LIFE GreenSheep project

"Demonstration and dissemination actions to reduce the carbon footprint in sheep farming"

Action C2: Training of advisers

TRAINING KIT

"How to assess and reduce the GHG emissions from the sheep farms"

TABLE OF CONTENTS:

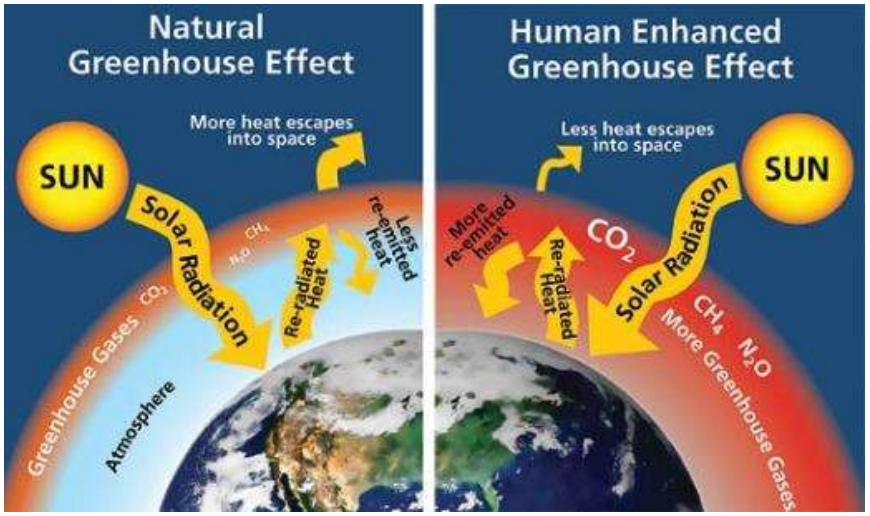
Chapter 1. GHG & Animal production activities

GHG = GREENHOUSE GASES

Because of their molecular structure they trap heat or longwave radiation released in the atmosphere and re-emit it back to the earth.

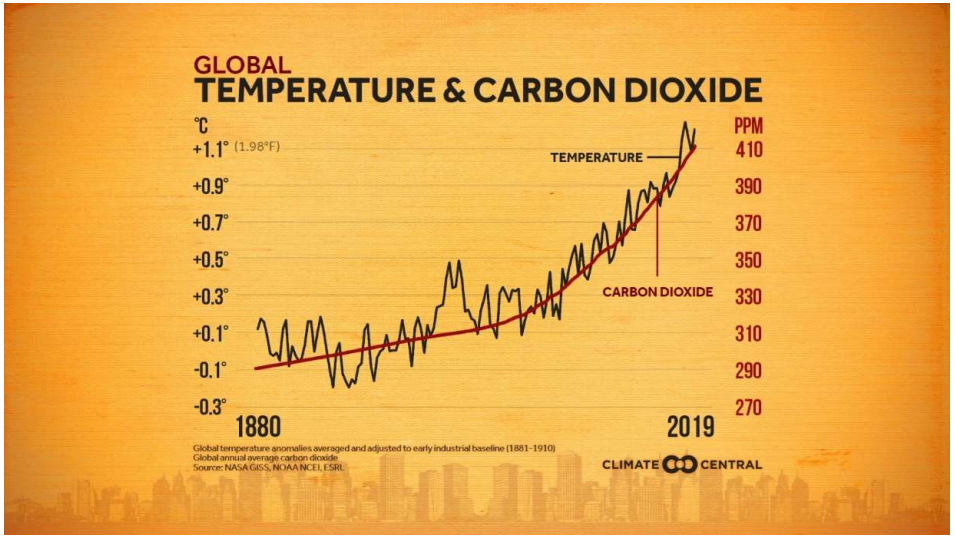
This heat trapping phenomenon is known as the **GREENHOUSE EFFECT.**

more GHG
↓
stronger greenhouse effect
↓
more global warming



natural GH effect = actually allowed the life on Earth

human GHG effect = too hot



strong correlation between GHG (for example %CO2) and the average temperature

Livestock production is indispensable...

(growing needs...)

→ **but it has its costs**

- financial costs,
- resources costs (land, cereals,...)
- environmental costs

→ **it also has an environmental footprint**

... organic wastes, packing wastes, plastics, Nitrogen leakages, GHG...

which has to be reduced

"Environmental pollution adversely affect the ecosystem. For many years, animals farming (although recognized as being necessary) raises a lot of policy concerns in terms of economic, environmental, and social aspects of sustainable agriculture"

GHG from livestock production:

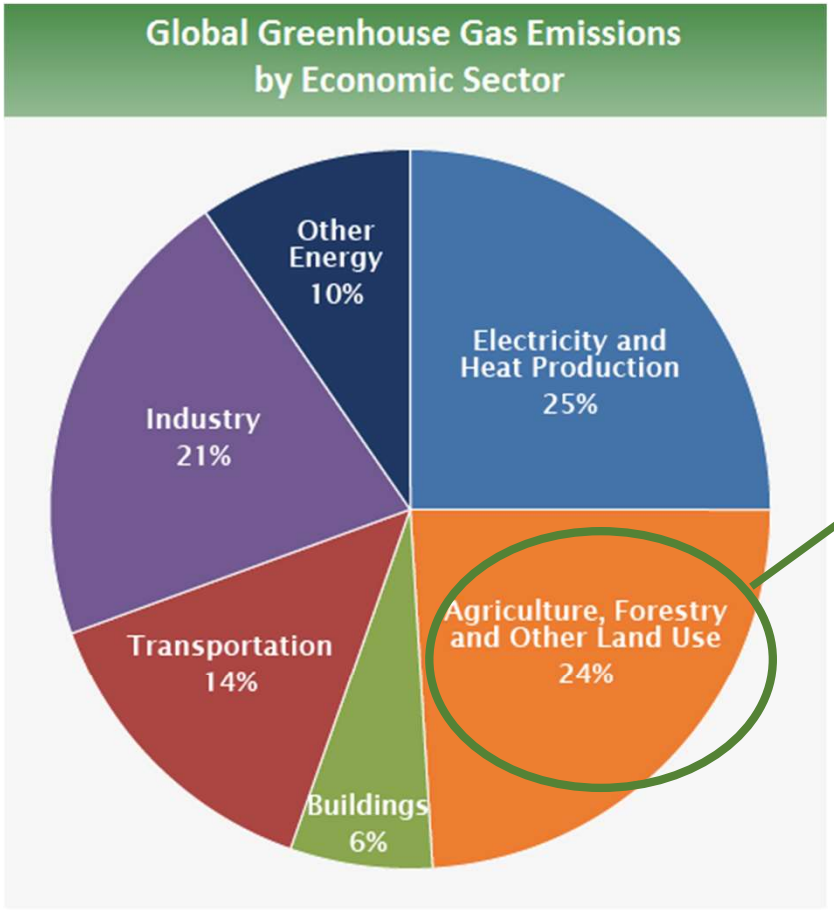
- CO_2 (32%)
- CH_4 (25%)
- N_2O (31%)
- others (water vapors, fluorinated gases)

(worldwide values, Moran, 2011)

expressed by a single parameter:
CO_2 equivalent (CO_2 eq),
using **GWP** values:
CO_2 = 1; CH_4 = 28; N_2O = 265
(GWP = Global Warming Potential)

→ **# tons of emitted CO_2**

 # tons of CO_2 to be reduced

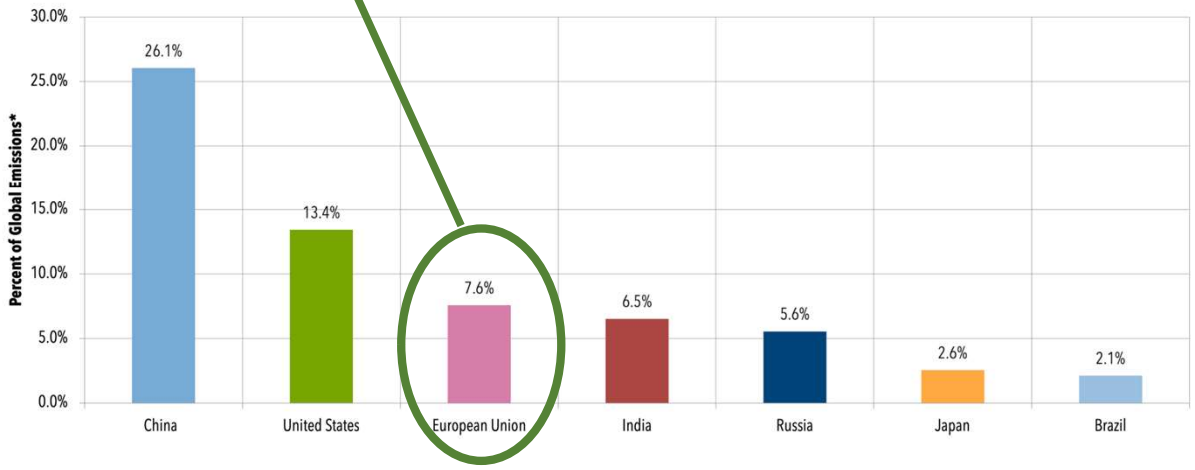


reference (Mihai .....)

