Future of EU livestock: how to contribute to a sustainable agricultural sector?

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la science pour la vie, l'humain, la terre

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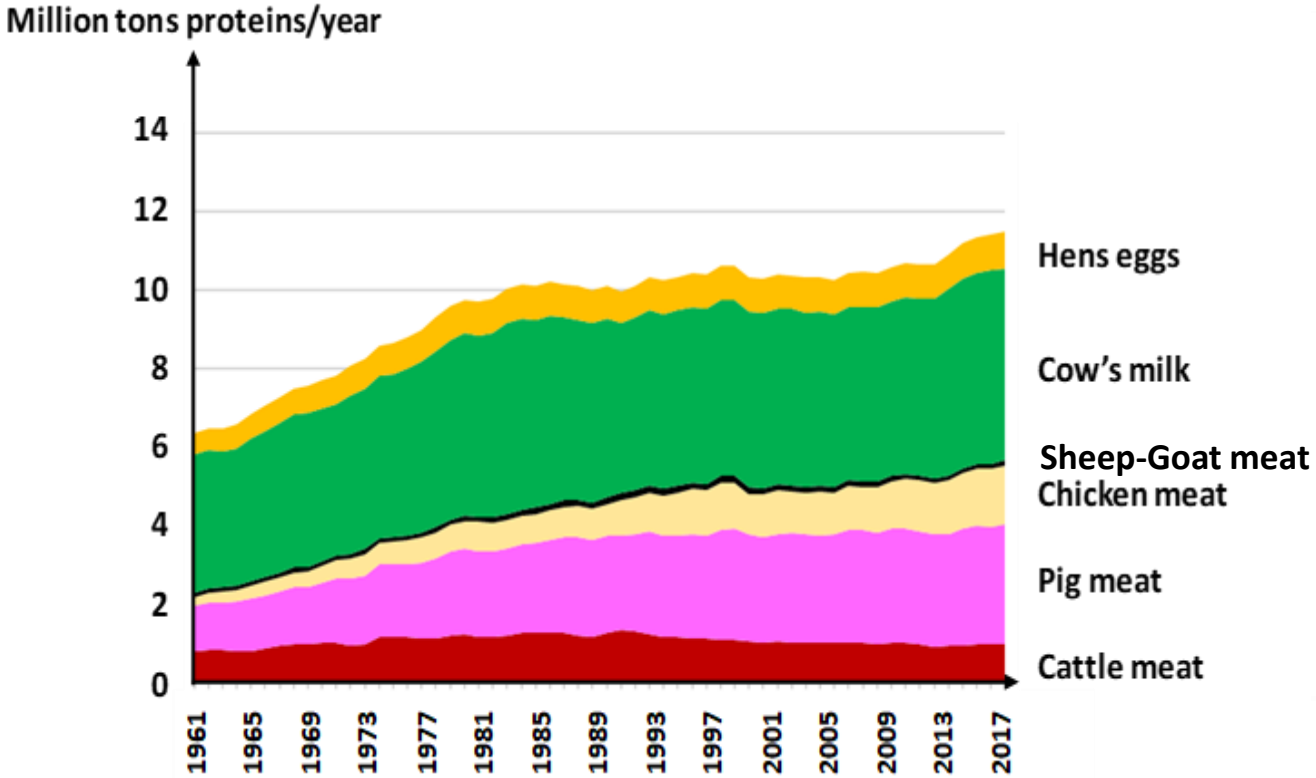
European Commission
Unit C2 – Analysis and Outlook
Unit C4 – Monitoring and evaluation

Part 1

European livestock farming today

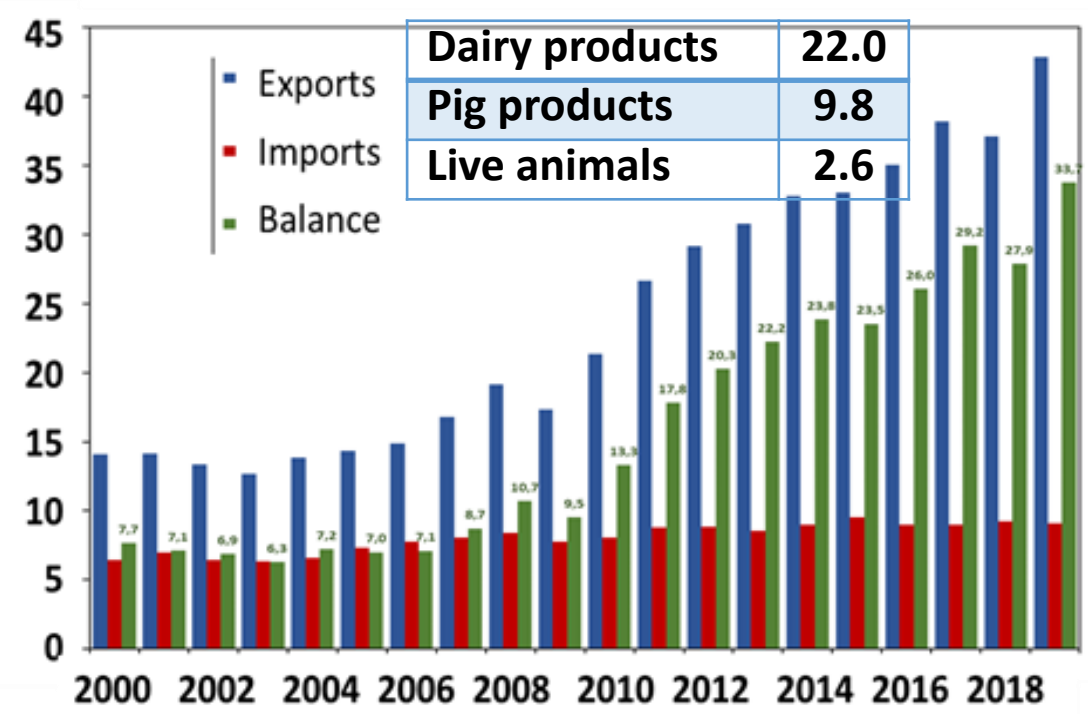
The economic importance of livestock sector

- **39.6 % of the output of the agricultural industry (EU-28, 2015), €165 billion**



