

**ADVISORY COMMITTEE ON ANIMAL FEEDINGSTUFFS**

**49<sup>th</sup> Meeting of ACAF on 3 March 2010**

**Presentation**


**Animals, their feeds and the environment: the inescapable  
consequence of food production**

**Presentation from Professor Chris Reynolds**


**February 2010**

## Animals, their feeds and the environment: the inescapable consequence of food production

University of Reading



Chris Reynolds  
School of Agriculture, Policy, and Development



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## “The Perfect Storm”

- Prof. John Beddington 2008

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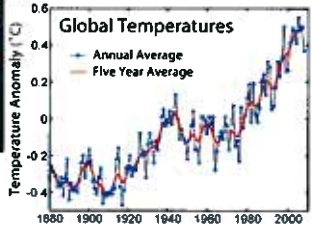
- As the world's population grows, competition for food, water and energy will increase. Food prices will rise, more people will go hungry, and migrants will flee the worst-affected regions. It is predicted that by 2030:
  - The world's population will rise from 6bn to 8bn (33%)
  - Demand for food will increase by 50%
  - Demand for water will increase by 30%
  - Demand for energy will increase by 50%

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## “The Perfect Storm”

- Climate change will add to the challenge

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## livestock's long shadow

environmental issues and options

FAO, 2007



## Ruminant Nutrition and the Environment

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- Methane** – green house gas (GHG)
- Nitrogen** – nitrates, N<sub>2</sub>O, NH<sub>3</sub>  
Eutrophication, GHG, air quality
- Phosphorus** – eutrophication
- Manure** – all of the above +
- Water** – demand and quality
- Soils** – forests vs grasslands

## “The Perfect Storm”

- Demand for food will increase by 50%

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**CHANGING EATING HABITS**  
Meat consumption in China per capita:

1980: 20kg  
2007: 50kg

**PRESSURE ON RESOURCES**

1,000-2,000 litres of water is needed to produce 1kg of wheat

10,000-13,000 litres of water is needed to produce 1kg of beef



SOURCE: FAO

www.bbc.co.uk, 2009.

6

No Process is 100% Efficient!! 



Bill Weiss, The Ohio State University

From The Times  
July 16, 2009  
How to stop cows burping is the new field work on climate change



From The Times  
October 27, 2009  
Climate chief Lord Stern: give up meat to save the planet

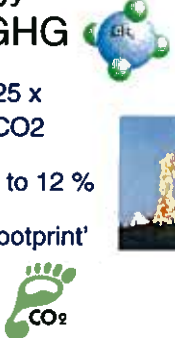



Methane is 23 times more powerful than carbon dioxide as a global warming gas



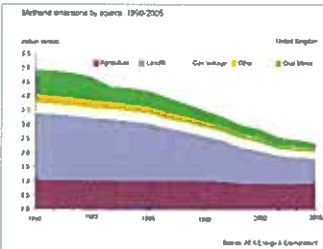

### Methane Energy Loss - \$\$\$ and GHG

- Per molecule methane ~25 x global warming effect of CO<sub>2</sub>
- Waste of feed energy – 2 to 12 %
- Concern for the 'carbon footprint' of milk, beef and lamb

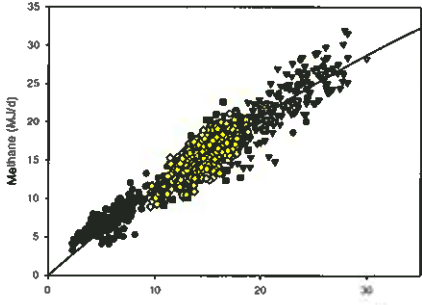



### Ruminant Farm Animals as Methane Producers

- Agriculture contributes 43% to the UK's emissions of CH<sub>4</sub>
- IPCC two sources
  - 85% fermentation
  - 15% manure
- Proportion is increasing
- Dairy farming accounts for 30% (~1% of total UK GHG)
- Major target for mitigation
- Beef and sheep 65%





