Carbon neutral dairy products: fantasy or reality?

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Introduction

The UK supermarket chain Tesco plans to label all 70,000 items it sells with data on each product's carbon footprint; Marks & Spencer are planning to go carbon neutral; Wal-Mart are aspiring to achieve zero waste and are sourcing sustainable products; and many other companies in the food sector are looking to change their business model in response to climate change. Tesco, for example, has made reduction of its carbon footprint an important business driver and has implemented a comprehensive three-pronged plan to: help its customers select and afford 'green' products; set an example in measuring and reducing its greenhouse gas (GHG) emissions around the world; and, by working with others, develop new low-carbon technology throughout the supply chain (Tesco 2007).

Food and beverage exporters, to the UK in particular, have already begun to respond to this market requirement. For example in a world-first, Grove Mill, a New Zealand winery, supplied Marks and Spencer with certified carbon-neutral wine in November 2006 (Grove Mill 2008). Through Landcare Research's carboNZero programme, they measured their carbon footprint, identified ways to reduce this and were certified as carbon neutral through an independent audit (carboNZero 2007). Initially, some industries resisted these developments by calling the 'food miles' concept protectionist (McLaren 2007) and continuing to question whether climate change is occurring. More recently, as IPCC (2007) and other reports have highlighted the seriousness of climate change to mankind and governments have enacted more policy measures to reduce GHG emissions, these attitudes have begun to change. Leading companies such as Fonterra are actively working to measure the carbon embedded in milk products (Harris 2007). While these developments are relatively recent, terms such as carbon credits, renewable energy, sustainable business, carbon footprint, life cycle analysis, emissions trading system, the Kyoto Protocol and carbon neutrality are now common in the agricultural media.

Nevertheless, many of these concepts and their implications for dairying remain foreign to dairy farmers. This paper attempts to redress this and provides context to the scale of GHG emissions in Australian agriculture. However, the scientific literature on carbon footprint management in dairying is still sparse and for this reason reports by Basset-Mens et al. (2007) and Ledgard et al. (2007), which report on a New Zealand life cycle analysis (LCA) for cheese production, are drawn on heavily.

Australian agriculture's greenhouse gas challenge

In 2005 agriculture accounted for 17% of Australia's GHG emissions (87.9 M t of CO_2 equivalent), including 60% and 84% of Australia's methane (CH_4) and nitrous oxide (N_2O), respectively (ABARE 2007; Table 1). Reduced land clearing and forest planting have strongly assisted Australia to meet its first Kyoto commitment target (108% of 1990 levels; Keogh 2007) but there is now less capacity to meet future targets through these mitigation mechanisms (Table 1).

Table 1: Net historical and projected agricultural and forestry emissions for Australia. (Source: ABARE 2007).

	1990	**2000**	**2005**	**2010**	**2020**
			$MtCO_2$-eq		
Agriculture					
Enteric fermentation	63.9	60.4	58.7	63.7	68.9
Manure management	2.1	3.3	3.4	3.3	3.5
Rice cultivation	0.5	0.7	0.2	0.4	0.3
Agricultural soils	14.4	17.4	16.6	16.8	17.2
Prescribed burning of savannas	6.6	13.2	8.7	11.1	11.1
Field burning of agricultural residues	0.3	0.4	0.4	0.3	0.3
Total	87.7	95.5	87.9	95.6	101.2
Land use, land use change and forestry (LULUCF)					
Forest land	−42.8	−47.9	−51.5	−43.1	−38.8
Other land use change	124.5	60.5	48.2	44.5	44.5
Total LULUCF	81.6	12.6	−3.2	1.4	5.7
Total agriculture and LULUCF	169.3	108.1	84.7	97.0	107.0

Other parts of the economy – which has been increasing emissions at 3–4% per year since 1990 – will need to share a much greater burden with agriculture in meeting future targets. Australia signed the Kyoto Protocol in December 2007 and indicated it aspired to a 60% reduction in GHG emissions by 2050. Intermediate targets are not yet specified but the Australian emissions trading scheme (ETS) for carbon will commence in 2010. This will greatly accelerate the development of carbon markets, which are already in operation internationally and in NSW through the GHG Abatement Scheme and the Greenhouse Friendly programme (ABARE 2007). New Zealand commenced an ETS with the forestry sector in January 2008 and will progressively introduce other sectors each year until agriculture joins in 2012. The ETS creates opportunities for farmers to participate in the carbon market both to provide (e.g. through land dedicated to regeneration of indigenous vegetation or exotic forest plantings) and potentially to purchase (e.g. to offset livestock emissions) credits. At this stage under the New Zealand ETS, livestock emissions will be managed at the processor-level but the mechanisms by which this can be cost-effectively achieved and provide incentives and rewards to farmers for GHG management are not yet clear (ABARE 2007, p. 506).