- **47 million tons of meat (2017)**
- **160 million tons of milk**

FAO stat, 2020

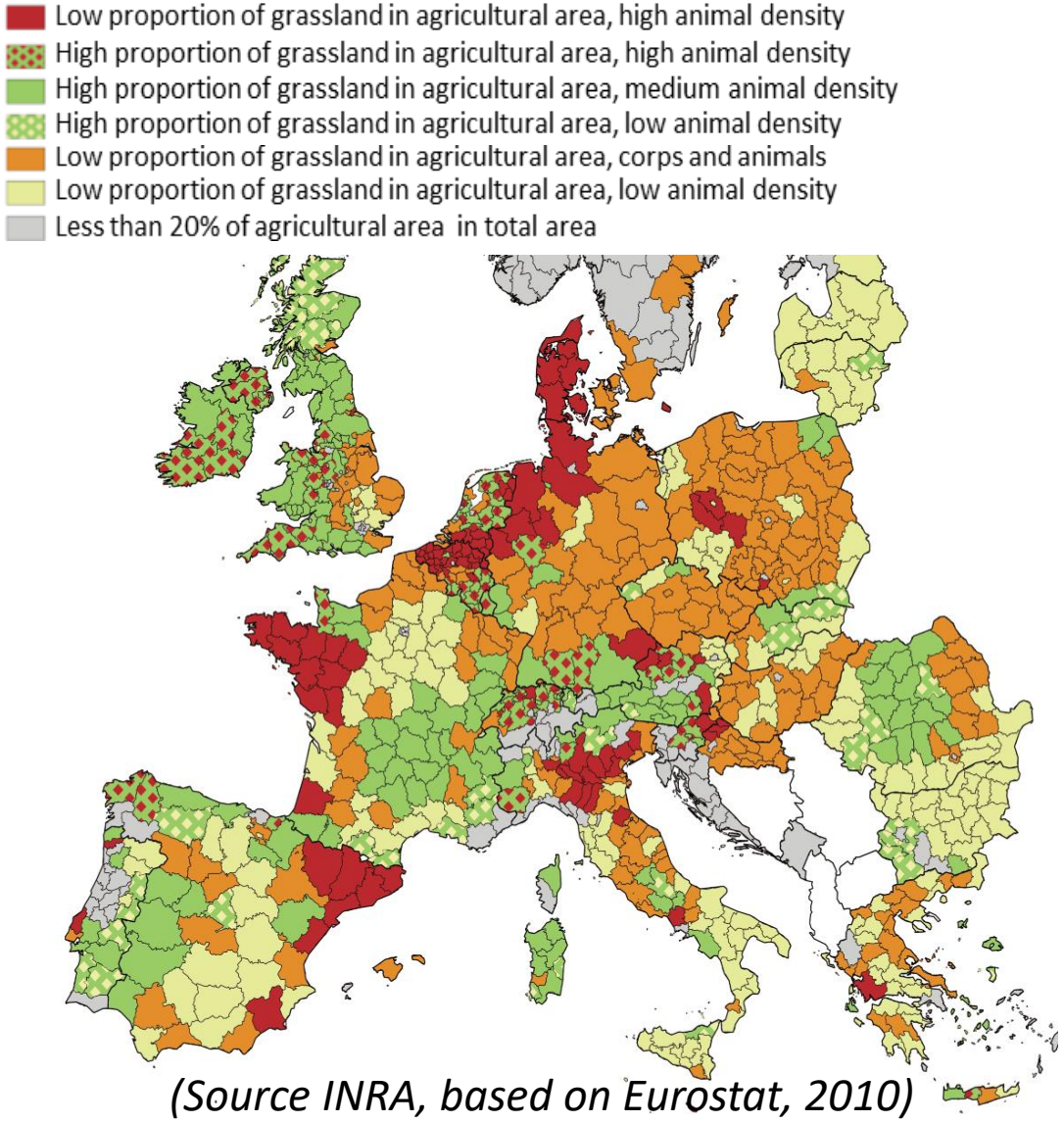


Dairy products	22.0
Pig products	9.8
Live animals	2.6

Higher prices than in others exporting area but a non price competitiveness based on safety, traceability and general quality

Adapted from Eurostat, 2020 *Chatellier et al., 2019*

Livestock farming is of crucial importance for many EU regions with a diversity of situations



(Source INRA, based on Eurostat, 2010)

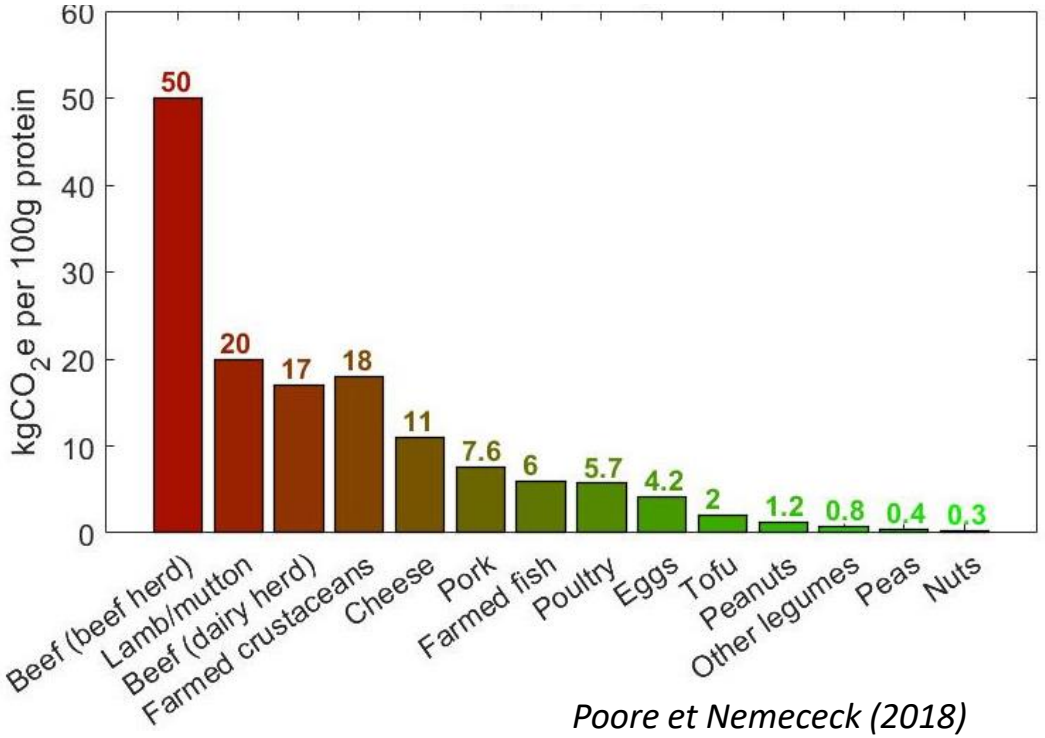
	AA (% total)	LU (% total)	LU/ha
	10.5	29.5	2.15
	6.7	14.6	1.70
	19.3	18.5	0.75
	6.8	2.1	0.25
	31.6	26.6	1.20
	25.0	8.6	0.30

- Livestock are present in almost all regions of Europe, 58% of EU farms hold animals,
- A third of all farm animals are concentrated within a small number of areas,
- On the mean 1 LU/ha EU Agricultural Area.

LCA have consistently shown the impacts of livestock

- **High impact of Animal based products,**
- **The impacts of the lowest-impact animal products exceed average impacts of plant proteins (GHG emissions, eutrophication, acidification and frequently land use),**
- **High variation among both products and producers.**

Kg CO_2-eq / 100 g protéine



Poore et Nemececk (2018)

- ***Maybe simplistic, but reminds us that we need to find ways of improving the sustainability of livestock farming***

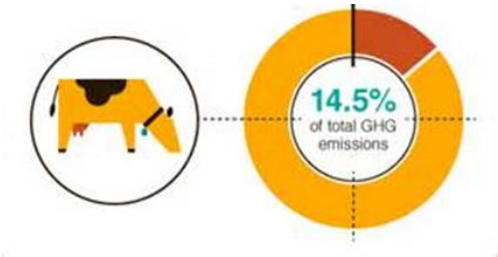
Five domains are considered

1. GHG emissions
2. Local impacts (namely nitrate and ammonia)
3. Biodiversity
4. Resource use efficiency
5. Animal health and welfare

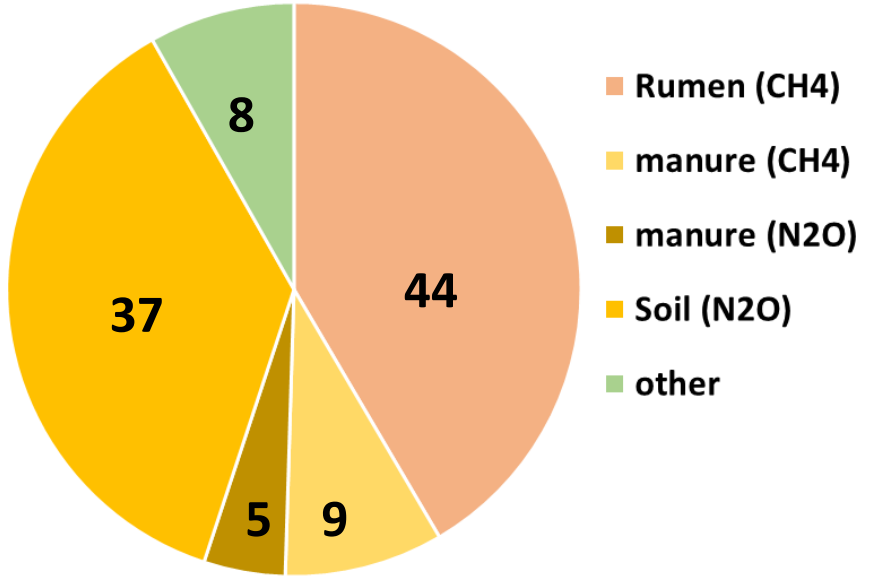
1. On farm GHG emission of Livestock sector