there is room for improvement / mitigation

24%

7.6%

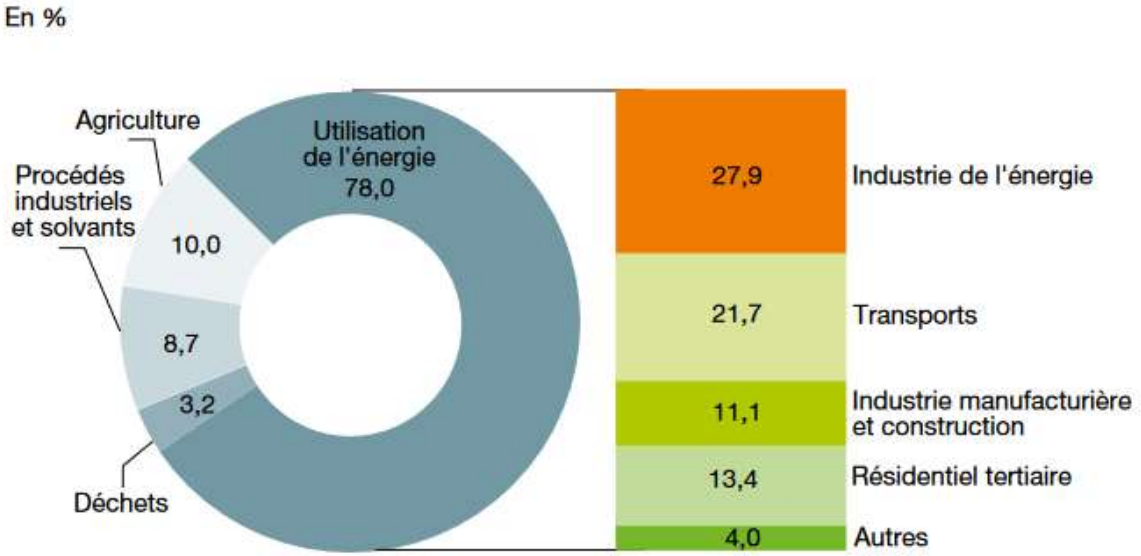


Greenhouse Gas Emissions By Top Emitters, 2018

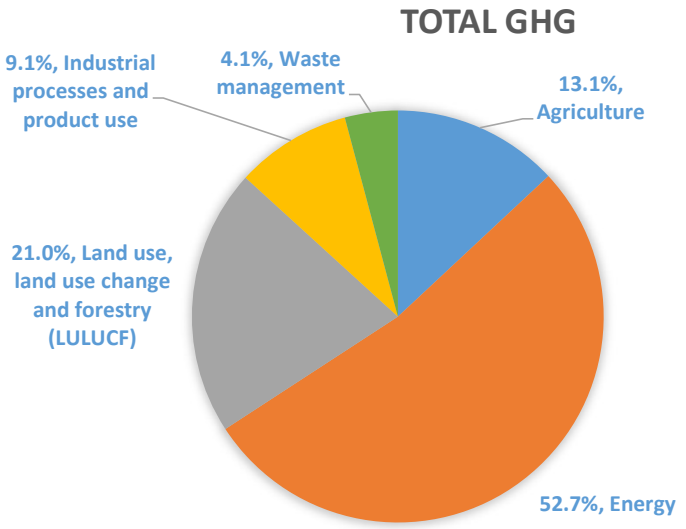
Agriculture contribution to the EU / national emissions of GHG

E.U.: 10% contribution of agriculture

ROMANIA: 13.1% contribution of agriculture



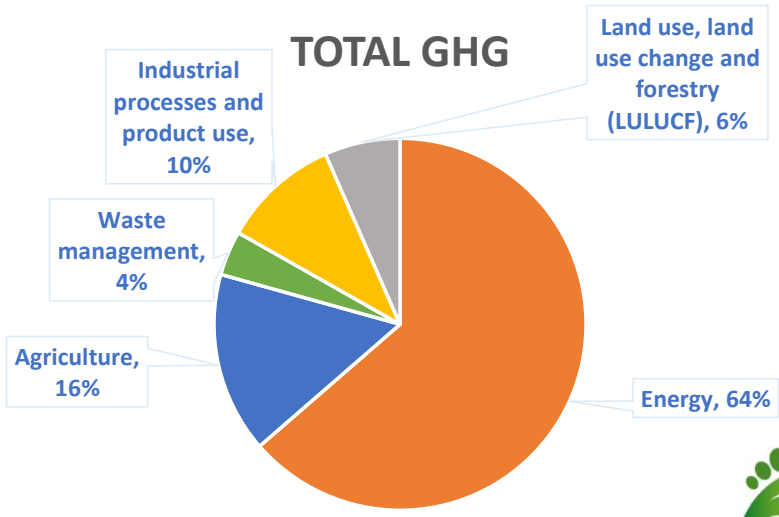
Source : AEE, 2018



Source: Eurostat, 2019

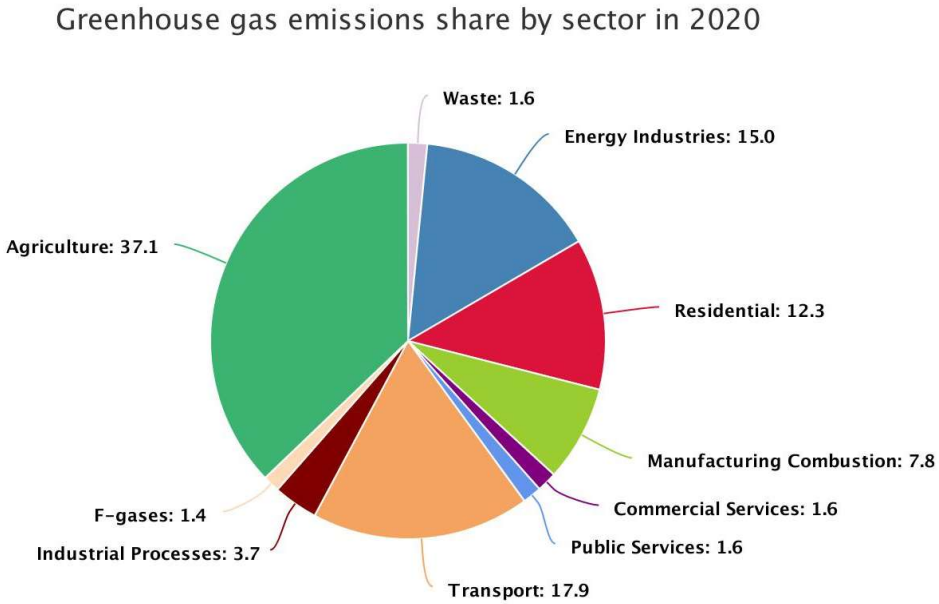
Agriculture contribution to the EU / national emissions of GHG

FRANCE: 16% contribution of agriculture



Source: Eurostat, 2019

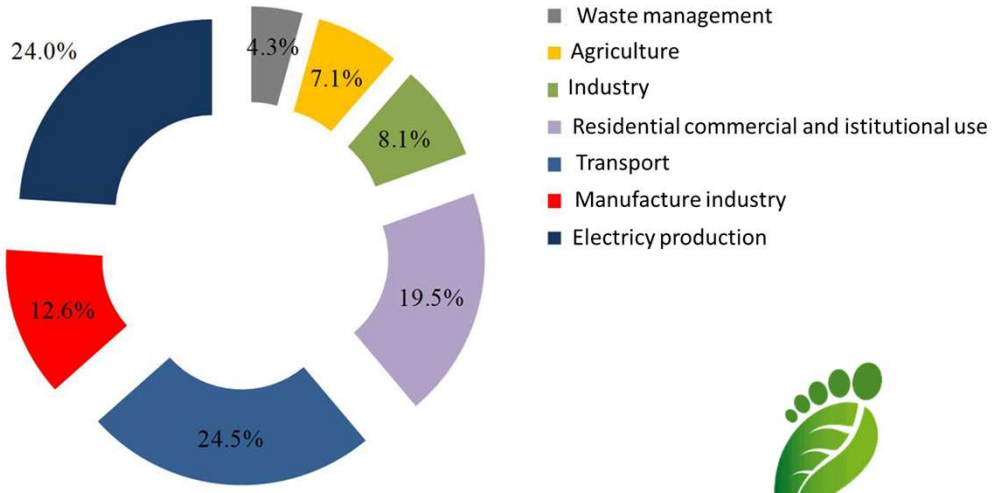
IRELAND: 37.1% contribution of agriculture



Source: EPA, 2022

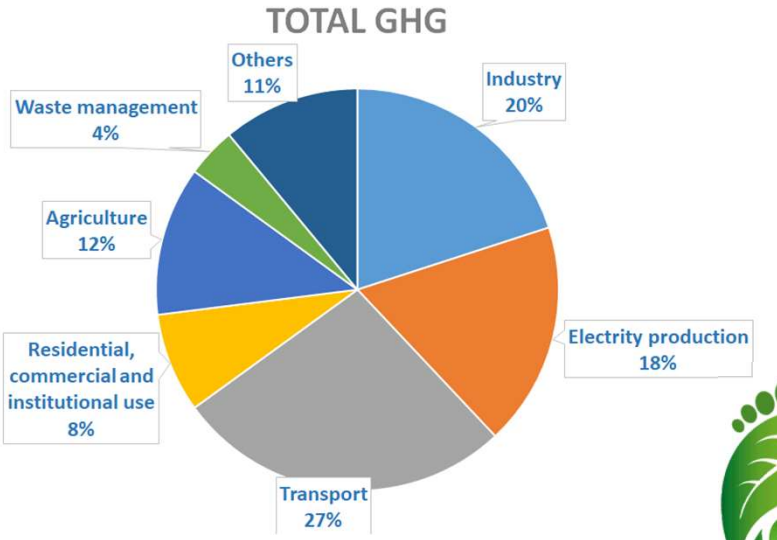
Agriculture contribution to the EU / national emissions of GHG

