INCLUDING OF BIODIVERSITY AND SOIL CARBON CHANGES IN LIFE CYCLE ASSESSMENTS OF MILK PRODUCTION

– IN FINLAND, DENMARK AND UK

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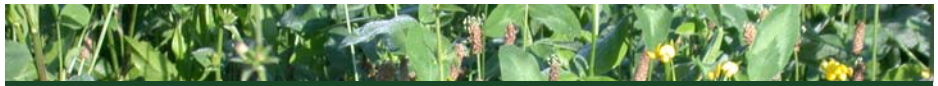


Outline

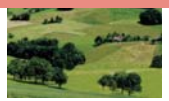
- Briefly about Life Cycle Assessment (LCA)
- How to include biodiversity in LCA?
- How to include soil carbon changes in LCA?
- A practical example: LCA of organic milk – incl. biodiversity and soil carbon changes

Which environmental impacts of food?

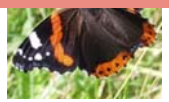
Global warming

Nutrient enrichment

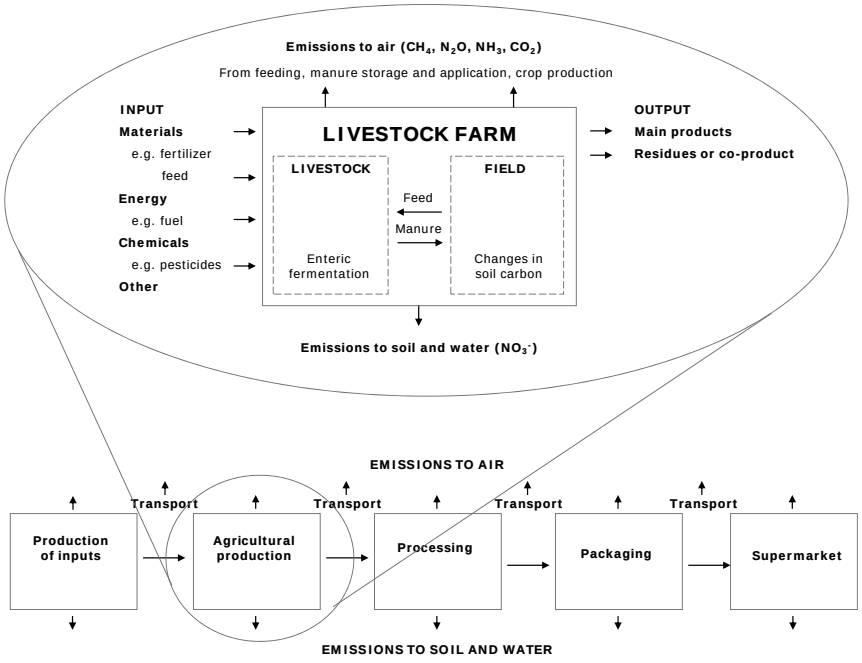
Biodiversity and soil carbon changes:
organic farming are significantly different from conventional!



Carbon sequestration / soil fertility

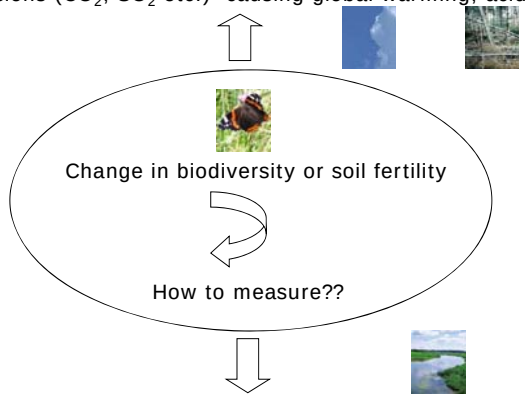


Biodiversity



Environmental life cycle assessment is focused on emissions

Measurable emissions (CO_2, SO_2 etc.) causing global warming, acidification etc.



Measurable emissions (NO_3^- etc.) causing eutrofication etc.

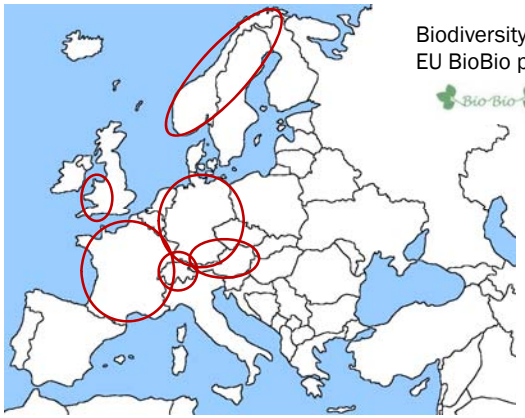
How to include biodiversity in environmental assessments?