Livestock emissions (Gt CO_2-eq)	
Europe	0.25
World	8.1

Food and Agriculture Organization of the United Nations *(FAO, 2019)*



Sectors	% total
Agriculture	10
Livestock	*6*
Industry	38
Transport	21
Tertiary	12



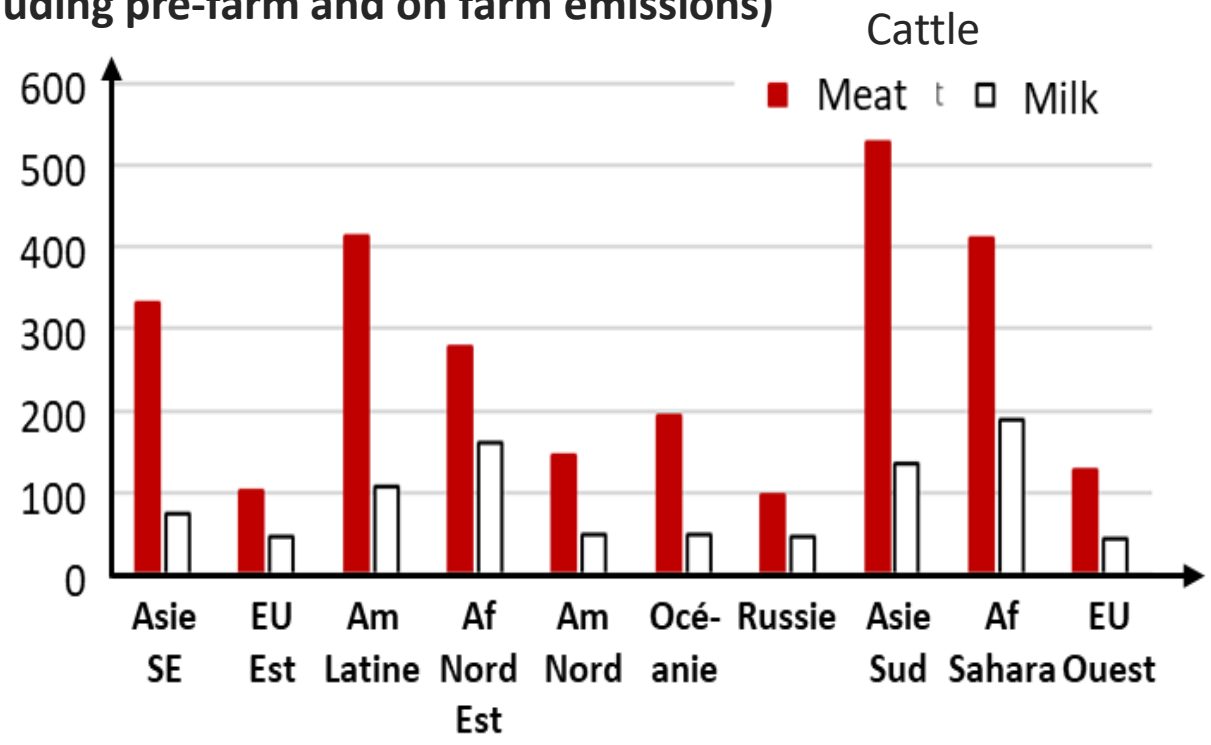
European Environment Agency, (2019) – mean 2003-2018

- **Further emission arise outside of EU. Globally livestock represents 85% of EU Agricultural emission,**
- **Enteric CH_4 and soil N_2O emissions are major issues.**

1. Emissions intensities of the EU livestock sector

- **EU livestock systems are efficient**

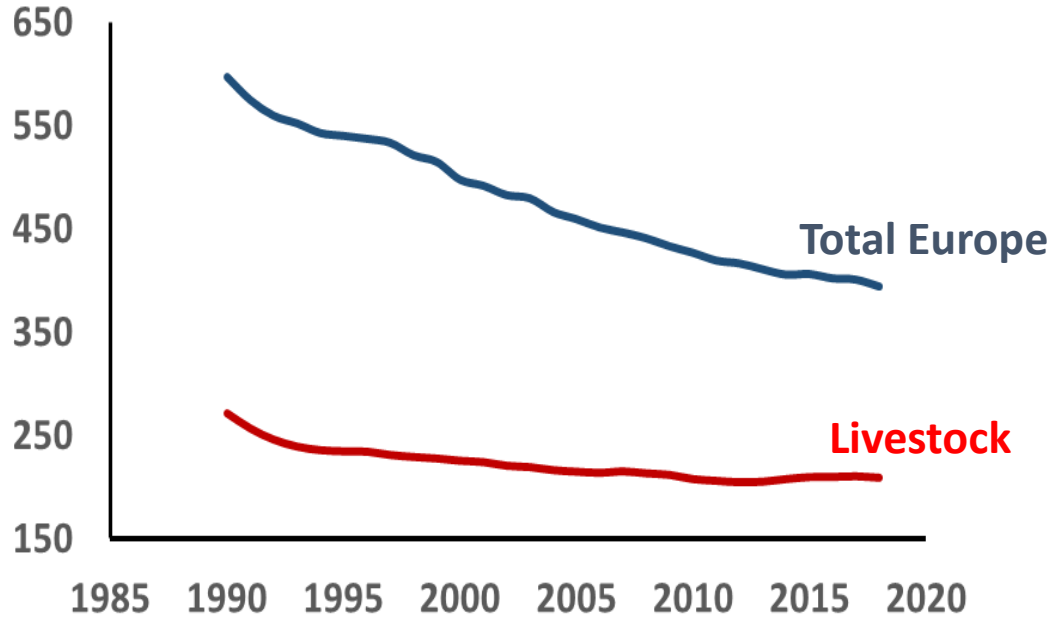
Emission (kg eq-CO2 / kg protein)
(including pre-farm and on farm emissions)



Adapted from FAO (2017)