ITALY: 7.1% contribution of agriculture



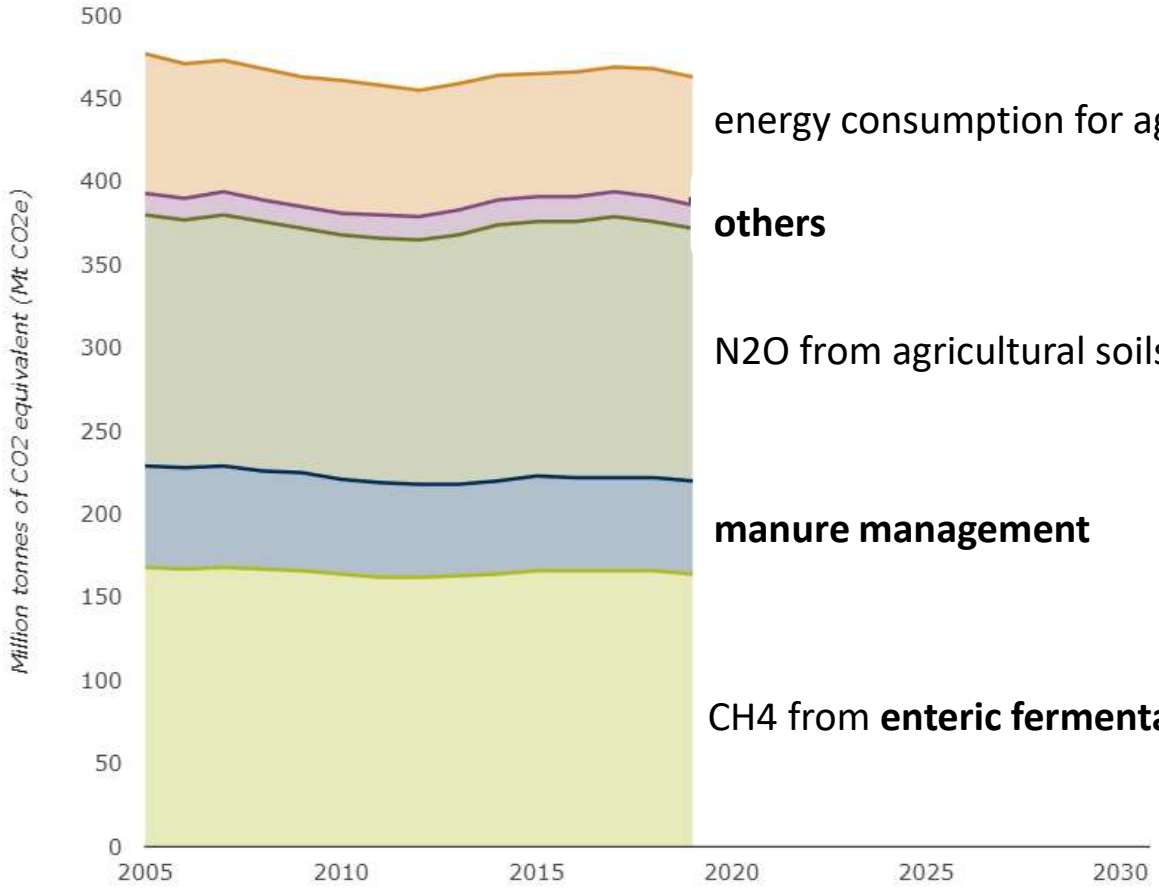
Source: ISPRA, 2018

SPAIN: 12 % contribution of agriculture



Source: MITECO, 2020

Livestock contribution to the agricultural emissions of GHG



energy consumption for agri &

others

N2O from agricultural soils

manure management

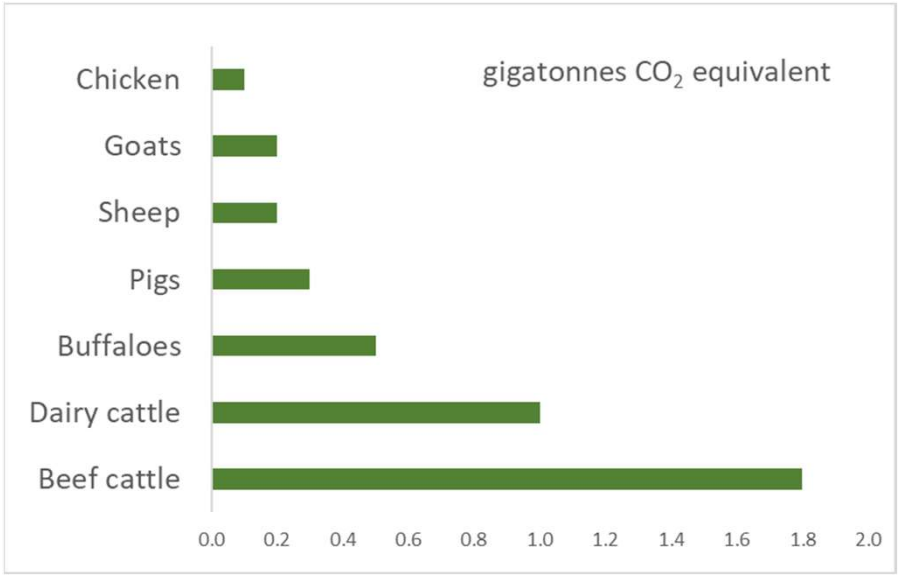
CH4 from **enteric fermentations**

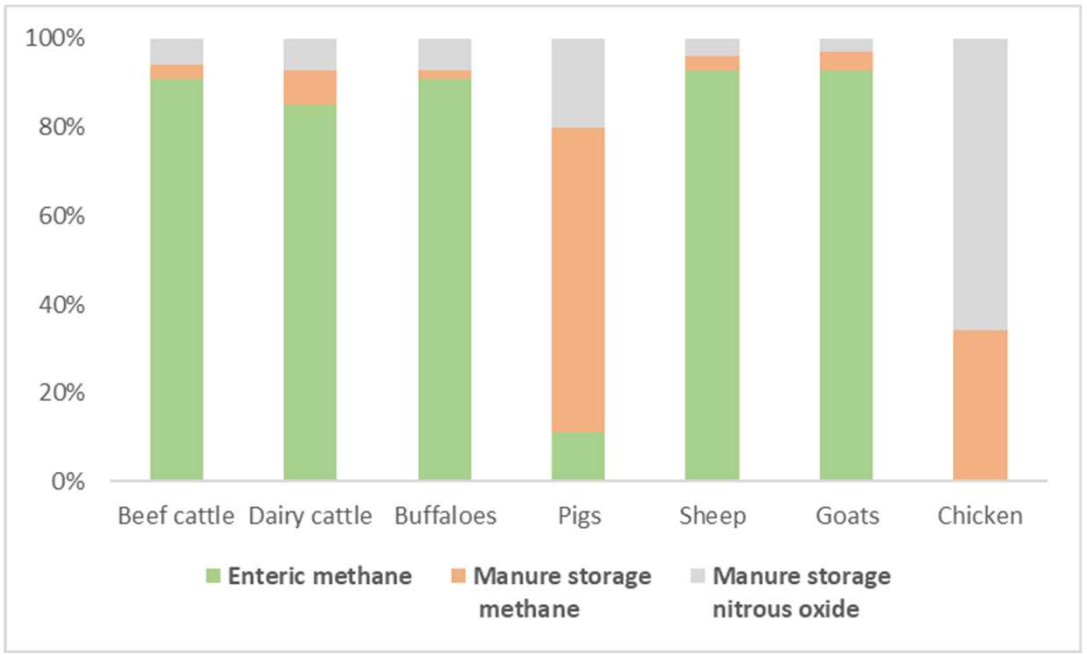
an important part of agricultural GHG is originating from the agriculture

with two main mitigation directions

https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-agriculture

Details on the GHG emissions from the livestock production



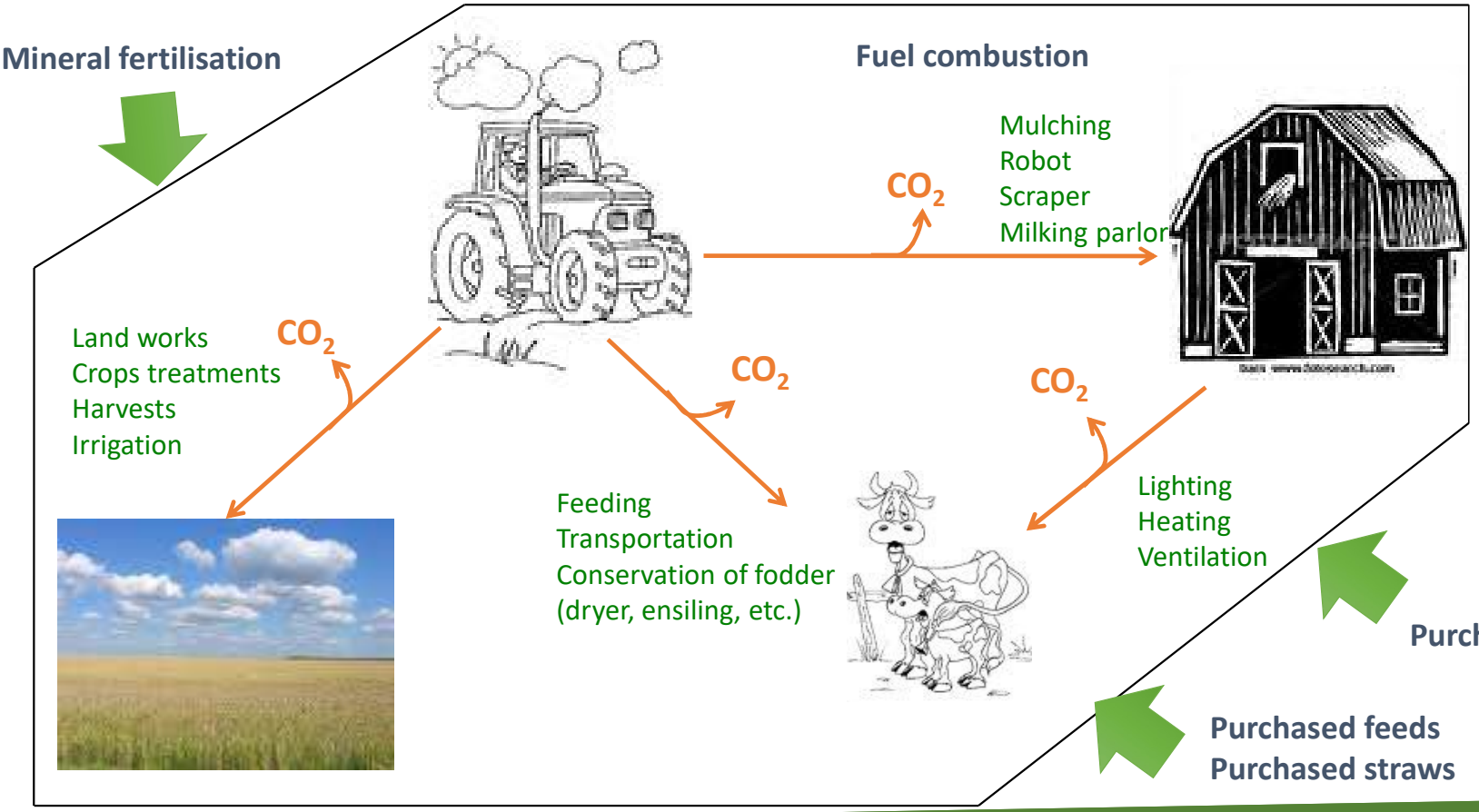


the time has come to focus on **sheep too**...

source: Grossi, 2019 (citing FAO data / 2010)

enteric fermentations = very important in ruminants

Livestock CO_2 emissions (GWP 1)



