Greenhouse gas emissions from ruminant production – mitigation strategies

NØK congress 2008

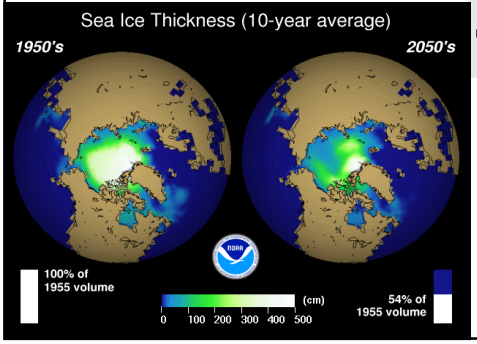
Harald Volden[1,2]

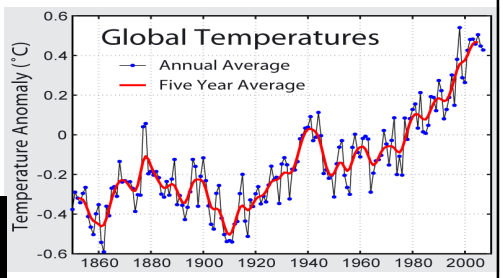
[1]TINE Rådgiving

[2]Norwegian University of Life Sciences

Status and future prospects

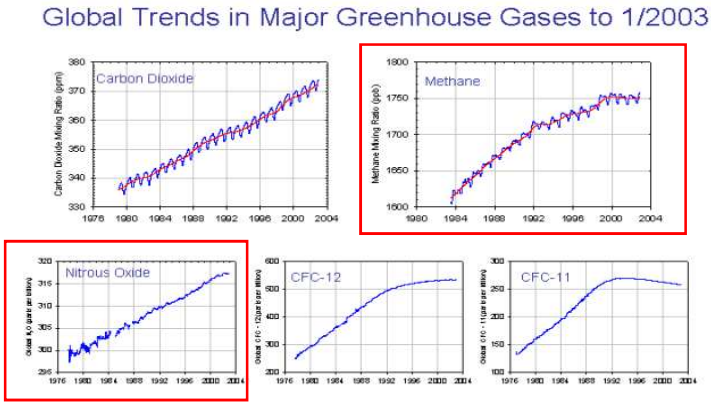
- **Global temperature is rising**





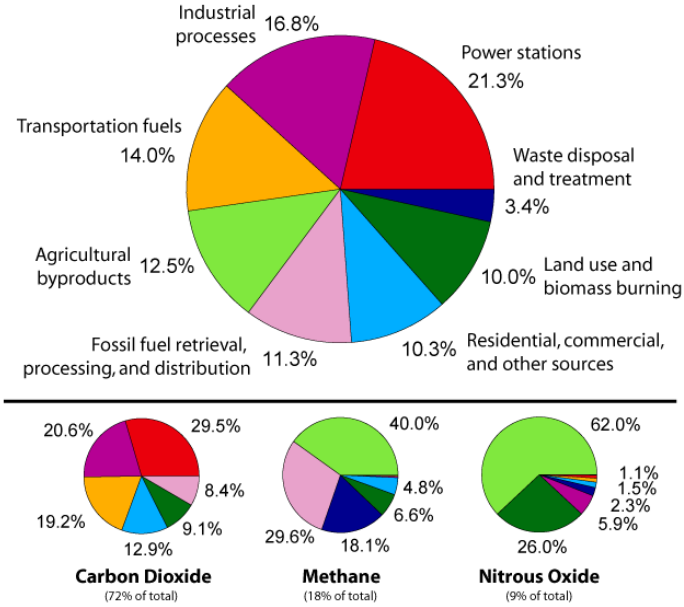
Status and future prospects

- **Greenhouse gases (GHGs) in the atmosphere**



Global trends in major long-lived greenhouse gases through the year 2002. These five gases account for about 97% of the direct climate forcing by long-lived greenhouse gas increases since 1750. The remaining 3% is contributed by an assortment of 10 minor halogen gases, mainly HCFC-22, CFC-113 and CCl_4.

Annual Greenhouse Gas Emissions by Sector



IPCC, 2007

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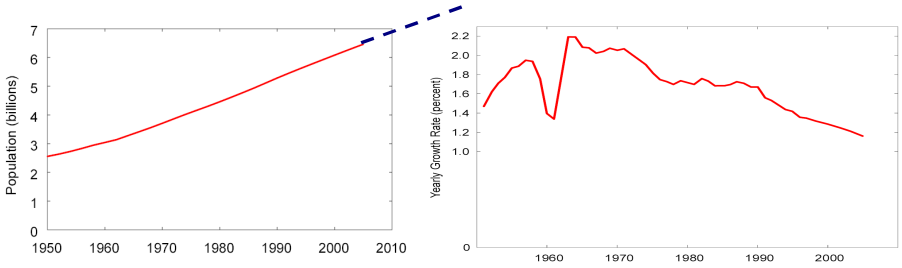
Status and future prospects