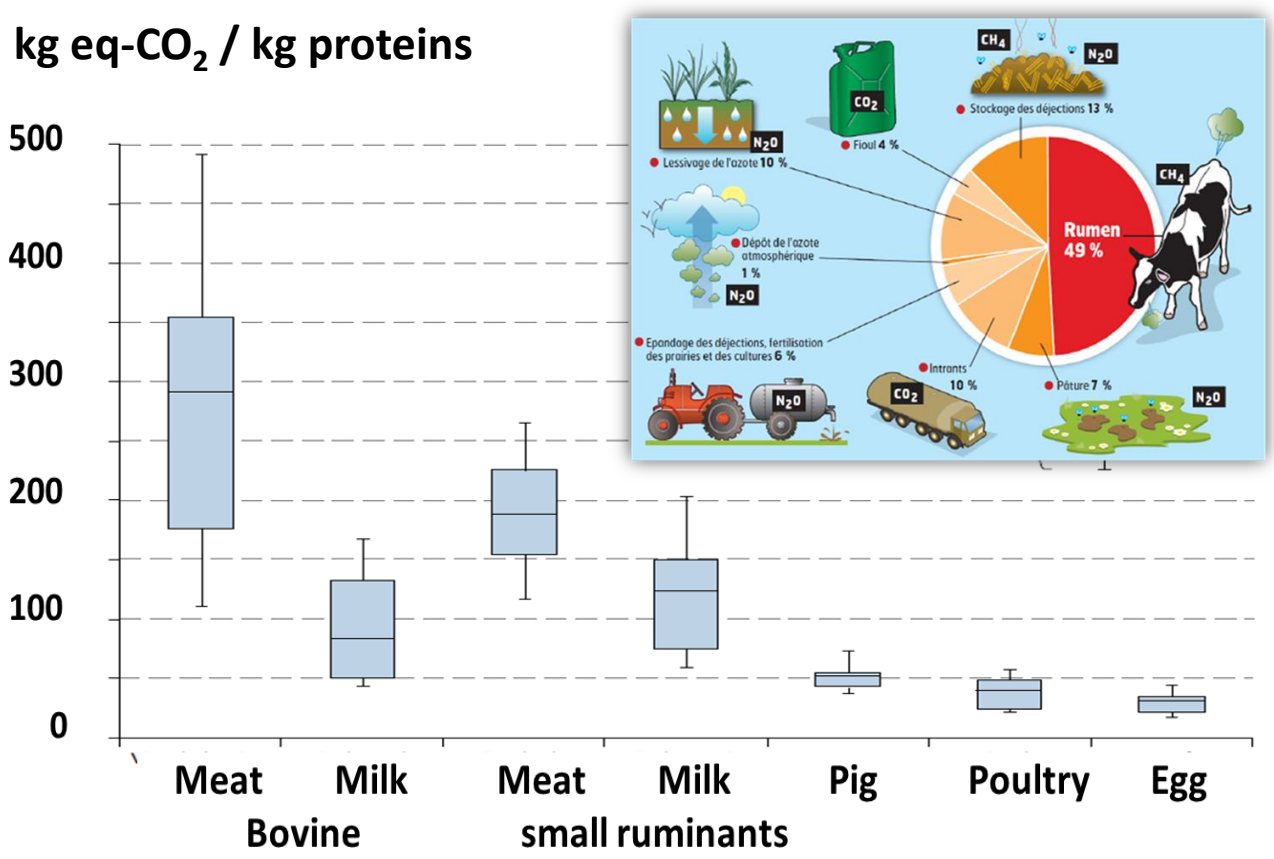
- **But progress is slow compared to other sectors**

CH_4 (Tg/year)



European Environment Agency, (2019)

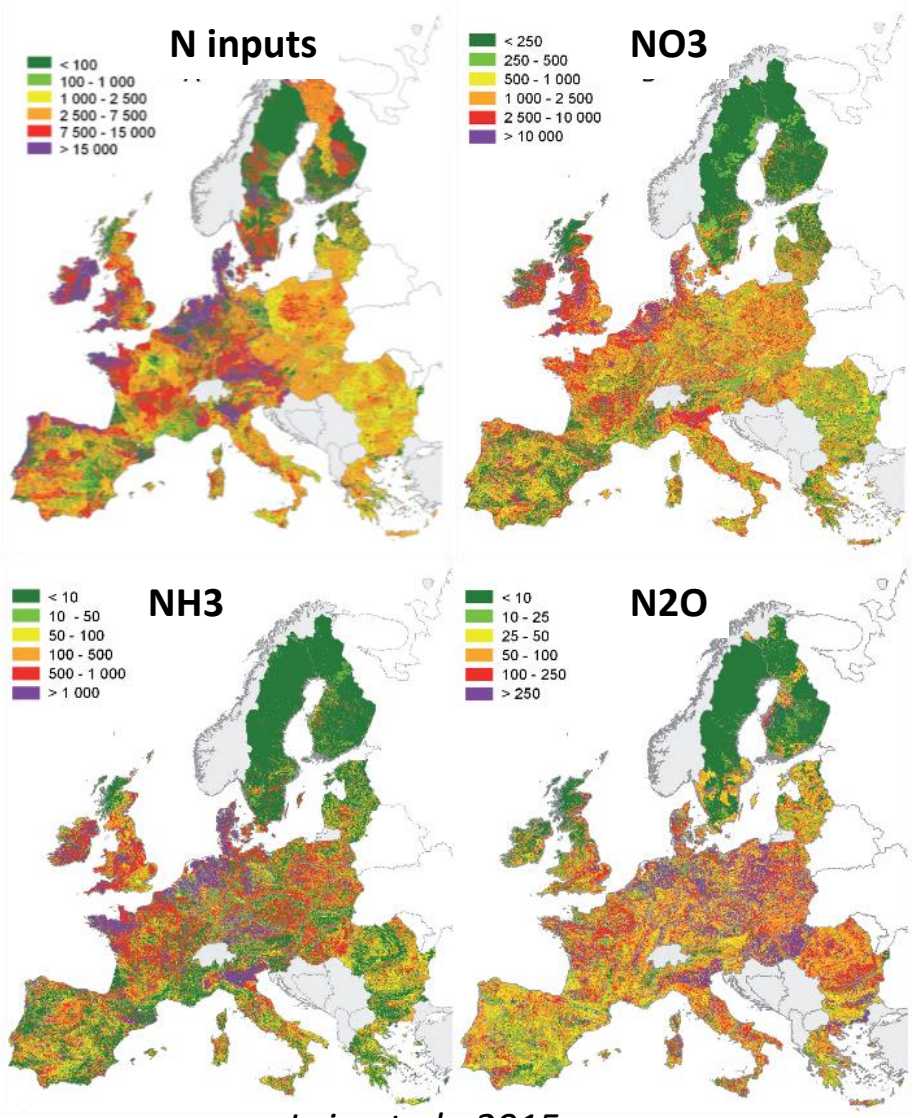
1. GHG mitigation options for the EU livestock



From Gerber et al., 2013

Efficiency	**Low emitting animals** **Animal health** **Herd management** **Feed production (legumes, agricultural land use)**
Resource recycling	**Smart use of manure** **Manure bio-refinery** **Use of plant by-products**
Nature based solutions	**Deforestation - imports** **Energy production (manure)** **Soil C storage (grassland, agro-forestry)**

2. Local impacts of livestock farming

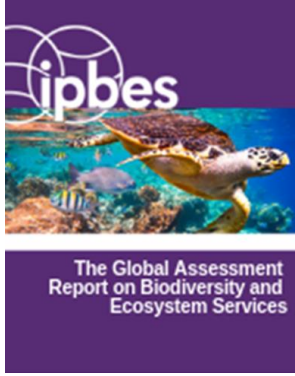


Leip et al., 2015

- **Livestock farming is responsible for**
  - **80% of N of agricultural origin present in all aquatic environments,**
  - **90% of NH_3 emissions of the agricultural sector.**

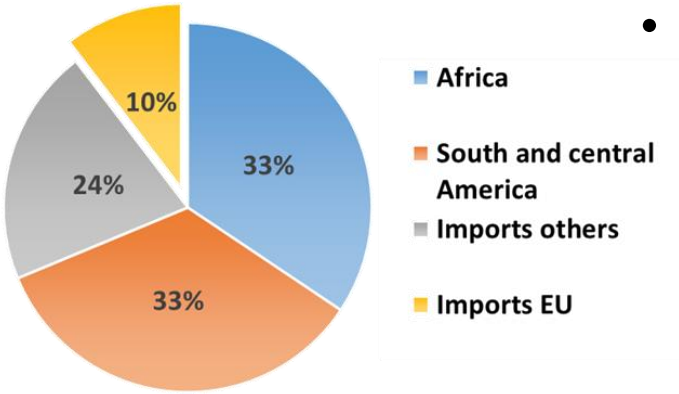
- **Avenues for improvement**
  - **Avoiding losses between animal and effective supply to the soil,**
  - **Bio-refinery of manures using cascading approach: high value ingredients – Minerals – Energy.**

