New Zealand’s Agricultural GHG Emissions

Policies and Approaches

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AgResearch
Outline of talk

• New Zealand’s unique situation
  – Agriculture in the NZ economy
  – Emissions profile

• New Zealand approach; policy pre-2007
  – Flatulence fiasco
  – PGGRC
  – Research priorities

• New Zealand approach; policy post-September 2007
  – Consultation document
  – Emissions trading scheme
  – Sustainable land management & climate change
Agriculture in the New Zealand economy

- Agriculture 53% of total merchandise exports – unique for a developed country

- Agriculture 17% of New Zealand GDP

- New Zealand approx 40% of world's tradeable dairy products, 66% of world's tradeable lamb products
## New Zealand GHG emissions

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2005</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N₂O emissions</strong></td>
<td>10.1</td>
<td>12.7</td>
<td>25.7</td>
</tr>
<tr>
<td><strong>CH₄ emissions</strong></td>
<td>22.4</td>
<td>24.7</td>
<td>10.3</td>
</tr>
<tr>
<td><strong>Total CO₂ₑ emissions</strong></td>
<td>61.9</td>
<td>77.2</td>
<td>24.7</td>
</tr>
<tr>
<td><strong>Agriculture as % of total emissions</strong></td>
<td>52.5</td>
<td>48.4</td>
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</table>
New Zealand agricultural GHG emissions in an international context

- Agricultural emissions in many developed countries going down, New Zealand’s rising at 1%/annum

- Research into agricultural GHG emissions low priority in many developed nations

- Agricultural emissions high in developing countries (e.g., South America) but economic development, not reducing GHG emissions, has greater priority
Situation pre-2007
NZ Climate Change Policy 2004-2007
The flatulence fiasco (2003)

- Government response to increases in GHG emissions from the agricultural sector.

- Agricultural sector exempt from any levies on GHG emissions but obliged to fund research into GHG mitigation (minimum $8.4m/year)

- Provoked farmer outrage and strong political opposition

- Popular government in dispute with a sector of the economy which earns $14 billion per annum in export revenue over an $8.4 million research levy
2003 political compromise

- Industry agreed to voluntarily fund GHG research and agreed an MOU with the Government

- Pastoral Greenhouse Gas Research Consortium (PGGRC) signed the MOU on behalf of the agricultural industry

- Target research investment achieved by adopting a broad definition of GHG research

- PGGRC became the principal route for funding agricultural GHG research in New Zealand; PGGRC 50% Government funded. Total funding approx $5m/annum, $3m on GHG mitigation.
Pastoral Greenhouse Gas Research Consortium

**Consortium Members and International Peer Reviewers**
- Fonterra
- Meat & Wool NZ
- PGG-Wrightson
- DEEResearch
- AgResearch
- Dairy InSight
- Fertiliser Manufacturers Research Assoc.

**Science Providers**
(AgResearch, Livestock Improvement, Lincoln University, Dexcel and others)

**Pastoral Greenhouse Gas Research Limited Manager**

**Science Advisory Group**

**Consortium Governance Board**

**PGGRC IP holding entity**

**Commercialisation**
PGGRC Goals

- To develop one or more greenhouse gas mitigation solutions that can be implemented within New Zealand's agricultural industries
  - That are practical in terms overall economics, product safety, and animal safety, and will produce sustainable results that are accepted by the international regulatory authorities and our customers.
  - Reduce GHG production by 20% compared to business as usual.

*Initial concentration on methane but nitrous oxide research added in 2004*
PGGRC Research Priorities
(funding $5m/annum)

• Rumen microbial ecology
• Rumen microbial genomics
• Anti methanogen vaccine
• Exploiting animal to animal variation
• Low GHG farm systems development
• Nitrification inhibitors (DCD)
Rumen microbial ecology
Rumen microbial genomics

Whole genome atlas of *M. ruminantium*
Anti-methanogen vaccine

- **Efficacy of Australian formulations low, but approach highly attractive.**

- Identify methanogen fraction to induce antibodies that neutralize methanogens.

- Identify specific antigens which are targets for antisera that neutralize methanogens *in vitro*

- Identify adjuvants that stimulate a strong salivary antibody response to methanogen fractions.
Exploiting animal to animal variation

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>St. Dev</th>
<th>Lower Quartile</th>
<th>Upper Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₄ g/day</td>
<td>213.9</td>
<td>478.8</td>
<td>332.1</td>
<td>38.1</td>
<td>285.6</td>
<td>381.0</td>
</tr>
<tr>
<td>CH₄ kg/ DMI</td>
<td>11.0</td>
<td>31.1</td>
<td>19.3</td>
<td>2.9</td>
<td>16.1</td>
<td>23.1</td>
</tr>
</tbody>
</table>

Methane emissions from a herd of 302 Friesian x Jersey dairy cows measured between January 12th and February 6th 2004.
Low GHG emitting farm systems

- Nutrition – defining targets for plant breeders + identifying low CH$_4$ emitting forages
- Low N loss systems (herd homes, maize silage, stand-off pads)
- Systems modelling
Nitrification inhibitors

