

Mitigating Greenhouse Gas Emissions

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New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC)

The Centre

- Opened 3 March 2010 by Prime Minister John Key
- 100% Government funded, \$48.5 M over 10 years

Mission:

“To provide knowledge, technologies and practices which enable agricultural activities to continue to create wealth from agriculture for New Zealand in a carbon constrained world.”



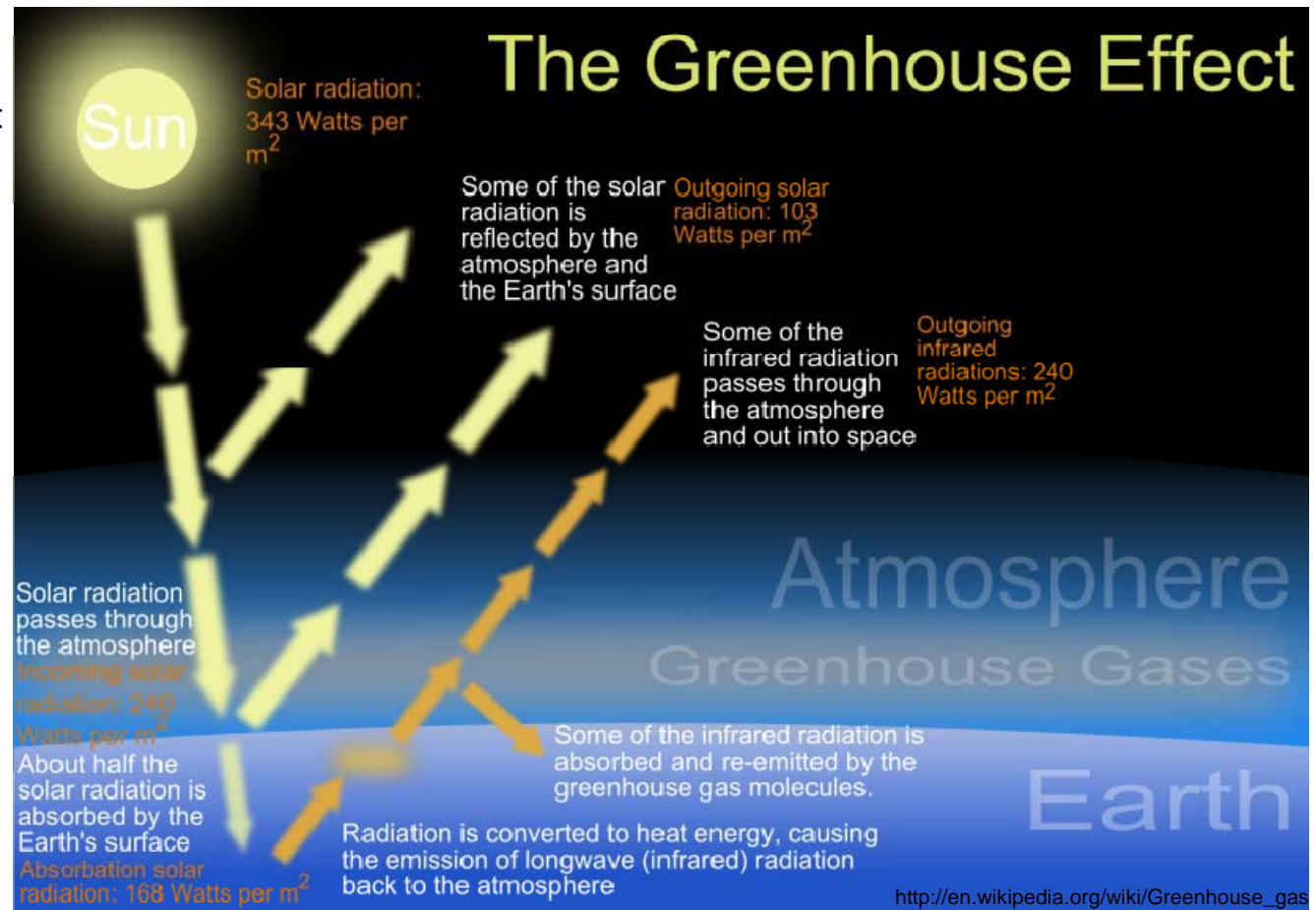
Greenhouse Gases (GHGs)

What are GHGs?

