Whole-farm systems modelling of greenhouse gas emissions from suckler cow beef production systems

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Background

- The global population is expected to exceed 9.7 billion by 2050[1]
- Increase global food production by 50%[1]
- Limited arable land reserves
- Natural resources available for food production vary considerably between countries

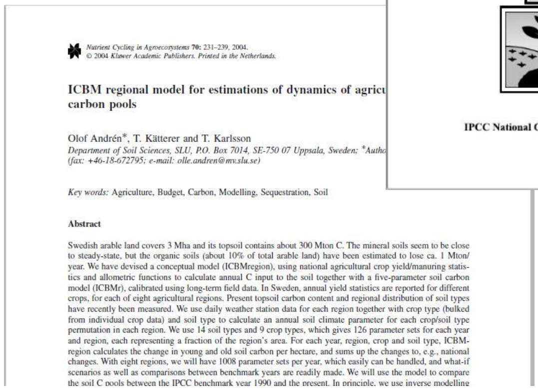
1) FAO 2017

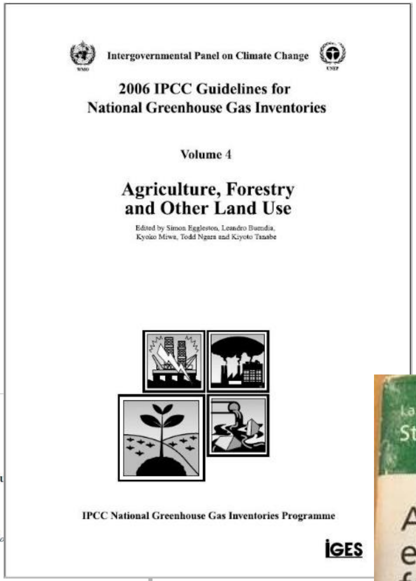
Background

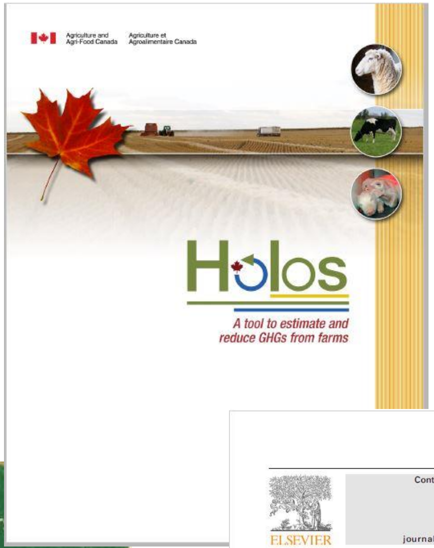
- Grass production accounts for 2/3 of cultivated area
- 55% of food production on energy basis
- Increased utilization of domestic grassland and pastures

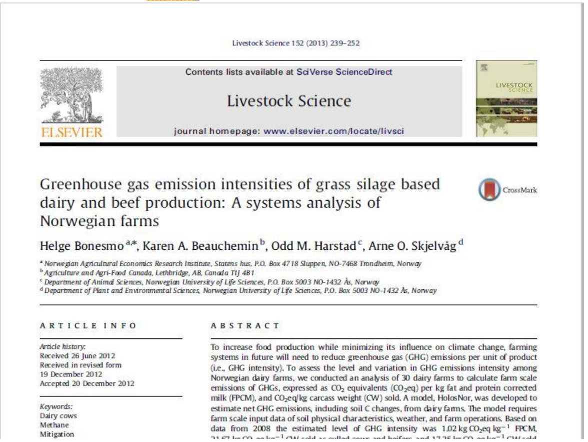
- Reduce greenhouse gas (GHG) emissions 40% by 2030
- Need for a flexible emission farm scale model adapted to production systems and national resources in Norway

Developing HolosNorBeef







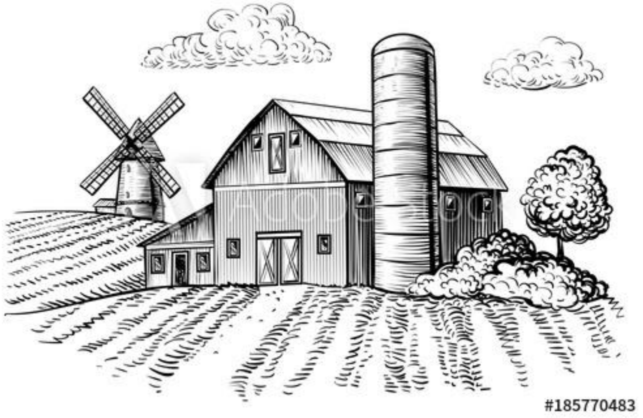


Input

Data material

Farm data - 2 locations (A and B)