Drivers for dairy farmers to respond to climate change

Climate change is an important but not the only factor driving change towards more eco-friendly and sustainable dairy production (Harris 2007; Figure 1). Food safety, animal welfare and environmental regulations have been shaping farm practice and supply chain credence for at least two decades. However, the concerns associated with climate change and new Government policy to reduce GHG emissions have given these initiatives added impetus and widened the focus for sustainable dairy production.

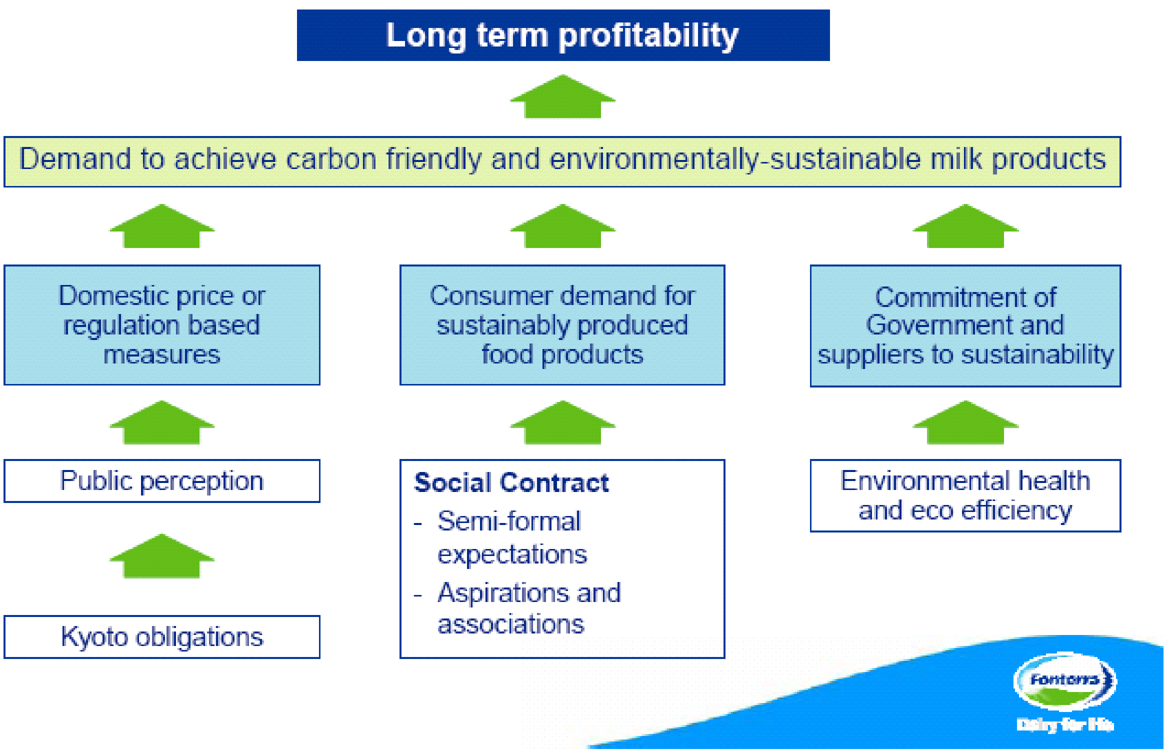

Figure 1: Drivers for the dairy industry to respond to climate change (Source: Harris 2007).

