Crying Over Spilt Milk: A Critical Assessment of the Ecological Modernisation of New Zealand's Dairy Industry

M. Jay
Department of Geography, University of Waikato, New Zealand

M. Morad[1]
Department of Urban, Planning and Leisure Studies, London South Bank University, UK

Ecological modernisation theory holds that capitalist economic structures can be transformed to avoid long-term environmental damage, through the introduction of modern environmental technologies and reforming modern institutions. Empirical evidence, drawing on ecological modernisation practices in some European and North American contexts, lends support to this view. However, it is not clear yet whether the practices of ecological modernisation can be applied with equal success to agricultural industries, based on farmers as multiple producers. The New Zealand dairy industry faces political and commercial pressure to improve its environmental performance while maintaining commercial competitiveness in a global marketplace. In response to such pressures, the industry's main umbrella organisation (Fonterra) has taken steps to improve the environmental management practices of the farmers who supply milk. The New Zealand dairy industry offers an example from which to assess the relevance of economical modernisation theory, as it applies to a large, technologically sophisticated, environmentally motivated company, representing the production practices of more than 11,000 dairy milk suppliers.

Keywords New Zealand dairy industry, ecological modernisation, environmental policy models

[1] Address correspondence to M. Morad Department of Urban, Planning and Leisure Studies, London South Bank University, London SE1 0AA, UK. E-mail: moradm@lsbu.ac.uk

Published in *Society and Natural Resources*, 20 (5), 2006

New Zealand is the world's largest exporter of milk and milk products, accounting for nearly a third of the international free-trade (MAF 2003, 17). The industry faces political and commercial pressure to improve its environmental performance, while maintaining competitiveness in a global marketplace. As a consequence of its environmental impacts, dairy farming has received widespread public criticism over the past decade. The industry has responded by bringing environmental concerns within the ambit of dairy farm management.

The aim of this paper is to assess ecological modernisation theory as an environmental policy model, in the light of New Zealand's dairy industry practices. The paper will critically assess some of the recent debates about ecological modernisation. It will briefly describe the nature and practice of dairying in New Zealand, and the tensions between environmental management and global economic pressures that drive the industry's production focus. The authors will discuss the difficulties of controlling non-point source pollution of water resources, and the problems of directing farm and land use management by farmers as multiple resource users.

The New Zealand dairy industry is a worthwhile example from which to assess ecological modernisation theory, because it is based on highly sophisticated technological and management structures; and under the impetus of market competition, the industry faces pressure to improve environmental performance. Mol (2002) has suggested that in a global context, there are trends which point to a 'taming of capitalism' including the development of multilateral or supra-national environmental organisations, trading agreements that incorporate quality standards and environmental protection, and the strengthening of global civil society.

While most of these features apply in the New Zealand case, the continuing decline of water quality in parts of the country suggests that practices of ecological modernisation may be unable to prevent cumulative environmental decline in the face of economic imperatives. The example of the New Zealand dairy industry

(arguably the biggest polluter industry in the country) suggests, firstly, that practices intended to reduce environmental impact may be difficult to maintain in an industry involving multiple actors; and, secondly, ecological modernisation may be insufficient to counteract incremental environmental effects of land use intensification within a democratic state.

Environment and Ecological Modernisation

As a term, Ecological Modernisation has been variously applied to several separate phenomena (Hertin and Berkhout 2003). They include a growing body of theoretical literature in environmental sociology, a normative theoretical framework for environmental policy analysis (Hajer 1995) and political and industrial programmes concerned with improving the environmental performance of industry, through the application of rational environmental policies. As both theory and practice, ecological modernisation is concerned with relations between economic development and environment.

Many theorists describe ecological modernisation as a general theory of environment induced social change (Mol and Spaargaren 2004). By this he means that environmental crises provide the impetus for social institutions to change. The argument in its strongest form is that, as economic development continues, a phase is reached where quality of the environment begins to take precedence over values of production and material consumption. In a less emphatic form, the argument is that ecological rationality is compatible with capitalist production and consumption, where technology and rational economic measures incorporate environmental externalities (Gouldson and Murphy 1996; Mol and Spaargaren 2004).

