ATB
Leibniz-Institut für
Agrartechnik und Bioökonomie

DairyMix

Gefördert durch:
Bundesministerium für Ernährung und Landwirtschaft
aufgrund eines Beschlusses des Deutschen Bundestages

The role of livestock in sustainable circular bioeconomy systems: the MilKey and DairyMix projects

Prof UZ Dr. Barbara Amon

FAO LEAP Conference for LAC, 5th and 6th Nov 2024

Leibniz Association

Sustainability of livestock systems

Livestock-Environment Interaction and Assessment

Joint Lab

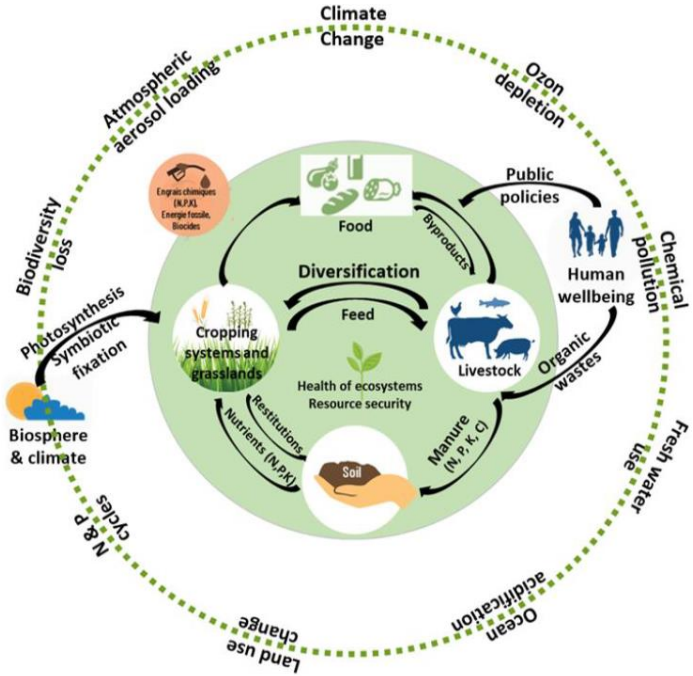
Funded by the European Union

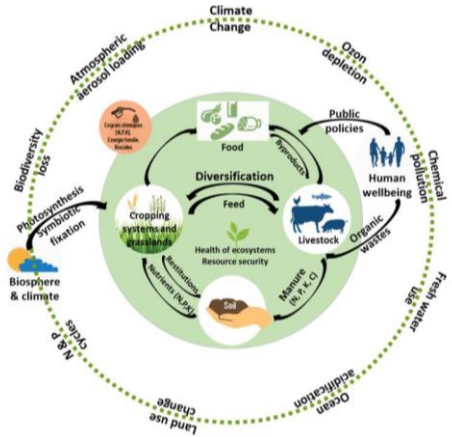
duction

Manure management

Housing •

Feeding •



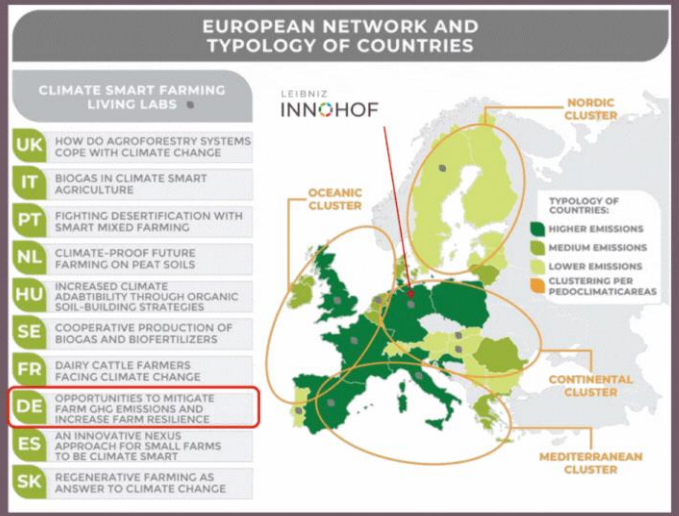


M4Models

Source: Animal Task Force - Strategic Research and Innovation Agenda (April 2021)

