



UNIVERSITÀ DEGLI STUDI DI MILANO
DIPARTIMENTO DI SCIENZE AGRARIE ED AMBIENTALI

Environmental impact of dairy farming systems in Denmark, Germany and Italy

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63rd Annual Meeting
EAAP 2012
August 27th - 31st, 2012

Bratislava, SLOVAKIA



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BACKGROUND

- Dairy producers will meet increasing environmental demands in the future (limits on GHG emissions etc.)
- Removal of milk quota might accelerate the process of intensification and specialization
- Best strategy for efficient and environmentally friendly dairy systems?



AIM OF THE STUDY

- To analyze the environmental impact of different dairy farming systems in Denmark, Germany and Italy performing an LCA
- To identify the most important parameters influencing the environmental sustainability



LCA – FROM CRADLE TO FARM GATE

OFF-FARM

ON-FARM

Energy

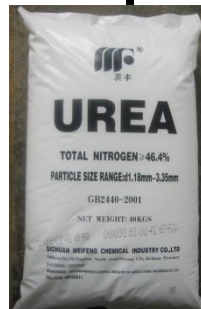
Crop production

Enteric emissions

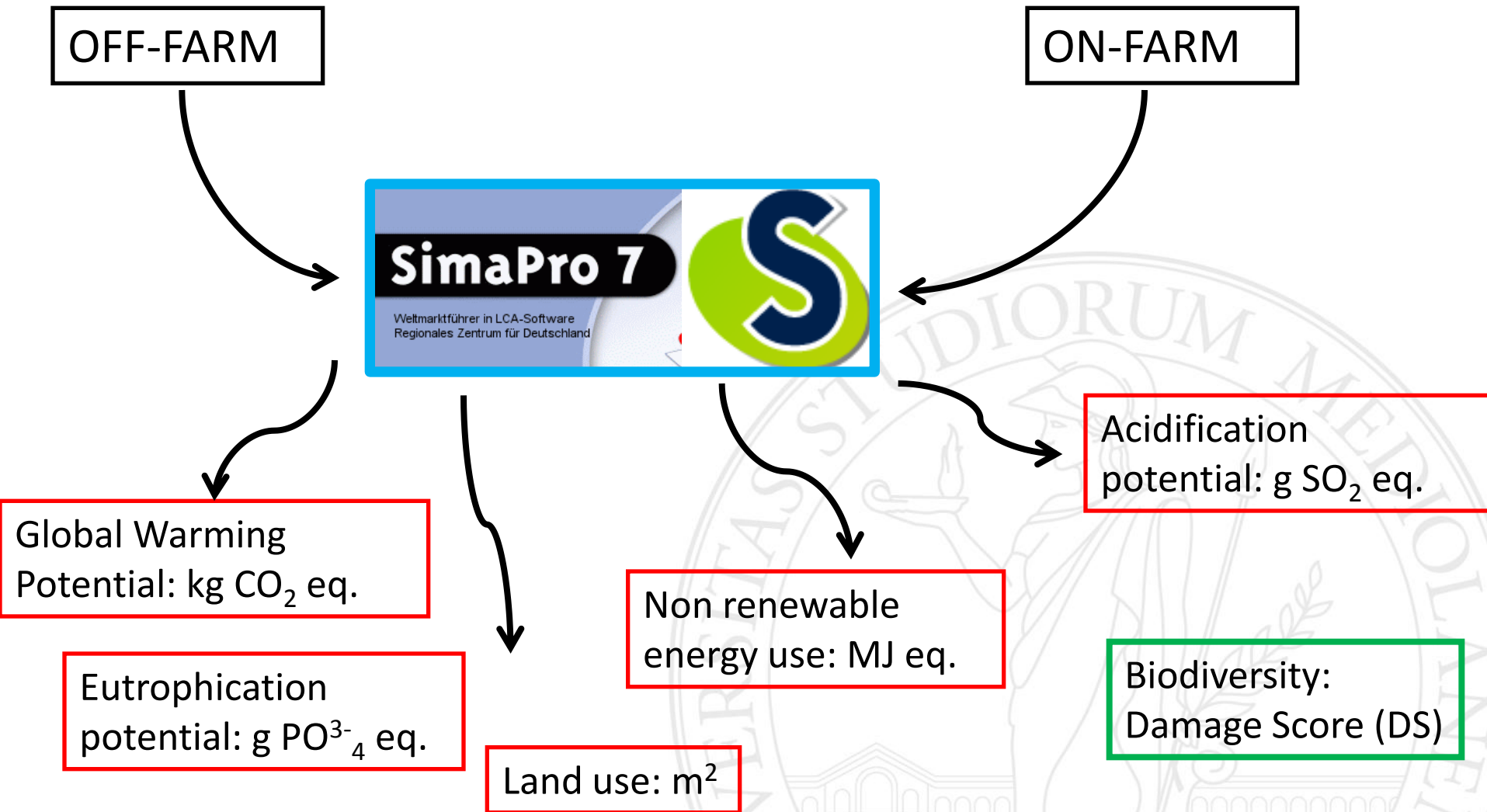
Storages

Stables

FU:
1 kg
ECM



LCA: TOOL AND IMPACT CATEGORIES

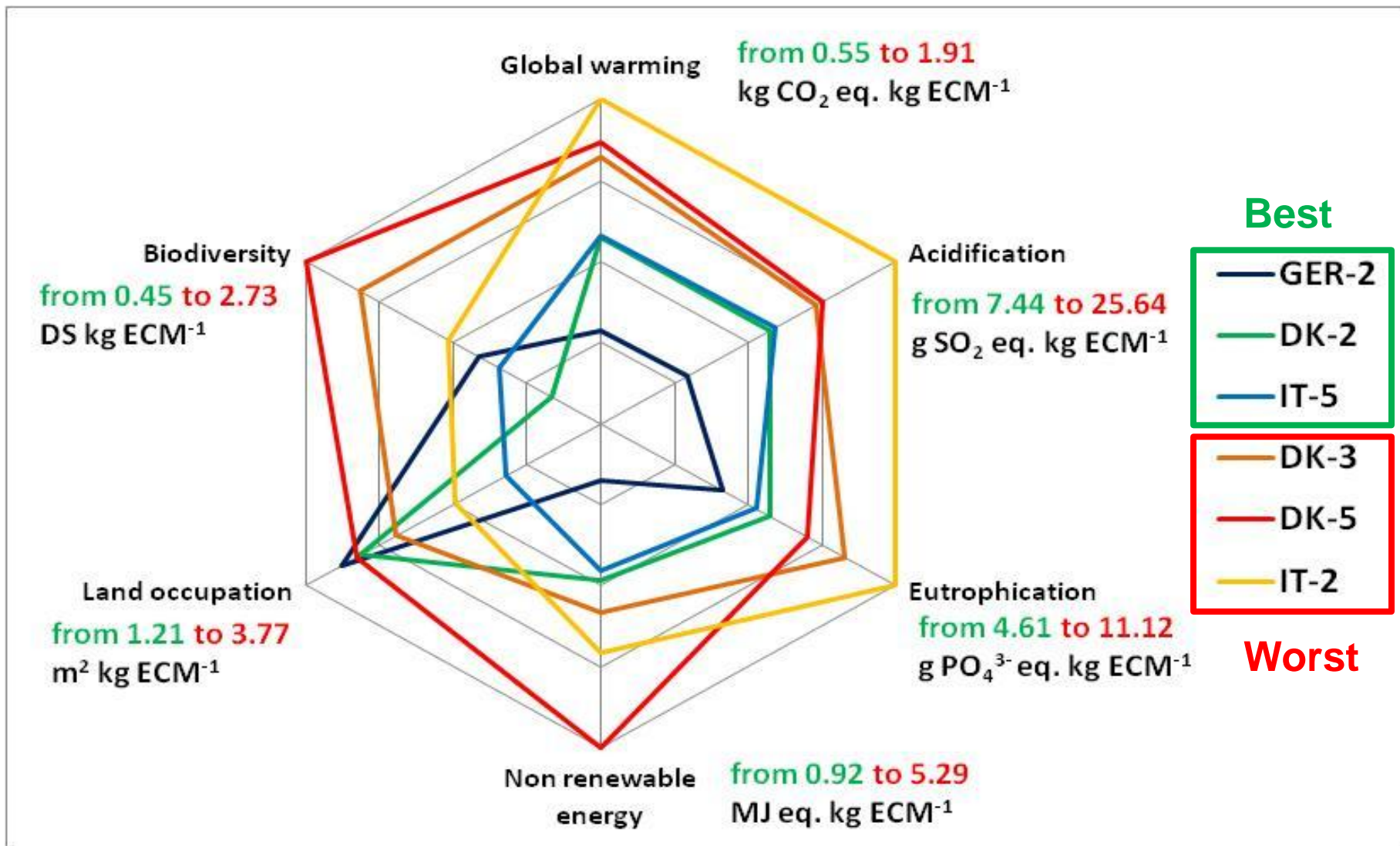


FARMS CHARACTERISTICS

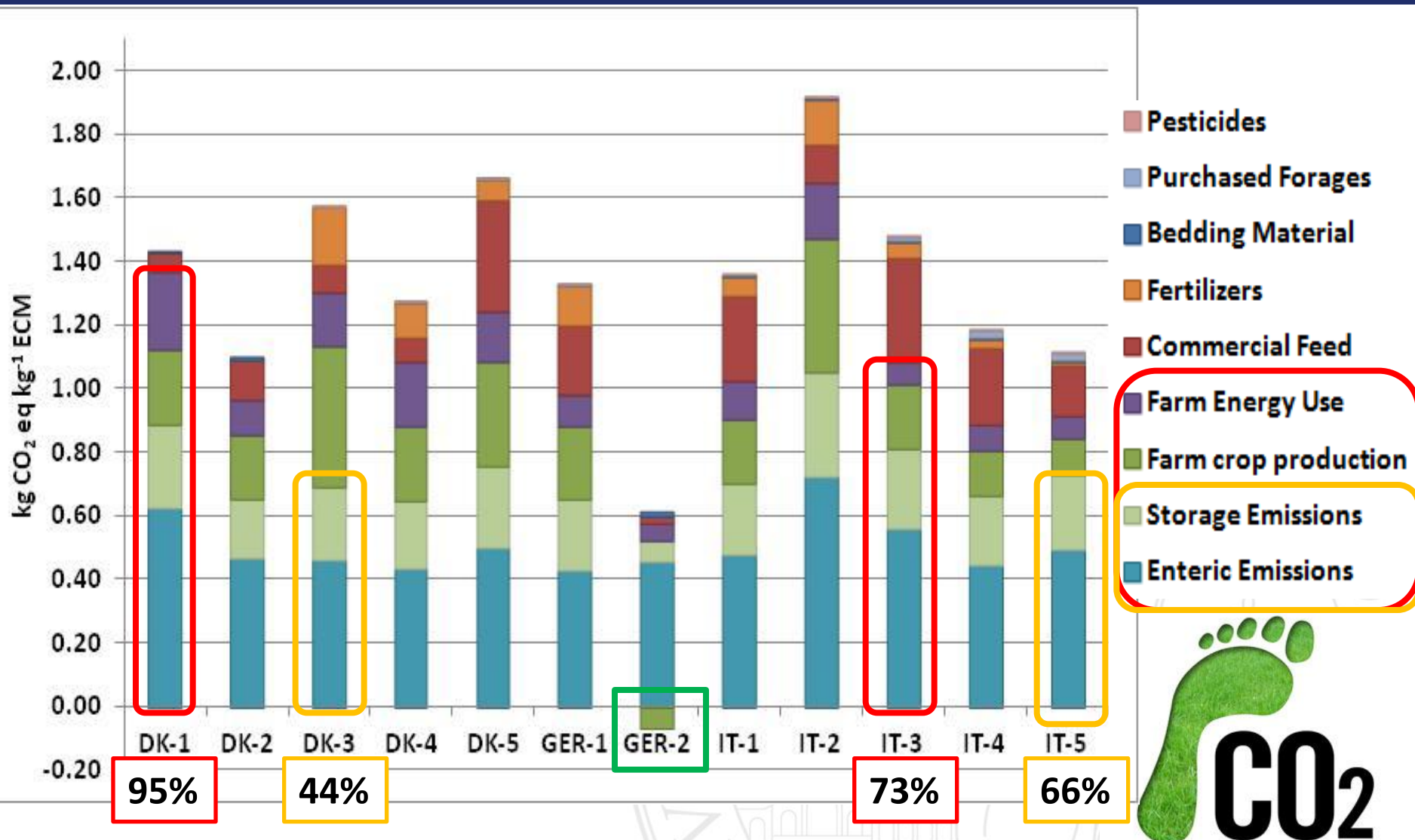
		DK-1	DK-2	DK-3	DK-4	DK-5	GER-1	GER-2	IT-1	IT-2	IT-3	IT-4	IT-5
HERD													
Cows	no	168	122	116	127	123	92	36	77	35	98	350	170
Milk production	ton ECM cow⁻¹	6.27	7.72	8.53	10.43	7.98	10.96	6.28	10.22	6.33	9.39	10.48	7.89
Concentrate	% of herd DMI	26.9	26.6	44.9	39.6	61.5	36.9	3.3	44.1	13.1	45.2	42.5	25.2
Pasture	% of herd DMI	21.9	24.8	6.2	6.5	0.0	0.0	71.2	0.0	0.0	0.0	0.0	0.0
Efficiency	kg ECM kg ⁻¹ DMI cow	0.91	1.18	1.22	1.34	1.19	1.40	1.34	1.31	0.82	1.16	1.40	1.19
N efficiency ex animal	%	18.2	19.7	20.3	22.6	21.9	23.7	18.7	23.3	16.3	21.7	25.6	23.7
LAND													
Crop area	ha	225.5	162.5	135.7	142.5	74.4	64.0	43.0	58.0	21.4	30.0	60.0	23.0
Maize	% farm land	2.3	0.0	16.3	31.8	32.5	50.7	0.0	36.2	38.0	53.3	25.0	26.1
