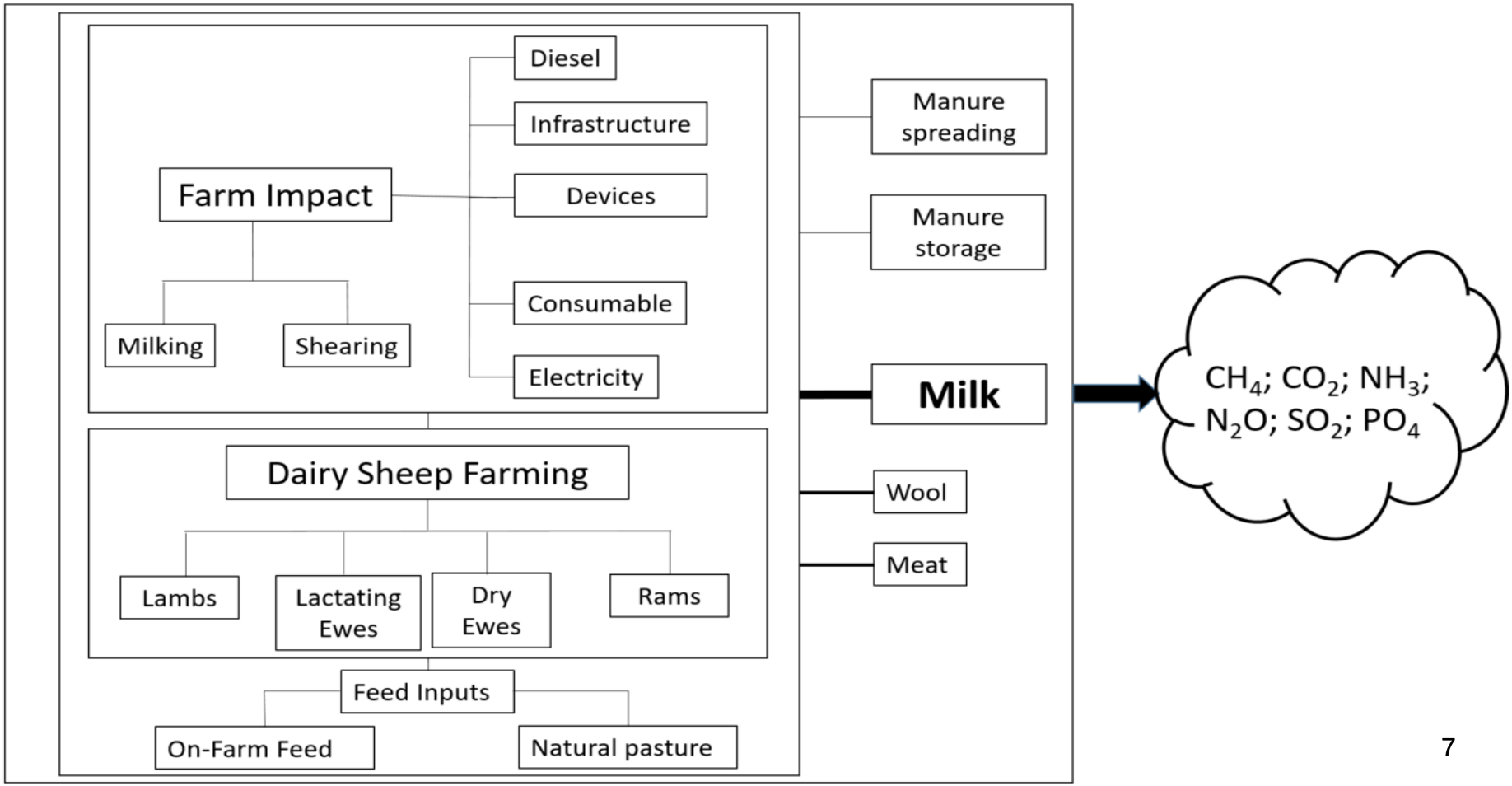
4 Farms

Breed: Merinos

Data collection: directly on farm-questionnaire to the farmers

Materials and methods

System boundaries of the dairy sheep farming system



Materials and methods

- Functional unit (FU) was 1 kg of Fat and Protein Corrected Milk (FPCM)
- Milk fat (FC) and protein (PC) content was 8.0% and 5.3%, respectively
- FPCM = (Kg of milk) (0.25 + 0.085 FC + 0.035 PC); Pulina et al. (2005)

