



With the contribution of the LIFE financial
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LIFE 15 CCM/IT/000123



ECO-SUSTAINABLE DAIRY SHEEP PRODUCTION:

an LCA approach from Sardinia, Italy

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CLIMATE
ACTION
IN SUPPORT
OF THE PARIS
AGREEMENT
BOLOGNA, 26-27 OCTOBER 2017



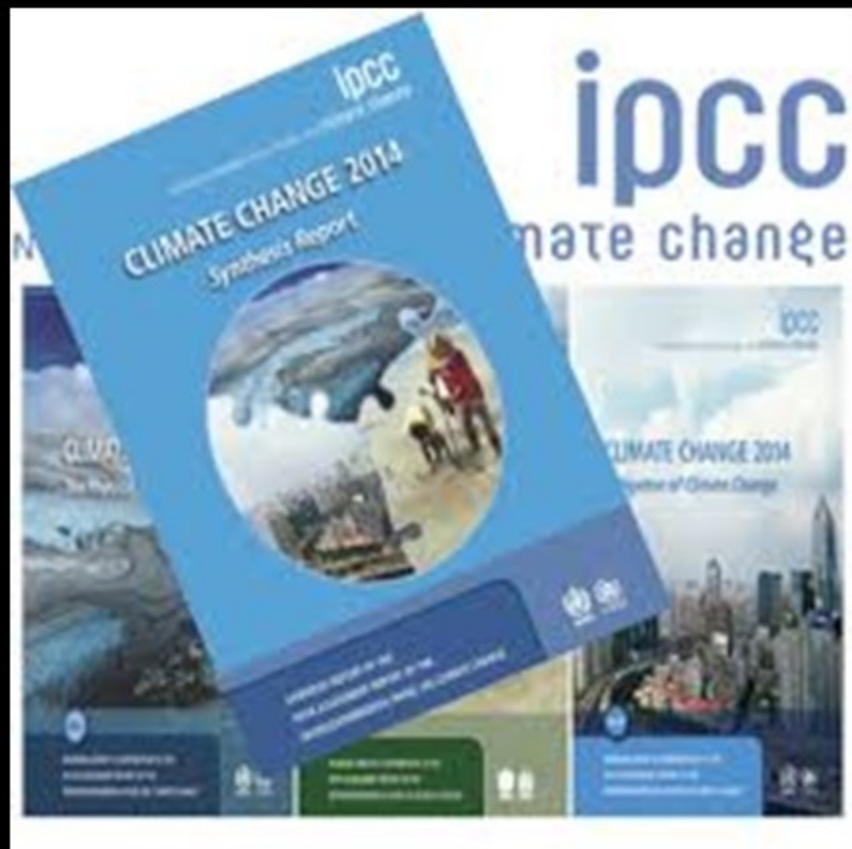
REGIONE AUTÒNOMA
DE SARDIGNA
REGIONE AUTONOMA
DELLA SARDEGNA





“Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production”

- Agri-food sector is a GHG emissions source (24%), the second most impacting economic activity.
- 10-12% of total CH₄ and N₂O anthropogenic emissions.
- 6.5% of GHG emissions in livestock are related to small ruminants (0.5 Gt CO₂-eq).
- 6.3 millions of sheep in Italy, 66% of which in Sardinia.





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Looking for an eco-sustainable sheep supply chain: environmental benefits and implications

The project SheepToShip LIFE aims to enhance the contribution of the sheep sector – from sheep farming to processing milk and dairy products – towards the achievement of EU climate change targets.

By developing and promoting innovative and eco-sustainable production models, SheepToShip LIFE aims to meet its overall objective of **reducing by 20% in 10 years greenhouse gas emissions from the Sardinian sheep farming sector and dairy supply chain.**

Total budget

€ 2,610,043

EU contribution

€ 1,533,561

Duration

4 years, from 01 July 2016
to 30 June 2020





The LIFE Programme **2014-2020**

The project SheepToShip LIFE is co-funded by the European Commission within the framework of the LIFE Programme, the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout Europe. The LIFE Programme, managed by the European Commission, was set up in 1992 to contribute to the development and implementation of EU environmental and climate policy and legislation.

The Regulation (EC) No 1293/2013 established the new 'Programme for the Environment and Climate Action (LIFE)' for the period from 1 January 2014 to 31 December 2020. SheepToShip LIFE is financed within the priority area 'Climate Change Mitigation' of the sub-programme 'Climate Action' as an initiative to combat climate change by reducing greenhouse gas emissions from sheep farming in Sardinia.