Potentially disappeared fraction (PDF) compared to forest

Type of land use	Median
Baseline (semi-natural forest)	0.00
Organic infertile grassland	-0.33
Organic moorland grass	-0.05
Organic fertile grassland	-0.01
Organic tall grassland	0.04
Intensive infertile grassland	0.21
Intensive Moorland grass	0.23
Less intensive fertile grassland	0.36
Organic arable land	0.36
Less intensive tall grassland	0.44
Less intensive arable land	0.44
Intensive woodland	0.55
Intensive fertile grassland	0.65
Intensive tall grassland	0.70
Intensive arable land	0.79

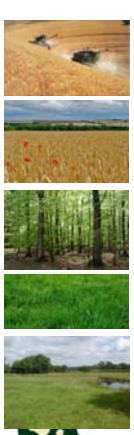
De Schryver et al. (2010)

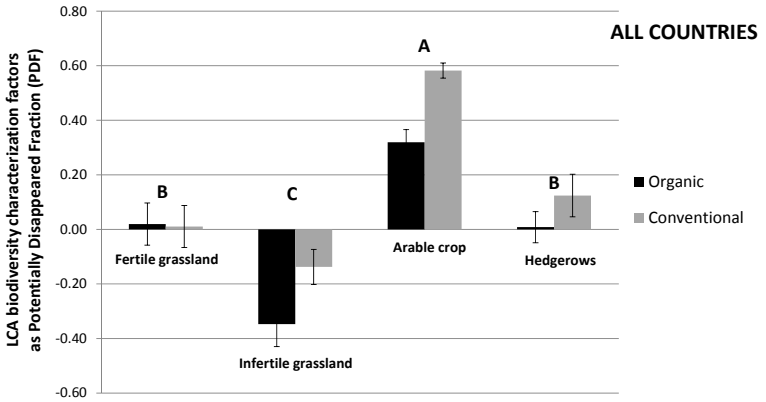
Estimate biodiversity values (PDF) based on data from EU BioBio project



Biodiversity data from EU BioBio project

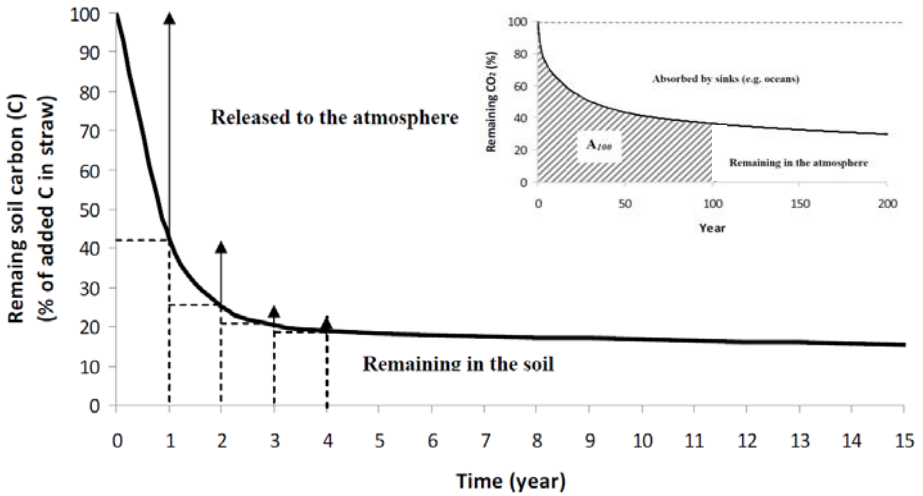
Biodiversity damage potential:
Potentially disappeared fraction (PDF)





How to include soil C changes in environmental assessments?