As a theory, ecological modernisation "tries to understand, interpret and conceptualize the nature, extent and dynamics of this transformation process" (Mol 2002, 93). Theoretical approaches have included analyses identifying how modern societies construct the environment (Hajer 1995); how social and economic change

impacts on the environment and environmental relations (Gouldson and Murphy 1996; 2000); and understanding the social and economic institutions that promote or resist environmental sustainability (Buttel 2000; Hertin and Berkhout 2003; Gouldson and Murphy, 1996; 2000; Jamieson and Baark, 1999). More recently, theorists have broadened their analysis to include the role of consumption as a driver of production (Carolan 2004; Mol and Spaargaren 2004). As a practice, ecological modernisation, seeks to develop methods and models for reducing environmental impacts, through such means as emissions and waste reduction, resource substitution and minimisation of resource consumption. Examples of representative practices associated with ecological modernisation include “strategic environmental management”, “cleaner production”, “industrial life cycle analysis”, and “environmental quality assessment” systems such as ISO 14001.

As proponents of a body of theory with normative leanings, ecological modernisation theorists formulate policies which encourage or prescribe environmental improvements. As a social practice, ecological modernisation methods point to the means by which industrial society can make a transition toward ecologically sustainable production. In the words of one proponent (Mol 2002, 98-99) ecological modernisation theorists “seek to contribute to the development of normative political trajectories of transformation that ought to take place in order to turn the tide of environmental destruction”.

Much of the analytical and descriptive work of ecological modernisation has related to issues of particular relevance to the industrialised urban societies of Europe. It reflects the fact that European countries have been at the forefront of developing rational environmental practices to cope with such issues as energy development (through energy saving technologies), air pollution, waste recycling and disposal, transport (through the development of cleaner technologies). In contrast to the emphasis on urban-based industries, relatively less attention has been given to farming and agriculture by ecological modernisation theorists, although a significant

body of literature has emerged over the past few years on some of the damaging environmental effects of intensive agriculture within the European Community (Benton et al. 2003; Buller et al. 2000; Potter 1998; Stoate et al. 2001).

A recent analysis that examines agriculture directly in the light of ecological modernisation practices is that by Jokinen (2000). The latter discussed the differing normative assessments of the impacts of agri-environmental policies in Finland, since joining the European Union in 1995. Jokinen notes that agricultural and environmental policy-makers evaluate the effects of uptake of agri-environmental policies by farmers differently. Agricultural policy-makers, who generally view the changes in the light of concerns about the survival of domestic agriculture and the vitality of rural areas, regard relative improvements as satisfactory; and that farming is improving in its environmental performance. Environmentalists, however, tend to view the changes pessimistically in the light of environmental absolutes – i.e., whether or not the changes have made absolute environmental improvements. They note that agriculture remains a major contributer to coastal pollution and regard farming as the main cause of the problem.

Green et al. (2003) have addressed the food production system as a whole. They focus on the role of technological innovation in relation to the broad scope of food production systems from farm to factory, and food distribution and consumption. As proponents of ecological modernisation, they make the point that the environmental effects of agriculture must be judged not merely on agricultural production, but in relation to the environmental impacts of the total “food production and consumption system”. In this light, they suggest that “new industrial” agricultures involving technologies of crop management, genetic modification, and non-soiled methods of production may impose fewer environmental costs than industrialised modern or traditional forms of production.

Ecological modernisation theory has been criticised for its persistent technological optimism (Mol and Spaargarn 2000), ignoring the dynamics of power

which can (and frequently do) subvert environmental reform (Kiel and Desfor 2000), for ignoring issues of equity (Gibbs 2000), and for underplaying the nature and scale of social changes required to move to more sustainable forms of development (Blowers 2000; Gibbs 2000). In the light of such criticisms, ecological modernisation theorists have tempered early claims about the inevitability of ecologically modernist development (Mol 2002). Christoff (1996, 497) reflected the fear of many critics of ecological modernisation that it "may serve to legitimise the continuing instrumental domination and destruction of the environment, and the promotion of less democratic forms of government, foregrounding modernity's industrial and technocratic discourse over its more recent, resistant and critical ecological components".