Calculating a carbon footprint

An environmental footprint is calculated by preparing a ‘cradle to grave’ life cycle analysis (LCA) where all of the ‘*potential environmental impacts of a product are assessed by quantifying and evaluating the resources consumed and emissions to the environment at all stages of its life cycle -*

from extraction of the resource through the production and use of raw materials, the product itself, and the use of the product to its reuse, recycling or final disposal' (Basset-Mens et al. 2007, p. 2; Guinee et al. 2002). A carbon footprint is a sub-set of this and incorporates the product's (or depending on the unit of study, farm's) GHG and energy use (Basset-Mens et al. 2007). The footprint is expressed as carbon dioxide (CO_2) equivalents (where nitrous oxide is 310 CO_2 equivalents, and methane (CH_4) is 21 CO_2 equivalents). GHG emissions from energy-used (Figure 2) is classified as being either direct (e.g. electricity, fuel) or indirect (e.g. urea fertiliser) (Ledgard et al. 2007). The milk production system has a marked effect on the size of the farm's footprint – as Basset-Mens et al. (2007) showed, intensification of milk production through greater use of urea and/or maize also increased the farm's footprint relative to a low-input pasture system (Figure 3). In a New Zealand case study for cheese, Ledgard et al. 2007 estimated that urea contributed 41%, electricity 28% and fuel use 6% of the total energy used to put milk in the vat for the typical farm in 2004/05. Of total energy use, 87% was expended on-farm for production activities and 13% off-farm for grazing and bought-in feed. Total GHG emissions of 0.94 kg CO_2-equivalent/kg milk comprised 57% methane, 33% nitrous oxide and 10% carbon dioxide.

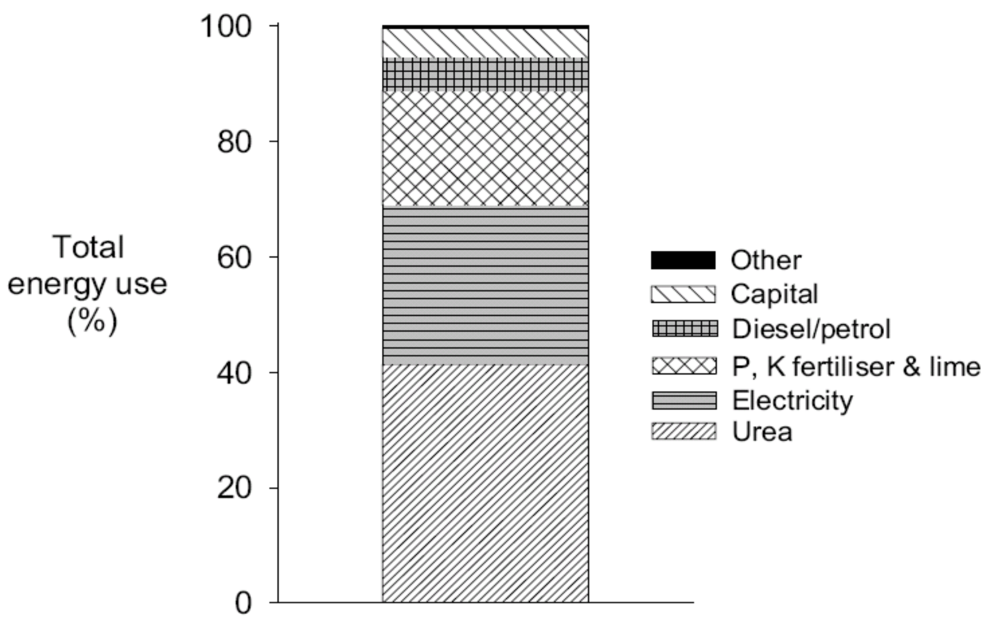

Figure 2: Sources of energy used by the average 2005 New Zealand dairy farm from production to milk-in-the-vat. (Source: Ledgard et al. 2007).

The LCA for a dairy product, such as cheese, incorporates energy use and GHG emissions during processing, transport, distribution and consumer travel as illustrated in Figure 4 for New Zealand cheese.