Decay of biomass carbon added to the soil
- combined with Bern Carbon Cycle Model



This overall approach was published in J of Clean Prod (2013):

…then the soil carbon sequestration values for cattle feeds was published in J of Clean Prod (2014):


Journal of Cleaner Production

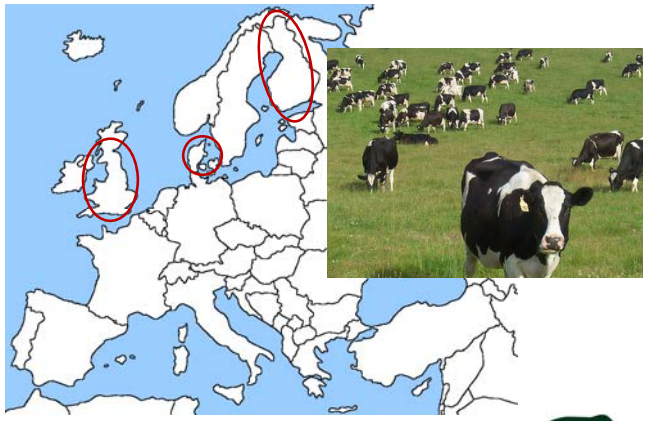
Method for calculating carbon footprint of cattle feeds – including contribution from soil carbon changes and use of cattle manure

Ulrich Mogensen*, Troels Kristensen, Thu Lan T. Nguyen, Maria Teyleiman Knudsen, John E. Hermansen

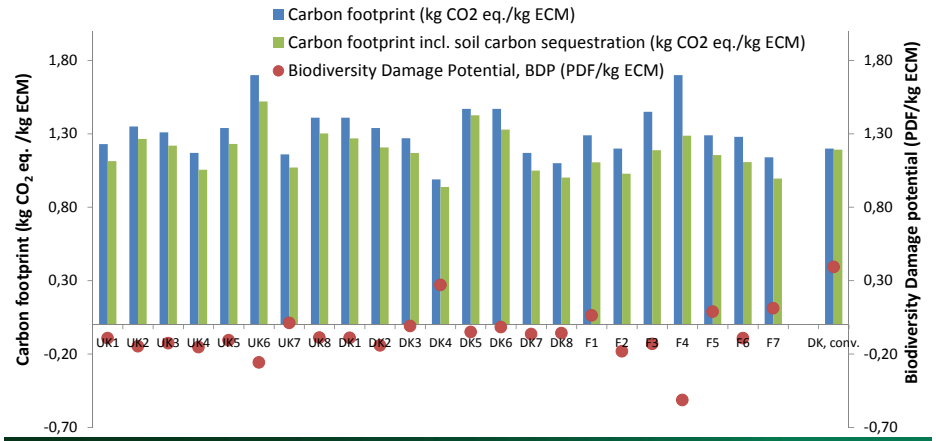
Values for biodiversity and carbon sequestration - depends on the cattle feed

		Carbon sequestration (kg CO2/(ha year)	Biodiversity Damage Potential, (PDF/m2)
Cereals (straw incorp.), rape seed, maize cob	ORG	30	0.35
	CONV	30	0.58
Cereals (straw remov.), maize or barley silage	ORG	-450	0.35
	CONV	-450	0.58
Grass clover	ORG	850	-0.18
	CONV	850	-0.06
Permanent grassland	ORG	200	-0.35
	CONV	200	-0.12

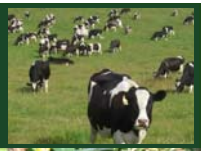
Use the methods on dairy farms in UK, DK and SF - and calculate the LCA results

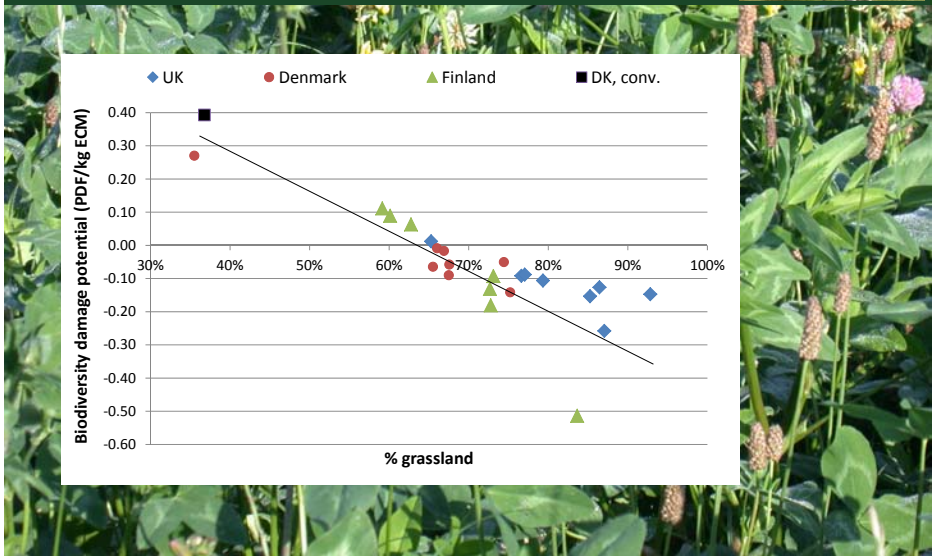


Carbon footprint and biodiversity damage potential of milk from dairy farms in UK, DK and SF