Livestock CH4 emissions (GWP 27.9) ≡ CO_2

Rumination

Enteric CH_4

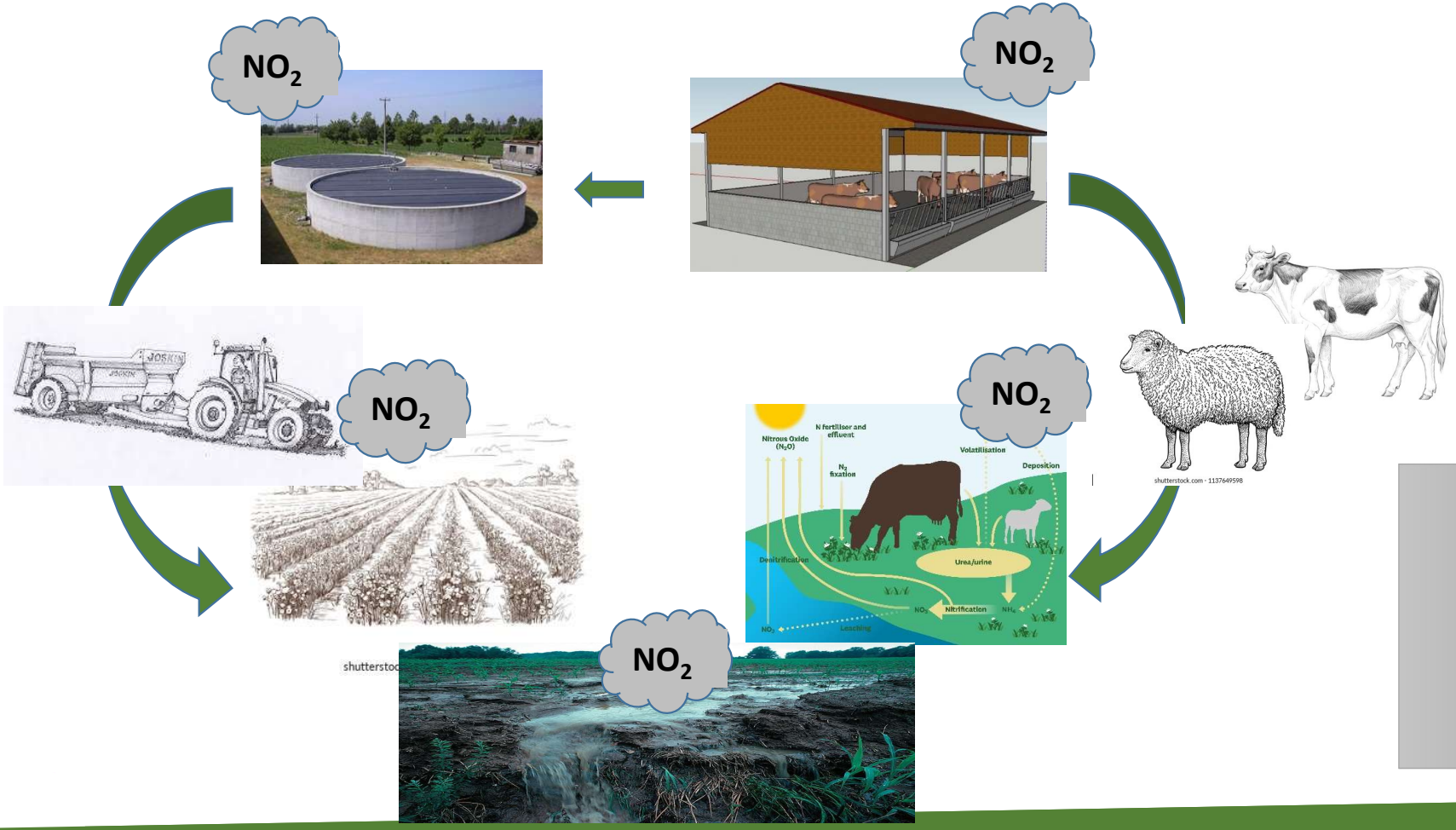
Manure

Building Storage Pasture

Manure CH_4

4 emissions'zones = animals (enteric fermentation) / building / storage / pasture

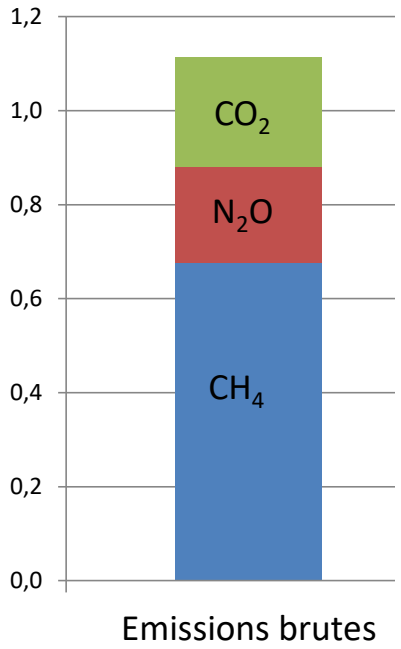
Livestock N2O emissions (GWP 273) ≡ CO_2



5 emissions' zones:
- buildings
- storage
- pasture
- spreading
- soil

Calculation of the GHG emissions
(impact on climate changes)

Total GHG emissions (kg eq CO_2)

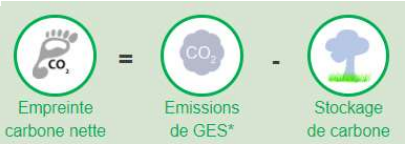


Total GHG emissions (kg eq CO_2)

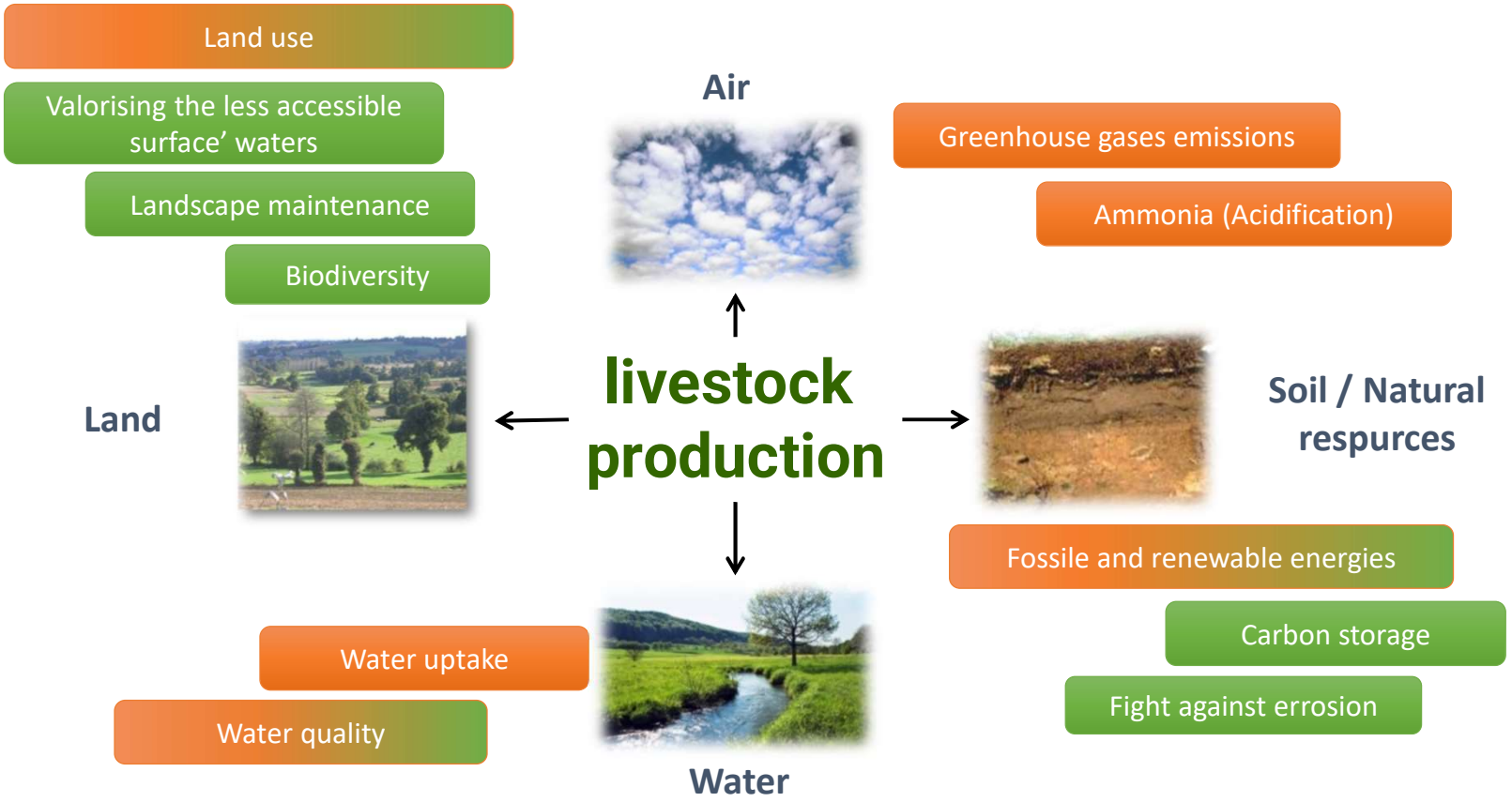
= CO_2 (kg éq CO_2) + CH_4 (kg éq CO_2) + N_2O (kg éq CO_2)

Global Warming Potential of the main GHG originating from agriculture (IPCC, 2021)

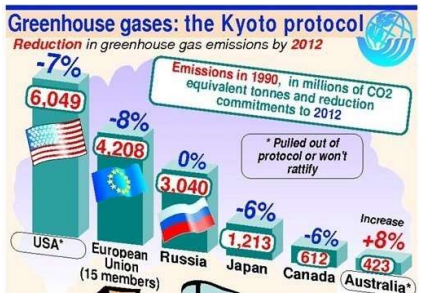
GHG	GWP coefficient / 100 years
CO_2	1
CH_4	27.9
N_2O	273