Ryegrass+Maize II	% farm land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	75.0	26.1
Grassland in rotation	% farm land	47.1	40.9	14.2	44.2	0.0	8.6	90.0	0.0	0.0	0.0	0.0	0.0
Permanent grassland	% farm land	11.1	21.2	11.9	5.9	0.9	40.7	10.0	63.8	33.8	0.0	0.0	30.4
Lucerne	% farm land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	23.9	0.0	17.4
Total grassland	% farm land	58.2	62.0	26.1	50.1	0.9	49.3	100.0	63.8	42.2	23.9	0.0	47.8
Crop yield	ton DM ha ⁻¹	6.37	5.18	6.06	7.17	6.83	8.56	5.26	8.84	13.29	19.48	29.07	16.39
FARM													
Stocking rate	LU ha⁻¹	1.1	1.1	1.2	1.2	2.1	2.1	1.1	2.2	2.5	5.6	9.8	11.0
Milk intensity	ton ECM ha ⁻¹	4.66	5.52	6.72	8.69	11.86	15.69	5.25	12.69	10.34	30.69	61.14	58.32
Total N	kg N ha ⁻¹	134	141	264	274	290	435	134	337	496	787	1273	1123
N surplus	kg N ha ⁻¹	86	89	194	217	224	324	125	177	197	792	1001	498
feed self sufficiency (base on DM)	%	92.9	82.9	84.6	85.3	50.5	63.1	96.7	65.1	76.0	54.3	47.5	27.7