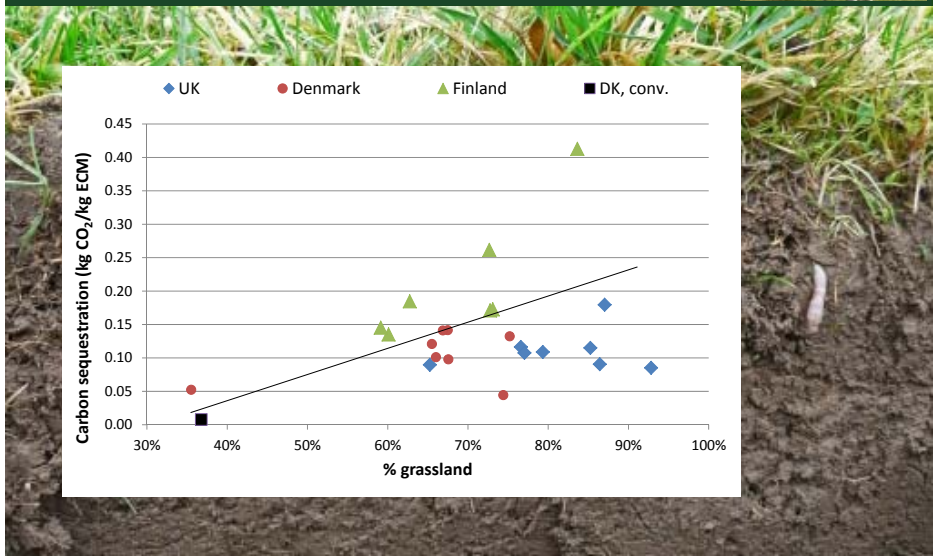


Biodiversity vs. % grassland

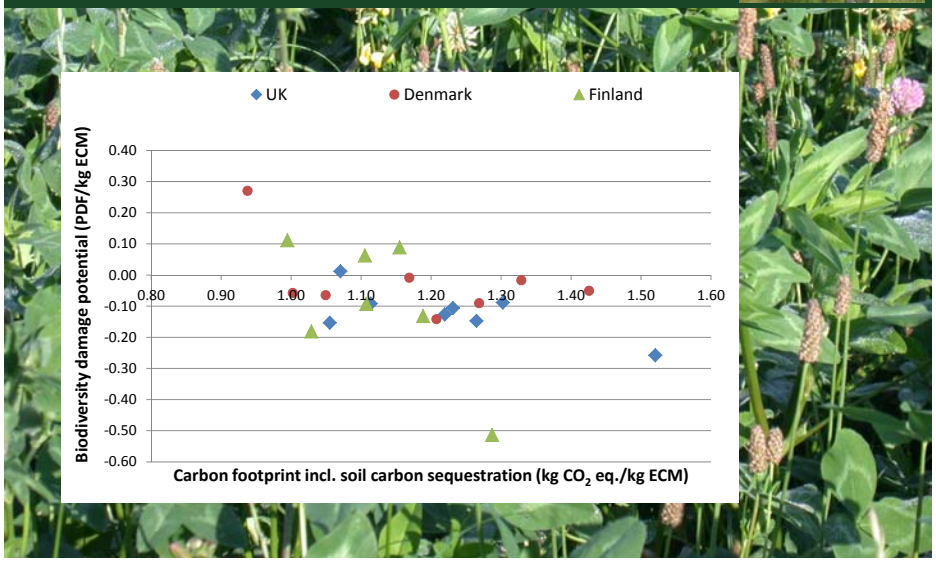




Carbon sequestration vs. % grassland



Biodiversity vs. carbon footprint



Conclusion

- Organic dairy farms has a positive impact on bidiversity and soil carbon changes compared to conventional
- Currently, this is not reflected in LCA's since biodiversity and soil carbon sequestration is generally not included.
- This study shows that biodiversity and soil carbon changes can be included in life cycle assements
- The results indicates that there is a significant difference between organic and conventional milk production in biodiversity and soil carbon sequestration
- The positive impact on biodiversity and carbon sequestration increases with increasing percentage grass in the feed ration.

Thank you!