Materials and methods

Main characteristics of four dairy sheep farms production system

Farms	1	2	3	4	Averages
Lactating ewes (n)	95	130	550	850	**406**
Total Milk production (kg year^{-1})	5.000	15.000	55.000	40.000	**28.750**
Size (ha)	45	15	55	150	**66**
Meadow hay (t year^{-1})	3	21	62.5	150	**59.1**
Permanent Pasture (t year^{-1})	60	47	18	288	**103.2**
Oats seeds (t year^{-1})	3.5	3	30	60	**24.1**
Barley flour (t year^{-1})	2	2	0	0	**1**
Diesel (t year^{-1})	12	6	10	14	**10.5**
Electricity (kW year^{-1})	3125	2200	2000	2847	**2543**

Materials and methods

- The data was assessed by using the commercial software package SimaPro 8.01 PhD, method ILCD 2011

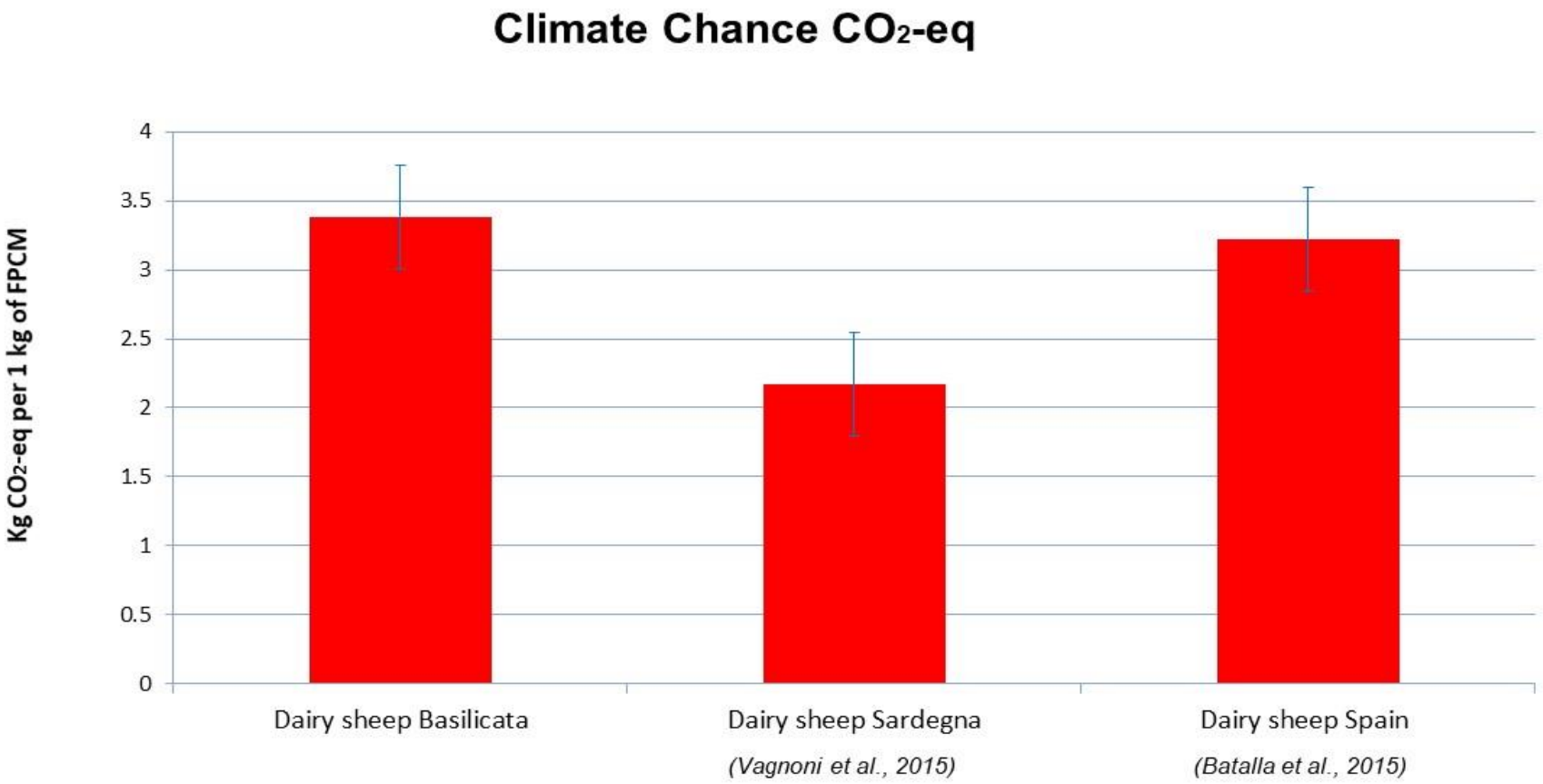
- The environmental assessment was based on the following impact categories and units:

- Climate Change (CC): kg CO2-eq
- Terrestrial Acidification (TA): g SO2-eq
- Marine Eutrophication (ME): g PO4-3 -eq
- Non-renewable energy use (NRE): MJ-eq

Results and discussion

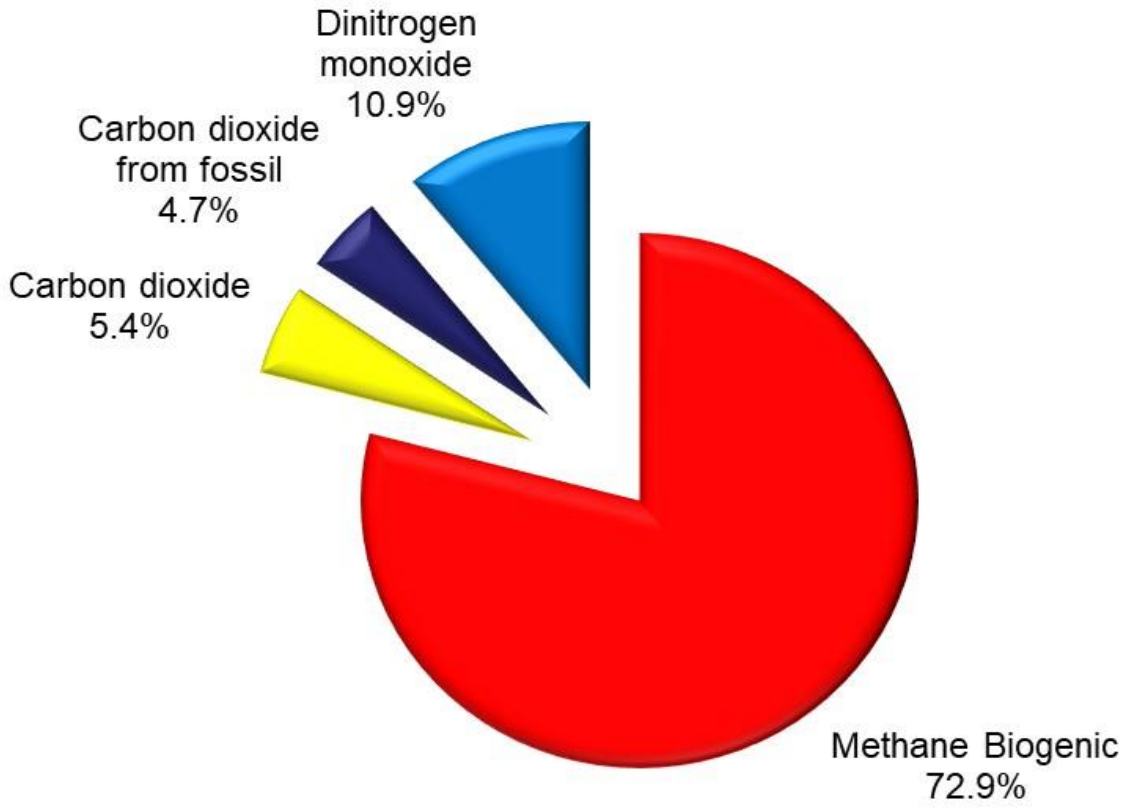
Impact categories and units:	Per 1 kg FPCM	Min.	Max.	S.E.
Climate Change (CC): kg CO2-eq	**3.38**	2.13	5.10	1.35
Terrestrial Acidification (TA): g SO2-eq	**37.74**	22.46	65.99	19.31
Marine Eutrophication (ME): g PO4-3 -eq	**8.67**	4.25	13.72	3.89
Non-renewable energy use (NRE): MJ-eq	**6.31**	3.23	8.26	2.19