- 12,000 dairy sheep farms.
- 3.3 million sheep heads.
- 3.15 million litres of milk.

Sardinia as a European laboratory for climate change mitigation



Sardinia was chosen as the only intervention area because it represents a valuable model of the entire Mediterranean sheep sector, in terms of both sheep population and representativeness of the typical European husbandry systems. Sardinia can therefore serve as an 'open-air laboratory' where a model of actions and measures on climate change at European level could be tested.



Improving the environmental quality of sheep production systems and demonstrating the environmental, economic and social benefits deriving from eco-innovation in the dairy supply chain and sheep farming sector.



Promoting the implementation of environmental and rural development policies, guided by the life-cycle approach, and aimed at enhancing **the environmental quality** of local sheep's milk and cheese supply chains.

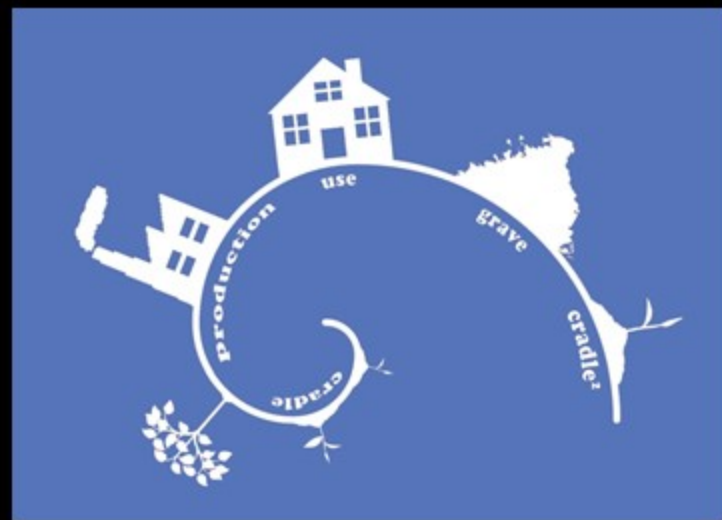


Increasing the level of knowledge and awareness of stakeholders and the general public regarding the environmental sustainability of products made from sheep's milk and their contribution to the mitigation of climate change.



LCA approach for assessing the environmental aspects and potential impacts associated with a product.

According to the ISO standards, LCA is defined as a method for analysing and determining the environmental impact along the product chain of (technical) systems, from cradle to grave.



European Commission recognises LCA as best framework for assessing the potential environmental impact of products (COM 2003)

- **Sustainable Consumption and Production Action Plan and Sustainable Industrial Policy Action Plan (CEC 2008)**

- Ecodesign Directive (2009)
- Lead Markets Initiative
- Integrated Product Policy
- Environmental Technologies Action Plan (CEC 2004)
- EU Eco-Management and Audit Scheme

