

System level impacts of environmental and social optimization

Expert analyses of different countries

EAAP 2024, Florence; 1 September, Paul Galama (WUR) and Bob Rees (SRUC)



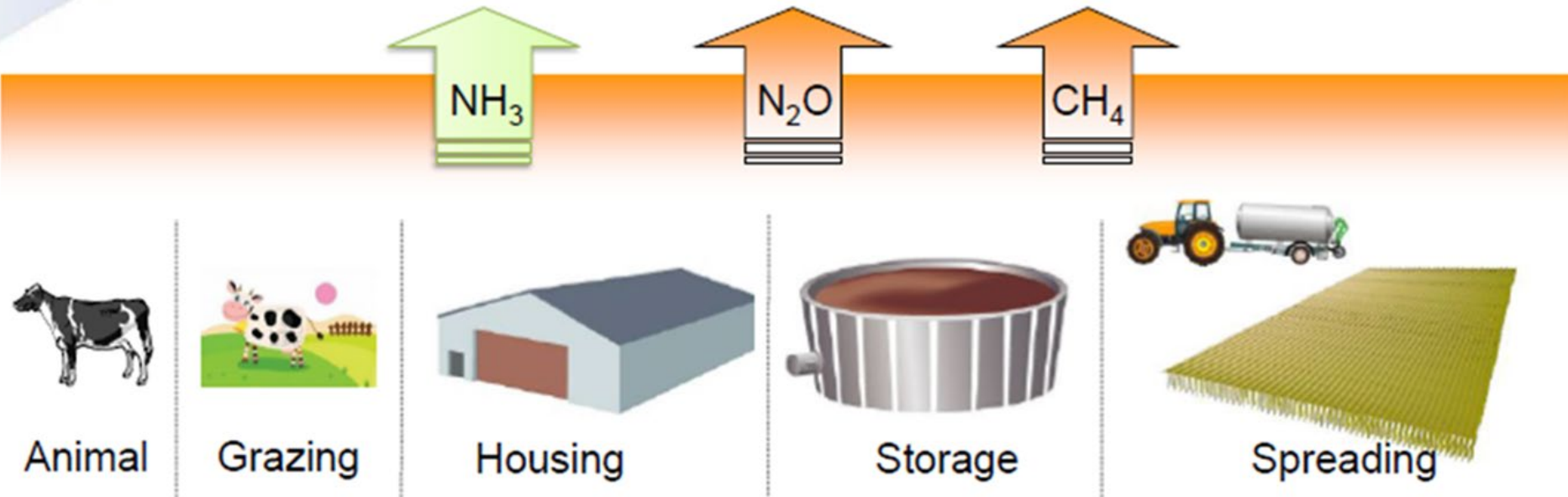


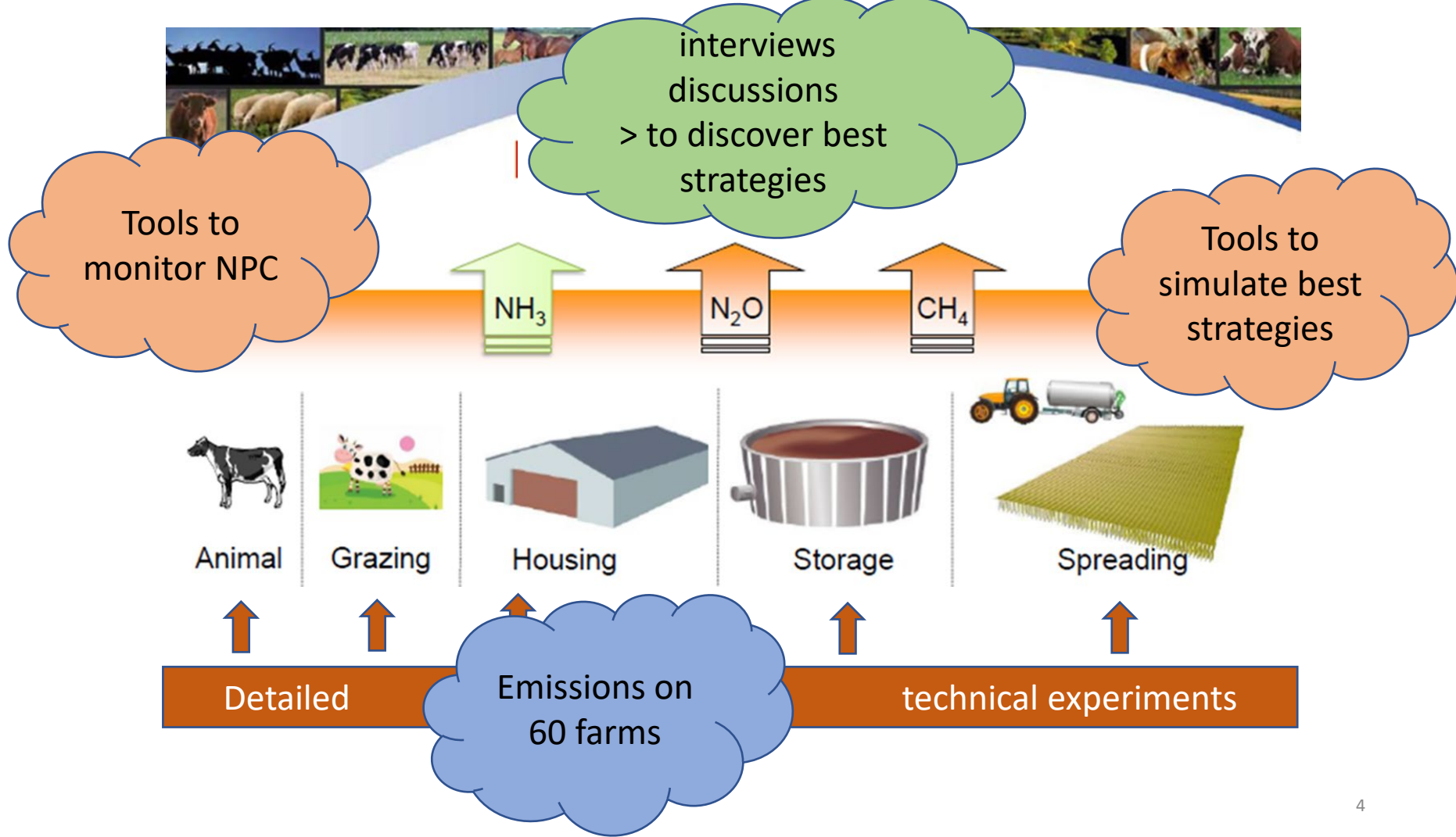
Netherlands
United Kingdom
France
Germany
Italy
Poland
Latvia
Lithuania

