Modelling the effects of climate change policy on the NZ dairy sector

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Climate Change and New Zealand

- 48 % of NZ's GHG emissions come from agriculture
- Land-based industries contribute 70% of NZ's export earnings
- NZ emissions could be around 20% above our target during the first commitment period (2008 – 2012) if we do nothing to reduce our emissions

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Linking trade and the environment in the LTEM

- Trade model – links the economic/financial flows between countries for agriculture
- A tool to aid trade and environment policy negotiations and analysis
- Avoids problem of valuing environment and/or developing a single environmental indicator
- Started with Groundwater then GHG now biodiversity

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LTEM

- Partial equilibrium model based on VORSIM
- 22 commodities and 19 countries
- simulates impact of policy changes, including, tariff rate quotas, minimum prices, MFN access, quotas, WTO constraints, tariffs and subsidies
- Also can simulate scenarios relating to the development of new markets
- Base year 2004 running put to 2020

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Summary of key relationships within the model for Dairy

- Supply of raw milk = f (Price milk, Price beef, Price feed grains, Animals, N, elec, diesel)
- Supply of dairy products:-= f (Relative prices of the dairy products and the raw milk supply)
- Demand for dairy products = f (Relative prices, Income per head, Population, Support policies)
- Prices = f (World price, Market support, Direct Support, Other support)

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Agricultural GHG emissions

- Agriculture is a contributer of GHGs
- **Methane (CH_4) - CO_2 equivalent: 21**

  Methane from livestock produced from two main sources: enteric fermentation and manure management

- **Nitrous Oxide (N_20) - CO_2 equivalent: 310**
- Number of sources from agriculture, mainly from animal waste and soil processes

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Key Variables for GHG calculations

- Each commodity (beef, sheep and dairy) has its own GHG equation

  $$GHG = 21(\alpha NA) + 310(\beta N, \theta NA) + (energy)$$

- *Animal numbers = f(Relative prices of N and Concentrates, relative producer prices)*
- *Fertiliser application = f(Relative prices of Nitrogen and Concentrates)*
- *Energy = diesel, electricity, conc, fertiliser*

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Mitigation

- Limit on animal numbers
- Nitrogen limits
- Improve feed quality
- Change production system
- Product substitution
- Carbon tax
- Tradeable permits

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Impact of mitigation strategies

Scenarios:

- 1. Base scenario

  2. EU reduces stocking rate and N fertiliser application

  NZ systems remain the same

  3. NZ and EU both reduce stocking rate and N fertiliser application
- These results are compared with the base scenario in 2010

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Raw Milk Producer Returns
(% change from base in 2010)

	EU	NZ
2	-10.0	2.2
3	-9.7	-30.7

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Change in GHG emissions
(% change from base in 2010)

	EU	NZ
2	-34.7	0.87
3	-34.7	-21.9

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Conclusions

- NZ is committed to meeting the targets set under the Kyoto Protocol
- The impacts of implementing this could be serious for the agricultural sector, as well as the economy as a whole
- Also the impact of carbon labelling and carbon footprinting has potential to affect exports

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Current/Further Work

- Expand energy in the model
- Add forestry to model
- Separate out energy and food markets
- Expand capability to model mitigation
- Expansion of trade model to include a variety of indicators such as biodiversity

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