- **Smarter Consumption**

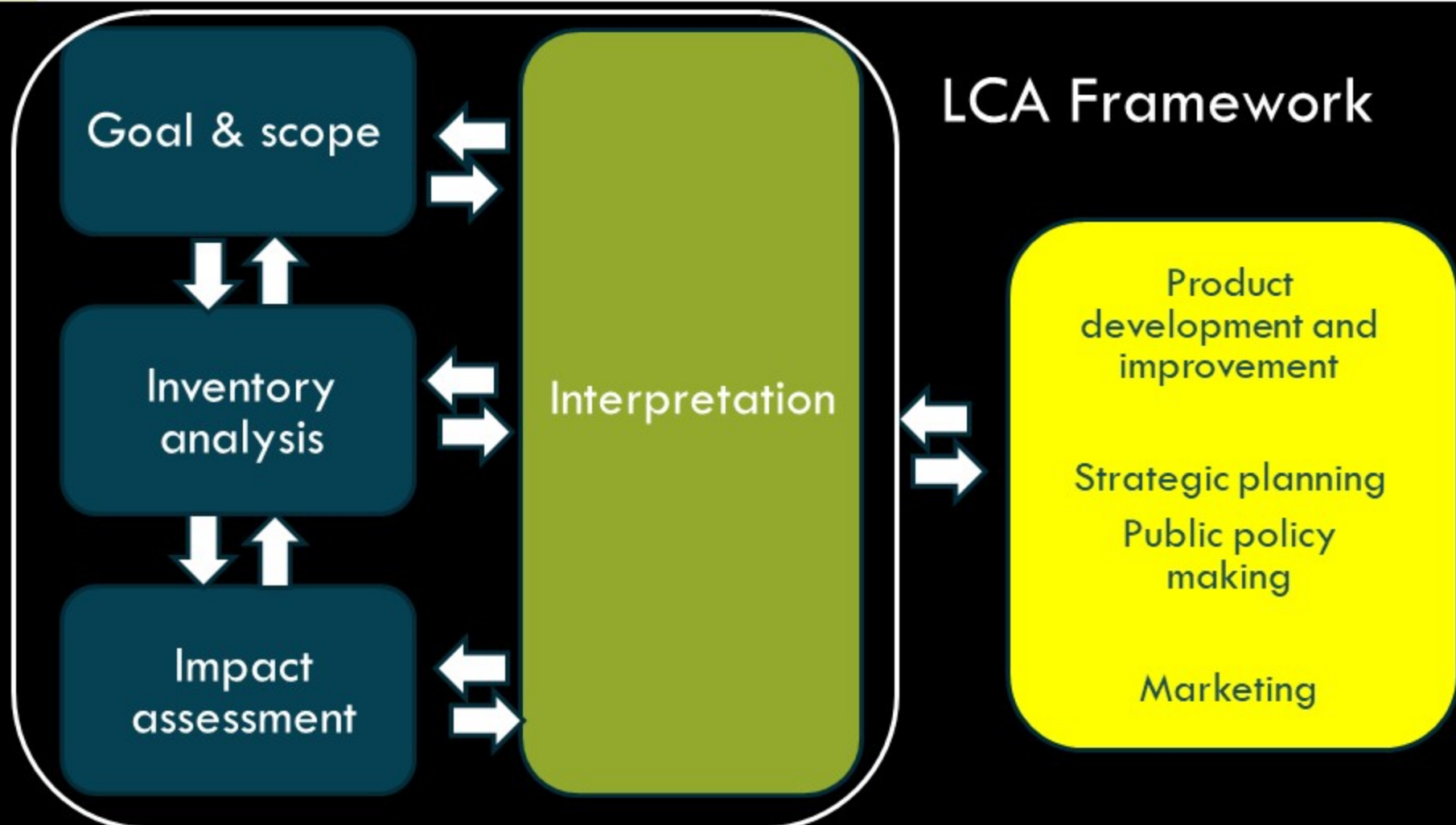
- Green Public Procurement
- EU Eco-label
- Retail Forum
- Circular economy