Results and discussion



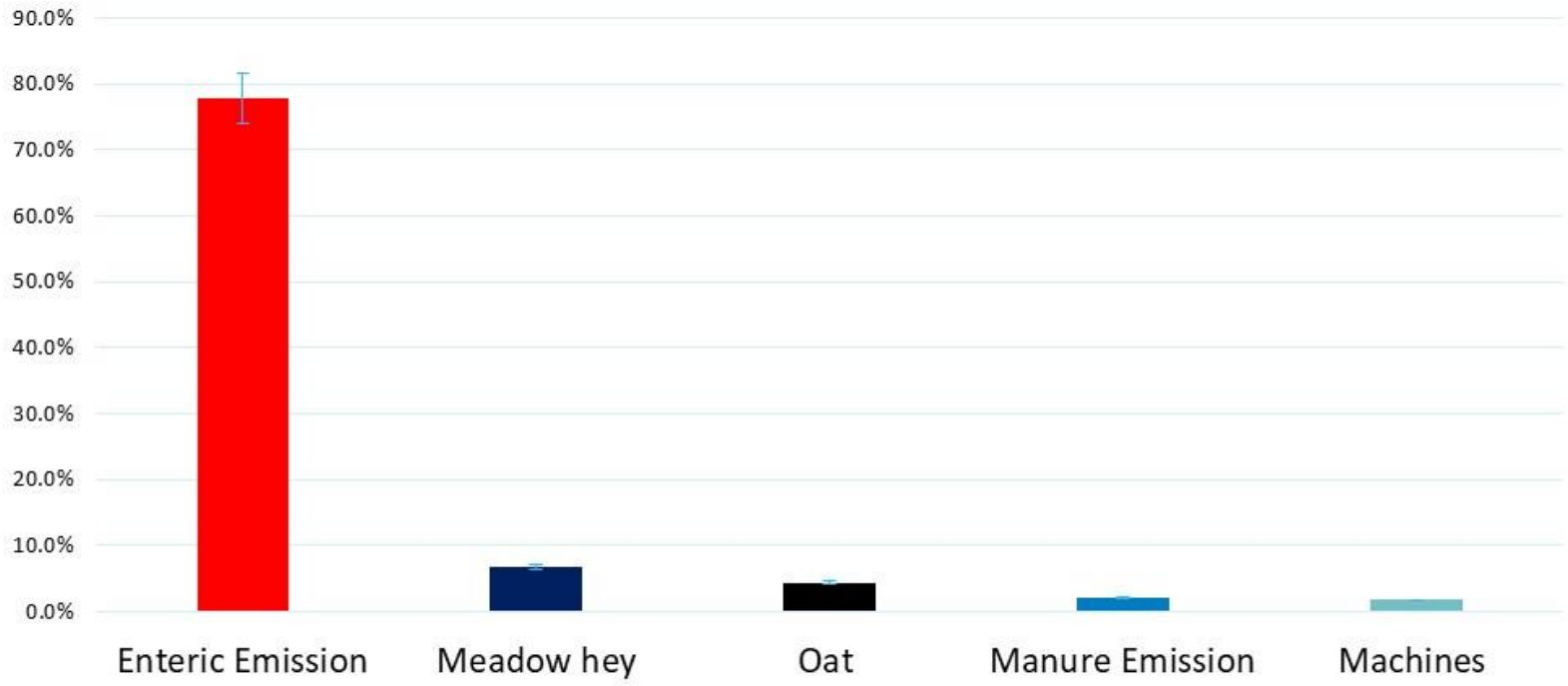
Results and discussion

Main pollutant emissions in air contributing to Climate Change

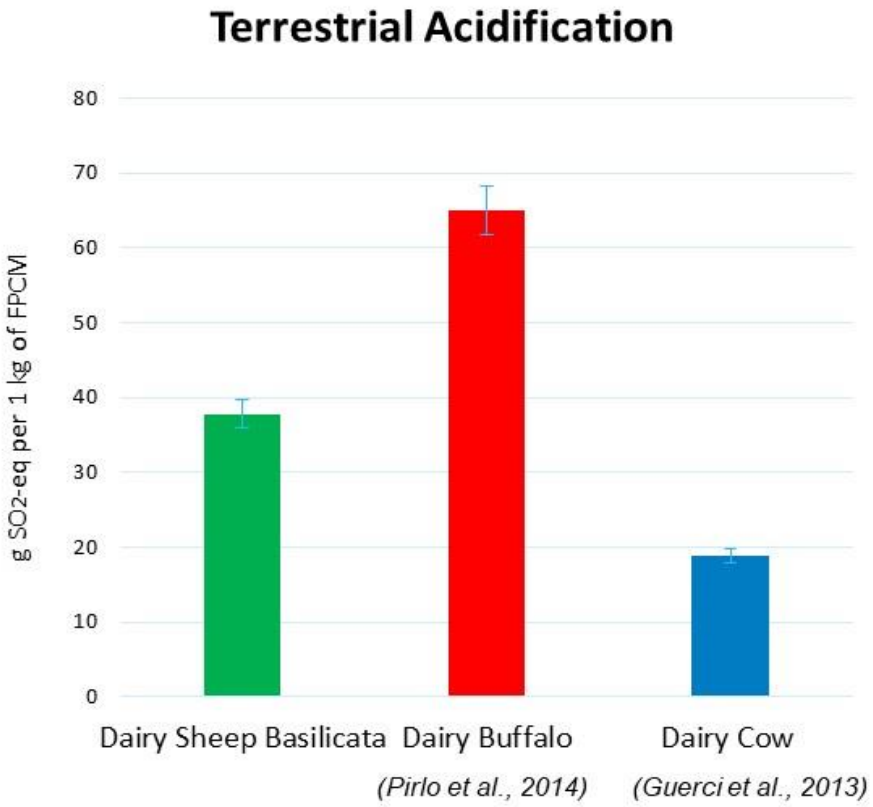


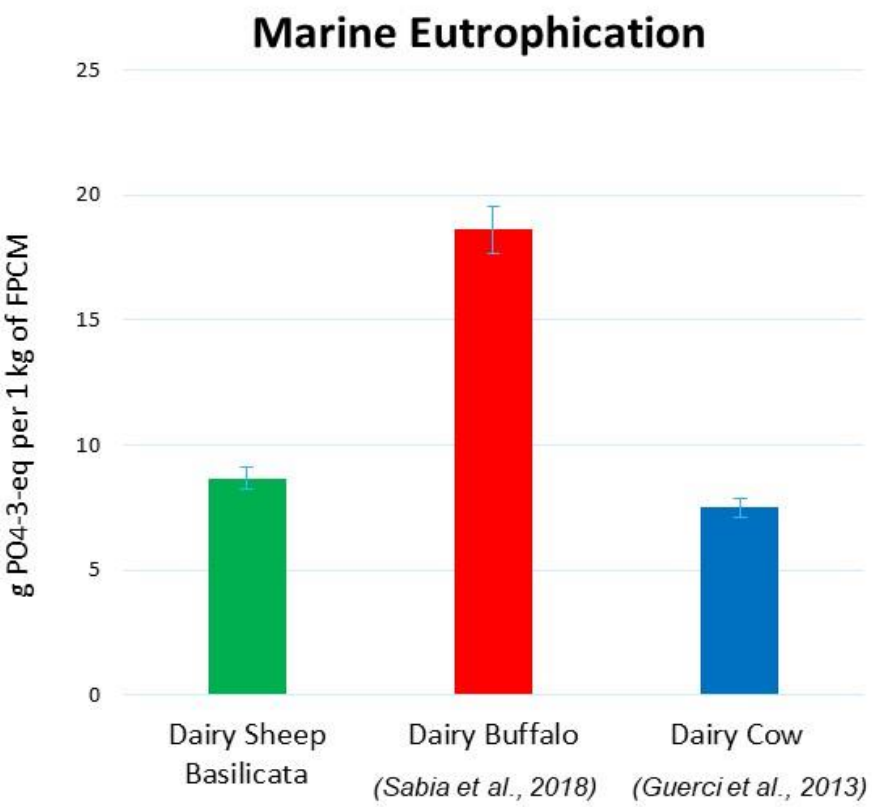