GHGs are gases in an atmosphere that absorb and emit radiation within the thermal infrared range.

GHGs greatly affect the temperature of the Earth; without them, Earth's surface would be on average about 33 °C colder than at present.

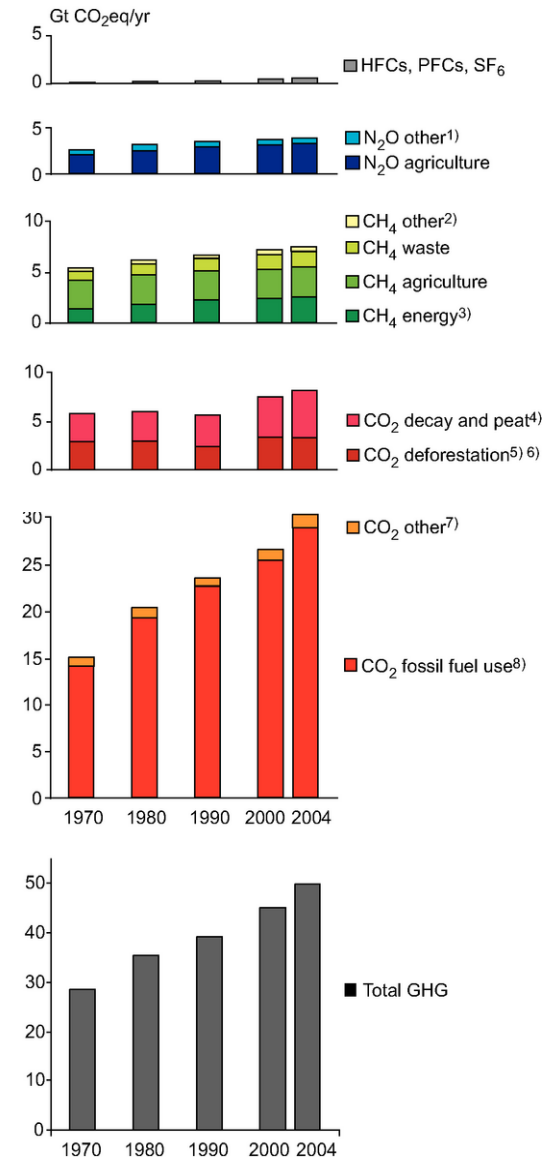
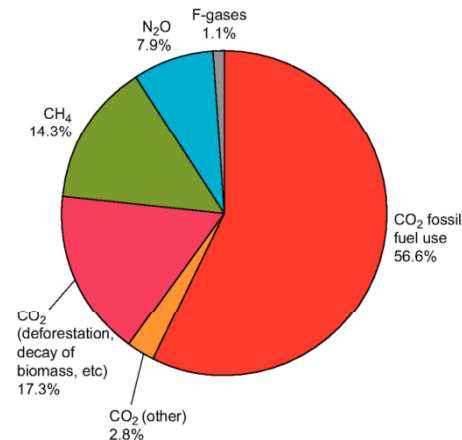
The primary GHGs in the Earth's atmosphere are water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and ozone.



Global anthropogenic GHGs

Since pre-industrial times, increasing emissions of GHGs due to human activities have led to a marked increase in atmospheric GHG concentrations