- **The world's population is increasing (July 2008: 6.680 billion)**



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Status and future prospects

- **A need for increased food production**
- **Geographical changes in agricultural production**

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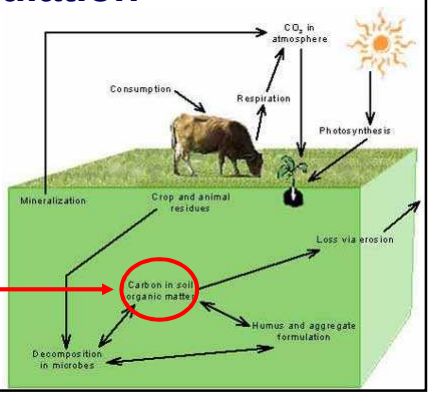
Dilemma

Ruminant production results in increased GHG emissions

We need to increase food production to meet the increasing population

Red meat/milk products vs. white meat

Grassland as a net sink for atmospheric CO_2 ?



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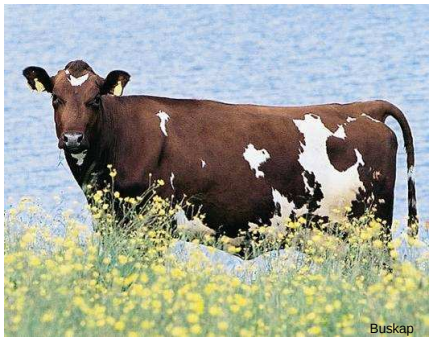
GHGs from ruminant production

- **Methane (CH_4)**
  - **From enteric fermentation in ruminants**
  - **2-12 % of dietary gross energy is lost as CH_4**
  - **Two sources**

87% rumen
- **95% lungs**



13% hindgut
- **89% lungs**
- **11% anus**

99% of total methane is respired

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Murrey et al., 1976

Estimated reduction potentials of targeted CH4 abatement strategies from animal agriculture

(modified from Boadi et al, 2005; Beauchemin et al., 2008)

Strategy	Reduction potentials, %
Increased dietary concentrate level	25
Increased dietary fat level	25-30
Increased forage and pasture digestibility	20-25
Increased proportion of maize silage in grass silage based diets	15 ?
Improved animal productivity	25-30
Ionophore supplementation (e.g. monensin)	11-30
Protozoa inhibitors (in vitro)	20
Plant secondary compounds (e.g., condensed tannins and saponins (in vitro)	2-12
Animal breeding/increased feed efficiency	21

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Effect of increased concentrate proportion on methane emission in dairy cows

Milk yield and concentrate prop.	Methane, kg/yr
8500 kg, 35% concentrate	151
8500 kg, 55 % concentrate	144

-5%

Volden og Nes, 2006

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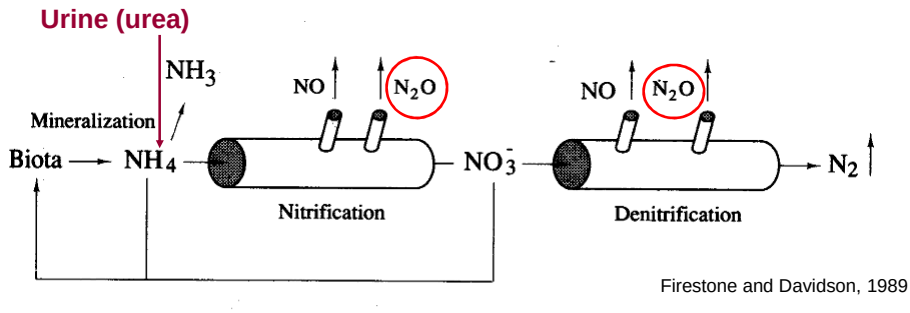
GHGs from ruminant production

- **Nitrous oxide N_2O**
  - **From manure**
    - **Nitrification (aerobic)**
    - **Denitrification (anearobic)**



Firestone and Davidson, 1989

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Estimated reduction potentials of targeted N2O abatement strategies from animal agriculture

(modified after de Klein and Eckard, 2008)

	Reduction potentials, %	
Strategy	**N_2O**	**Urinary N**
Animal interventions		
Improved dietary protein to energy ratio		10-45
Diuretic (e.g. salt)	5-10	
Condensed tannins		9-59
Nitrification inhibitor bolus	30-60	
Animal breeding		3
Soil/management interventions		
Fertilizer management	2-13	
Effluent management	50	
Wet season grazing management	7-11	
Soil water management	57-59	
Nitrification inhibitors	61-86	

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Conclusions

- Strategies to reduce the GHG emissions need to be assessed on a whole farm basis
- Reduction strategies should always consider associated emissions, to ensure that reductions in one part of the system do not stimulate higher emissions in another part of the system
- important to identify the strategies that have the largest reduction in emission for a given production level
- Mitigation strategies should focus on N_2O rather than CH_4

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