Reduce $\text{N}_2\text{O}$ emissions by up to 70% during the May – October
Variability of response and long-term efficacy still being studied
Economics limiting uptake at present
Need to incorporate into national inventory to gain benefit of GHG reduction
Situation post-2007
## Sustainable Land Management & Climate Change

<table>
<thead>
<tr>
<th>Long-term Options</th>
<th>Options for Encouraging Emissions Reductions Now</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Research</td>
<td>4. Incentive for nitrification inhibitors</td>
</tr>
<tr>
<td></td>
<td>Pay a financial incentive to encourage the use of nitrogen inhibitors</td>
</tr>
<tr>
<td>2. Technology transfer</td>
<td>5. Charge on nitrogen fertiliser</td>
</tr>
<tr>
<td></td>
<td>Impose a charge on nitrogen fertilisers</td>
</tr>
<tr>
<td>3. Voluntary reporting</td>
<td>6. Tradable permit regime for agriculture emissions</td>
</tr>
<tr>
<td></td>
<td>Devolution of agriculture greenhouse gas emission obligations and permits to farmers</td>
</tr>
<tr>
<td></td>
<td>7. Offset schemes for agricultural emissions</td>
</tr>
<tr>
<td></td>
<td>Farmers required to offset emissions by emission reductions elsewhere i.e. tree planting, biofuels etc</td>
</tr>
<tr>
<td></td>
<td>8. RMA standards to control agricultural greenhouse gas emissions</td>
</tr>
<tr>
<td></td>
<td>Development of a National Environmental Standard to control agricultural greenhouse gas emissions: i.e. input and/or output controls</td>
</tr>
<tr>
<td></td>
<td>9. RMA standards to control new agricultural land use after deforestation</td>
</tr>
<tr>
<td></td>
<td>Controlling the greenhouse gas emissions and other effects arising from land use change from forestry to agriculture</td>
</tr>
</tbody>
</table>

### Price-based measures

- Government pricing mechanisms
- Market-based mechanisms
- Regulation

### Options focusing on land use change from forestry to agriculture

- 10. Charge where deforested land is used for agriculture
- Impose a charge on agriculture emissions created when land is converted from forestry to agriculture
New Zealand’s climate change solutions

- Sustainability programme designed for all New Zealander’s to act
  - Emissions Trading Scheme
  - Energy Strategy and NZEECs
  - Transport: fuel efficiency labelling, biofuels sales obligation, public transport funding
  - Sustainable Land Management and Climate Change Plan of Action
Emissions Trading Scheme: Key in-principle decisions ...(1)

- Economy-wide ETS covering all sectors and all gases
- Sectors’ entry into ETS will be staggered – forestry first
- Units of trade will be a New Zealand Unit (NZU)
- NZUs will be convertible to Kyoto Protocol units (with limits)
- Kyoto Protocol units can be used to meet ETS obligations
- Each NZU must be backed by a Kyoto unit
- Key obligation - participants report their emissions (or the emissions that will arise from their activities) and surrender units equal to those emissions
- Absolute emission levels not intensity based
Scheme administration

- All scheme participants will be required to hold an account in the NZ ETS registry

- Participants will get units by:
  - Buying them off other participants
  - Free allocation from government
  - Buying international units
  - Government may auction units if required
### Entry to the ETS by sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>Commencement of obligations</th>
<th>End of initial compliance period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry (includes deforestation of pre-1990 forest land and afforestation post-1989)</td>
<td>1 January 2008</td>
<td>31 December 2009 (first compliance period for deforestation two years)</td>
</tr>
<tr>
<td>Liquid fossil fuels (mainly transport)</td>
<td>1 January 2009</td>
<td>31 December 2009</td>
</tr>
<tr>
<td>Stationary energy (includes coal, natural gas and geothermal)</td>
<td>1 January 2010</td>
<td>31 December 2010</td>
</tr>
<tr>
<td>Industrial process (non-energy) emissions</td>
<td>1 January 2010</td>
<td>31 December 2010</td>
</tr>
<tr>
<td>Agriculture (includes pastoral and arable farming and horticulture)</td>
<td>1 January 2013</td>
<td>31 December 2013</td>
</tr>
<tr>
<td>Waste</td>
<td>1 January 2013</td>
<td>31 December 2013</td>
</tr>
</tbody>
</table>
Agriculture Emissions

- Covers agriculture gases
  - Methane from enteric fermentation
  - Nitrous oxide from animal urine and dung
  - Nitrous oxide from synthetic fertilisers

- Main sources covered: pastoral agriculture, horticulture, and arable production (~98% of emissions)

- 1 January 2013 entry date to honour the 2003 Memorandum of Understanding and operational challenges

- Sector to monitor and report emissions by 2011
Point of obligation

• Principle to minimise the number of participants in the scheme (reduce transaction costs)

• Initial Government preference for company/processor level point of obligation
  – Meat and dairy processors (N₂O & CH₄)
  – Fertiliser companies (N₂O)