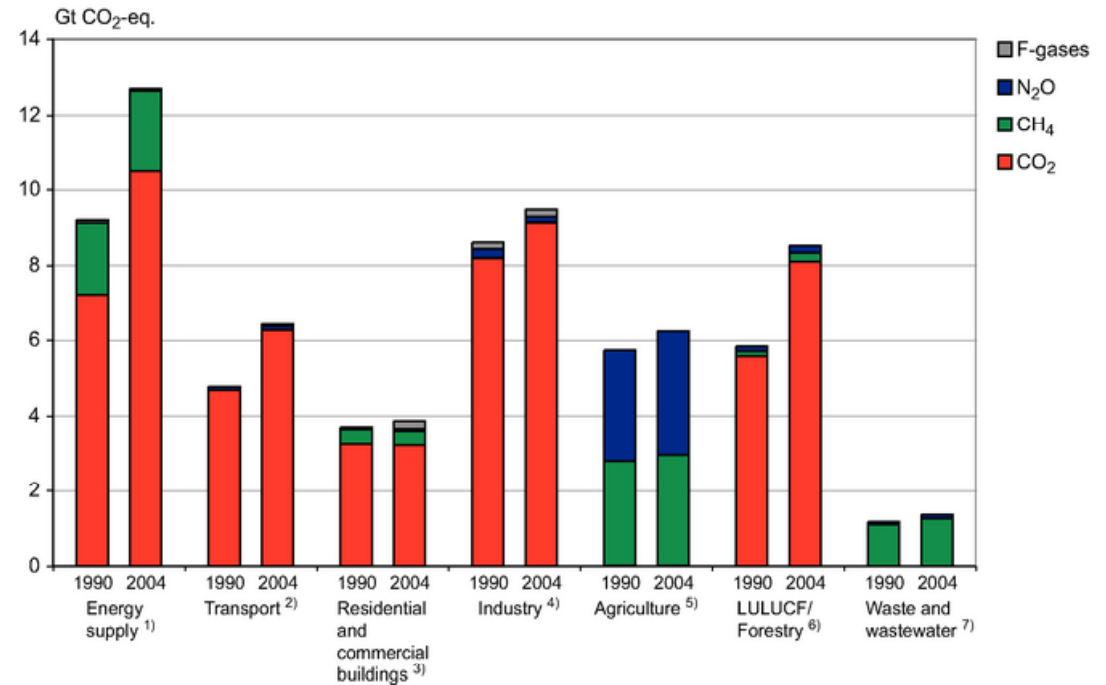
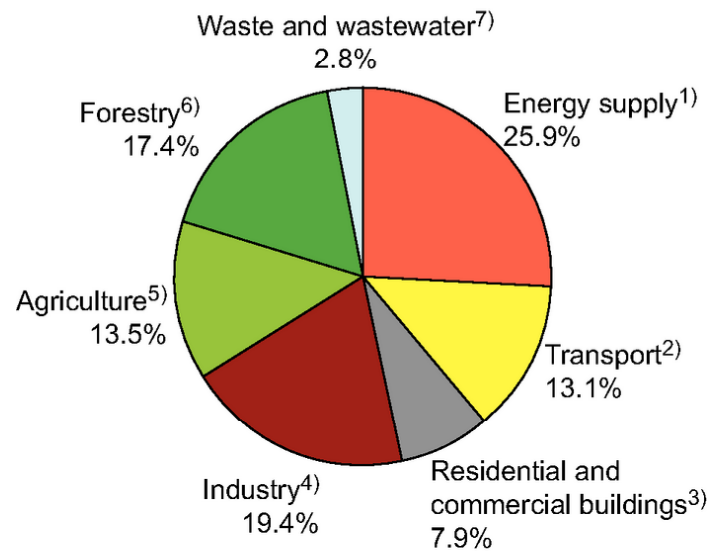
Between 1970 and 2004, global emissions of CO₂, CH₄, N₂O, HFCs, PFCs and SF₆, weighted by their global warming potential (GWP), have increased by 70% (24% between 1990 and 2004), from 28.7 to 49 gigatonnes of carbon dioxide equivalents (GtCO₂-eq)



Gas	Relative global warming potential (IPCC, 2007; 100 year horizon)
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous oxide (N ₂ O)	298