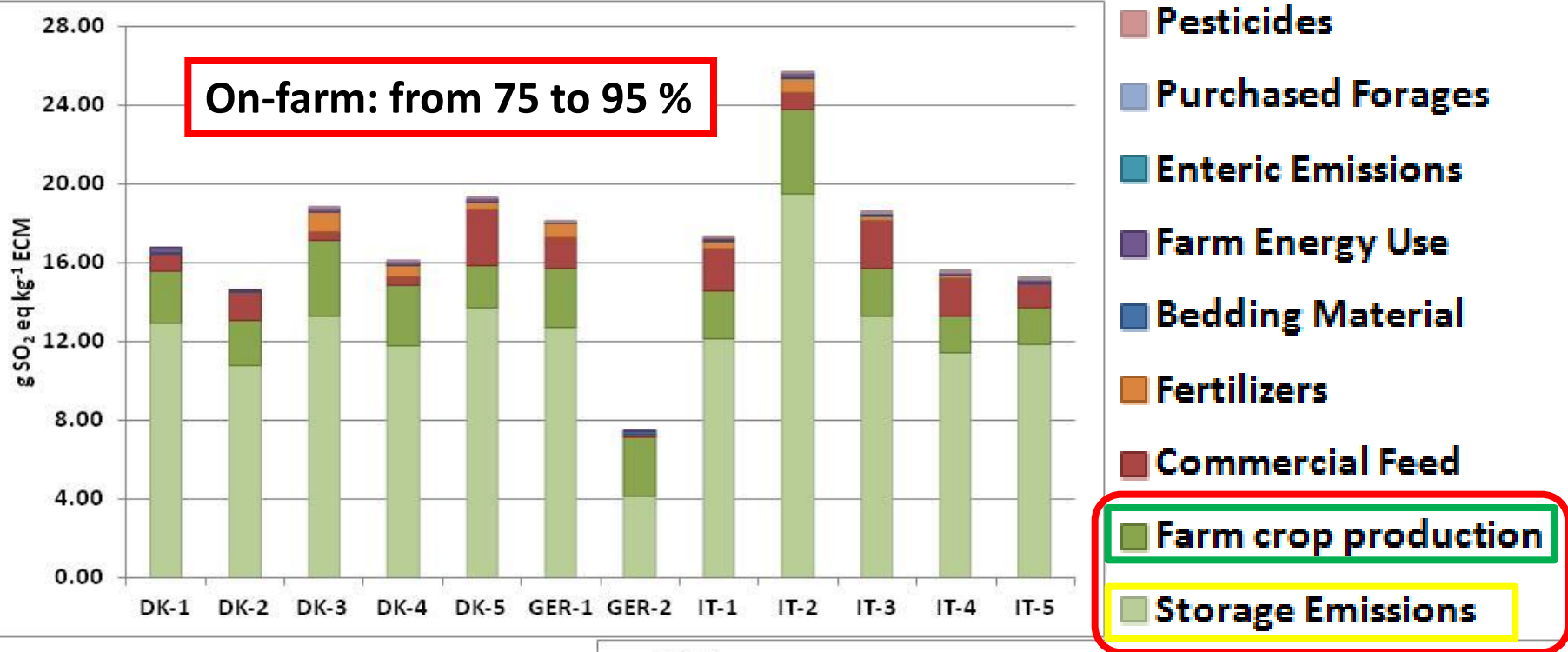


ENVIRONMENTAL IMPACT RESULTS



CONTRIBUTION TO GLOBAL WARMING

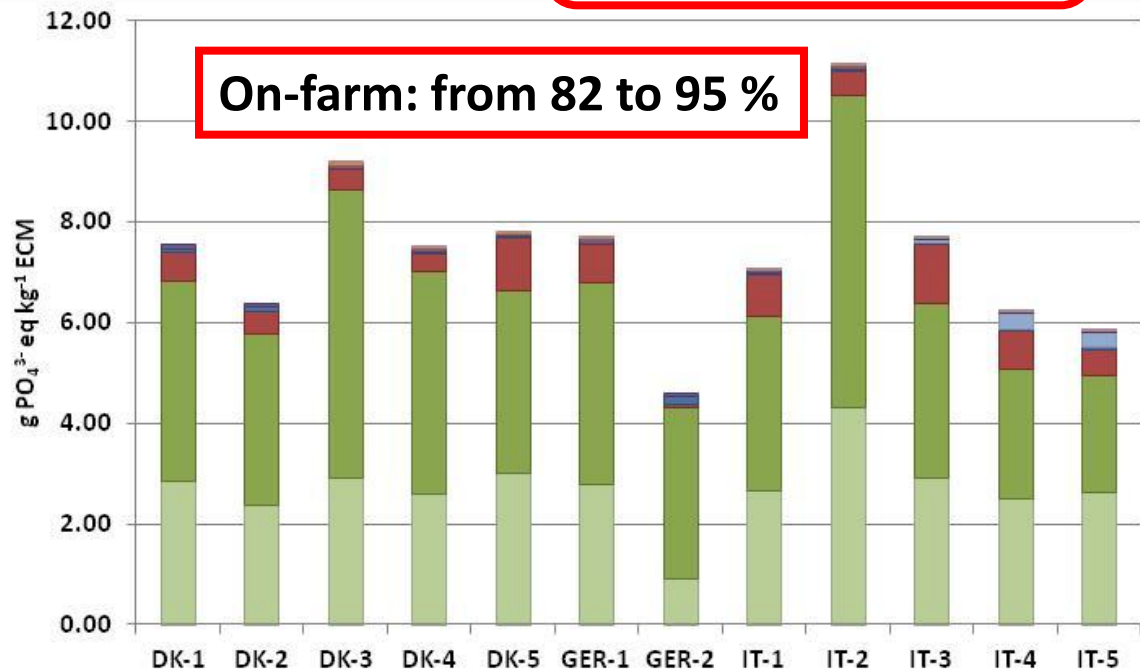