- Areas and yield (silage and cereals)
- Silage quality
- Soil and weather data
- Fuel, electricity
- Pesticides, fertilizer



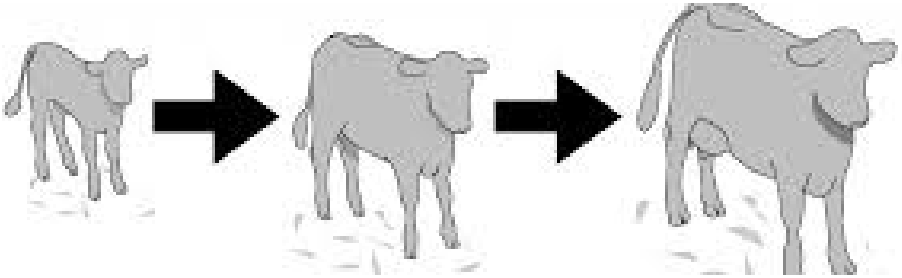
Farm characteristics (unit)	A	B
Farm size[2] (ha)	44.6	41.5
Pasture and ley area[2] (ha)	38.9	40.1
Silage yield[23] (FUm/ha)	3020	3190
Silage nutritive value[2] (FUm)	0.87	0.84
Cereal area[2] (ha)	**7.7**	0.9
Cereal yield[2] (FUm/ha)	**5260**	3600
Electricity[2] (kWh/year)	26300	29100
Fuel[2] (L/year)	**3855**	2947
Preservatives[2] (NOK)	**6293**	440

2) NIBIO 2016
3) Eurofins

British (Angus/Hereford)

Continental (Charolais/Limousin/Simmental)

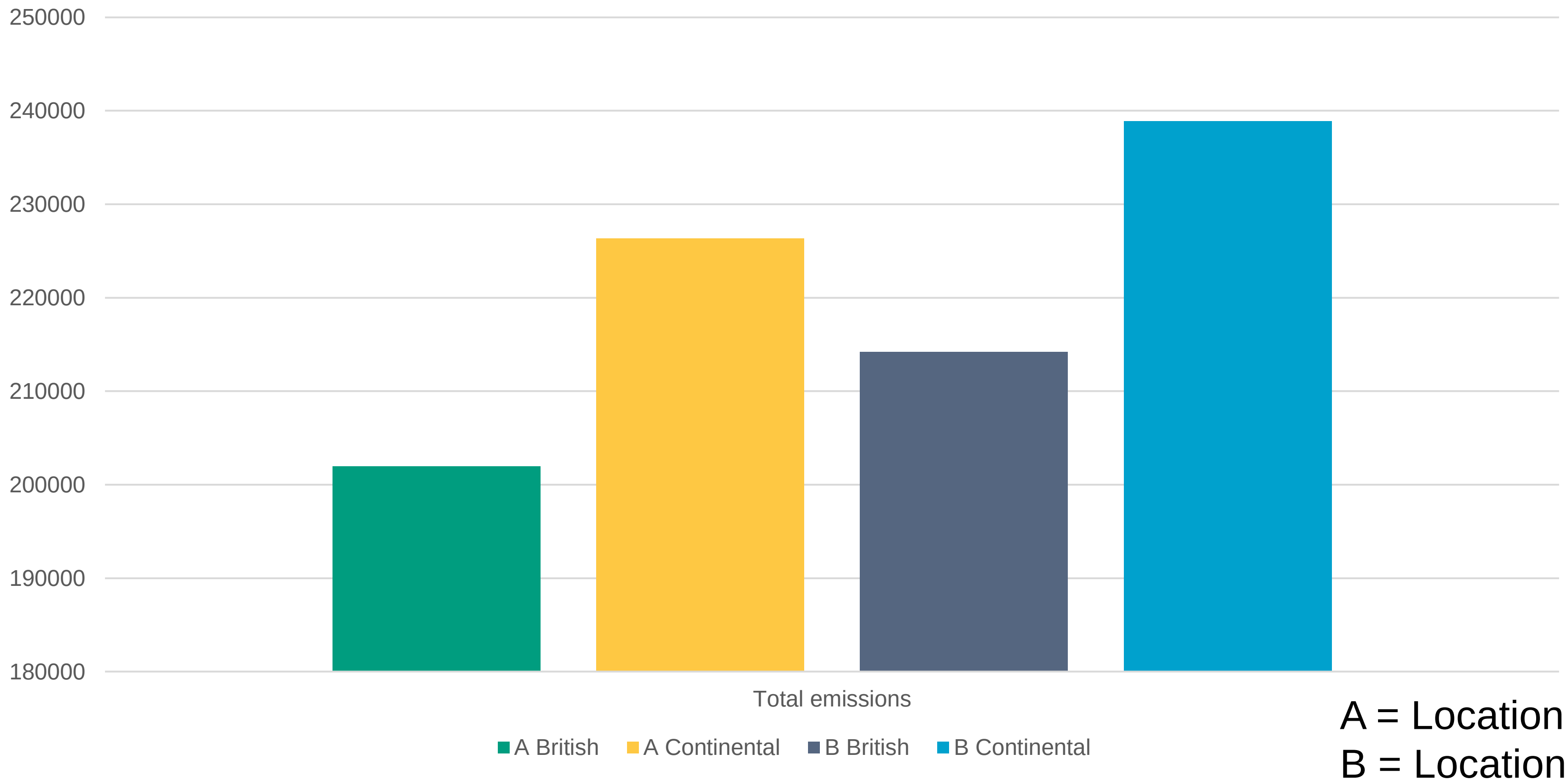
- –Stilbirth, proportion twins, death<180 days
- –Replacement rate
- –Weights (birth, weaning, slaugther, adult)
- –Age (weaning, slaugther, first calf,…)
- –Proportion concentrates
- –Proportion pasture