3. Livestock and biodiversity: a complex relationship



- Livestock contributes to biodiversity loss through different drivers (habitats loss, pollution, over exploitation of resources, climate change)
- Within each driver, livestock systems can have positive contributions

- Deforestation is a major cause of biodiversity decline



- Eu = 10% of the global embodied deforestation: soya, meat, palm oil, cocoa, rubber, timber

(European commission, 2019

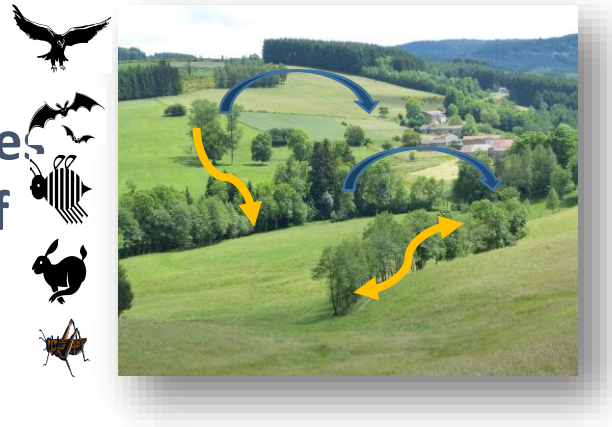
Imported soya	% total
Low risk of deforestation	78
High risk of deforestation	22

(FEFAC, 2018-19)

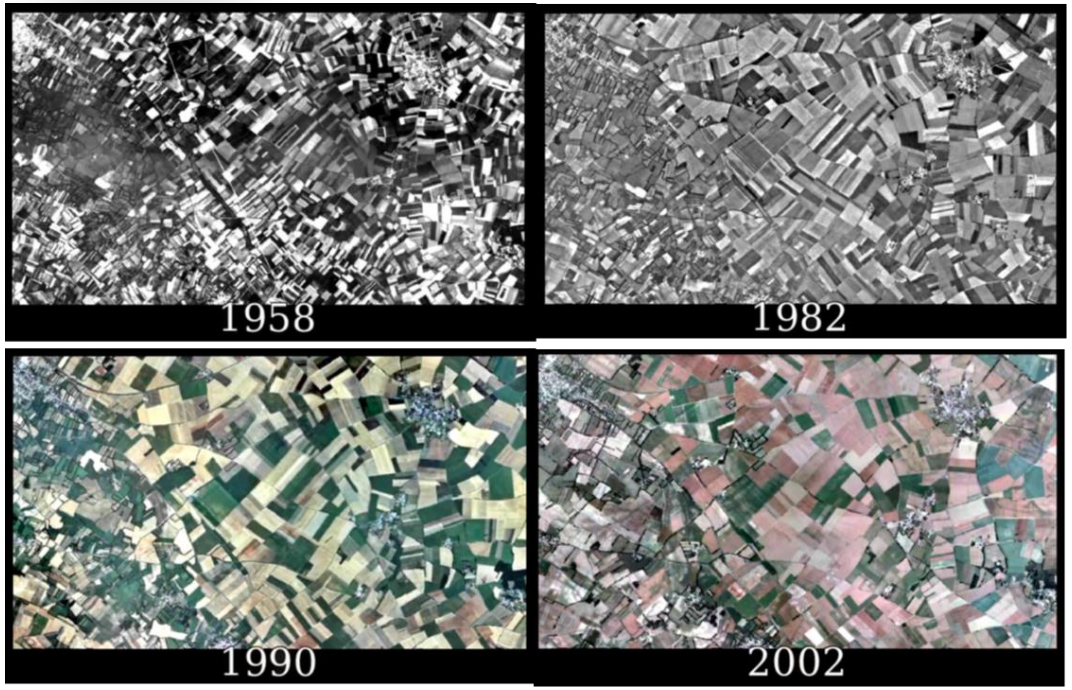
3. Livestock (Ruminants) can produce Biodiversity

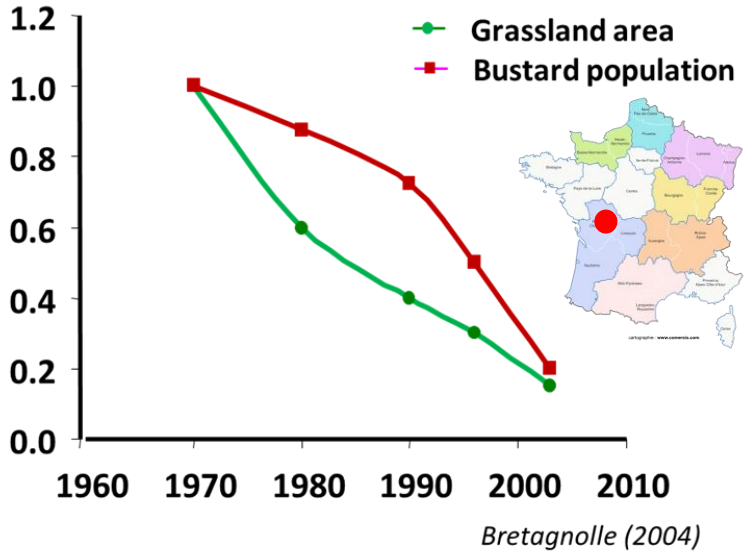
- Diversity of forage species (including honey plants) and grassland types

- Diversification of land uses, landscapes and maintenance of open habitats



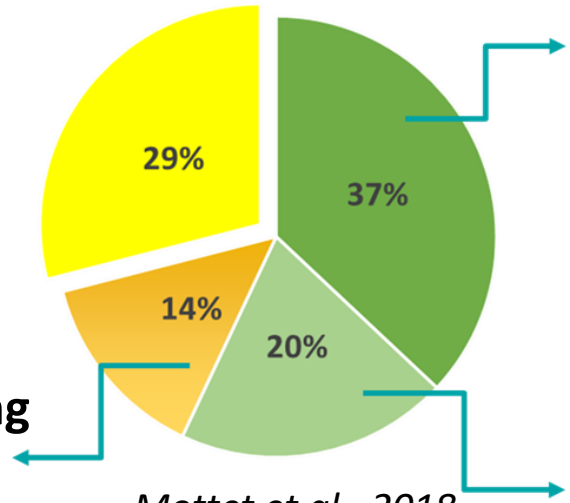
- Homogeneisation of landscape with disappearance of grass farming in favour of cereals reduces biodiversity





4. Resources: Do livestock use resources inefficiently?

- **Livestock use 70% of agricultural land**



Mottet et al., 2018

This part can only be used by herbivorous

- Permanent grassland, marginal land
- Sown grasslland
- Crops for feed
- Crops for food

This part (globally 30% of cropping area but up to 50% in OECD countries) is questionable

This part might be used for crops production but it ensures the provision of ecosystems services