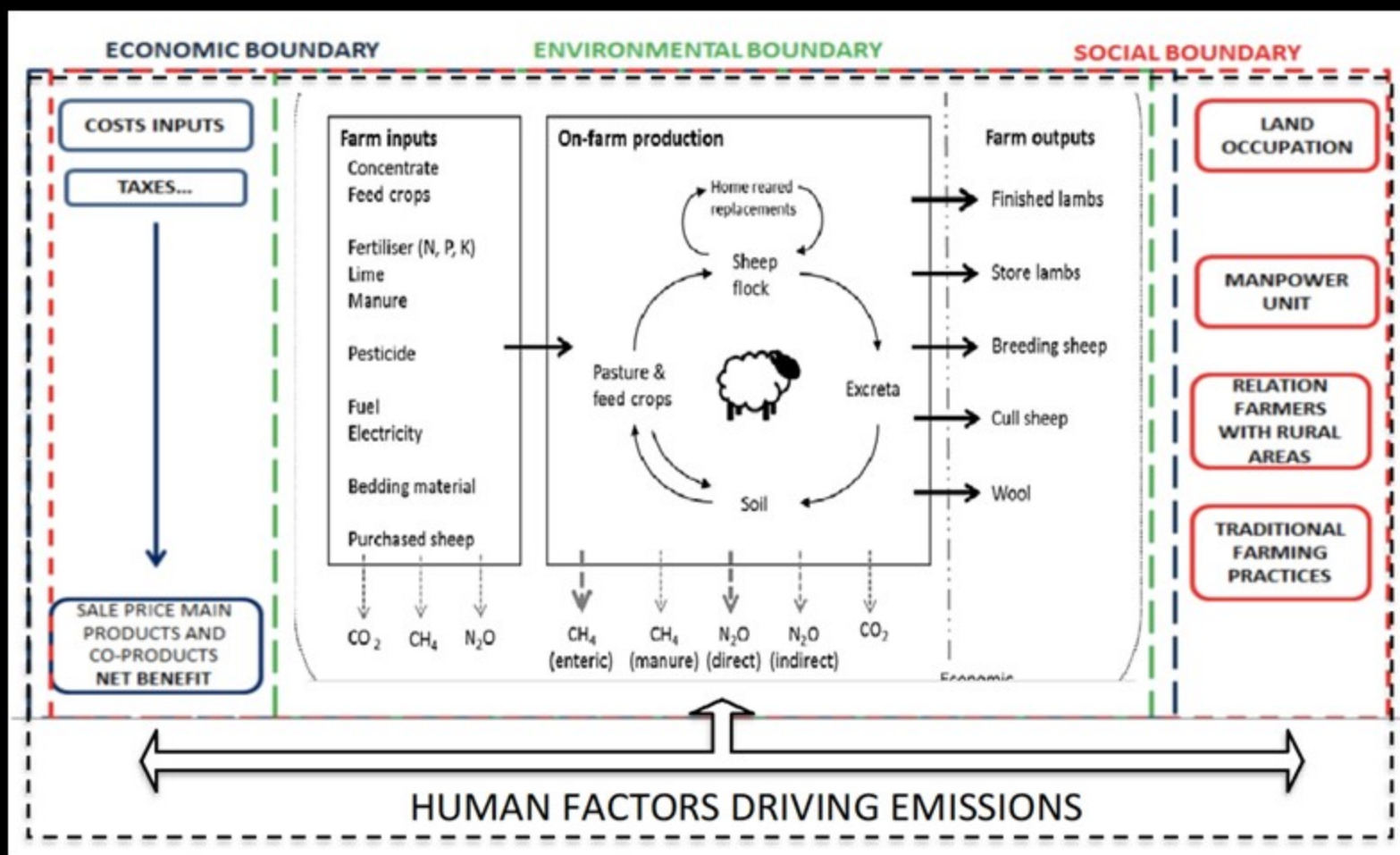
- **Natural resources policies**

- Resource-efficient Europe flagship initiative (COM 21 2011)
- Thematic Strategy on the Sustainable Use of Natural Resources (COM 670 2005)
- Critical Raw Materials (2011)
- Biofuels Directive (2009/28/EC)