Climate Care Cattle



Discover best strategies in the whole chain

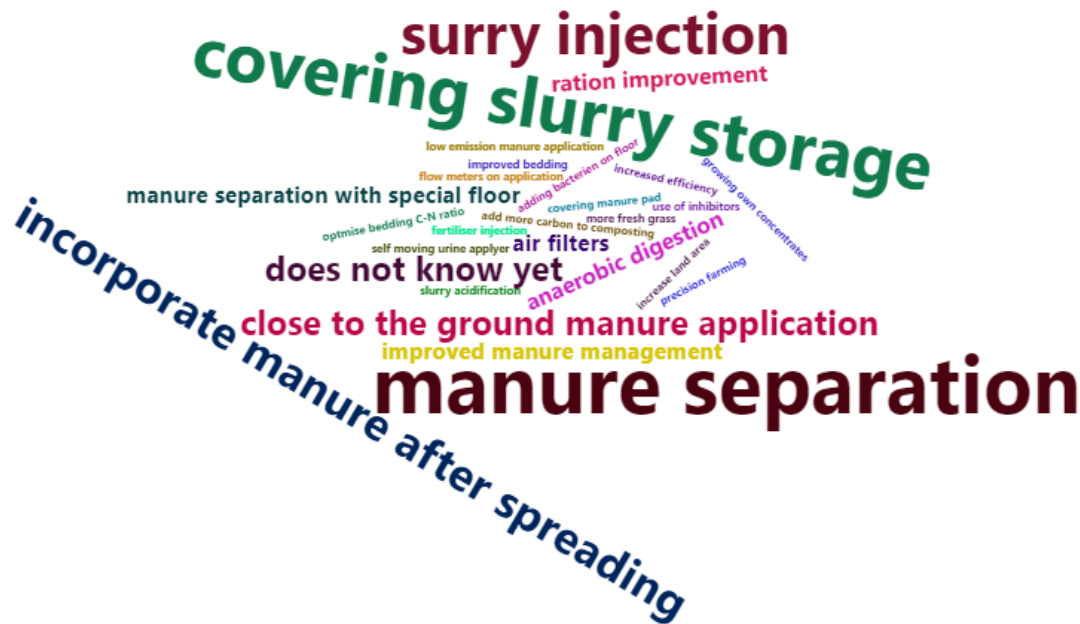




Results questionnaire (Survey farmers): GHG reduction in the future



Results: NH₃ reduction in the future



Mitigation strategies and systems workshop

1. Methodology and highlights scoring 52 separate strategies and farming systems with experts from 8 countries
2. Results carbon footprint on 60 farms
3. Take home messages



Mitigation strategies

1. Options

1. Livestock management
2. Pasture and soil management
3. Housing design and manure
4. Energy

2. Groups of 3-6 experts scored

1. Stage of implementation (1-5)
2. Scoring sustainability (1-5)



1. CO₂ and NH₃ emissions
2. Economics
3. Efficiency (animal, field)
4. Soil and biodiversity
5. Animal welfare

Livestock management

1. Less young stock much implemented, good for economics and environment. But older cows could be worse for welfare
2. Feed efficiency improves resource use, but you need higher quality of feed which needs more fuel, fertilizer and pesticides
3. Low protein diets in many countries not yet implemented; positive to reduce NH_3 and neutral for CO_2
4. Three-NOP not much implemented, neutral NH_3 positive CO_2
5. More milk per cow neutral for NH_3 , better for CO_2
6. Feeding more maize less NH_3 , worse for soil and biodiversity

Pasture and soil management

1. Most important to reduce NH_3 and GHG:
More grazing hours, higher nutritional value silage, more home grown protein and increased efficiency in crop farming
2. Assumption more grazing:
reduces slurry application on field
contribute to overall lower emissions
3. Mowing younger grass to reduce CH_4
4. Cover crops conserve nutrients and improve soil quality



Housing design, manure management and energy

1. Low emission floors, especially separation faeces and urine are effective to reduce emissions and more flexible fertilizing but expensive
2. Urease inhibitors reduces NH_3 loss, not expensive
3. Covering manure storage reduces emissions, mandatory in many regions



Housing design, manure management and energy

1. Low pH manure – low NH_3 , but not sure stays acid?
Disturbs soil fertility?
2. Profitability anaerobic digesting depends on size farm, price of energy, export green gas or making electricity on farm or central level
3. Solar panels or windmills more implemented than digester; energy for use on farm or sell it



Strategy	Intensive	Extensive	Organic	Mixed with arable	Visionair	
				regionale or farm level	nature based	
Crops	20% maize		more clover	alfalfa, maize, grain	no maize	high yielding crops
	12500 dm maize/ha	12500 dm maize/ha	9800 dm maize/ha		feed centre?	
Soil and water	Enhanced fertiliser	Nutrient budgeting		Increased circularity	Sensor technology	Precision fertiliser
Housing	low emission floor			separate feces and urine	freewalk, organic, multiple use	Low emission barn
					Sensor technology	separate feces and urine
Storage					milking robots? Concentrates	
Manure and fertilizing		lower fertilizer	no fertilizer	feces, urine, fertilizer		precision
Energy, general				electric tractors	mono biodigester ?	digester