Acidification

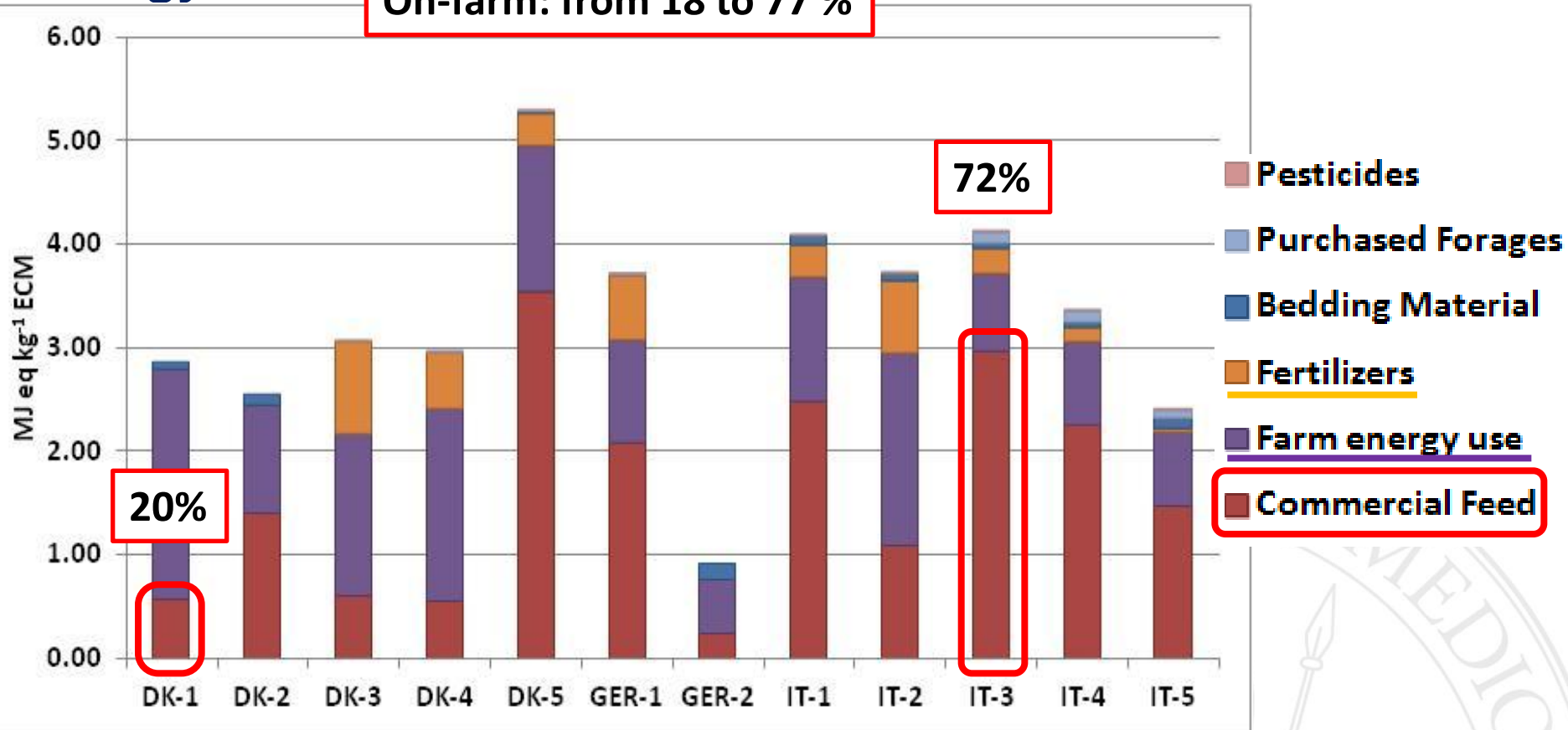


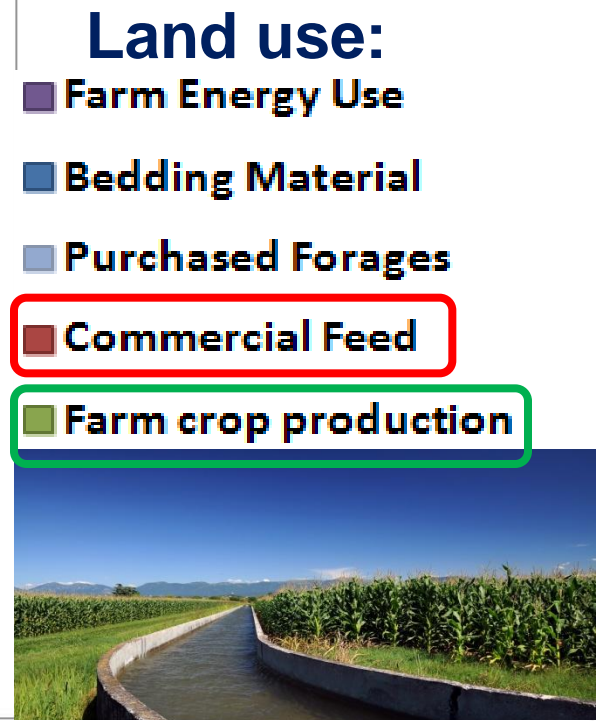
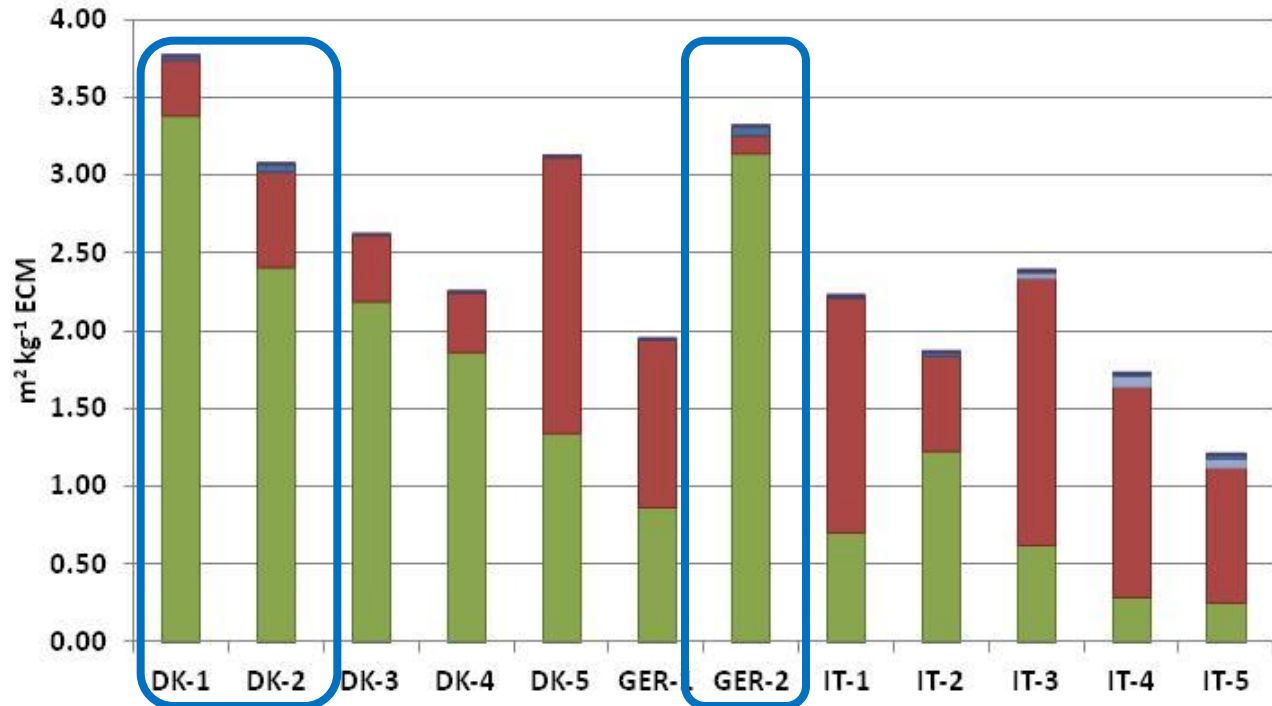
Eutrophication