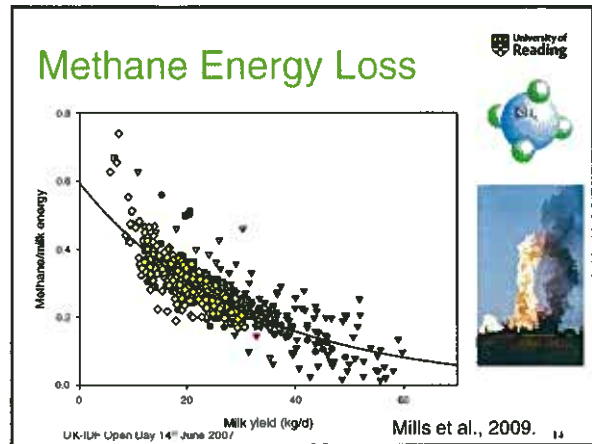
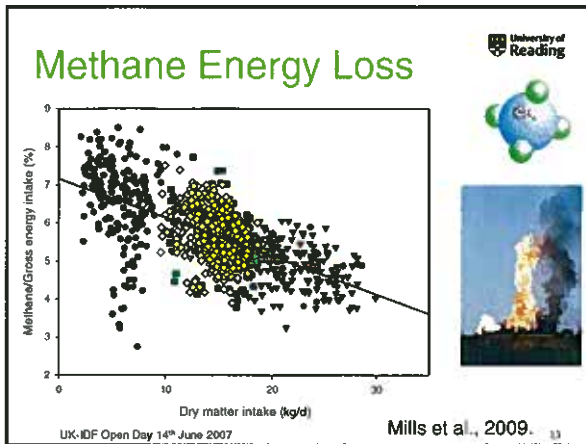
### Methane Energy Loss



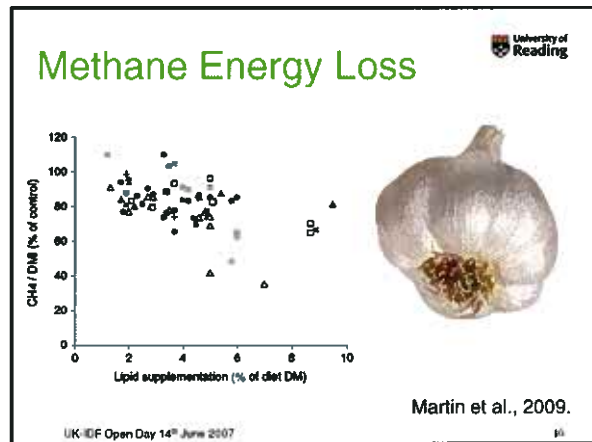
Mills et al., 2009.

UK-RIE Open Day 14<sup>th</sup> June 2007



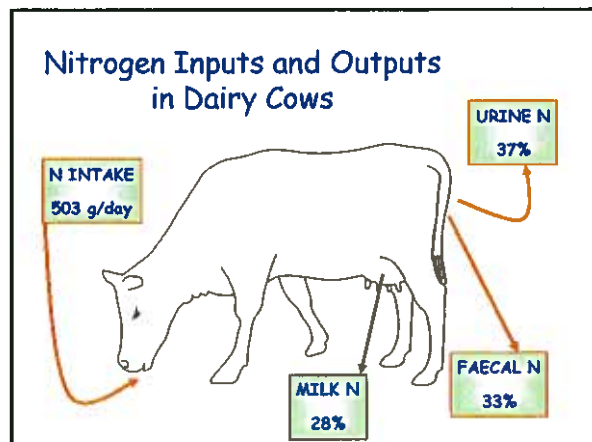
- ### What Can We Do About Methane?
- Changes at the herd level
    - Increasing longevity (reduced culling)
      - Improved fertility and reproduction
    - Extended calving intervals for high producing cows
    - Increasing system intensity (more milk per cow)
    - Genetics
  - Changes to nutrition (~30 L CH<sub>4</sub>/kg DMI)
    - Increase starchy feedstuffs & reduce fibrous feeds
    - Increase dietary fat
    - Additives
      - Yeasts
      - Plant extracts
      - Organic acids
  - Other methods
    - Vaccination