Data obtained from the IPCC Fourth Assessment 2007 report

Anthropogenic GHGs By Sector



Data obtained from the IPCC Fourth Assessment 2007 report

New Zealand

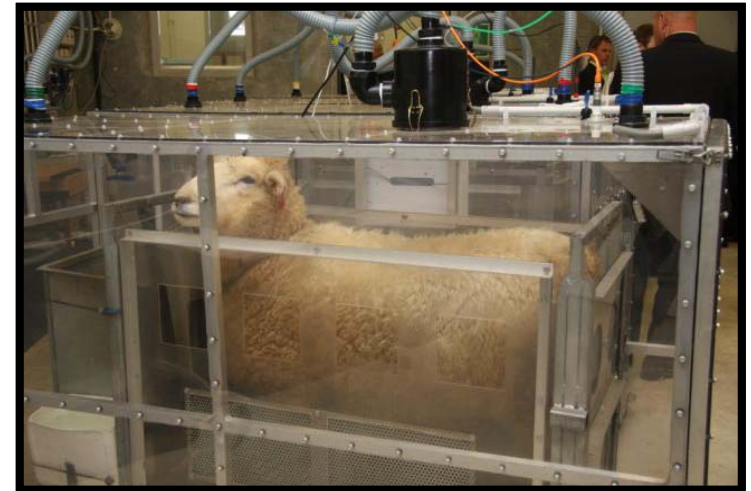
Agriculture drives New Zealand's economy

Agriculture responsible for:

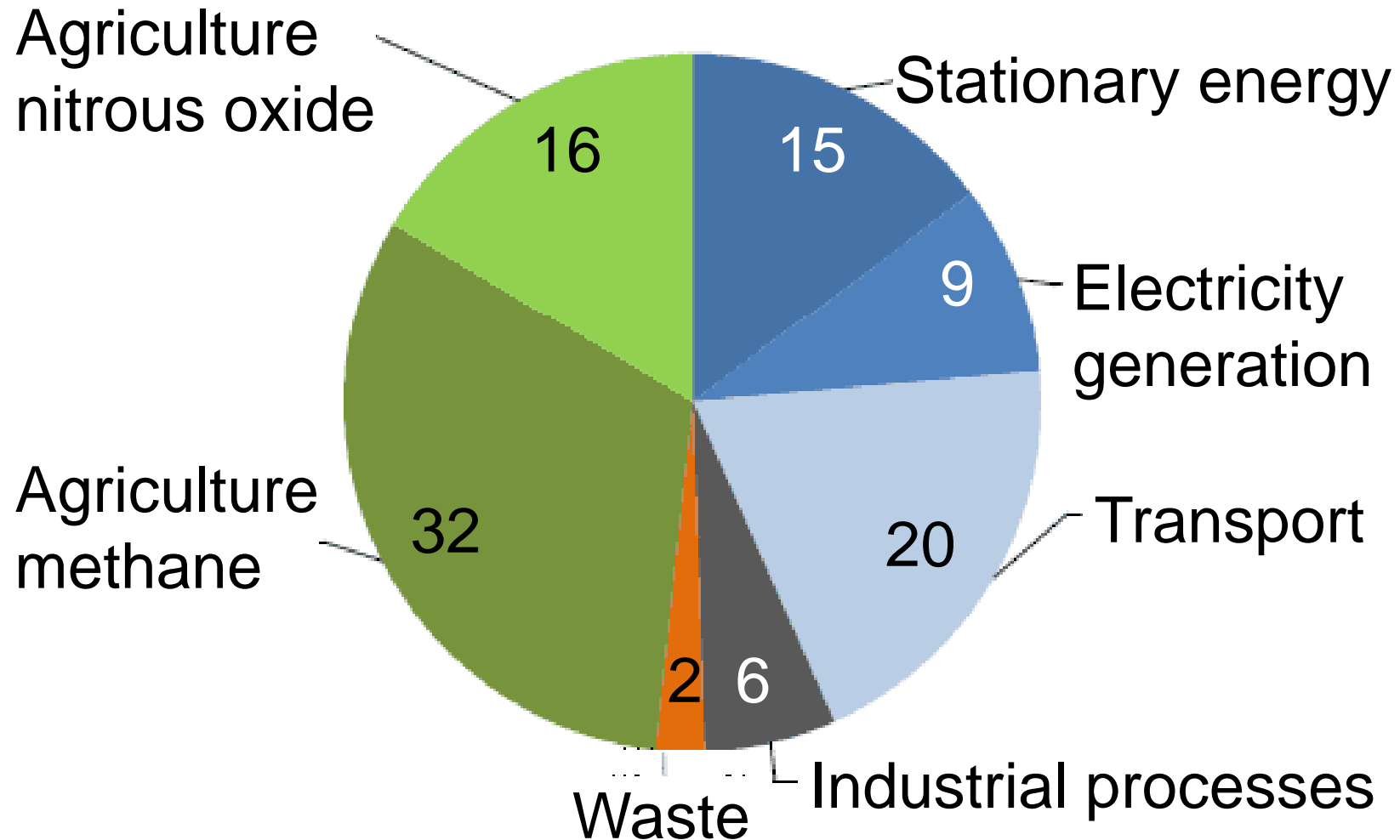
- 52% of NZ total merchandise exports

NZ produces:

- 40% of world's tradable dairy products
- 66% of tradable lamb products



NZ's Unusual GHG Profile



NZ's Commitment

“The Kyoto Protocol commits New Zealand to reducing its greenhouse gas emissions back to 1990 levels ... or to take responsibility for any emissions above this level if it cannot meet this target”

Source: Ministry for the Environment,
<http://www.mfe.govt.nz/publications/climate/nz-2020-emissions-target/html/index.html>, 29/07/2009



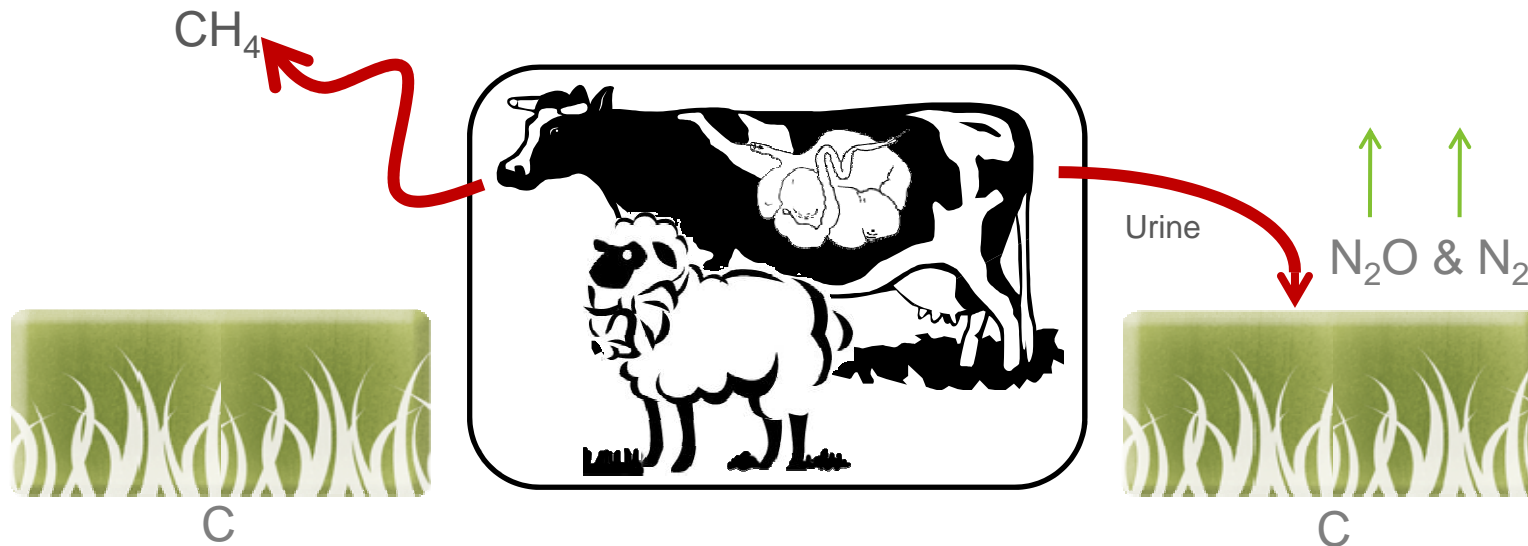