Conclusion: the impact of livestock production is both negative and ….positive



Chapter 2. The need for GHG mitigation



Kyoto Protocol

Paris Agreement

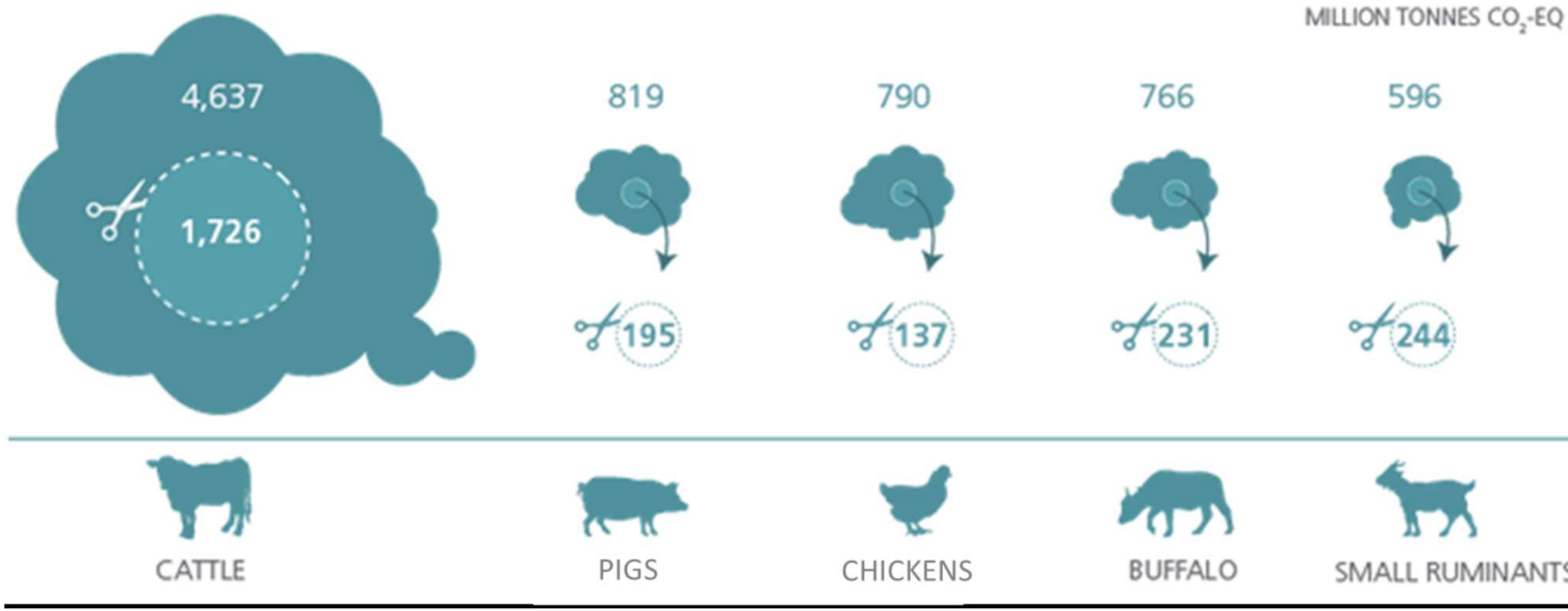
The EU Green Deal

various nations committed to implement measures that lead to various degrees of decreasing the impact of the human activities on environment

this includes GHG mitigation measures...

....even "farms' climate neutrality" is envisaged

The magnitudes of the foreseen emissions cuts:



which are not quite not small... also in case of sheep

There's a negative perception of the society regarding the livestock sector

(mainly cattle, but... extensive livestock production may also be targeted)

- public info measures...
- mitigation measures...
- RDI & training / education...

... are necessary

to balance it

(solving the issues, informing the society, etc.)

so the perception can be this one

(at least for the sheep sector)

NEED FOR GHG MITIGATION AT THE NATIONAL LEVEL

 # each member state has to contribute to the reach of EU goals:

- *"Member States' and regional/local authorities' **efforts to reduce greenhouse gas emissions** in the EU Emissions Trading System [...], agriculture, [...], land use, ..."*

- *"The development and implementation of **greenhouse gas accounting** and **climate change mitigation** …"*

- *"The **development of** [...] **practices which have an impact** on emissions and removals of emissions"*

 # the countries have to provide reports on GHG & livestock

 # the countries have to reduce the GHG and **prove it**

e.g. if the GHG estimations are **based on number of animals only**, **the only way** to reduce GHG is **reducing the number of animals**

 # more detailed assessment / monitoring = **more opportunities** to apply GHG mitigation techniques (that **may go hand in hand with the farm efficiency**)

mitigation initiatives

mitigation programs (subsidies, taxes...)

RDI financers

financed thematics (FP, H2020, HE, LIFE...)

Greensheep project

Chapter 3. Presentation of the GreenSheep project

Implementing countries: France, Italy, Spain, Romania, Ireland
Duration: 01.10.2020 – 30.09.2025
Budget: 4.612.221 euro (55% EC co-funding)
Coordinated by: IDELE, France

Project objectives:

- Launch a national and European dynamic progress initiative to reduce greenhouse gas emissions while ensuring sustainability of sheep farms
- Train current and future generations
- Promote innovative practices associated with GHG emissions mitigation in order to ensure the techno-economic, environmental and social sustainability of sheep farms
- Reduce by 12% the carbon footprint of milk and meat produced in sheep farms
- Create an national and European observatory of environmental and sustainable performances of sheep production systems

Project coverage & impact:

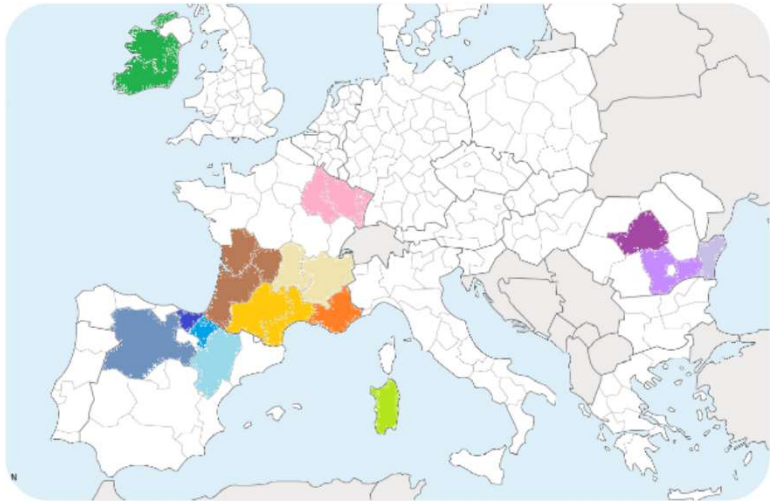
France (5 regions)

Ireland (all regions)

Italy (1 region)

Romania (3 regions)

Spain (3 regions)



Project coverage & impact:

the five countries cover **47% of European meat sheep** production and **63% of European milk sheep** production

this partnership allows us to cover **13 production systems** (from extensive grazing / low input to intensive / indoor), various **feed resources**, various **feeding systems**, various **types of farms**, various **breeds**, etc.

the project targets a **large network of farms and advisors** :

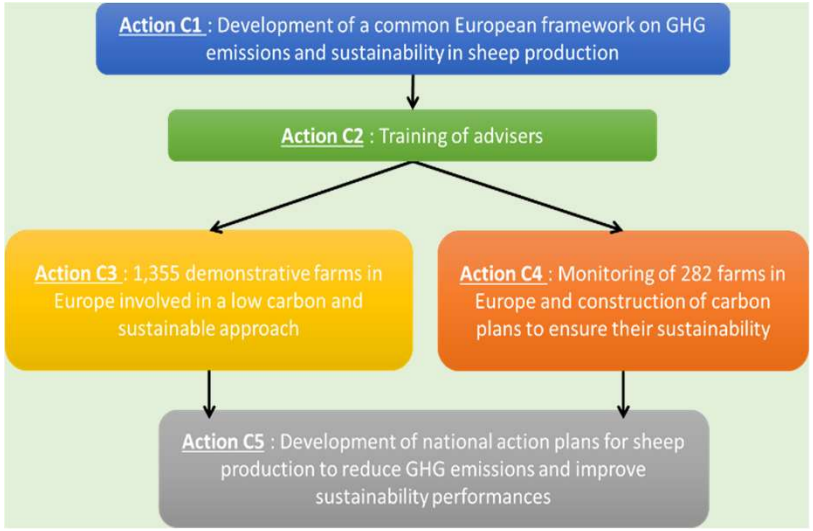
- 1 355 demonstration farms
- 282 innovative farms
- 143 advisers trained on monitoring tools & mitigation techniques

the project will sum up a **large set of mitigation techniques** that can lead to the **GHG emissions reduction while maintaining farm profitability**

Project actions:

Actions F : Project management and monitoring of the project' progress

Actions C : Implementation actions



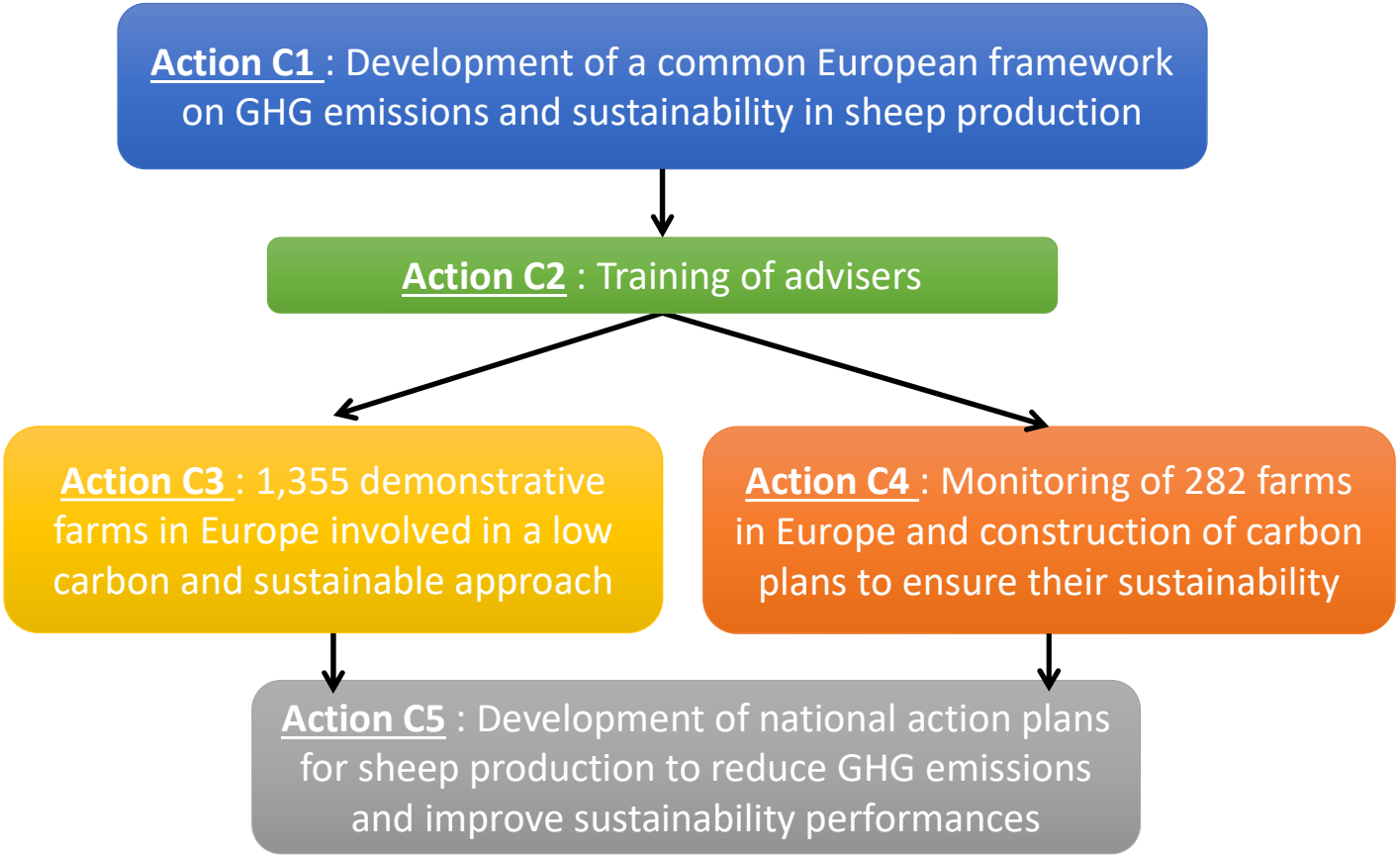
Action D : Monitoring of the impact of the project actions