Sustainability of livestock systems

Integrated approach to agro-forestry-livestock systems



- Multi-stakeholder environment
- Co-creation of innovation
- Agroforestry, carbon farming and other climate-smart practices

b-forestry-stems ●

uture-proof livestock production

CLIMATE FARM DEMO

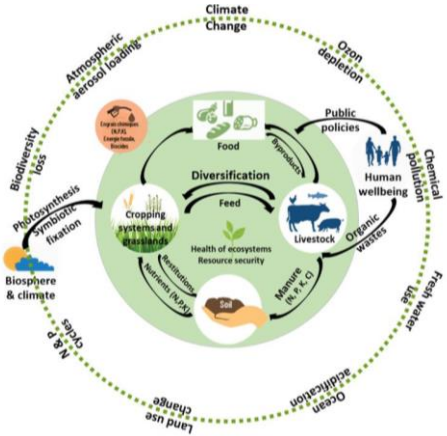
DairyMix

STEP UP

Carbon Farming

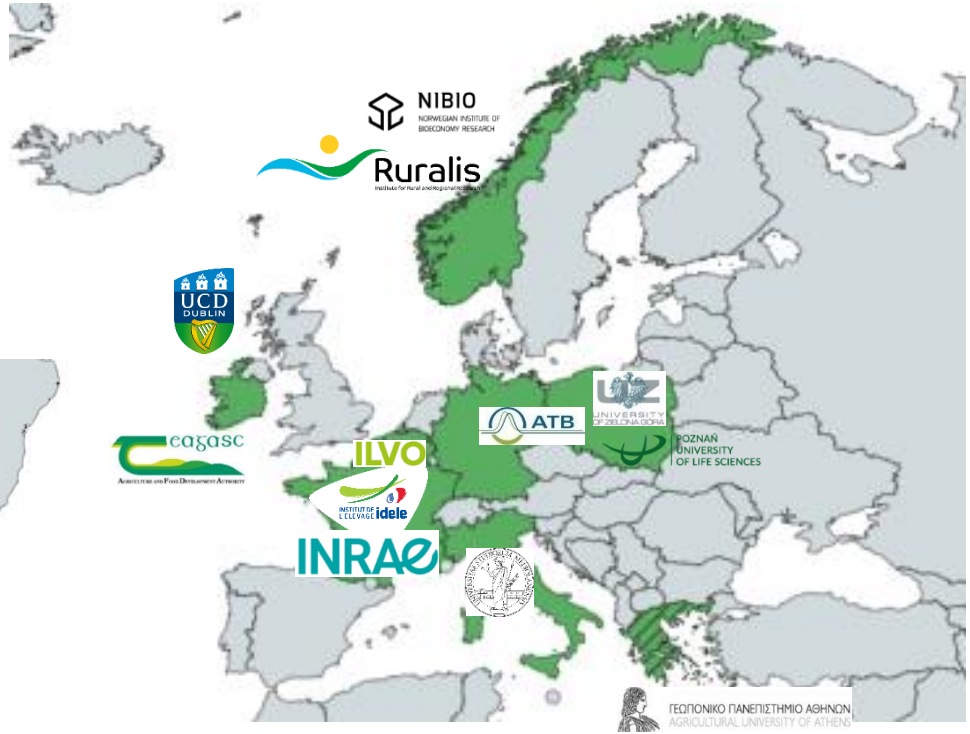
M4Models

MELS



The projects “MilKey” and “DairyMix”

The projects "MilKey" and "DairyMix"

