Greenhouse gas emissions and mitigation potential of Norwegian dairy sector

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Outline

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Introduction

- GHG emissions in Norway increased by 6% between 1990 and 2011 (53.4 Mt CO2e in total).
- 4.5 $MtCO_2e$ emissions produced from agriculture in 2011 (a reduction by 11% from 1990 levels).
- Major GHGs from agriculture are CH_4 and N_2O.
- Projected increase in population (and increased demand for food production) by 20% by 2030 is likely to increase GHG emissions.
- Norwegian Ministry of Agriculture and Food suggests a 20% reduction in agricultural emissions from 1990 levels by 2020.

- Agriculture contributes almost 50% of the total human-sourced CH_4 emissions produced in Norway. About 90% of agricultural emissions in Norway are attributed to feed and livestock production.
- Emissions associated with production of concentrates and vegetables are rather low.
- Instead, a large proportion of arable land is only suitable for pasture production that can be grazed by ruminants

Dairy sector

- Dairy sector contributes 30% (plus emissions from replacement cows) of GHG emissions from animal production.
- Table shows the distribution of emissions between different animal categories, reflecting that the emission reductions from cattle sector is prerequisite for reducing Norwegian agricultural emissions in total.

Animal type	Numbers (1000)	CH_4 Enteric	CH_4 Fertiliser	N_2O	Total	%
Dairy cattle	204	620	74	188	882	30
Beef cattle	70	174	19	34	227	8
Young cattle	476	627	99	157	883	30
Total	750	1421	192	379	1992	68
Sheep	1513	454	24	124	602	20
Goat	61	17	1	7	25	1
Horse	67	25	24	25	74	2
Pigs	561	23	30	52	105	4
Poultry	14803	2	36	33	71	2
Fur animal	212	0	3	8	11	<1
Other animals		76	14	16	106	4
TOTAL		2018	324	644	2986	
Proportions among sources		67	11	22		

Systems characteristics

- Pasture available for grazing between May and September
- Pasture availability is adequate for spring-calving cows from peak lactation onwards
- Need for improved forage production and development of alternative feed sources
- Growing grains and forage crops is challenging
- Due to cold weather conditions in winter, energy balance of the rations cannot be maintained, reflecting excessive use of silage

Combined dairy and beef systems

- 75% of the beef production (fattening of surplus calves and culled dairy cows) is supplied from dairy systems.
- Efforts to increase milk yield → reduced meat production.
- More specialised dairy and beef systems
- As a result, increased total GHG emissions?

Land use change

- The increased food production in Norway will end up with increased feed requirement for animals to produce more product.
- The current conditions of arable land in Norway to grow concentrates are poor.
- Import of soya from Brazil or palmitic oil from Indonesia.
- If the milk production was to be increased with the current systems in place, more concentrates will need to be purchased abroad
- More forage will be available as surplus in Norway
- In order to increase the food production, Norway may need to cultivate more of the wetland, which in return is likely to increase the CO_2 emissions.

HOLOSNor

- farm-scale model estimating net farm GHG emissions from combined dairy and beef farming systems in Norway, accounting for soil C changes
- IPCC methodology with modifications
- enteric CH_4, manure-derived CH_4, on-farm N_2O emissions from soils, off-farm N_2O emissions from nitrogen (N) leaching, run-off and volatilization (indirect N_2O), on-farm CO_2 emissions or C sequestration due to soil C changes, CO_2 emissions from energy used on farm, and off-farm CO_2 and N_2O emissions due to supply of feed inputs
- Calculations of enteric CH4 are based on the IPCC Tier 2 approach

HolosNor – findings (Bonesmo et al. 2012)

- According to the HolosNor estimates, the major source of the total GHG emissions intensity of 30 farms (1.02 kg CO_2e/kg FPCM; 1.45 kg CO_2e/kg FPCM if no allocation existed for meat) on Norwegian grass silage-based dairy and beef systems was attributed to enteric CH_4.
- A large variation exists in GHG emissions intensity among dairy farms.
- The largest variation was observed for soil N_2O emissions among the farms, and it was followed by soil C change.
- In contrast, enteric CH_4 emissions were found to be lower on farms where GHG intensities were higher, reflecting no relationships between the variation in enteric CH_4 and the variation in GHG intensity.
- Overall, the increased use of N fertiliser for grass forage production contributed to the increase in emissions intensity the most.

Thank you

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