Animal characteristics (unit)	British	Continental
Cows, average final LW[4] (kg)	600	**800**
Heifers, birth weight[4] (kg)	38	**42**
Heifers, weaning weight[4] (kg)	251	**295**
Heifers, age at slaughter[5] (months)	18.2	**17.5**
Heifers, age at first calving[5] (months)	26.0	28.9
Young bulls, birth weight[4] (kg)	40	**45**
Young bulls, weaning weight[4] (kg)	269	**322**
Young bulls, age at slaughter[5] (months)	17.5	**16.8**
Heifers carcass weight[4] (kg)	206	**244**
Young bulls, carcass weight[4] (kg)	291	**353**
Beef produced[5] (kg carcass)	7699	**9635**

4) Aby et al 2012
5) Animalia 2016

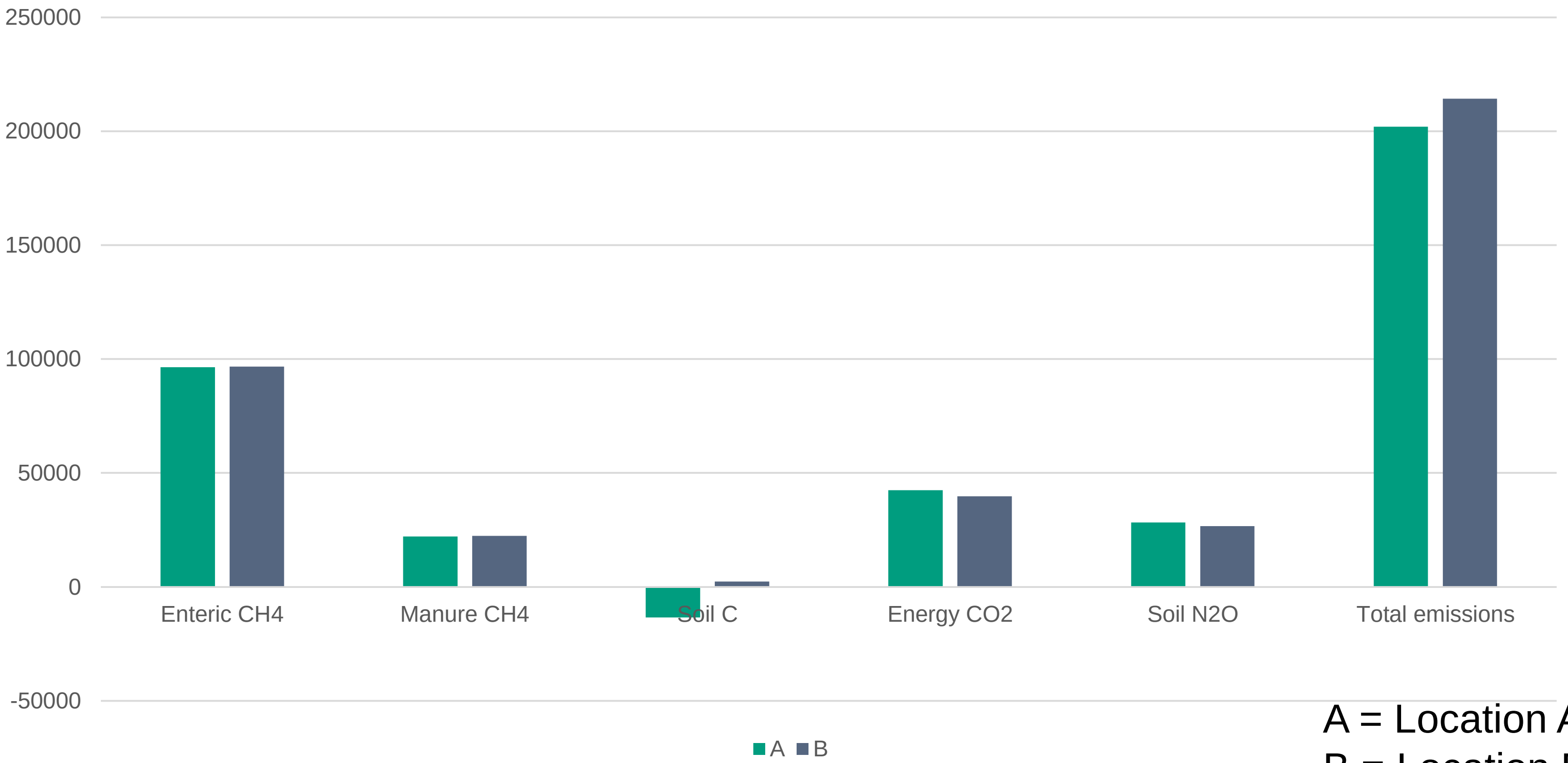
Total emissions (CO_2 eq)



A = Location A
B = Location B

Samsonstuen et al, in prep

Emissions (CO_2 eq) - location



A = Location A
B = Location B

Samsonstuen et al, in prep

Emissions (CO_2 eq) – breed

Samsonstuen et al, in prep

Emission intensities (kg CO_2 eq/kg beef)

	A		B	
	British	Continental	British	Continental