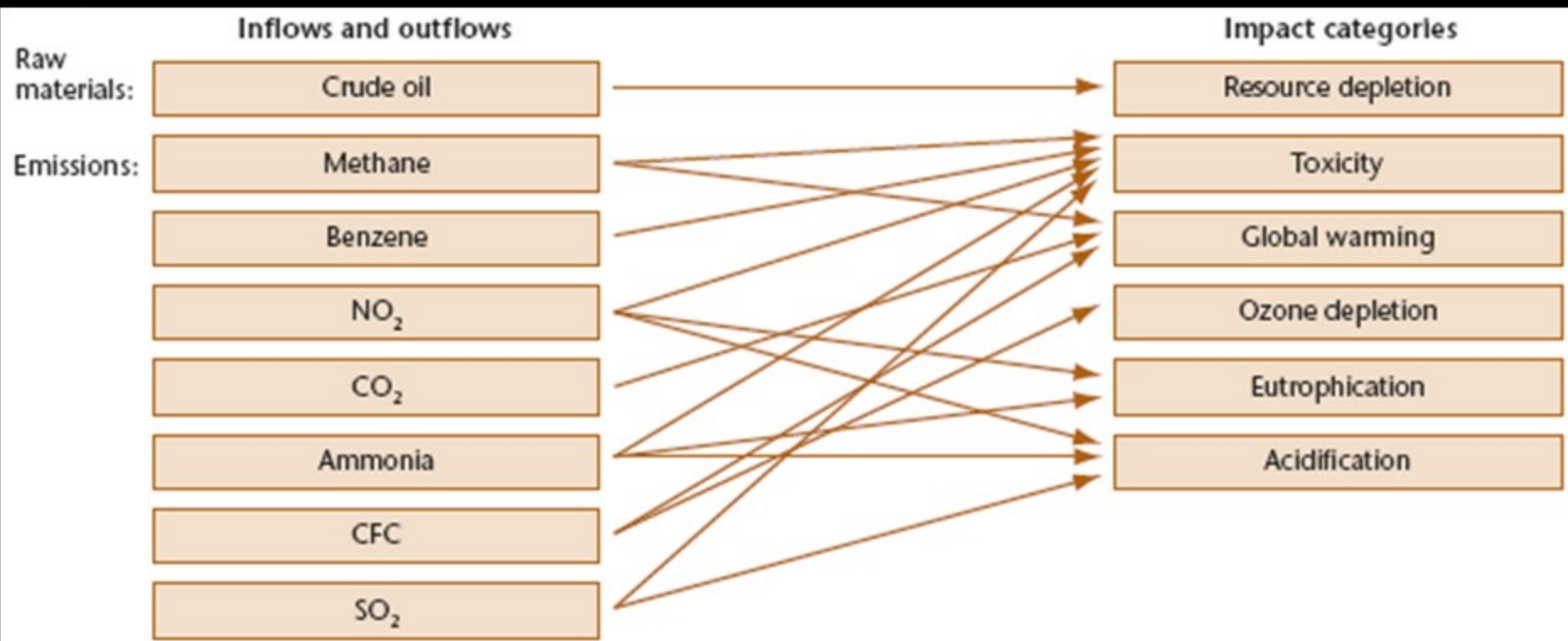
- **Waste and Recycling legislation**

- Thematic Strategy on the prevention and recycling of waste (COM 666 2005)
- Waste Framework Directive (EC 2006)
- Waste Electric and Electronic Products (WEEE) Directive

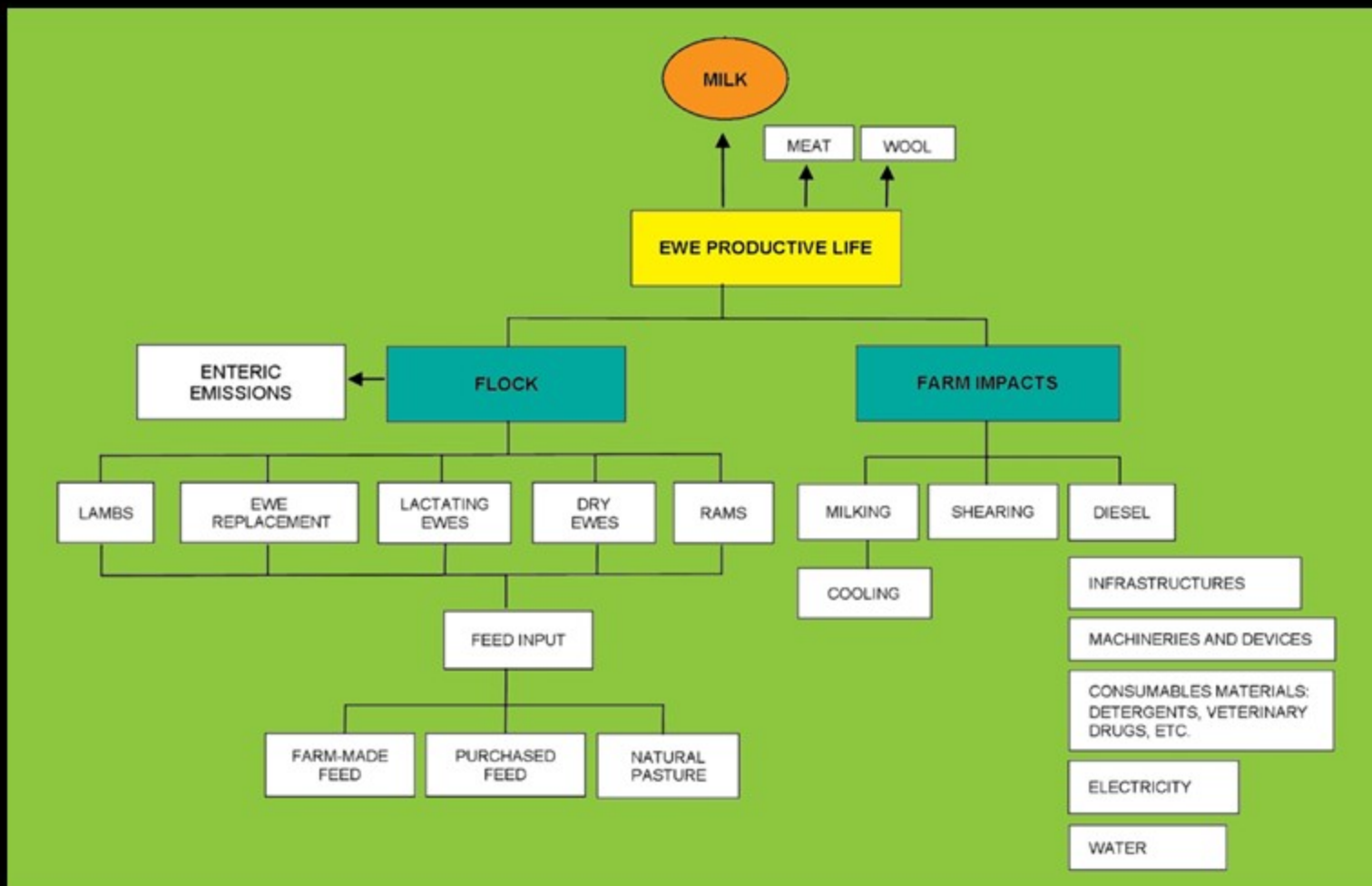




(Adapted from Jones et al., 2014; Batalla et al., 2014).