- D1 : Quantifying the GHG emissions mitigation and carbon sequestration gains
- D2 : Evaluation of the other environmental gains allowed by the project
- D3 : Analysis of the socio-economic impacts of the project

Actions E : Communication & dissemination of results

- E1 : Communication Kit
- E2 : LIFE Green Sheep Communication
- E3 : LIFE Green Sheep project information and awareness
- E4 : LIFE Green Sheep results dissemination
- E5 : European projects networking

… focus on C-type (technical) actions:



Action C1 : Development of a common European framework on GHG emissions and sustainability in sheep production

focus on:

- inventory of the existing methodologies/tools
- knowledge sharing on the different approaches
- build a common methodology
- propose specific tools adapted to each production context in France, Ireland, Italy, Romania and Spain
- designing and sharing an inventory and a description of the mitigation techniques of GHG emissions

Expected results

- A common carbon footprint and sustainability assessment methodology
- National tools in adequacy with French, Irish, Italian, Romanian and Spanish sheep production context allowing comparisons
- A comparison of existing methodologies / tools
- A list of best mitigation practices inventoried

Action C2 : Training of advisers

building **a common knowledge,** for delivering on

- farm assessments
- on-farm demonstrations (CHG mitigation)
- dissemination (CHG mitigation)

providing **a harmonized training kit**

(translated in partner' language; to be used by the advisers for the environmental & sustainability farm assessments)

organising **training courses for the projects' advisors**

Expected results

a **harmonized training kit (the training support)**;

143 trained advisors

+ skills to implement innovative solutions;
+ skills to monitor the 282 innovative farms;
+ skills to disseminate
+ skills to build action plans (part of them)

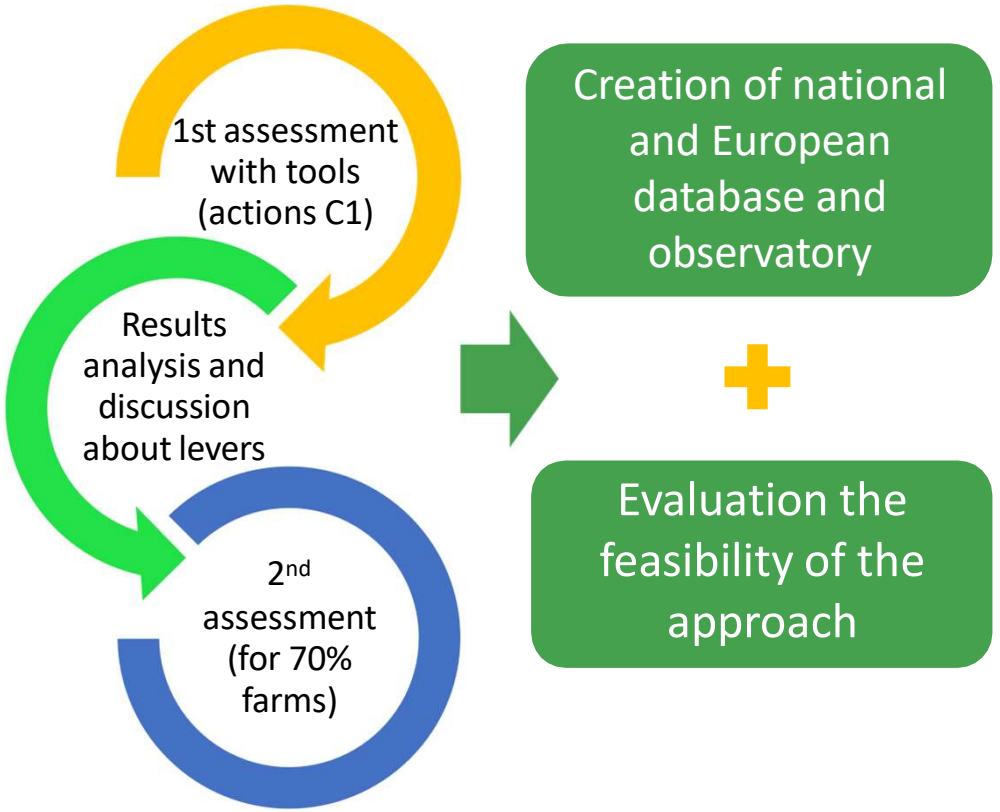
Action C3: 1,355 demonstrative farms in Europe involved in a low carbon and sustainable approach

Assessing GHG emissions but also other environmental, economic and social performances, on 1,355 demonstrative farms,

Creating a national and European observatory with 1,355 sheep farms in contrasting production contexts,

Determining the environnemental efficiency and the sustainability performances of farms according to production systems and practices,

Achieve 5% GHG mitigation on demonstrative farms scale.



Action C4: Monitoring of 282 farms in Europe and construction of carbon plans to ensure their sustainability

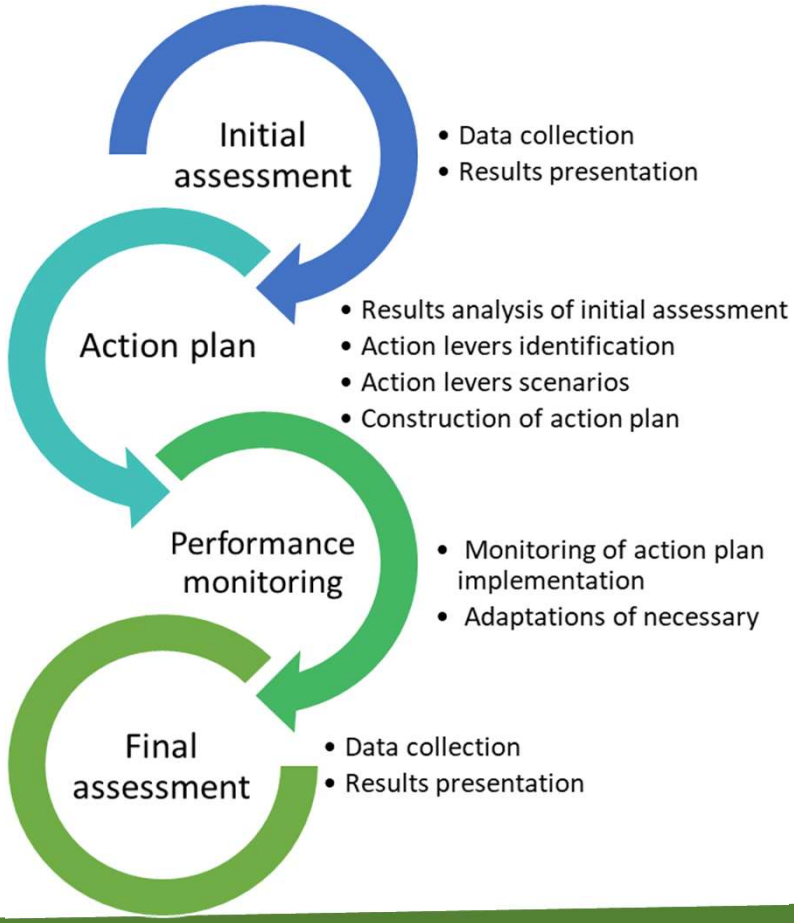
Assessing GHG emissions but also other environmental, economic and social performances, on 282 innovative farms,

Developing innovative farms with a low carbon footprint,

Demonstrating the feasability of mitigation practices in real conditions,

Evaluating the technical, environmental and economic benefits of adopting mitigation GHG practices at farm level,

Achieve 12% GHG mitigation on innovative farms scale.



Action C5 : Development of national action plans for sheep production to reduce GHG emissions and improve sustainability performances

Establishing 22 low carbon and sustainable action plans corresponding to the main production systems existing in the five countries,

Collecting & analyzing farmers' and advisers' feedback

Describing the partnership strategy to be put in place for the wide spreading of a Green Sheep action plan.

Expected results

22 Green Sheep **national action plans**,

> 3 **“low carbon” practices** for each system,

survey including > 70% of the farmers and advisers,

> 1 partnership developed/country/production

GHG emission mitigations, via “low carbon” plans

farmers' & advisers' feedback, surveys & synthesis

Green Sheep partnership strategy

Chapter 4. The tools used for GHG assessment & monitoring

Carbon Sheep : the Italian tool

ArdiCarbon : the Spanish tool

see the ARDICARBON section

Teagasc Sheep LCA: the Irish tool

see the SheepLCA section

CAP'2ER® / DEO : the French tools

adapted for the Italian & Romanian specifics (breeds, production systems, input data availability, etc.)