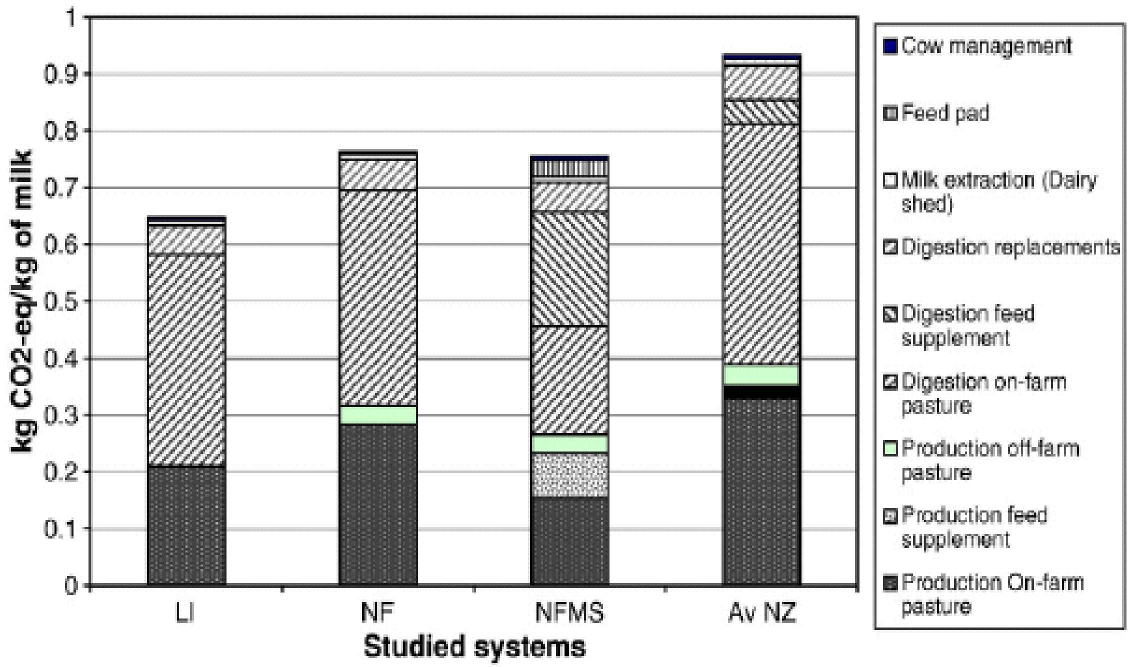

Figure 3: Sources of GHG emissions and direct energy use (kg CO2-eq/kg milk) for different pasture-based production systems (LI = Low input, NF = Nitrogen fertiliser, NFMS = N-fertiliser plus maize silage and an average (Av NZ) system). (Source: Basset-Mens et al. 2007).

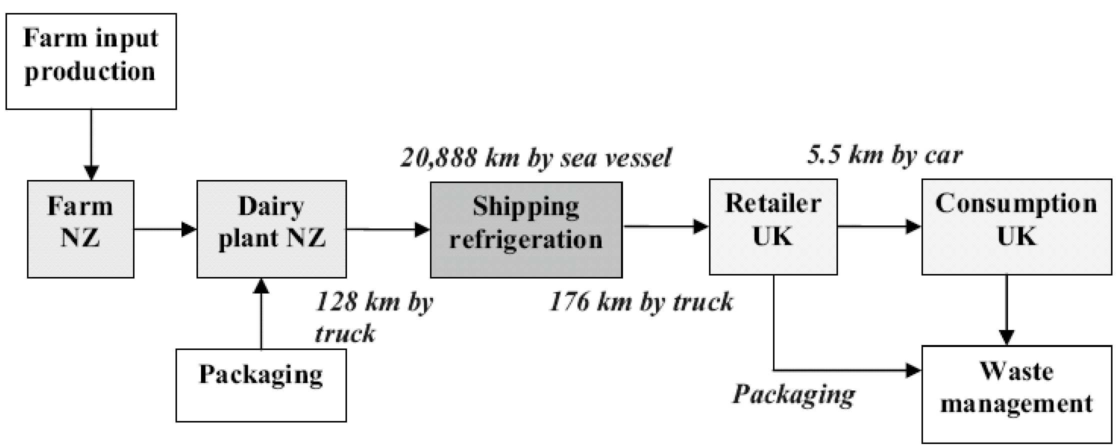

Figure 4: Components in the life cycle of New Zealand cheese with one-way distances from farm to plate (Source: Ledgard et al. 2007).

'Food miles', a termed coined by the SAFE Alliance in 1994 (Paxton 1994, p. 1), refers to the total energy consumed in this 'pasture to plate' chain (Mila I Canals et al. 2007). In its original use the term had a broader interpretation to include wider social and ecological implications of international food trade than has become common usage (McLaren 2007). McLaren (2007) provided a full review of food miles and their implication for food industries remote from the marketplace, especially for a distant exporting country such as New Zealand. She noted that food miles variously embody climate change, air quality, traffic efficiency, local economies and communities, biosecurity, animal welfare and food security. Some have labelled food miles as protectionist but as listed above this is a simplistic view and, now that more LCA reports are showing local market produce is not necessarily more eco-efficient, not credible (McLaren 2007).