The authors of this paper additionally argue that, in relation to agriculture, practices of ecological modernisation may not be effectively workable, since the social, economic and bio-physical complexities of the real world often circumvent rational management ideals and institutional procedures. Multiple individual producers, such as dairy farmers, are subject to varying pressures of family, community, local environmental differences and economic contingency. In the context of social, community and environmental diversity, it may not be possible to devise environmental policy measures that counter the effects of cumulative growth in production. Furthermore, under an imperative to minimise production costs in the face of global marketplace competition, ignoring the long-term externalities of environmental deterioration may be the most rational action for individuals and industry.

The New Zealand Dairy Sector and the Environment

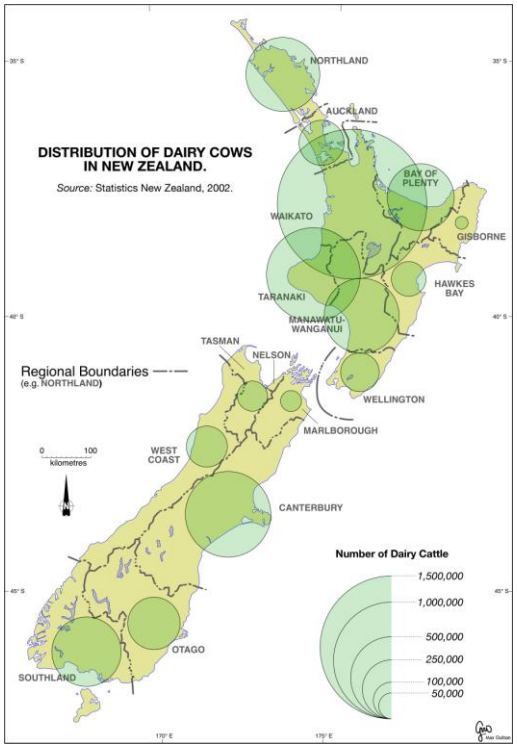
New Zealand's moist and equable climate allows almost year-round grass growth over most of the country. Cows are reared outdoors with grass or hay as their main feed. The ability to grow grass at relatively low cost year-round is a key economic advantage in the global marketplace. New Zealand dairy farms are dependent upon

a technological support structure of great sophistication and scale. The milking machinery in the dairy shed is a significant capital complex, while the technological infrastructure of plant science and animal breeding that farmers depend on is highly technical and scientific. Milk is collected daily by tankers and manufactured into more than 600 products. Farmers are given daily information on the quantity and quality of the milk they supply, and must conform to a host of regulatory requirements related to milk hygiene, animal welfare and environmental practices.

The average New Zealand dairy cow produces 315 kilograms of “milk solids” per annum and as much natural waste as 14 people (LIC 2004). The environmental consequences of dairying include pollution of surface and groundwater; destruction of wetland and native lowland forest for farm development; indirect damage to freshwater and estuarine habitat through contamination and nutrient pollution of surface and groundwater; loss of native biodiversity (through damage or destruction of native habitat); soil erosion, soil contamination and damage to soil structure; and discharge of greenhouse gases (PCE 2004; Boothroyd, et al. 2000; Burns et al. 2000; EW 1998; MfE 1997). Results from recent studies indicate that water quality in lowland streams throughout New Zealand is generally poor, particularly in areas of heavy dairy farming (Larned et al. 2003, as cited by PCE 2004). Within the Waikato region (see Figure 1), which supports 35% of the national herd, non-point source pollution of all major rivers and streams is closely associated with the distribution and density of dairy cattle as is also true of faecal contamination (Boothroyd et al. 2000; Davies-Colley et al. 2001; EW, 1998; Vant et al. 2000). Contaminants in some parts of the country exceed World Health Organisation standards. In most parts of the country, the main pollution is from non-point sources (i.e. from fields rather than milking sheds). In most areas non-point source pollution from livestock and pasture run-off exceeds pollution from point sources such as town sewage works and factory waste discharges (Collins 2002).