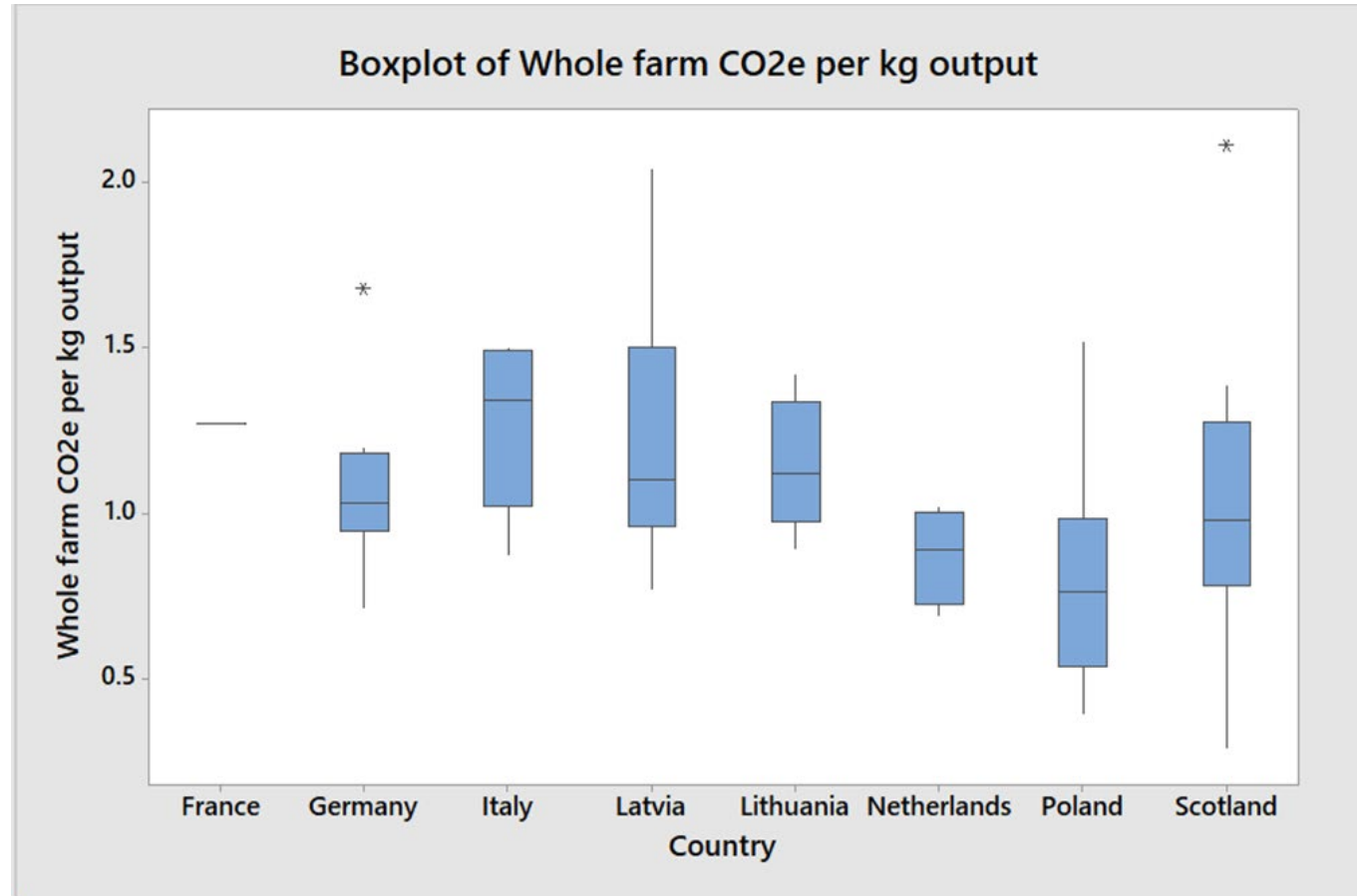
Impact

Impact	Intensive	Extensive	Organic	Visionair	
				Nature based	High tech
NH ₃ stable per kg LU	4	1	4	1	1
NH ₃ field per ha	2	4	1	4	3
CO ₂ off farm per kg FPCM	5	2	1	1	3
CO ₂ on farm per kg FPCM	2	5	4	1	3
Economics-investment	2	4	4	2	5
Net farm income	2	5	1	3	3
Efficiency field	1	4	4	3	2
Efficiency animals	1	4	3	1	2
Soil	4	2	2	1	3
Biodiversity	4	2	1	1	3
Animal welfare	3	4	1	2	2