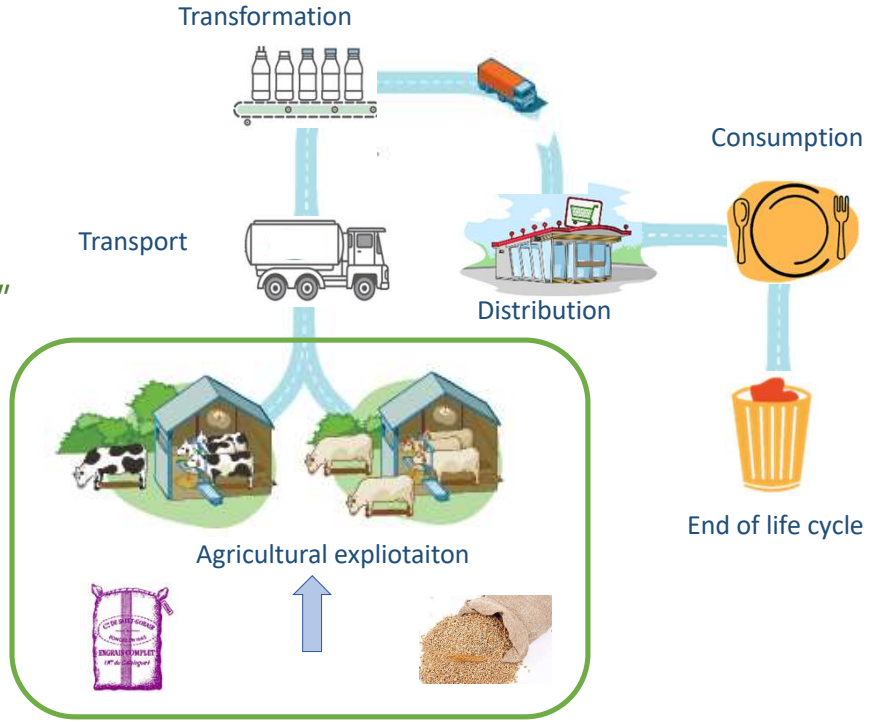
(Lurgintza)

see the CAP2'ER section

all three tools (CAP'2ER, ArdiCarbon, LCA Sheep)
are based on the principles of LCA (life-cycle assessment)

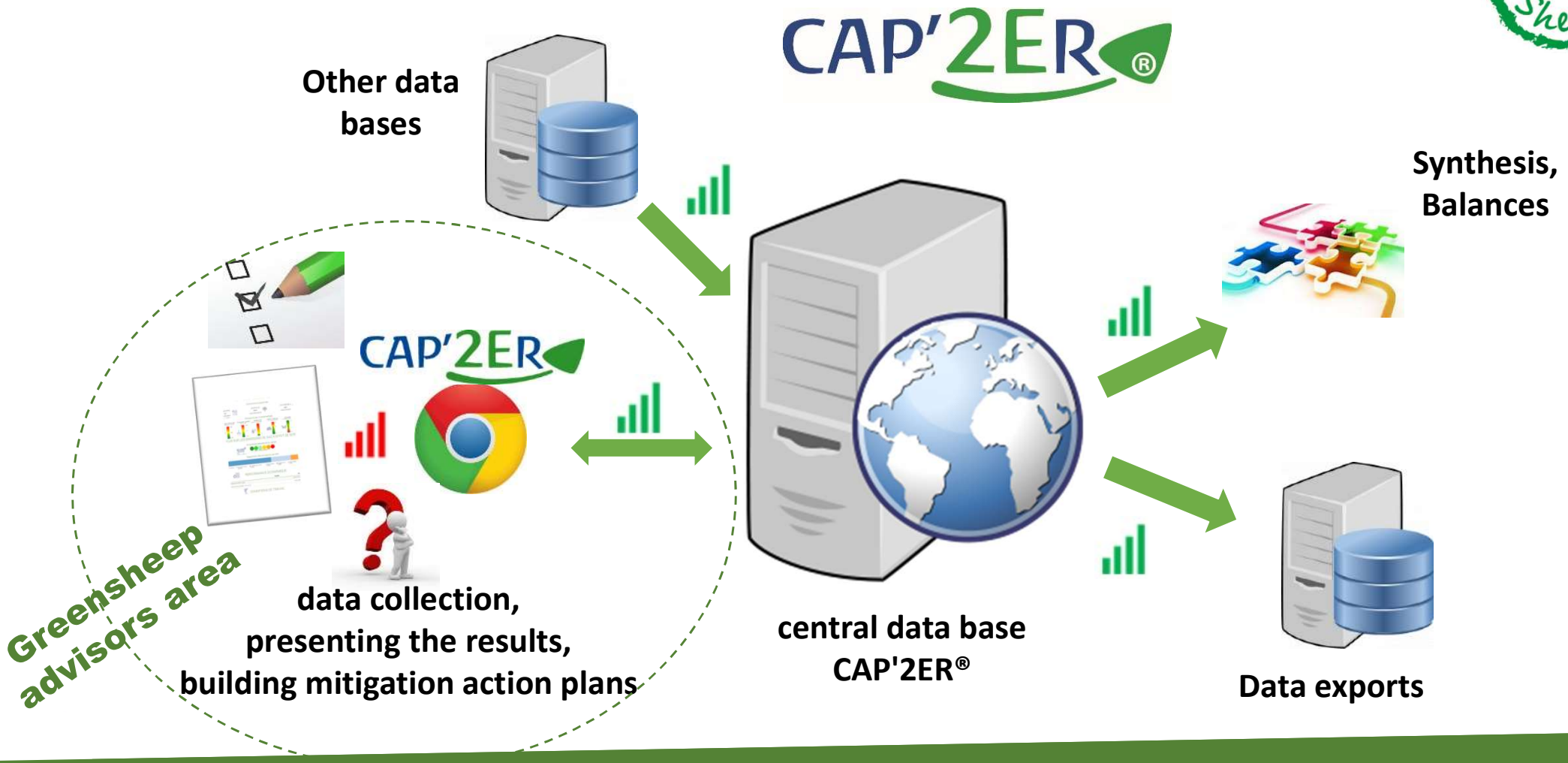
INPUT DATA:
- animals' data (heads / categories)
- details on land surfaces
- production parameters
- feeding data...

the tools address the upper part of the "farm to fork" flux:



OUTPUT DATA:
- GHG emissions (all three)
- C sequestration (CAP2ER, ARDICARBON ...
- N use efficiency (CAP2ER, ARDICARBON...
- other output data...

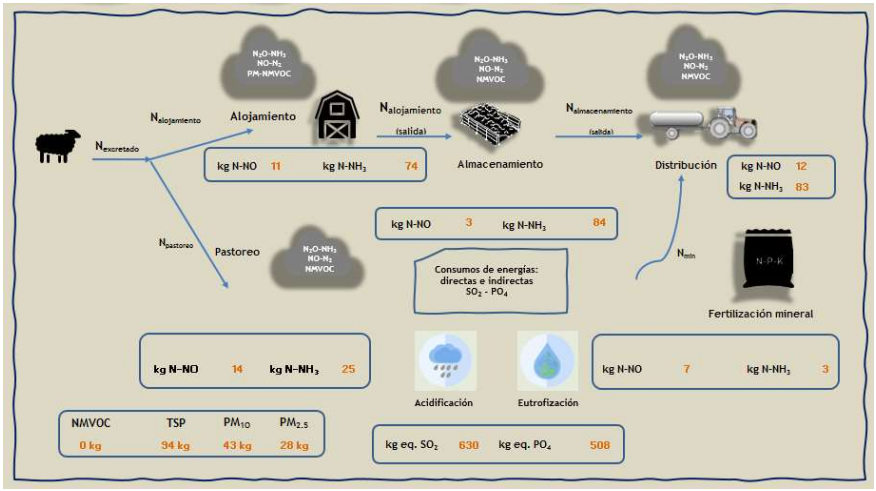
a glimpse on CAP’2ER:

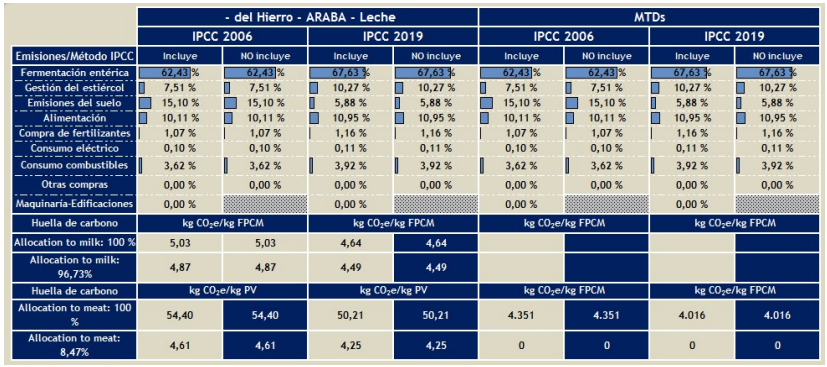


a glimpse on ARDICARBON:

INPUT DATA …

… Excel based tool …

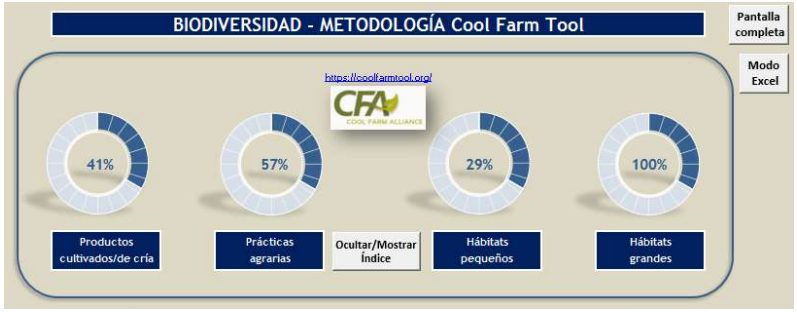




	- del Hierro - ARABA - Leche				MTDs			
	IPCC 2006		IPCC 2019		IPCC 2006		IPCC 2019	
Emisiones/Método IPCC	Incluye	NO incluye	Incluye	NO incluye	Incluye	NO incluye	Incluye	NO incluye
Fermentación entérica	62,43 %	62,43 %	67,63 %	67,63 %	62,43 %	62,43 %	67,63 %	67,63 %
Gestión del estiércol	7,51 %	7,51 %	10,27 %	10,27 %	7,51 %	7,51 %	10,27 %	10,27 %
Emisiones del suelo	15,10 %	15,10 %	5,88 %	5,88 %	15,10 %	15,10 %	5,88 %	5,88 %
Alimentación	10,11 %	10,11 %	10,95 %	10,95 %	10,11 %	10,11 %	10,95 %	10,95 %
Compra de fertilizantes	1,07 %	1,07 %	1,16 %	1,16 %	1,07 %	1,07 %	1,16 %	1,16 %
Consumo eléctrico	0,10 %	0,10 %	0,11 %	0,11 %	0,10 %	0,10 %	0,11 %	0,11 %
Consumo combustibles	3,62 %	3,62 %	3,92 %	3,92 %	3,62 %	3,62 %	3,92 %	3,92 %
Otras compras	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %
Maquinaria-Edificaciones	0,00 %		0,00 %		0,00 %		0,00 %	
Huella de carbono	kg CO_2e/kg FPCM		kg CO_2e/kg FPCM		kg CO_2e/kg FPCM		kg CO_2e/kg FPCM	
Allocation to milk: 100 %	5,03	5,03	4,64	4,64				
Allocation to milk: 96,73%	4,87	4,87	4,49	4,49				
Huella de carbono	kg CO_2e/kg PV		kg CO_2e/kg PV		kg CO_2e/kg FPCM		kg CO_2e/kg FPCM	
Allocation to meat: 100 %	54,40	54,40	50,21	50,21	4.351	4.351	4.016	4.016
Allocation to meat: 8,47%	4,61	4,61	4,25	4,25	0	0	0	0