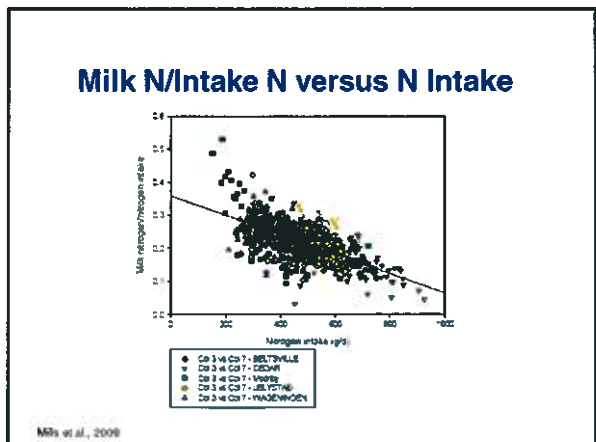
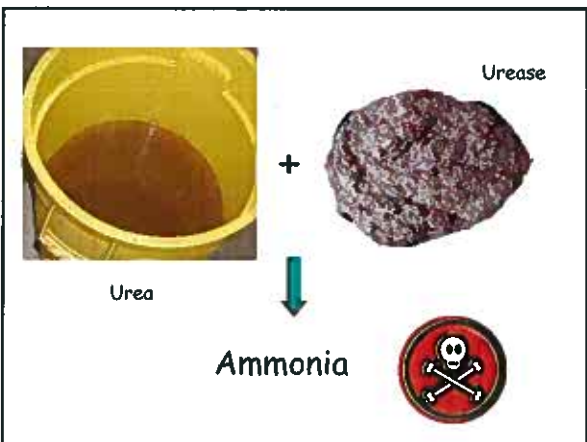
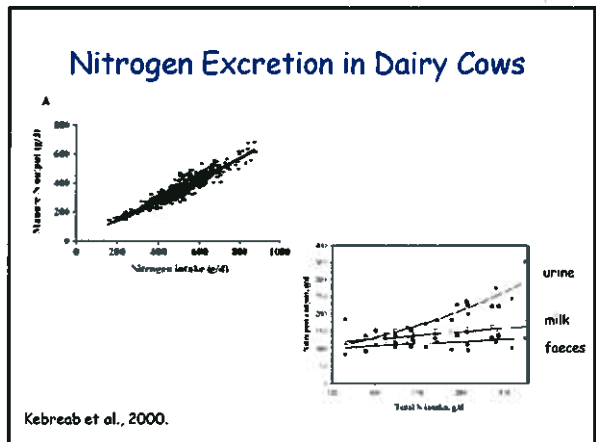
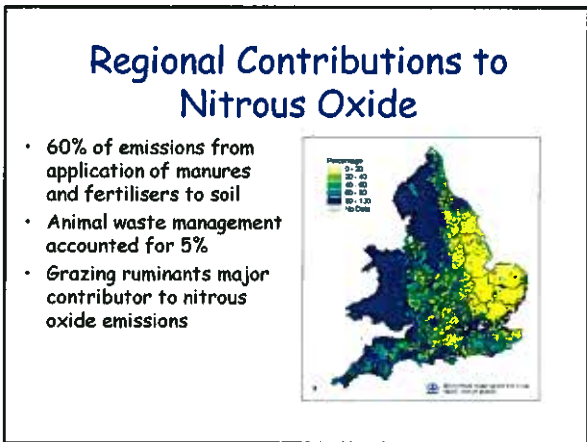
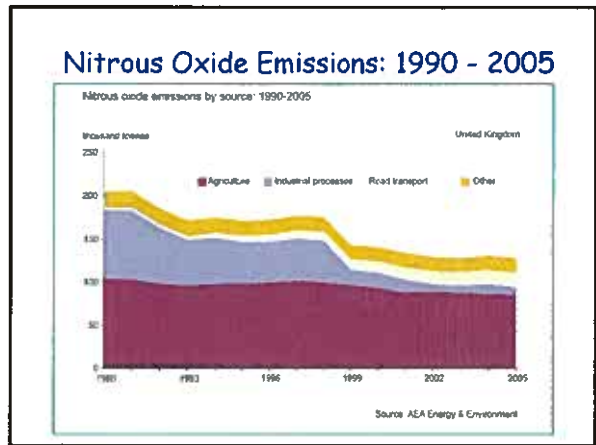
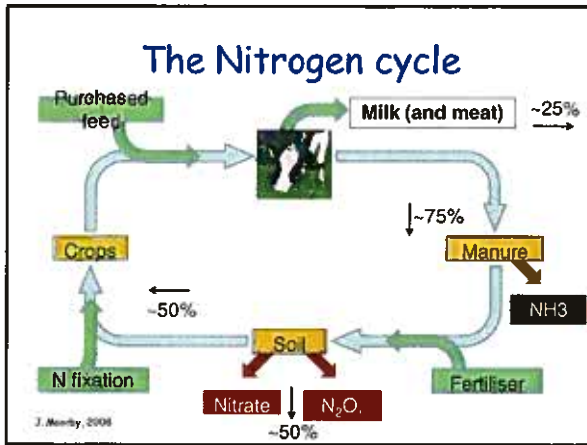