Leading Partners in Science



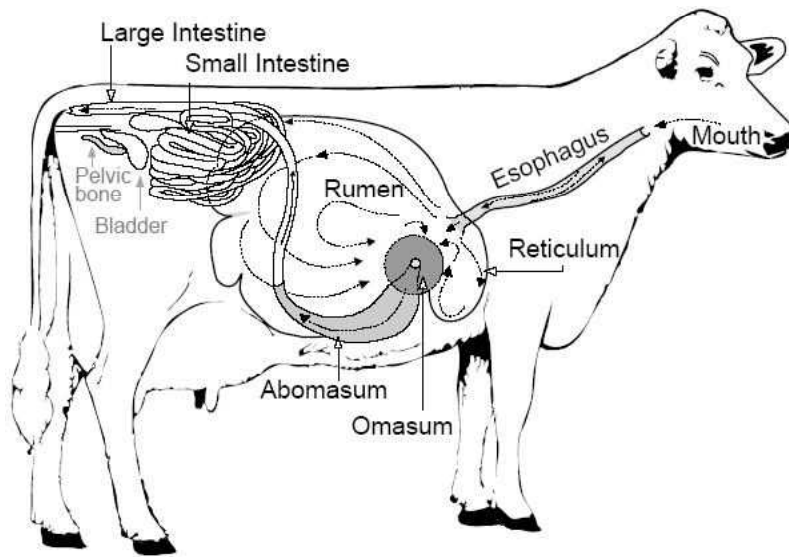
NZAGRC Research Activities

Main aims of research

- Reduce emissions of methane (CH_4)
- Reduce emissions of nitrous oxide (N_2O)
- Reduce carbon losses in agricultural soil
- Increase carbon sinks in agricultural soil

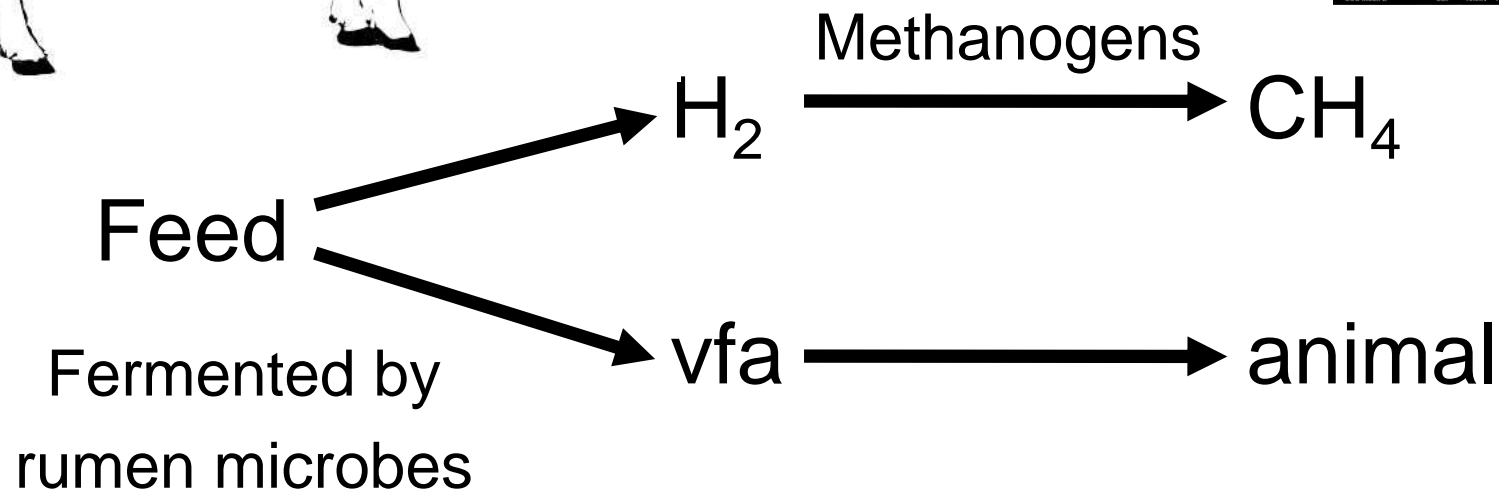
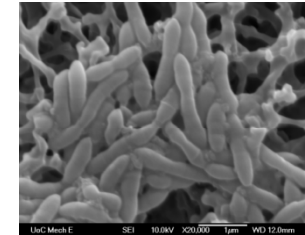


Ruminant Methane



- Ruminant animals, have a special type of stomach called a **RUMEN**, which is home to billions of microbes which can digest feed.