Life cycle analyses for alternative dairy farm systems in New Zealand and the EU have revealed that the former are relatively efficient (Basset-Mens et al. 2007) and that when these are integrated with modern shipping transport, the food miles of New Zealand products can be lower than those produced in-market (Ledgard et al. 2007, Saunders & Barber 2007).

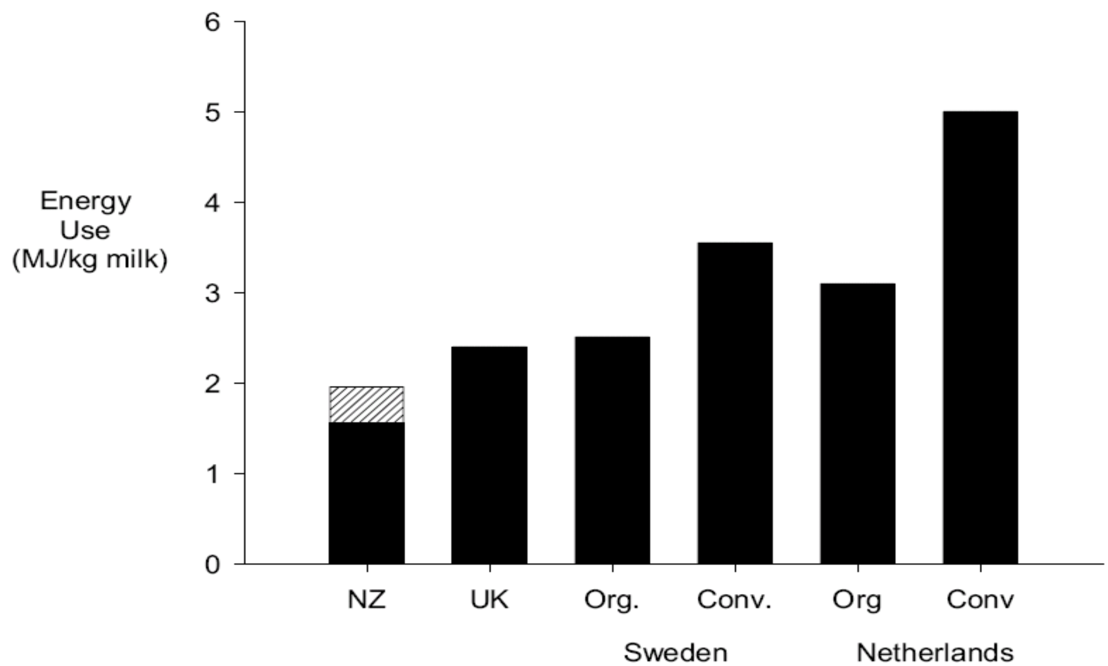

Figure 5: Comparison of GHG emissions to the milk-in-the-vat stage for dairy production systems in New Zealand (NZ), the United Kingdom (UK) and for conventional (Conv.) and organic (Org) farms in Sweden and The Netherlands. Food miles to the UK market are shown by the hatched section of the NZ bar. (Source: Basset-Mens et al. 2007).

The carboNZero programme

The carboNZero programme was developed by Landcare Research to measure, manage and mitigate GHGs and direct energy use for businesses, households and individuals (carboNZero 2007, Smith et al. 2006). It services users across sectors through easy-to-use Web applications, a certification process, and a suite of licensable certification marks. The programme enables verification of an organisation’s emissions inventory (and reductions achieved), and a certification standard for marketable carbon neutrality. The programme has led to many firsts in carbon-neutral products and services including for wine, energy, travel, and public services.

Where mitigation is required carbon credits can be acquired through Landcare Research's EBEX21 scheme (EBEX21 2007). Under this programme landowners covenant land for 100 years to allow reversion and establishment of indigenous vegetation. The carbon inventory of the land is assessed at regular intervals and credits sold to firms and organisations that are unable to completely manage down their GHG emissions. This creates a dual benefit – the landowner is recompensed for restoring indigenous biodiversity (often on lower quality, unstable hill land) and the firm achieves carbon neutrality. To avoid 'greenwash' the carboNZero programme puts a high emphasis on implementing steps to reduce energy use and GHG emissions rather than simply offsetting the present footprint. Significant cost savings and improvements in eco-efficiency have been documented by organisations completing the programme.