Published in *Society and Natural Resources*, 20 (5), 2006

FIGURE 1 Distribution and density of dairy cows



The scale and intensity of dairy farming in New Zealand is driven by global economic circumstances that influence the industry as a marketing and manufacturing enterprise. Dairying generates more than 20% of export earnings and 7% of national income (Fonterra 2003; PCE 2004). Between 90 and 95% of dairy production is exported (MAF 2003) more than three quarters of it in the form of bulk commodities (milk powder, butter and casein) and the rest as cheese and speciality ingredients. About a third is exported to high-value markets in North America, Europe, Australia and Japan; and the rest to the middle income countries of Asia, Central America, the Middle East and elsewhere (MAF 2003). Exclusionary trade practices by North American and European countries, and the importance of such middle-income countries for two thirds of export income, means that the industry is constrained to maintain a strategy of low-cost production.

Fonterra Co-operative Group is the largest of New Zealand's three extant dairy companies, with more than 11,000 farmer members. As the world’s largest

exporter of dairy products on the open market, it comprises a manufacturing infrastructure, research and product development facilities, and a world-wide network of subsidiary companies (Fonterra 2003). Although co-operatively owned by the farmers who supply milk to the company, it is strongly influenced by global market trends and processes. Global trends such as the increasing power of retail firms in food chains have influenced the company to consolidate its own power and international advantage, through amalgamations and strategic alliances with large domestic or multinational companies, such as Arla and Danone in Europe, and Dairy Farmers of America.

Fonterra's policy and decision-makers are sensitive to customer perceptions and marketing image (Fonterra 2003). International competition has driven improvements in the company's manufacturing and distribution processes. Poorly performing factories have been closed down and manufacturing shifted to fewer, larger, more efficient and environmentally cleaner factories. Waste streams have been reduced at key factories, by transforming whey and lactose into commercial products. The company nowadays talks about 'integrating the cow to customer value chain' (Fonterra, 2005) and has sought to reduce operating expenses and improve logistics efficiency. To improve on-farm environmental management, the company has adopted initiatives designed to encourage farmers to improve on-farm environmental management. These have consisted of videos and pamphlets on cleaner production methods for farmers, and for river catchment monitoring studies in the major dairying regions. These monitoring studies are intended to identify links between farm management practices and environmental impact. The company has also been partner to an agreement with central and regional governments to introduce policies encouraging farmers to fence off streams and rivers, and provide stock crossings of streams only at controlled points. These policies also include fencing off significant wetlands, encouraging appropriate disposal of dairy shed effluent, and management of nutrients applied to farm soils (MfE 2003).

Published in *Society and Natural Resources*, 20 (5), 2006

However, there are significant practical difficulties in persuading more than 11,000 suppliers to follow strict environmental performance standards. In practice, farmers differ greatly in their capacity and willingness to implement environmental improvements. Almost all environmental improvements involve economic costs, whether in the form of improved effluent disposal facilities, protection of waterways, limitations on stock density or limiting stock access to wetlands or areas of native vegetation. Farms differ in terms of topography (e.g., presence or absence of streams, underlying soil conditions), financial status (e.g., levels of debt, amount of economic farm surplus), and ownership status (e.g., absentee owner, shared or company ownership). Likewise, farmers as individuals differ in their willingness and ability to comply with environmental measures. Young farmers may have more openness to the necessity, but less financial capacity to implement environmental measures. From Fonterra's perspective as a co-operative, farmers are owners as well as shareholders; and the company cannot risk alienating too many owner-shareholders by imposing draconian measures.

Fonterra is obliged to find markets for the milk which its suppliers produce. But because of the global organisation of milk production and marketing, already compounded by protected North American and European markets, Fonterra is compelled to focus its operations on the manufacture of products aimed at middle-income countries. As commodity products have little to distinguish them in market terms (New Zealand milk powder or casein are not appreciably different from the product of any other dairy producing nation) the opportunities to earn a premium from dairy produce are constrained. In such circumstances, New Zealand's dairy industry leaders have been forced to conclude that "leverage" in the global marketplace depends on size and scale. In short, New Zealand's dairy sector may have little choice but to follow a path that will continue to minimise the cost of production. In stark practical terms, minimising dairy production costs often comes down to minimising the environmental component of cost.