### NITROGEN

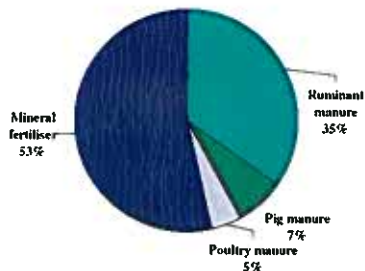
Nitrates, Nitrous Oxide and Ammonia

Figure 1. Nitrate and Ammonia concentrations in surface waters, 1970-2000.





## Sources of Phosphorus



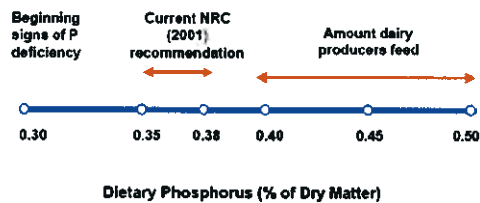
## P Averages for Dairy Cows

	Conc.	Amt/day
Diet	0.38% DM	79 g
Fecal	0.68% DM	46.9 g
Urine	0.025 g/L	0.5 g
Manure	0.077%	47.4 g

P efficiency (milk + retained) = 0.40

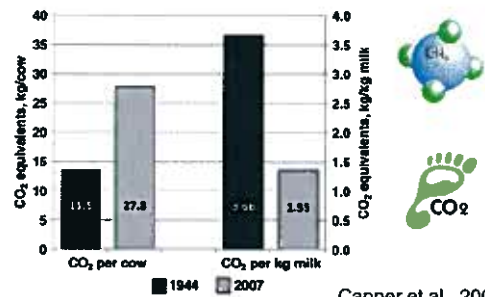
B. Weiss, 2004.

## Phosphorus Overfed in Lactating Dairy Cows



Wu and Satter.

## The Changing 'Carbon Footprint' of Milk Production



Capper et al., 2009.

## Reducing Environmental Impact

- Methane - numerous dietary approaches show promise
  - Reductions observed in sheep typically not realized in lactating dairy cows
- Nitrous oxide and ammonia
  - Feed less protein - how low can we go?
    - Optimizing amino acid absorption?
- Phosphorus - feed to requirement
  - Phytase in nonruminants
- Manure management - all of the above

## FUTURE

- Multidisciplinary 'systems' approach essential to controlling environmental pollution from agriculture
- Solutions to one environmental pollutant may impact on another pollutant so do not consider in isolation