Direct kg CO_2 per kg beef carcass	21.4	19.4	22.9	20.7
Total kg CO_2 per kg beef carcass	26.2	23.5	27.8	24.8

Samsonstuen et al, in prep

Emission intensities (kg CO_2 eq/kg beef)

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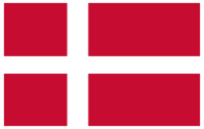
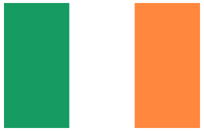
Samsonstuen et al, in prep

Intensive system[6]: **25.4**

Average farm[7] : **22**



Intensive system[6]: **23.1**
Extensive system[6]: **29.7**



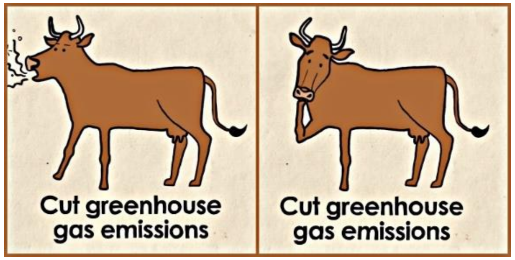
Average farm[8] : **23.1**

6) Mogensen et al 2015
7) Beauchemin et al 2010
8) Foley et al 2011

Conclusions

- Emission intensities of the same magnitude as the other Nordic countries
- The Continental breeds have higher total emissions, but lower emisson intensities
- Location important to consider
- Emissions varies between location and breed
- Average inputs
- Expect large variation between individual farms

Next step: 30 commercial suckler cow farms



Thank you for your attention!