Research is in progress to obtain emission factors and other data to apply the carboNZero programme more widely in the pastoral, horticultural and wine sectors. Calculators to estimate a farm household's footprint are on the carboNZero website (http://www.carbonzero.co.nz/).

Practical options for farmers to consider

Customer expectations and regulations are evolving rapidly with respect to climate change, and dairy farmers should keep a close watch on developments. They should become familiar with practices and technologies that can both affect and lower on-farm energy use and GHG emissions. With energy costs increasing and more extensive carbon markets forthcoming, steps to improve energy efficiency and minimise GHG should be explored. On New Zealand dairy farms cost savings of up to 20% can be obtained in electricity use (see www.Fencepost.com) and fuel use can be lowered through more fuel efficient plant and equipment, and regular repairs and maintenance. Ledgard et al. (2007), Harris (2007) and ABARE (2007) provide indicators where farmers could lower GHG including through herd nutrition, fertiliser policy, crop rotations and managing seasonality.

Summary

Customers, particularly but not exclusively in the EU, are seeking food and beverage products with low carbon footprints and – as part of their quest to satisfy consumer-demand, exercise corporate social responsibility (CSR), reduce reliance on fossil fuels, and meet regulatory requirements – food processor and other actors in supply chains are looking to manage their energy use and GHG emissions. The many gaps in knowledge about the footprint of dairy systems and products will be filled over the next few years. Work to date shows that exporting countries like New Zealand can be more eco-efficient and have lower food miles than in-market producers. Technologies and management are available to farmers to reduce the carbon footprint of dairying and this will be spurred on by the introduction of ETS and national targets for GHG reduction in Australia (and New Zealand). The carboNZero programme provides a rigorous framework for measuring, managing and mitigating a firm's carbon footprint and for this to be certified through independent audit. It is concluded carbon-neutral dairy products can be a reality and that some are likely to be available to consumers in the near-term.

References

ABARE 2007. Climate change. *Australian Commodities Report 14*. Pp. 494–515.

Basset-Mens, C.; Ledgard, S.; Boyes, M. 2007. Eco-efficiency of intensification scenarios for milk production in New Zealand. *Ecological Economics* (in press).

carboNZero 2007. The carboNZero programme. http://www.carbonzero.co.nz/, viewed 20 January 2008.

EBEX21 2007. Carbon credits from forest regeneration projects. http://www.ebex21.co.nz/, viewed 20 January 2008.

Harris, B. 2007. *Climate change and carbon footprints: Fonterra – treading lightly*. Presentation to the World Dairy Summit 2007 (2 October), International Dairy Federation.

Grove Mill 2008. About carboNZero. http://www.grovemill.co.nz/page/About-carboNZero, viewed 20 January 2008.

Guinee, J.B. et al. 2002. *Life cycle assessment: An operational guide to ISO standards.* Centre of Environmental Science, Leiden University, Leiden, The Netherlands.

IPCC 2007. *Climate change 2007*: Synthesis report, viewed at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf , 16 January 2008.

Keogh, M. 2007. Greenhouse compensation: size obviously matters. Quarterly Newsletter, *Australian Farm Institute 4* (3): 3–5.

Ledgard, S.F., Basset-Mens, S.; McLaren, S.; Boyes, M. 2007. Energy use, 'food miles' and greenhouse gas emissions from New Zealand dairying – how efficient are we? *Proceedings of the New Zealand Grassland Association* 69: 223–228.

McLaren, S. 2007. *Food miles: Fact or fiction?* Paper presented to 'Keep it real conference', Hobart (6–10 August).

Mila I Canals, L.; Cowell, S.; Sim, S.; Basson, L. 2007. Comparing domestic versus imported apples: A focus on energy use. *Environmental Science Pollution Research* 14: 338–344.

Paxton, A. 1994. *The food miles report: The dangers of long distance food transport*. The SAFE Alliance, London.

Saunders, C.; Barber, A. 2007. Comparative energy and greenhouse gas emissions of New Zealand's and the UK's dairy industry. *Research Report # 297*, AERU, Lincoln University.

Smith, A.; Stancu, C.; McKenzie, S. 2006. *Food miles – practical steps for New Zealand exporters*. Business and Sustainability Series, Briefing paper 3, ISSN 1177-3731.

Tesco 2007. Corporate social responsibility: Climate change. http://www.tescocorporate.com/page.aspx?pointerid=5EE98B2713A047E6873CF95246F423D7 , viewed 20 January 2008.