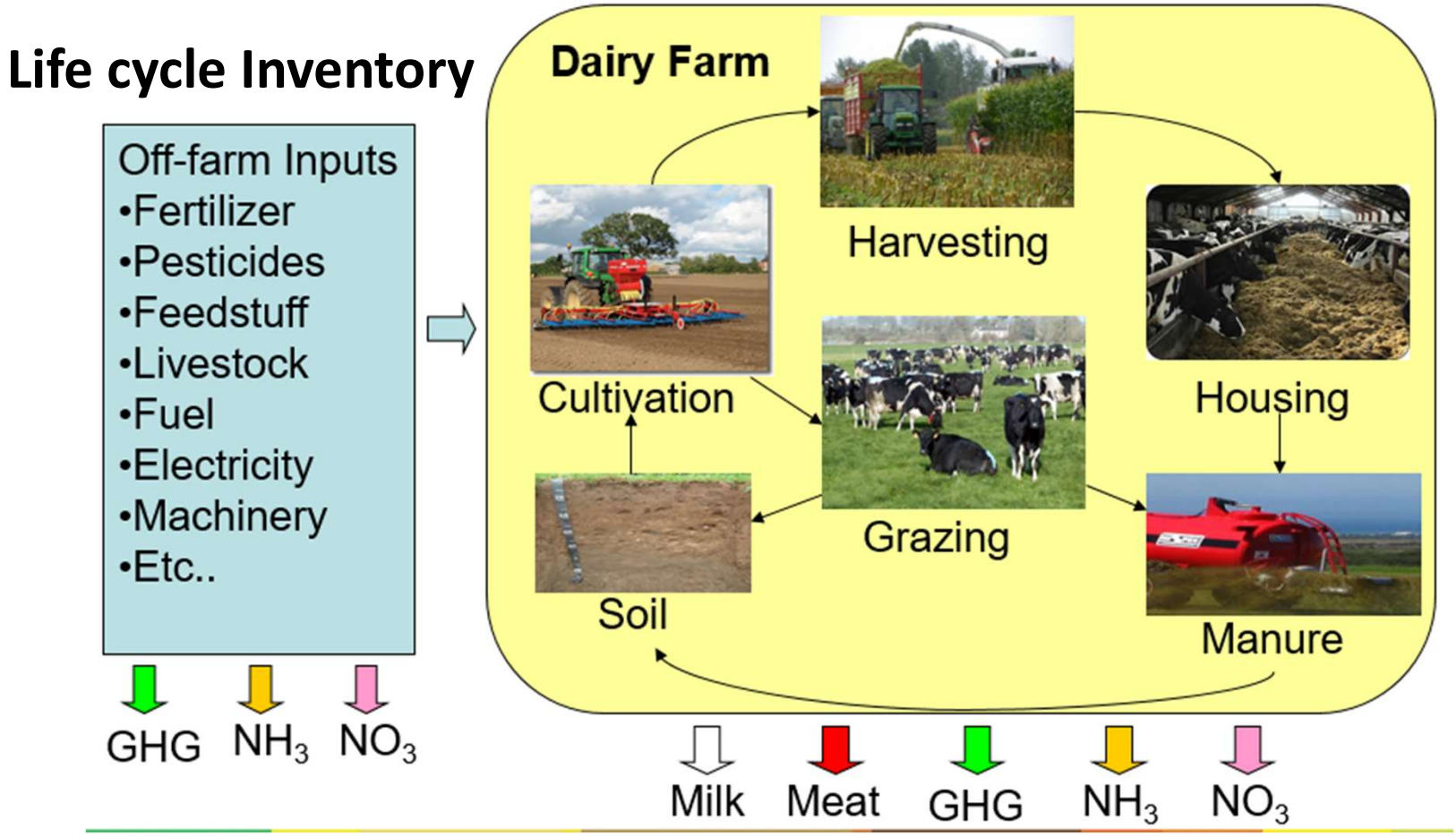
… sustainability, LCA and carbon sequestration assessment from a holistic approach …

… and dashboards to present results.



It also allows tailor made and ex ante assessments (What if..?)

a glimpse on Teagasc Sheep LCA:



Chapter 5. Potential GHG mitigation techniques

at the farm level, <u>two purposes</u> of focusing on these techniques

- to **promote the techniques** toward the **<u>demo farms</u>** & outside the project in order to generally stimulate GHG mitigation & farms efficiency
- to **present the techniques** to the **<u>innovative farms</u>**, **analyse** them, etc., **choose** the most convenient, in order to generate **<u>action plans</u>** allowing **GHG mitigation & (preferably) farm efficiency**

=> there is a need to focus on their side effects, e.g. on feeding efficiency

=> there is a need to build an inventory to choose from (clustered by specialties)

Factors that are known to influence GHG emissions from the livestock production

HERD MANAGEMENT & PERFORMANCE
Choice of animal species/breed
Genetic selection
Herd structure
Health & fertility management

MANURE STORAGE & USE
Adapted protein intake
Reduced protein digestibility
Improved diet digestibility
Use of fibrous feeds
Optimized excreta management
Excreta recycling

FEED PRODUCTION AND STORAGE
Choice of feed types
Plant breeding
Improved harvested methods
Optimized fertilizer use
Feed conservation/processing methods
Feed waste management

ENTERIC FERMENTATION
Choice of diet components
Improved diet digestibility
Enhanced feed intake capacity
Rumen modifiers

sources: Dickhoefer et al. (2014), Livestock Management and Environment (2016)

Potential mitigation directions (drivers)

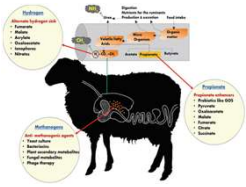
The European Union has strongly highlighted the importance of GHGS mitigation practices in the Directives and Common Agriculture Policy (CAP) measures 2014-2020.

«Herd management & performance» driver

«Manure storage & use» driver

«Feed production, storage & use» driver

«Enteric fermentation» highlight



Mitigation techniques – inventory

(based on previous projects, literature data, feed-back from industry, ...)

HERD MANAGEMENT & PERFORMANCE / FARM MANAGEMENT

Increased production efficiency trough **individual production control**
Increased **reproduction efficiency** through Vet Service
Low input **soil tillage techniques** (minimum tillage.. etc.)
Optimal **sizing of machinery and tools** equipment
Use of **renewable energy sources** (self-production and/or supplier selection)
Collect data to describe the animal's typical diet and performance in **each subcategory**;
Estimate feed intake from the animal performance and diet data for each subcategory (IPCC, 2006)

MANURE STORAGE & USE / MANURE MANAGEMENT

Use of manure as a **natural fertilizer** for agricultural land but also for pastures
Adaptation of the manure storage facilities

FEED PRODUCTION, STORAGE & USE

Feedstuffs supply strategies

Early harvest and/or **hay wrapping**

Increase of **self-produced forage**

Increase of self-produced/local **concentrates use**

Permanent grassland and **pasture cultivation**

Use of feeds from **sustainable supply chains**

Dietary optimisation

Use of **feed additives** for methanogenesis reduction

Use of **feed blocks** as integration for low quality forages

Increase the proportion of **dietary lipids** (with cautions)

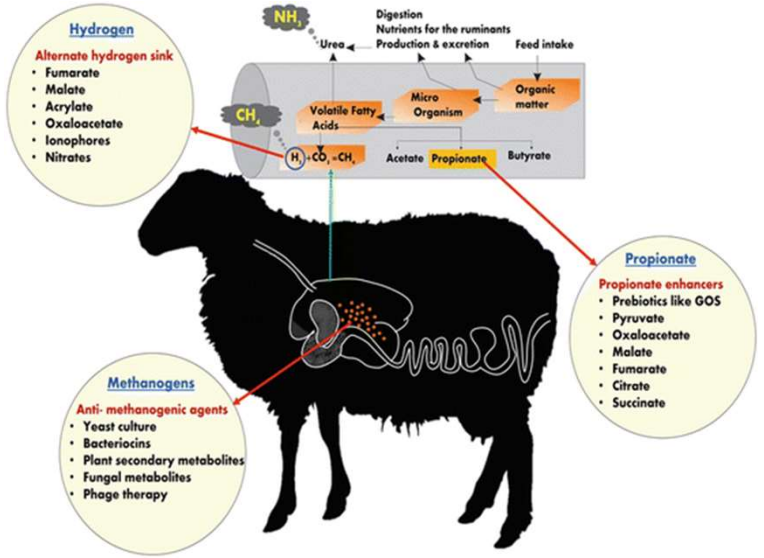
Overall **anti-methanogenic feeding strategies**.

Increase the **overall digestibility** of the diet

Increase of **legume forages** and reduction of **protein concentrates**

HIGHLIGHT: Manipulation of enteric fermentation

feed additives, lipids, protozoa roles, overall feeding strategies, choice of ingredients...



CONCLUSION: It is possible to obtain both GHG mitigation and livestock production efficiency / farm profitability

Optimising the overall farm management
feeding, herd management, manure / fertilisers, use of energy….

Improving the production performances

Controlling the production costs

Reducing the environmental footprint (including GHG)

Annexes