Energy use:

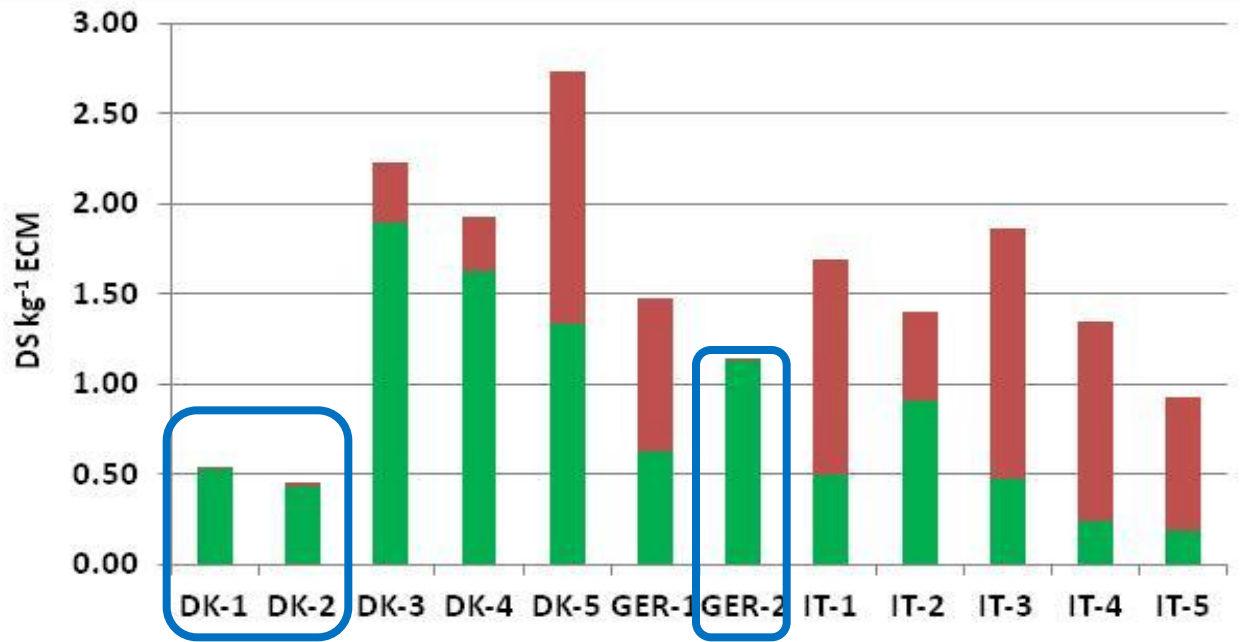
On-farm: from 18 to 77 %



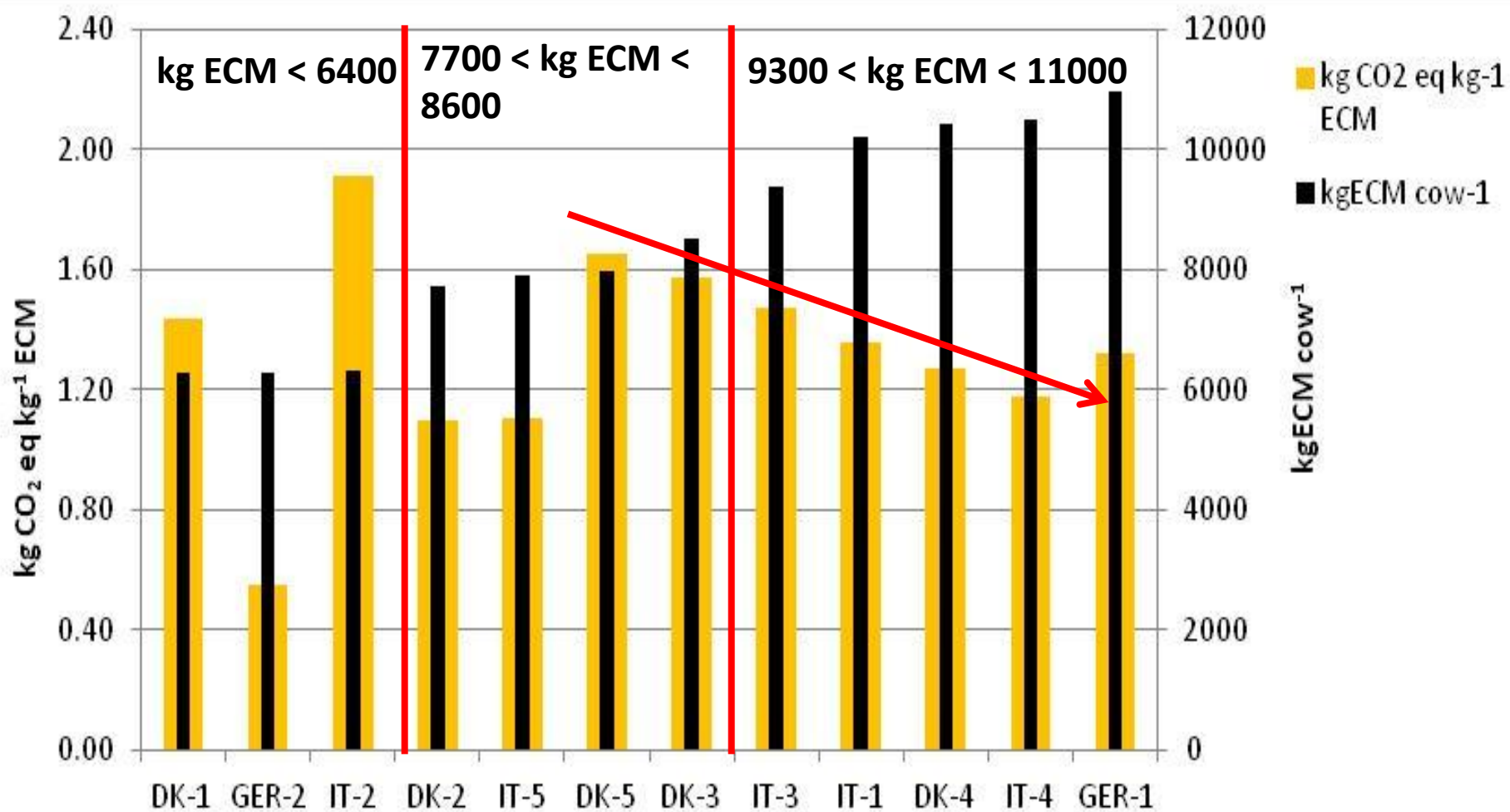


Biodiversity:

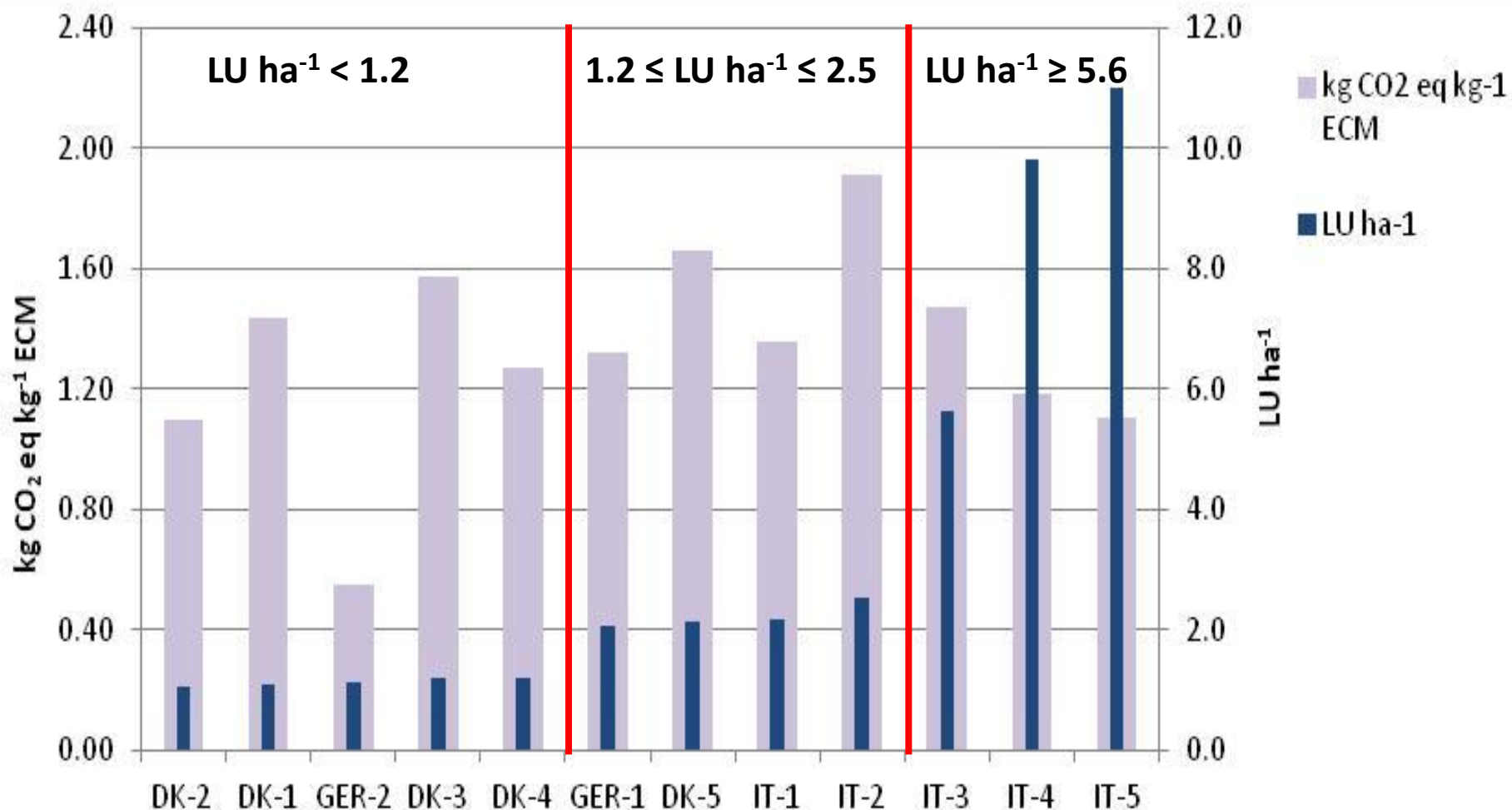
- DS off-farm
- DS on-farm



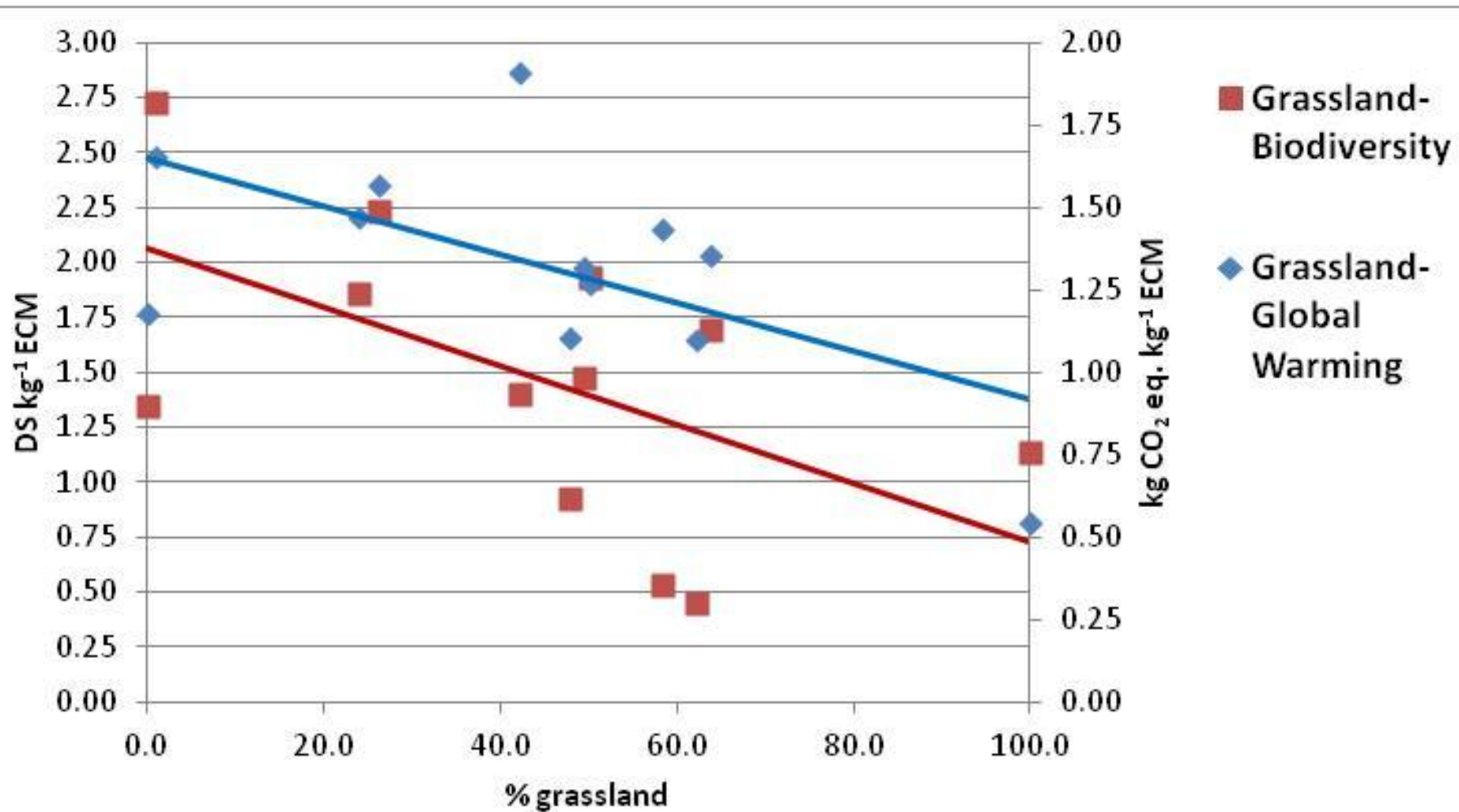
RELATION BETWEEN MILK PRODUCTION LEVEL AND GLOBAL WARMING



RELATION BETWEEN STOCKING RATE AND GLOBAL WARMING



RELATION BETWEEN SHARE OF GRASSLAND, GLOBAL WARMING AND BIODIVERSITY



CONCLUSIONS

- Huge variability among the systems: but generally high contribution of on-farm activities on global impact
- Relation among the impact indicators: improving one impact category means to improve the global environmental sustainability of the farm
- No relation in a product perspective between the environmental impact and the milk production (kg ECM cow⁻¹) and the stocking rate
- High proportion of grassland improves the environmental sustainability and reduces biodiversity losses



CONCLUSIONS

- LCA: a useful tool to quantify the global product orientated environmental impact - but uncertainty and some different basic assumptions make it difficult to compare with other works
- Farm specific conditions should be considered - and also local impacts should be analyzed (i.e.: eutrophication ha⁻¹) to better identify sustainable systems
- First “attempt” to estimate the biodiversity losses to produce 1 kg of milk - but it needs further improvements



THANKS



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