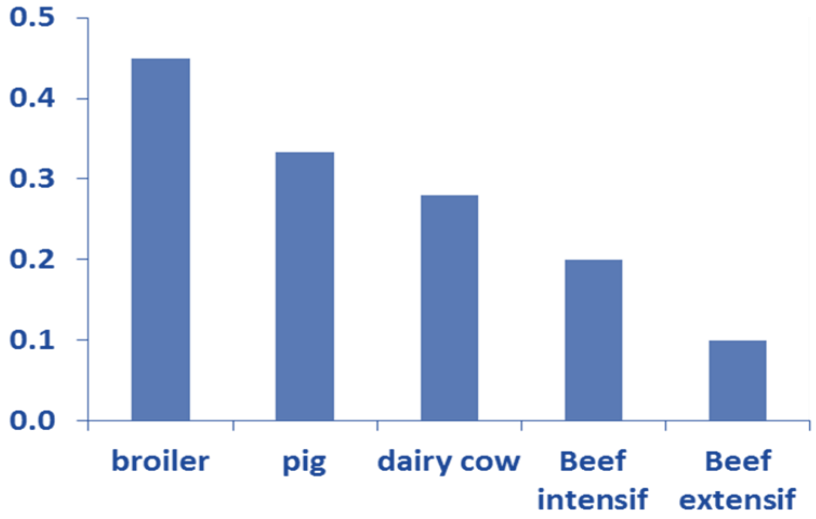
Ten Years For Agroecology ***IDDRI***

- **Food from marginal land not able to produce plants products? Ruminants can do!!**
  - In Europe, permanent Grasslands and rangelands cover 73 M ha (40% Eu AA)
  - Marginal land provide 25% of world animal products *Sere and Steinfeld, 1996*

4. Resources: Do livestock use resources inefficiently?

- **An apparent low efficiency**

kg protein of animal origin / kg of plant protein



(Peyraud et al., 2014, 4ième Foresight SCAR, 2015)

- **But livestock recycle biomass that is not directly usable for human food**:

kg of edible animal protein (milk, meat) / kg of edible plant protein used as feed

	Ruminants	Non ruminants
Global	**1.6**	**0.5**
Europe	**0.4 to > 2.0**	**0.4 to 1.6**

(Mottet et al, 2017 ; Wilkinson, 2011; Ertl et al., 2015; Laisse et al, 2019)

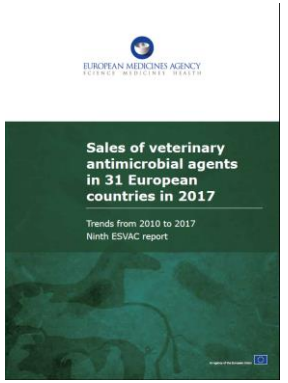
Livestock farming is more efficient than often claimed

5. Animal welfare and animal health

- **Livestock systems have had implications for animal welfare**
  - Stress and pain with artificial living conditions, damage of animal integrity, reduced lifespan of reproductive females, economic “non-value” of some young males,
  - Shortcoming in transport of live animals and slaughtering conditions despite some efforts.

- **Animal diseases can cause serious social and economic damage and threaten human health**
  - Intensive farming systems may facilitate the transmission of epidemics,
  - Animals in extensive systems are more exposed to some pathogens.

- **Reducing the use of antibiotics**
  - EU banned the use of antibiotics as growth promoters in 2006 and their prophylactic use will be banned in 2022,
  - The overall decline in sales between 2011 and 2017 was 32%.

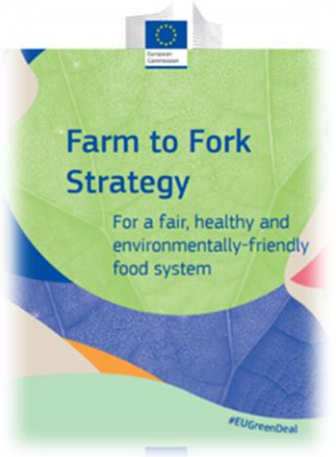


European Medecine Agency, 2019

Part 2

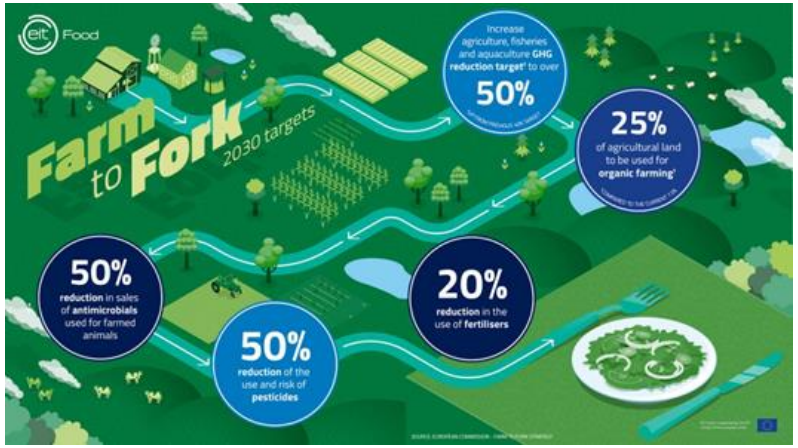
Evolution of the livestock sector: drivers of changes and improvement of livestock sustainability

The drivers of change for 2030-2050



- **A society calling for agriculture to change: growing societal expectations**

- **Climatic and environmental emergencies coupled with health and societal concerns**
  - **Environment**: Green deal, Farm to Fork and Biodiversity strategies,
  - **Ethics**: The issue of animal welfare will greatly affect the future of animal farming,
  - **Nutrition**: A reduction in the consumption of meat (both for ethics and health reasons).

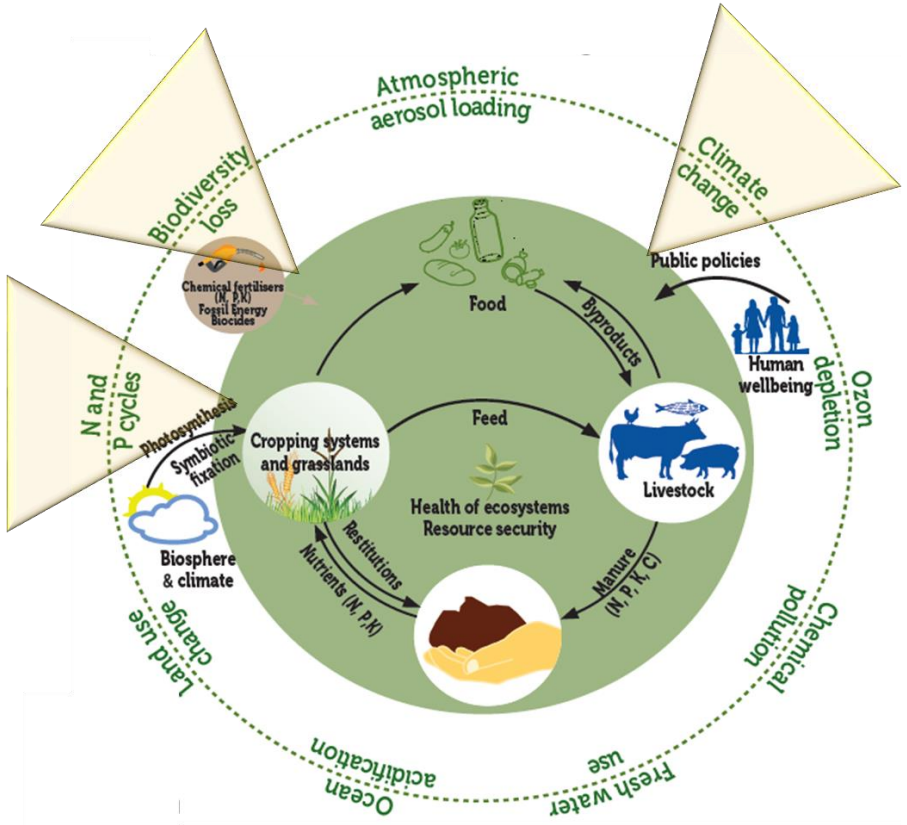


- **Technical innovations in farming systems**
  - Advances in biotechnologies, digital technologies and technological processes,
  - Investment in research to develop science based solutions avoiding dogmatic approaches.