• Farm level option provides better incentives to change behaviour. Feasibility?
Assistance to the sector

- **Total quantity** of free allocation of NZUs will be 90% of 2005 total emissions
- Allocation to phase-out to 2025 (up for discussion)
- No decisions made on allocation within the sector (eg. dairy *v*iz-*a*-viz sheep)
- Government preference is for allocation to **benefit** farmers
Transition arrangements for agriculture

90% of 2005 allocation NZU’s
Estimated supply price impacts at $15/t CO$_2$-e and 25/t CO$_2$-e

- Price impacts sensitive to assumptions

- Figures assume:
  - Processor/company level point of obligation
  - Allocation spread evenly across sectors
  - Benefits of free allocation fully reflected in payout
  - No emissions reductions

- Figures based on 2006/07 prices

<table>
<thead>
<tr>
<th>Possible Impact in 2013 (90% of 2005 free allocation)</th>
<th>$15/t CO$_2$-e</th>
<th>$25/t CO$_2$-e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>-1.0%</td>
<td>-1.6%</td>
</tr>
<tr>
<td>Beef</td>
<td>-0.2%</td>
<td>-0.3%</td>
</tr>
<tr>
<td>Sheepmeat</td>
<td>-0.7%</td>
<td>-1.2%</td>
</tr>
<tr>
<td>Venison</td>
<td>-0.1%</td>
<td>-0.2%</td>
</tr>
</tbody>
</table>
Sustainable land management and climate change *Plan of Action*

- ETS cornerstone of NZ’s efforts to reduce carbon emissions, but:
  - On its own won’t do enough to reduce agricultural emissions
  - ETS won’t address challenge for land management sectors to *adapt* to climate change or take advantage of *business opportunities*
  - Government will invest $175 million over next 5 years on Sustainable Land Management and Climate Change *Plan of Action*
  - Plan will be developed and delivered in close partnership with land management sector
Plan of Action: Proposed Structure and Activities

**Peak Group**
Sets goals and strategic direction and monitors progress

- **Adaptation Working Group**
- **Research, Innovation & Technology Transfer Working Group**
- **ETS Design Technical Advisory Group**
- **Business Opportunities Working Group**

**Pillar 1 Adaptation**
- Govt / Sector partnership
- Policy development
- Community Irrigation Fund
- Impacts/ adaptation strategies

**Pillar 2 Reducing emissions and creating carbon sinks**
Further policy development of agriculture and forestry elements of ETS
- Farm-scale Greenhouse Gas Reporting
- Forestry complementary measures
  - Afforestation Grant Scheme

**Pillar 3 Business opportunities**
- Government / sector partnership
- Policy development
- Greenhouse gas foot printing
- BioChar/Bioenergy
- Sustainable Building Strategy
- Avoided deforestation (international strategy)

**Research and Innovation**
Research into agriculture and forestry adaptation and mitigation and National Inventory research

**Technology Transfer and Information** – changing farm/forestry management practices

**Communication and Engagement**

<table>
<thead>
<tr>
<th>Vote Agriculture and Forestry</th>
<th>All figures are $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pillars and Initiatives</strong></td>
<td><strong>2007/08</strong></td>
</tr>
<tr>
<td><strong>Pillar 1: Adaptation</strong></td>
<td></td>
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<tr>
<td>Partnership and Policy Development</td>
<td>0.335</td>
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<tr>
<td>Community Irrigation Fund</td>
<td>0.112</td>
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<tr>
<td><strong>Pillar 2: Reducing Emissions and Creating Carbon Sinks</strong></td>
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<tr>
<td>Emissions Trading Policy Development</td>
<td>1.200</td>
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<tr>
<td>Farm Level Greenhouse Gas Reporting</td>
<td>0.860</td>
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<tr>
<td>Afforestation Grants Scheme</td>
<td>1.068</td>
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<tr>
<td>GIS infrastructure</td>
<td>2.468</td>
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<tr>
<td><strong>Pillar 3: Business Opportunities</strong></td>
<td></td>
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<tr>
<td>Partnership and Policy Development</td>
<td>2.844</td>
</tr>
<tr>
<td>Bioenergy and Bio-Char research and development</td>
<td>3.775</td>
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</table>
Plan of Action: Funding for Supporting Work Programmes

<table>
<thead>
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<th>Vote Agriculture and Forestry</th>
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</thead>
<tbody>
<tr>
<td>Research and Innovation</td>
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<tr>
<td>Research</td>
<td>4.300</td>
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<tr>
<td>Inventory Development</td>
<td>2.720</td>
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<tr>
<td>Technology Transfer</td>
<td></td>
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<tr>
<td>Partnership Development and Implementation</td>
<td>2.744</td>
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<tr>
<td>Communications and Engagement</td>
<td></td>
</tr>
<tr>
<td>Communications and sector engagement</td>
<td>0.897</td>
</tr>
<tr>
<td>TOTAL OVER 5 YEARS</td>
<td></td>
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</tbody>
</table>