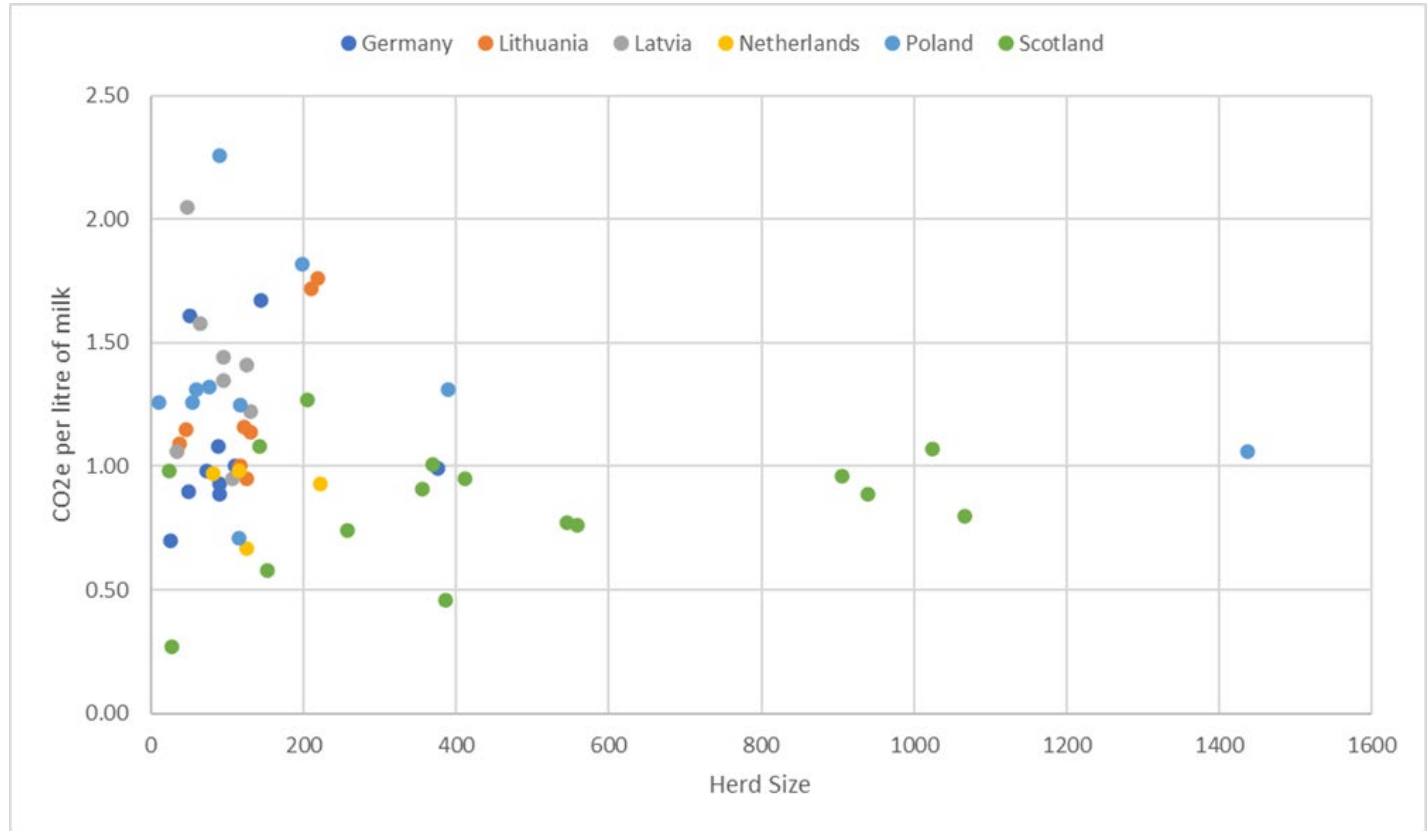
Score 1 to 5: 1 = Much better, 2 = Better, 3 = Neutral, 4 = Worse, 5 = Much worse

Carbon footprint of dairy farming across Europe

Tool:
Agricalc
(Scotland)



Relationship between carbon intensity and herd size



Conclusions, take home messages

1. Strategies and future options differ by region depending on climate, soil, management, regulation and infrastructure suppliers / processors and knowledge exchange
2. More variation CO₂ eq within than between countries
3. Be aware of trade offs and how emissions are expressed per cow per 100 kg milk or per ha; extensive versus intensive
Other trade offs:
 - * growing and feeding of more maize
 - * housing in relation to emissions and animal welfare
 - * grazing in relation to emissions, manure management, welfare
4. Combine expert judgement, model simulations and measurements

More international knowledge exchange about farming systems!?

Thanks,

Paul Galama and Bob Rees