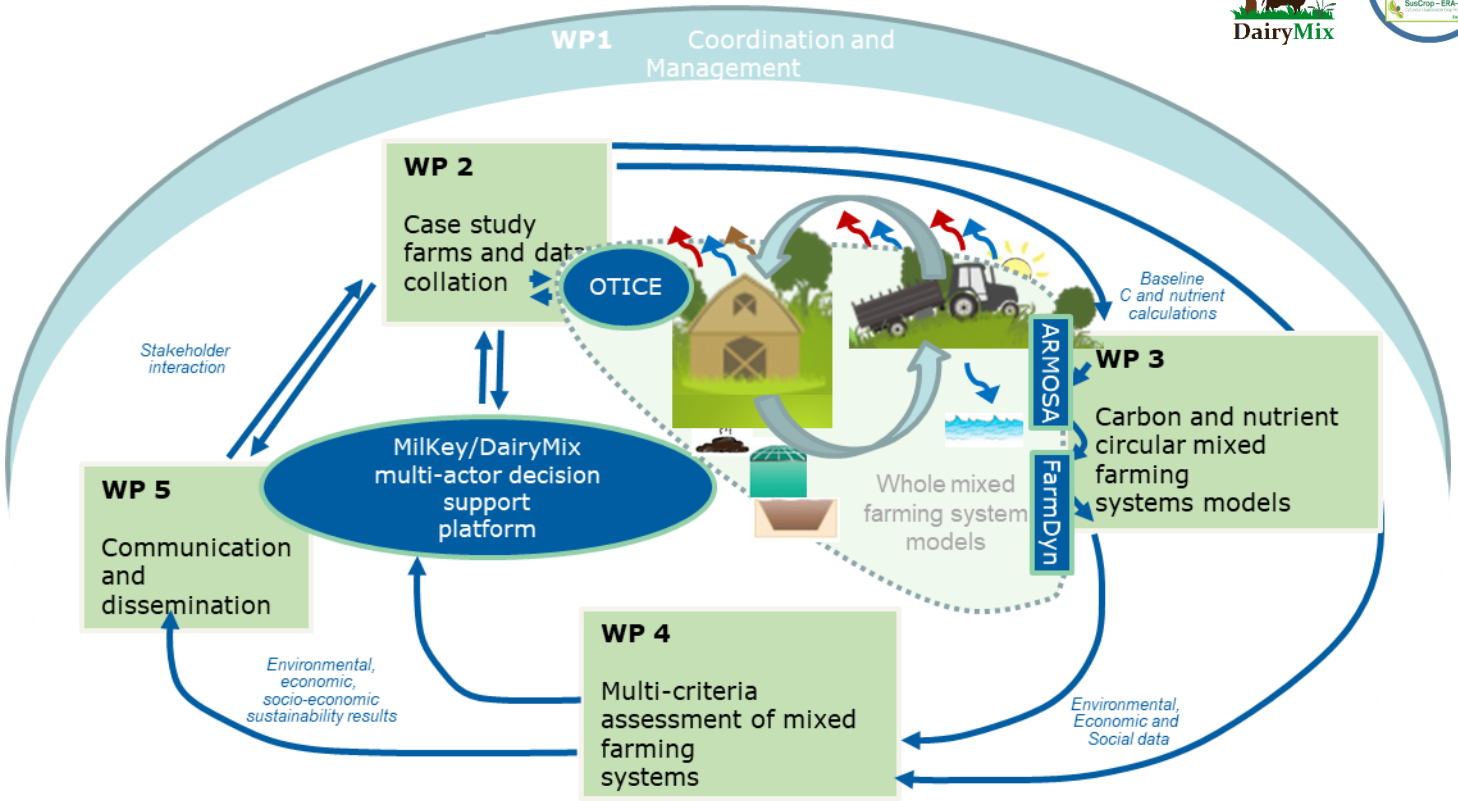


Partners from Europe and Argentina

Advisory Board members from Brazil (EMBRAPA), Chile, China, Portugal, Spain, UK

AIM: Multi-criteria assessment, decision support, modelling and management tools for ***sustainable circular mixed dairy farming systems*** that reduce external inputs (e.g concentrates and mineral fertilizers).

DairyMix workflow



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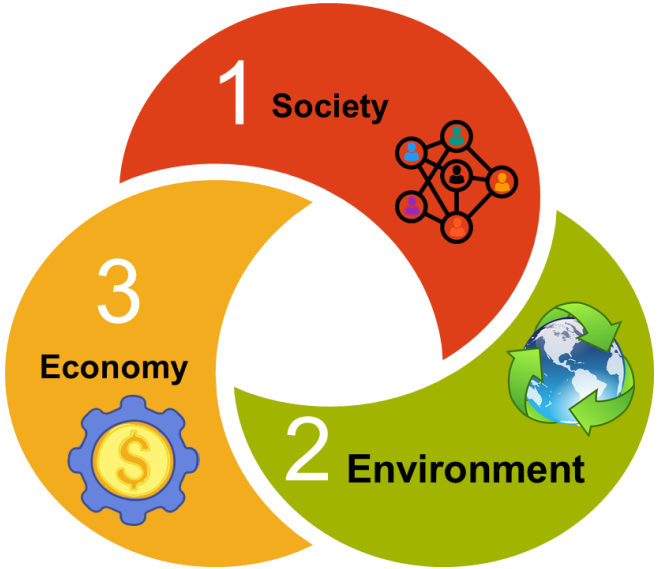
3-pillar sustainability of dairy production systems

- Three sustainability branches:
  - **Environmental**
  - **Economic**
  - **Social**