A new paradigm for thinking the future of livestock farming

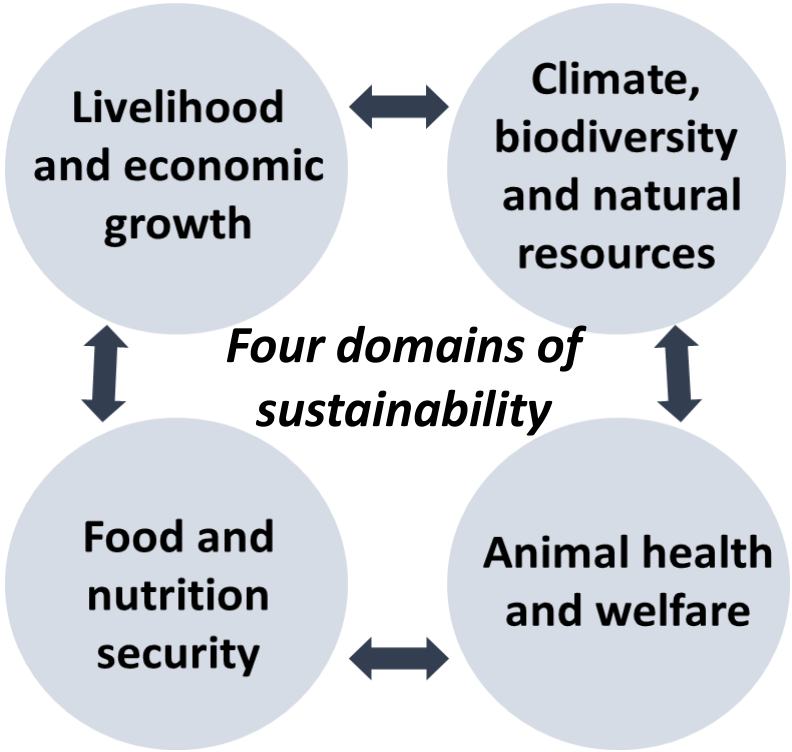
- **A conversion of the agricultural sector** is required that targets nearly every aspects

Connected circularity in planet boundaries: a challenge for livestock



ATF-P4F policy brief, (2020)

Rethinking the performances of livestock systems



(ATF-Strategic Research and Innovation Agenda, 2021)

Expected benefits of circular agri-food systems

Innovative Food systems

Efficient use of non (scarcely) renewable resources

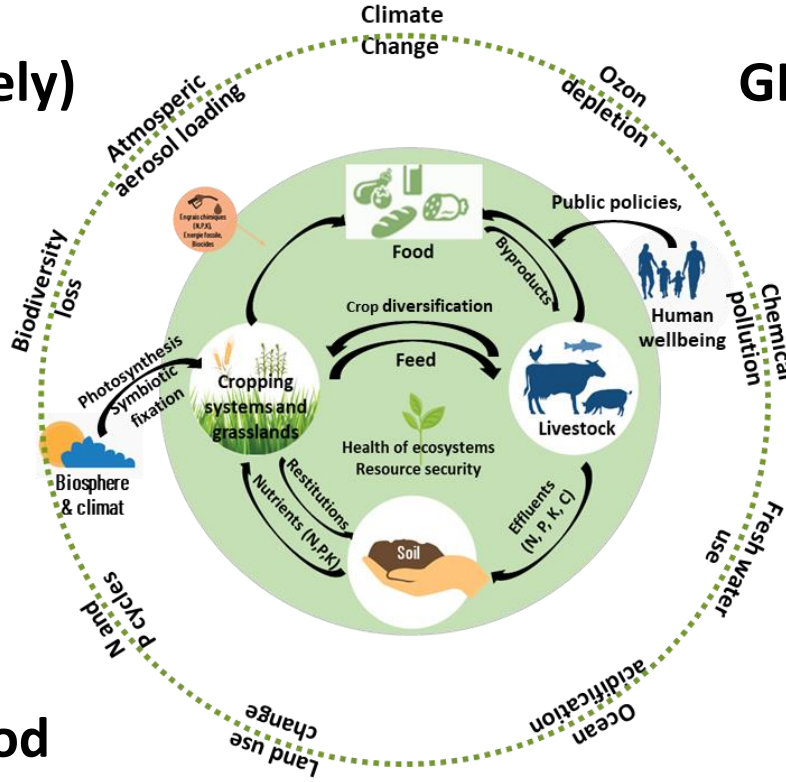
Food Sovereignty

Protein autonomy

Recycling biomass between sectors

Adaptation to climate change

High quality food



Environmental services

GHG mitigation

Pesticide and mineral fertilisers use

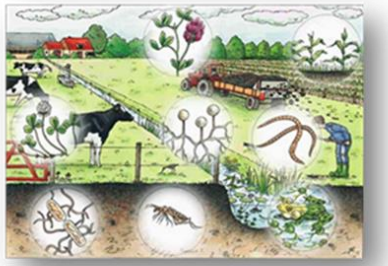
Closing nutrient cycles

Restauration of biodiversity

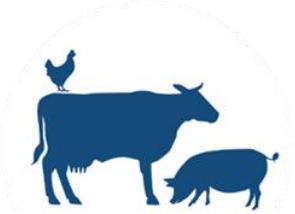
Quality of ecosystems and soil fertility

- Balances are to be found according to political and territorial contexts,
- Difficulties: new actors coordination to changes the socio-technical systems, exploration and demo of new business models, public policies to guide and support transitions.

Livestock for more sustainable food production: some examples

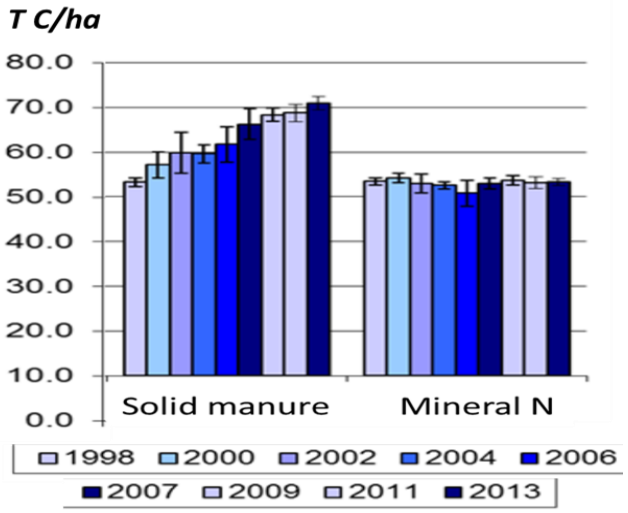


Animal can use a diversity of feeds thus allowing diversification of rotations



Manures, grasslands

Soil OM content
Soil structure
Soil erosion
Soil biology



t/ha		
OM	30	70
Erosion (t OM/ha/y)	3.6	0.3
Invertebrates	0.5	3.5
Microbes (µg/g soil)	8.0	11.6

(adapted from Eurostat, 2010)