- Methane is produced by certain microbes called **METHANOGENS**.



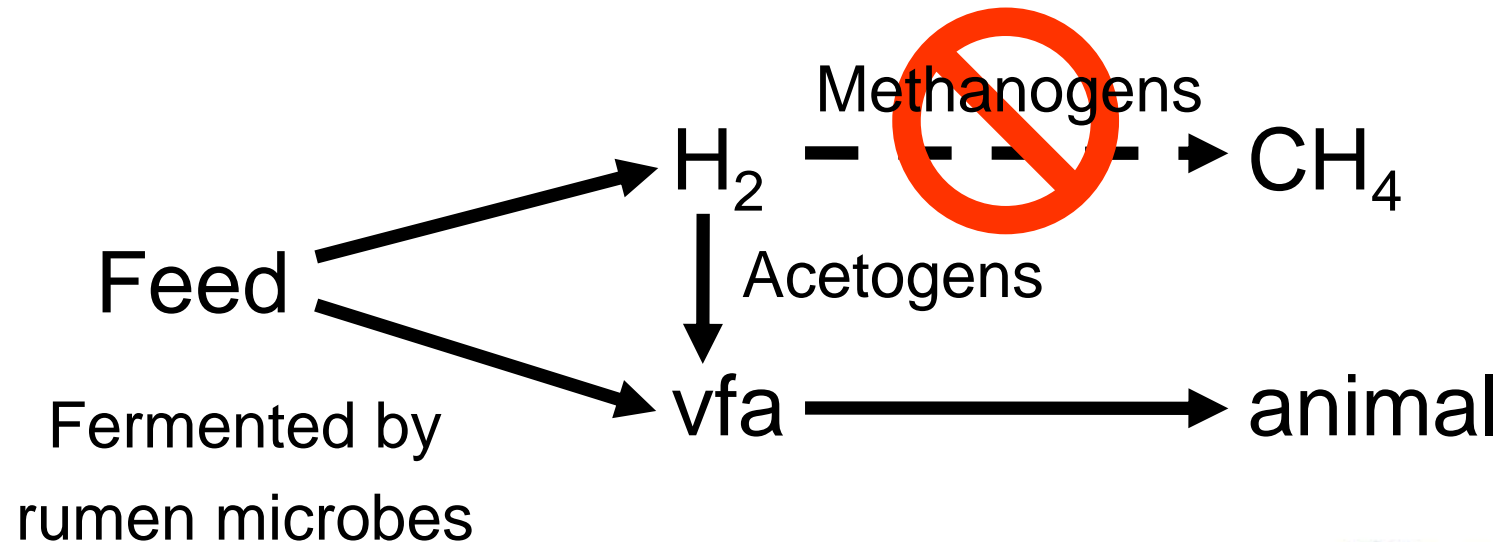
Routes for CH₄ Mitigation

Short term	Medium term	Long term
<p>Reduce animal numbers¹</p> <p>Manipulate diet</p> <p>Increase productivity per animal²</p>	<p>Rumen modifiers</p> <p>Plants with low CH₄ yield</p>	<p>Targeted manipulation of rumen ecosystem¹</p> <p>Breed animals with low CH₄ yield¹</p>

¹ Options with high mitigation potential

² Reduces CH₄/kg product, increases emission/animal

Targeted Manipulation of Rumen Ecosystem



- Understand methanogen species present (Microbial Ecology)
- Sequence their genomes (Microbial Genomics)
- Identify methanogen enzymes that can be inhibited (Chemogenomics)
- Develop vaccines that target methanogens (Reverse Vaccinology)



Greenhouse Gas Emissions in Context

Can the earth sustain 9+ billion people?

- The world needs to increase total food production by 50% in the next 30 years.
- Rising demand for milk and meat products.

But

- 'Worldwide the number of overweight people (about 1 billion) has now surpassed the number of malnourished people (about 800 million).'¹
- The livestock sector emerges as one contributor to two very serious environmental problems

GHG emissions are only one of the challenges facing the livestock sector.

¹Steinfeld et al (2006)