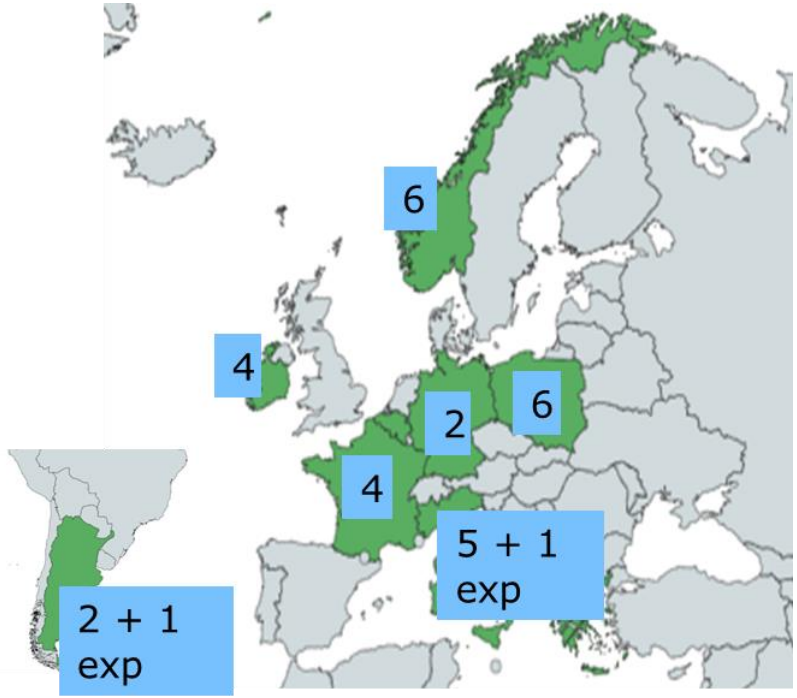
Objectives:

- ✓ Assess environmental, economic and social sustainability of mixed farming system options for dairy production
- ✓ Develop multicriteria sustainability concepts for mixed farming systems for dairy production
- ✓ Identify and analyse synergies and trade-offs

Case Study Data Collection

- Submitted case studies:
  29 commercial farms
  + 2 experimental farms

- Specialized dairy farms representative of their countries/NUTS2 areas
  + diversified farms
  = **gradient of farm specialization**



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Case Study Data Collection

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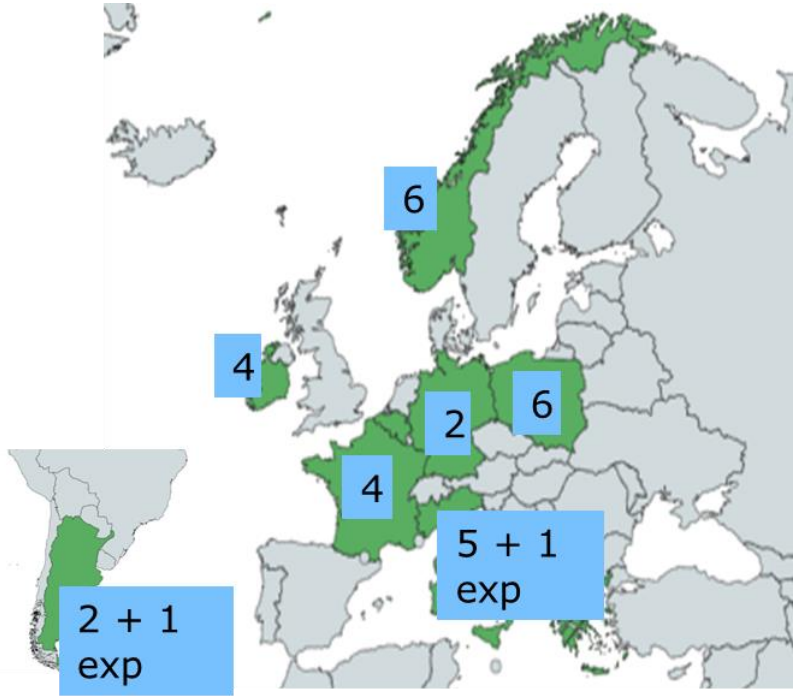
- Extensive template for (environmental, economic, social) data collection

1. **General farm data**: UAA, Conventional or organic production, Presence of beef enterprise and participation in agri-environmental scheme

2. **Farm holder data**: Age, Agricultural education, Gender, Off farm employment