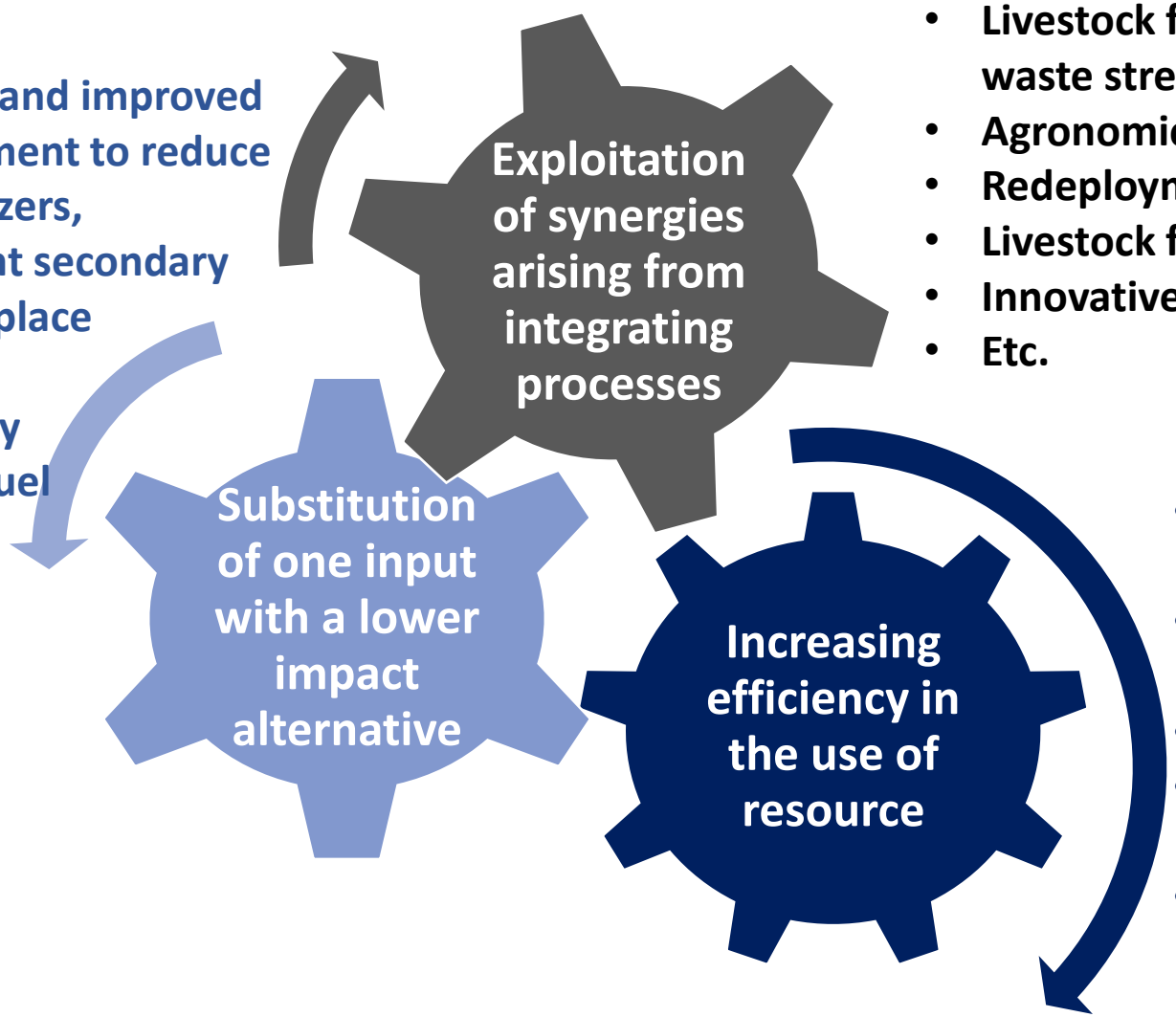
- Crops receiving less pesticides
- Cutting off the cycle of plant pests

ÉCOPHYTO DEPHY

Solid manure input every other year

Pathways of progress (1)

- N-fixing legumes and improved manure management to reduce synthetic N fertilizers,
- Vaccines and plant secondary compounds to replace antimicrobials,
- Renewable energy to replace fossil fuel
- Etc.



- Use the ability of livestock to use a range of biomass: crop diversification,
- Livestock for a full use of biomass: by-products, waste streams, new protein sources,
- Agronomic use of manure and manure bio-refinery,
- Redeployment of livestock in cropping regions,
- Livestock for soil C sequestration,
- Innovative business models,
- Etc.

- Breeding for increased efficiency robustness and use of lower quality feed
- Feeding and rearing strategies (including PLF),
- Innovative technology (feed quality),
- Integrated management of health and welfare,
- Etc.

Pathways of progress (2) : potential trade-off

Objectives	Some trade-offs
GHG mitigation	Biodiversity Animal welfare
Reconnecting plant and livestock sectors	Workload and organisation Continuity of business models
Improving Animal welfare	Animal health, Production cost Environment?
Biosecurity for animal health	Animal welfare

imply the need for tailored implementation to maximise the benefits while reducing the adverse impacts.

Pathways of progress (3) : avoid misinterpretation

- **Focussing on the cost/impacts of plant vs animal based food on short term, may lead to overly simplistic view**
- **One dimensional reduction of livestock in Europe may lead to unintended outcomes**
  - Reduction of GHG emission in EU will be offset by increased impacts in other regions,
  - Ruminant maintain marginal land whose biomass is often not mechanically harvestable,
  - Risks of conversion of grassland to cropland: loss of biodiversity, ecosystem services, soil C,
  - Risks of abandonment of grassland: loss of biodiversity, fermentation of plants, fires.
- **Rethinking the interplay between crop and livestock sectors associated with a transformation of the livestock production will be more smart and effective**

Pathways of progress (4) : the role of public policies

- **Ensuring agro-ecological transition of the livestock sector**
  - Rewarding grasslands for the public goods they provide (eco-scheme),
  - Removing coupled aids: antagonism/GHG mitigation ambition, lock farmers into production,
  - Supporting livestock farming in marginal areas,
  - Improving animal welfare: cross compliance + echo-scheme for additional improvements.

- **Reducing GHG emission: climate smart agriculture**
  - Taxes on livestock and mineral fertilisers, tax N_2O more strongly than CH_4 ?
  - C market with certified emission reduction units and carbon removals (farm level),
  - Policies reintegrating livestock and crop agriculture and promoting circular agriculture
- **New balance between proteins of animal and plant origin in our diets**
  - No tax on meat,
  - C labelling (private actors can differentiate themselves) and information campaigns

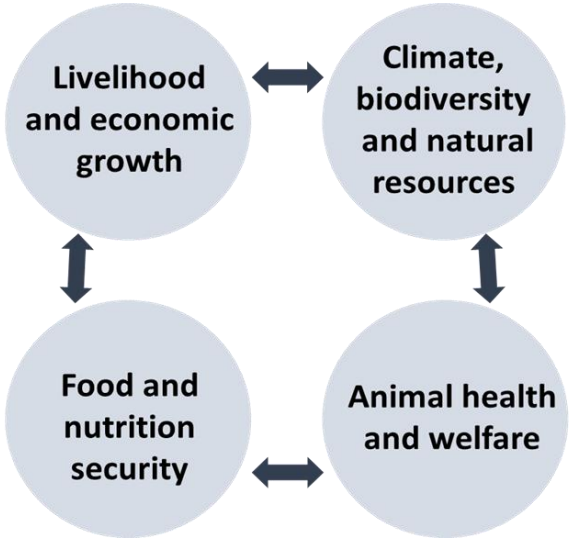
Part 3

Conclusion

- **Think twice: maintain a broad vision of livestock farming in sustainable food chains**
  - Move away from a simplistic plant vs animal or extensive vs intensive opposition,
  - The shadow of livestock can be mitigated,
  - Integrated solutions are needed.

- **Circularity provides a new ambition and new challenges for livestock.**
  - Livestock are essential:
  - They are recyclers by nature: conversion of biomass, production of nature based organic fertilizers,
  - They provide a range of societal goods and services.

- **Livestock systems should transform to fulfil its roles**
  - Four interdependent sustainability domains must be considered and placed at the heart of innovation,
  - Diversity of livestock production systems is essential to fit various demand and local contexts,
  - Need to articulate local and global scales, production of food and production of immaterial functions.



- **Developing more accurate models to track progress**
  - Assess the multi-functionality and complexity of agriculture and sustainability on a long term basis,
  - Help for policy makers and actors of supply chains to make decisions.


Agro ecological
Livestock farming is
much more than only
food production