Results and discussion

Main processes contributing to Climate Change



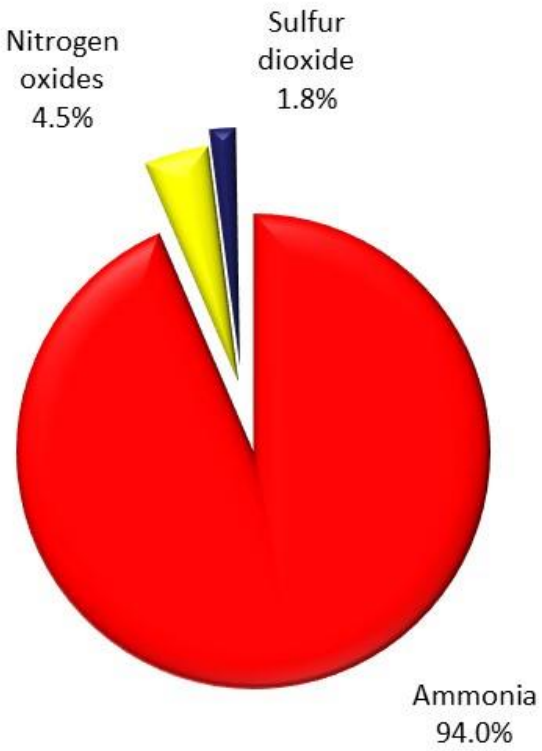
Results and discussion



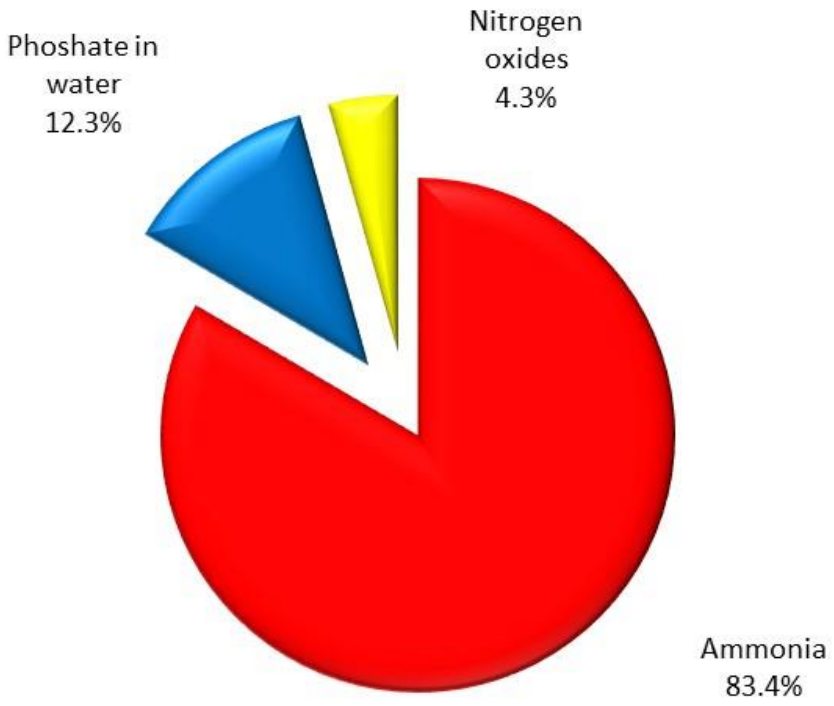


Results and discussion