Case Study Data Collection

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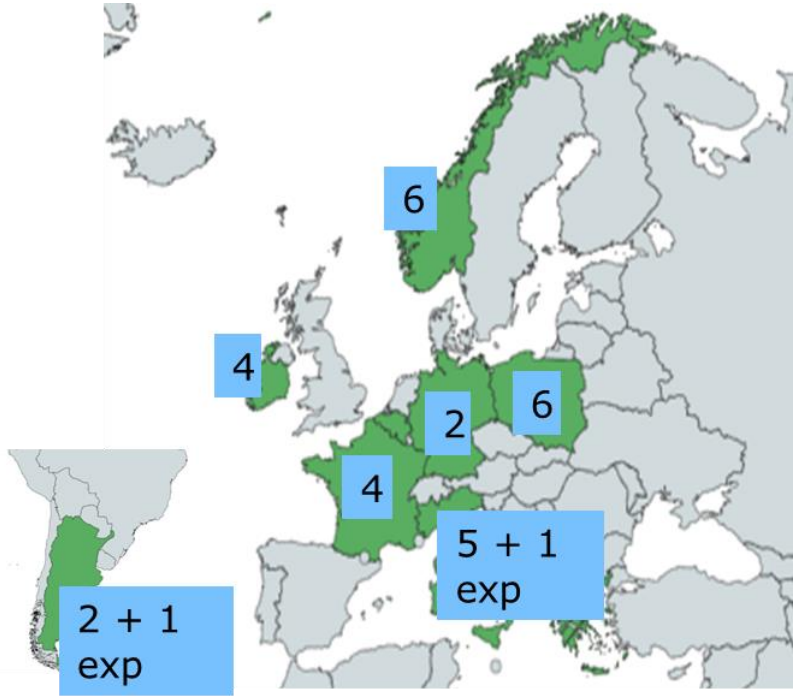
- Extensive template for (environmental, economic, social) data collection

3: **Dairy enterprise data**: Average dairy cow herd size, total milk production (litres), milk yield per cow (l/cow), milk fat content, milk protein content, FPCM per cow

4. **Grassland & Crop data**: Grassland excluded from rotation, Cropland excluded from rotation, grassland included in rotation, cropland included in rotation, crop species in rotation, crop rotation



Combining two approaches to circularity assessment

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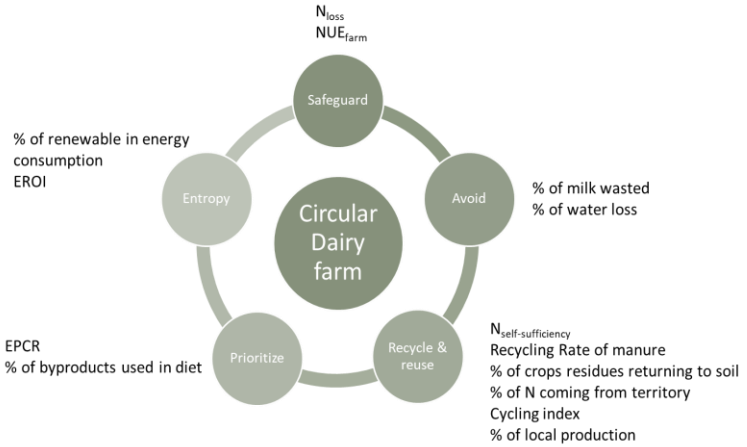
- **Circularity principles** in relation to circular bioeconomy (Muscat et al. 2021)
  - Multi-disciplinary approach taken- Economic, environmental and social perspective
  - Theoretical foundation: Application of the five Muscat principles for the bio-economy (Adaptation to the farm level)

- **Safeguard**
- **Avoid**
- **Prioritize**
- **Recycle and reuse**
- **Entropy**