Evaluation of environmental performances of 200
sheep farm and 10 dairy plants



Animal emissions and Emissions from feed, direct and indirect energy, post-farm sources.

Reference year: 2015

| | Methane | | | Nitrous Oxide | | CO ₂ equivalents | |
|----------------|---------|--------|-------|------------------|---------|-----------------------------|-------|
| | Enteric | Manure | Total | Manure | Enteric | Manure | Total |
| Kg/year | | | | | | | |
| kg/head | 1.4 | 0.8 | 11.2 | 0.04 | 260 | 31 | 291 |
| kg/adult sheep | 13.6 | 1.1 | 14.7 | 0.05 | 341 | 41 | 382 |
| Incidence | | | | | 89% | 11% | 100% |

Emission intensity: 3.2 kg of CO₂-eq per kg of fat and protein corrected milk (6.5% fat) – 1,565 kton of kg CO₂-eq

| Item | Used value | UM | source |
|---|--------------|---------------------------------------|------------------------|
| Sardinia milk production | 315,500 | million liters | Istat 10 year average. |
| Sardinian Sheep Heads | 3.15 | heads | Istat 10 year average. |
| Emissions per liter | 3.2 | kg of CO ₂ eq /kg 6.5% FCM | Atzori et al., 2014 |
| Emissions LCA | | | |
| Animal emissions (enteric and manure sources) | 73.10% | % of total | Gerber et al., 2013. |
| Milk processing | 10% | % of total | Specific local studies |
| CO ₂ equivalent emissions | | | |
| Animal emissions (enteric, manure) | 1,010 | kton of kg CO ₂ | estimated |
| Other farm emissions (fertilizers, energy, feeds) | 1,381 | kton of kg CO ₂ | estimated |
| Processing | 153 | kton of kg CO ₂ | estimated |
| Total Sardinian Sheep Sector emissions from cradle to dairy plant gate | 1,565 | kton of kg CO₂ | estimated |

*sheep milk density was consider equal to 1.033.

- Factors related to animal diet
- Non- nutritional factors
- Grasslands management



Nutritional scenarios

Rumen population modifiers

Intake and diet digestibility

Forages and forage-based diets

Plant bioactive compounds

Level of concentrate supplementation and concentrate to forage ratio

Concentrate source: lipid-based and starchy concentrates

Dietary additives to reduce denitrification and leaching of N in excreta

Dietary additives acting as electron receptors, etc.



Non-nutritional scenarios

Animal genetics, animal reproduction management and animal health are the most promising at medium and long term scale.

However, strategies based on the implementation of selection and reproductive strategies may entail investments that go far beyond farm financial capabilities.



Grassland management may contribute to reduce the GHG emissions

- Extensive systems: potentials of soil C sequestration of managed grasslands.
- Correct agronomic practices: increase of soil C sequestration, especially in extensive sheep farms.
- Permanent grasslands improve soil C stock respect to arable crops.
- Grazing: soil C sequestration.
- N fertilization: affect N_2O emission and soil C input from biomass residues.

- LCA approach determines the emission intensities and other environmental indicators, deduce tips and guidelines for impact mitigation, improve efficiency of the systems linking production processes with natural resources (air and climate, land, water, energy, etc) and to get social, economical and technical benefits of the studied systems and biological boundaries.
- To accomplish this purpose, the LCA inventory need to be accurately designed, with defined system boundaries, with non ambiguous functional units.

- Accurate estimates of animal emissions, crop emissions, purchased feed emissions, energy consumption and soil carbon sinks, the most important hotspot, that quantitatively affect the environmental performance of the farms.
- Environmental indicators provided from LCA inventories should be evaluated and ranked relatively to mitigation effectiveness.



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**sheep
to
ship**
LIFE

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sheep supply chain: environmental
benefits and implications

Strategies and solutions
for a low emission sheep
supply chain



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THANK YOU!



Società Italiana per
le Scienze del Clima
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