Main pollutant emissions contributing to Terrestrial Acidification

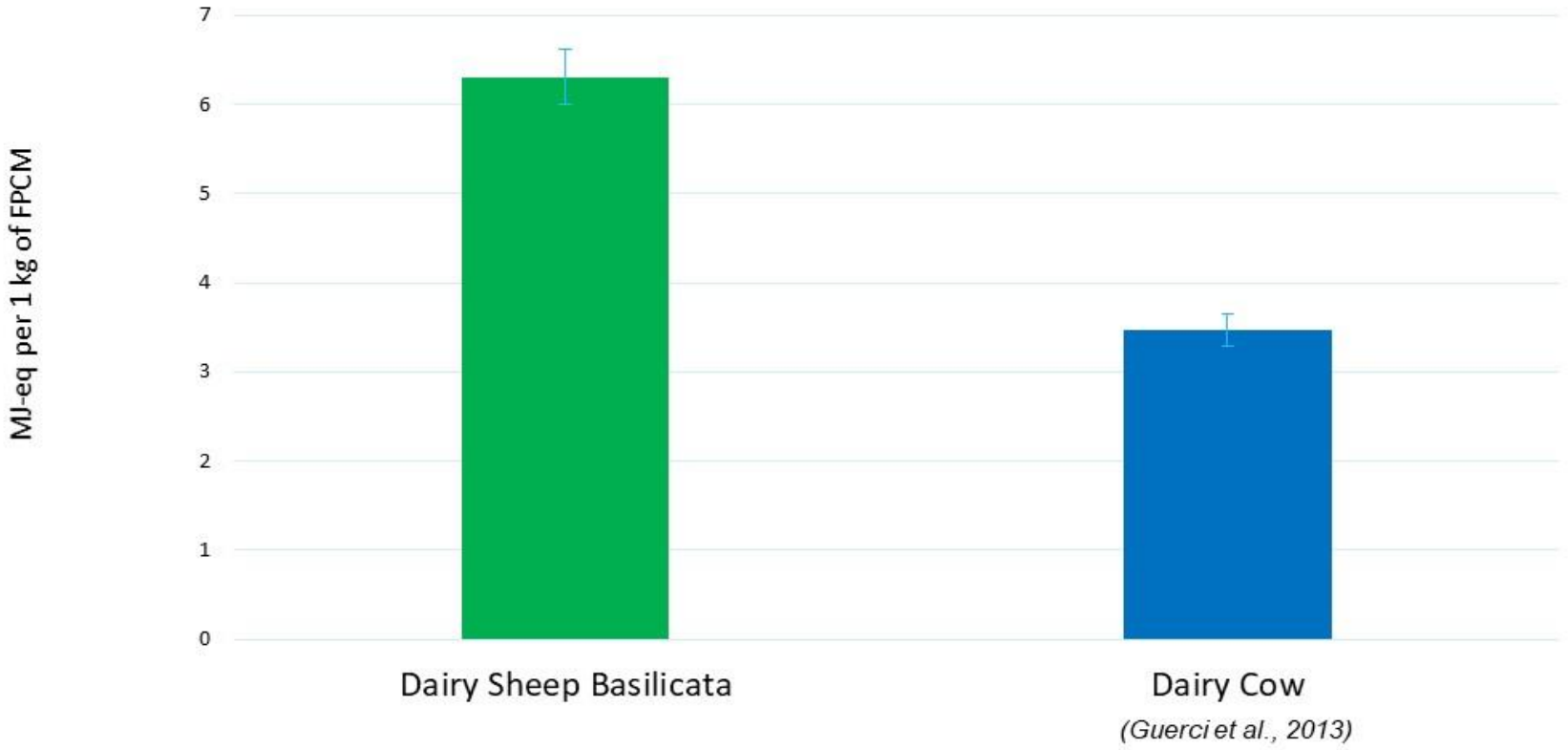


Main pollutant emissions contributing to Marine Eutrophication



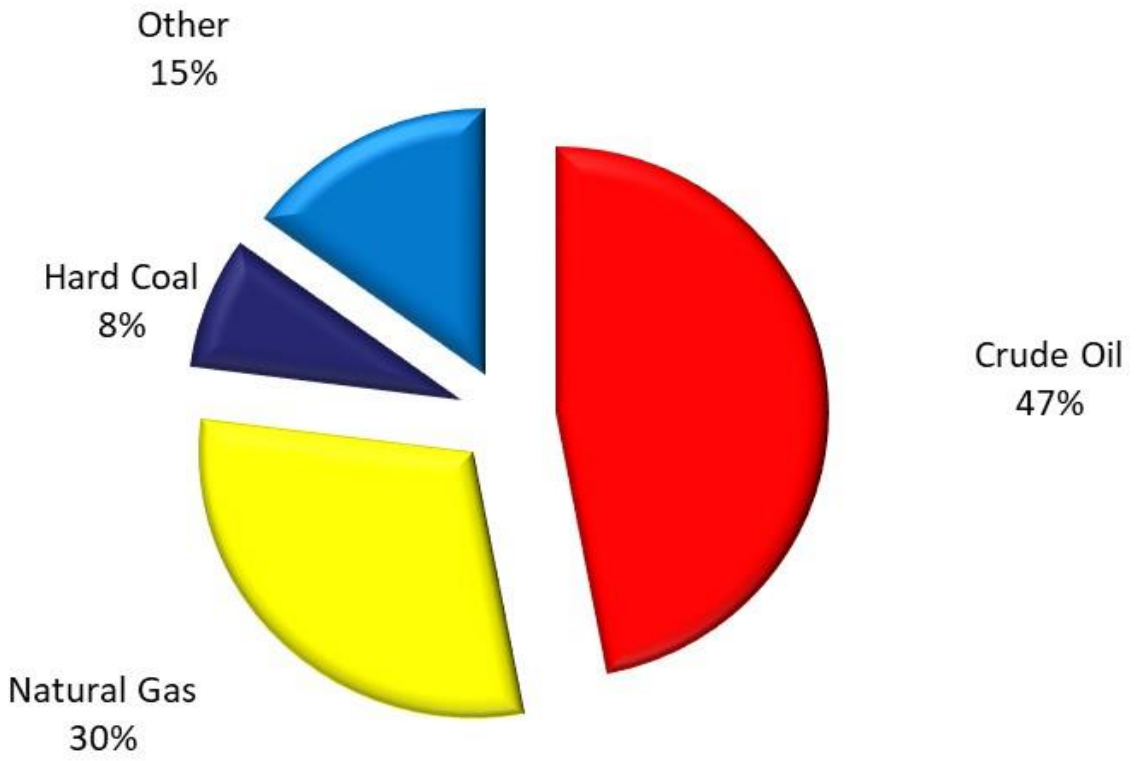
Results and discussion

Non-renewable energy use



Results and discussion

Main substances involved for Non-renewable energy use



Conclusions

Limited data on the environmental impact of dairy sheep production systems

Collection of primary data using questionnaire directly administered to farmers is the critical point of this study

The sustainability of dairy sheep farming can be achieved with its continuous monitoring in order to minimize the impact without impairing its competitiveness


Thank you for your attention