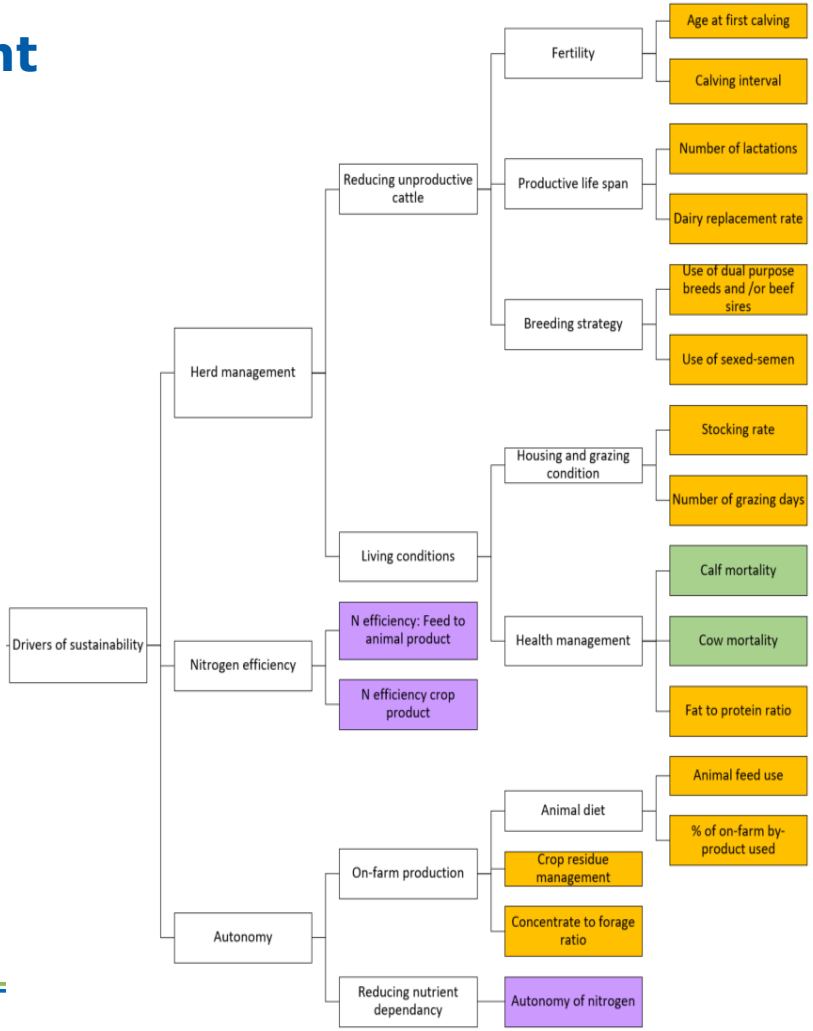
- **Cycling indicators** deriving from ecology or industry (e.g., Finn index, Figge index) (van Loom et al. 2023)
  - Concrete, established measures of circularity (i.e. nutrient flows, renewable energy)



Multicriteria sustainability assessment

- ✓ **Multi-attribute decision-making** (breakdown complex decision problems)
- ✓ Hierarchical model, tree-shaped structure
- ✓ Dependencies are considered

Attributes	Case Studies						
	FR_{01}	FR_{02}	DE_{01}	DE_{02}	IR_{01}	IR_{02}	NO_{01}
Environmental sustainability[1]	Medium	Medium	Medium to high	Medium	Medium to high	Medium to high	Low to medium
Environmental quality[2]	Medium	Medium	High	Medium	High	High	Very low
Water quality[3]	Medium to low	Low	Medium to high	Medium to low	Medium to high	Medium to high	Low
Eutrophication potential[3]	Medium to High	High	Medium to low	Medium to High	Medium to low	Medium to low	High
Contribution to climate change[3]	High	High	Medium to low	High	Medium to high	Medium to high	High
Global warming potential[3]	High	High	Medium to low	High	Medium to high	Medium to high	High
Air quality[2]	Medium	Medium	Very high	High	Very high	Very high	Very low
Air acidification[2]	Medium	Medium	Very low	Low	Very low	Very low	Very high
Soil quality[3]	Medium to High	High	Medium to High	High	High	High	Low to medium
Erosion risk[2]	Low	Very low	Low	Very low	Very low	Very low	Very high
Heavy metal balance[4]	Low	Low	Low	Low	Low	Low	Low



DairyMix/MilKey platform: decision support on mitigation measures

DairyMix

FACCE ERA-GAS · ICT-AGRI FOOD · ERA-NET SUSAN · SusCrop – ERA-NET

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https://www.milkey-project.eu/educational-platform

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DairyMix/MilKey platform: decision support on mitigation measures

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A wide range of ***GHG*** *and* ***N*** *mitigation options* is available

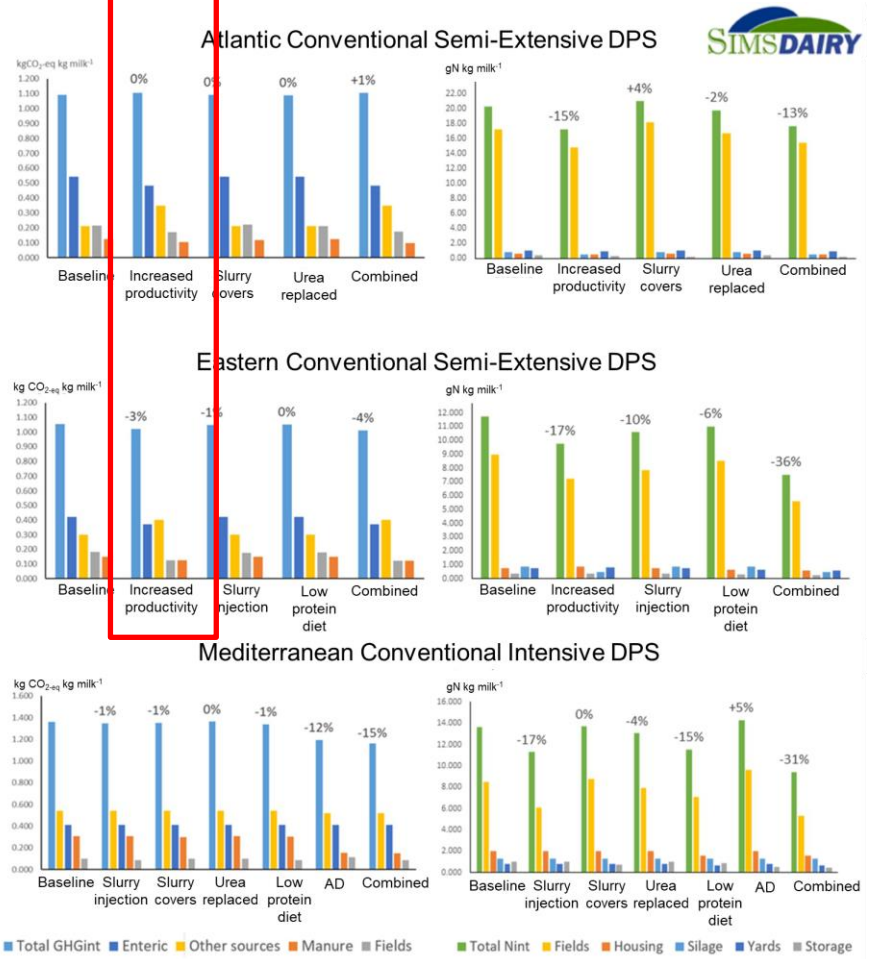
- examples: rigid covers, anaerobic digestion, diet management, slurry application techniques…

1. Modelling of <u>baseline GHG emissions and N losses</u> (SIMSDairy, Del Prado et al. 2011)
2. Selection of **<u>mitigation measures</u>** to be modelled/implemented, in relation to the region and to the individual DPS
3. Modeling of single and ***<u>combined</u>*** mitigation measures

DairyMix/MilKey platform: decision support on mitigation measures

* The effect of single measures and their combination is **context-specific**!

Example: Increased productivity reduced GHG emission in semi-extensive systems in Eastern Europe, but not in the Atlantic.



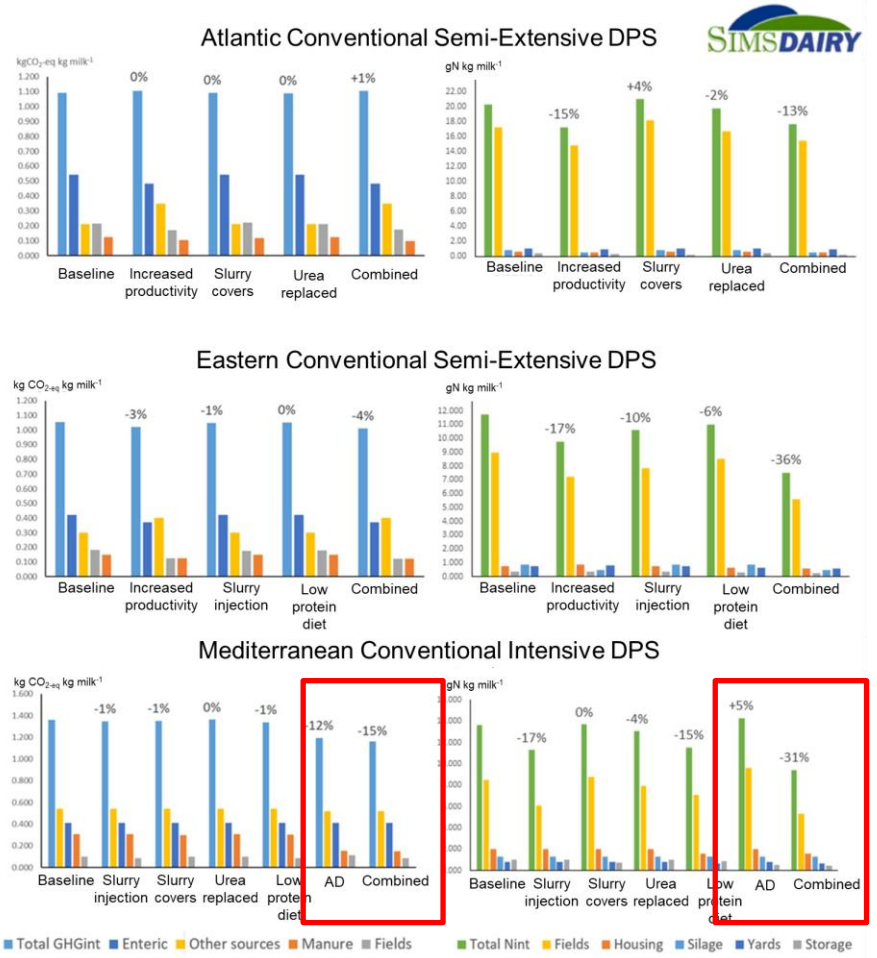
DairyMix/MilKey platform: decision support on mitigation measures

* The effect of single measures and their combination is **context-specific**!

Example: Increased productivity reduces GHG emission in semi-extensive systems in Eastern Europe, but not in the Atlantic.

* **Context-adapted combinations** of mitigation measures lead to a substantial emission reduction, while single measures often show trade-offs between GHG and N.

Example: In the Mediterranean, anaerobic digestion (AD) reduces GHG emissions, but as a single measure it can increase N losses. Combined measures reduce both.



Stakeholder interaction and policy support

TFEIP
Task Force on Emission Inventories and Projections
A group created under the UNECE Convention on Long-range Transboundary Air Pollution

LRTAP
Long-range Transboundary Air Pollution

UNECE

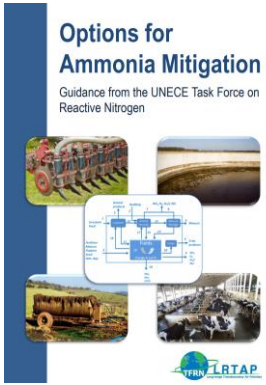
OECD
TFRN

ipcc
INTERGOVERNMENTAL PANEL ON climate change

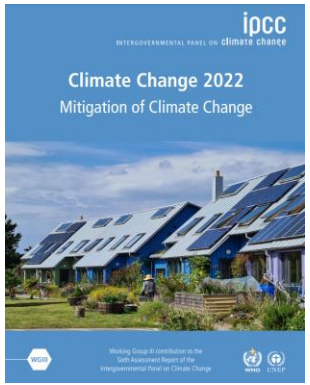
WMO UNEP

Food and Agriculture Organization of the United Nations

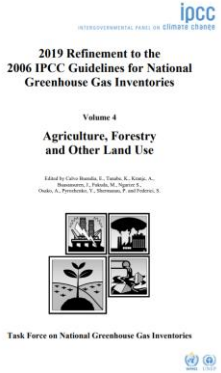
leap
LIVESTOCK ENVIRONMENTAL ASSESSMENT AND PERFORMANCE PARTNERSHIP



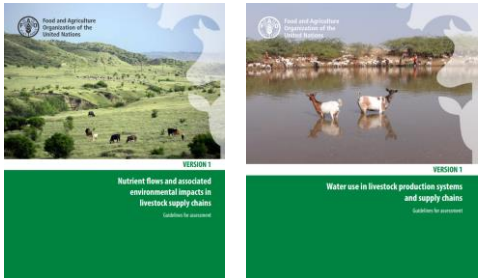
Co-chair of ammonia Guidance Document revision process

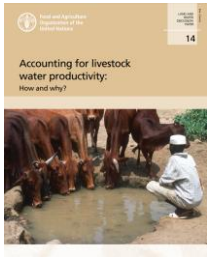


IPCC WG3 “Mitigation of Climate Change” Review Editor to the 6th Assessment Report



Lead Author of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories





Research-impact cycle

Research

Policy / Stakeholder interaction

Source: http://animaltaskforce.eu/

Research needs