Published in *Society and Natural Resources*, 20 (5), 2006

From a public policy perspective, the practicalities are equally complex. There are 14 regional councils in New Zealand charged with responsibility for regulating environmental management of natural resources. These vary in population, rural-urban ratios, wealth, local priorities, and organisational capacity. An official study (MfE 1999) found that regional councils differed greatly in their approach to dairy farm effluent control, from councils that place virtually no controls, to ones that are relatively strict. They also varied in the extent to which they monitored and enforced the implementation of farm effluent controls. Key reasons for policy differences between councils included perception of relative environmental risk from dairy effluent (which to a considerable extent depends on the quality, quantity, and uses of receiving waters); judgements about what is feasible in the circumstances of the region (some regions and their farmers being richer than others); the history of environmental management within the region (some regional communities being historically more used to regulation); and judgements about the efficacy of different methods of effluent disposal.

The foregoing description of dairying in New Zealand illustrates how the complexities of daily practices make ecological modernisation of an agricultural industry (involving thousands of actors) somewhat problematic. These complexities include the different motivations and capacities of individual producers, variation in the nature and difficulty of the task, given variations in physical landscape and financial capacity, uncertainties and argument about appropriate technologies, varying political and administrative motivation and capacity of regulatory authorities, and the ambivalent goals of the parent companies which face competitive economic pressure to minimize costs of production.

Published in *Society and Natural Resources*, 20 (5), 2006

Conclusion: Winning Some, Losing Many?

Ecological modernisation theorists generally propose that strategic environmental management needs to 'ecologise the economy and economise the ecology'. Such normative elements of the theory are concerned with developing criteria and policy models for 'internalising the externalities' of growth. However, within the specific context of the NZ dairy industry, the authors argue that there are major practical and political problems in internalising all the environmental effects of dairying, and off-setting the consequences of intensification. These difficulties relate to the nature of the environmental consequences (diffuse, cumulative and long-term), to problems of information and scientific uncertainty about the consequences of different forms of management (for example, spray irrigation of dairy shed effluent onto land versus discharge into effluent ponds), and to the fact that environmental consequences may take many years to become manifest. The difficulty is further compounded by the fact that farmers often assess the consequences of management based on what happens within their property, rather than the cumulative effect to a hydrological catchment as a whole.

Despite the effort to promote new environmental management policies and practices by the dairy company and regional government, the continuing decline of water quality in many parts of New Zealand suggests that ecological modernisation has not, to this point, succeeded in preventing gradual, but unremitting, environmental deterioration in areas suitable for dairying and intensive farm production. The deterioration comes both because, in a democratic society, it is not easy to ensure appropriate technologies and management compliance by all players; and because improvements in environmental management by farmers are invariably off-set by intensification of production, or the conversion of lower intensity land uses such as sheep and beef farming or forestry to higher intensity uses such as dairying, cropping and horticulture.

Published in *Society and Natural Resources*, 20 (5), 2006

While improved technology and management may offer the potential to overcome environmental constraints, agricultural industries are not merely a product of the technology they employ, since they are also institutionally complex and involve not only markets and regulatory institutions, but also individual producers, with own set of values, assumptions and priorities. The New Zealand dairy industry is an institutional complex that involves multiple inter-locking systems of farmer education, financial institutions, market competitors and state policies that promote growth with one hand but seek to protect public health and environmental quality with the other. A major problem for New Zealand society nowadays is how to weigh the economic benefits (and the lifestyle implications) of increased dairy production against the environmental costs of reduced water quality and loss of native biodiversity. While the benefits of dairy exports to the national economy are large, the environmental costs tend to be regionally localised, and many of the environmental costs remain subtle, complex, long-term and hard to quantify.

However, this complexity presents both a challenge and an opportunity for ecological modernisation policies. As Marsden observed (2004, 143), a virtue of ecological modernisation theory is that it "brings forth a new question. That is, how could/should the contested relationships between civil society, the state and the market be re-arranged in ways which would usher in different types of autonomous development which would incorporate ecological worth?". It is the authors' view that a new culture of ecological management has begun in a slow, fledgling and uneven way, with significant consequences for the future of New Zealand's dairy industry.

Acknowledgements

The authors wish to thank Fonterra and MAF for their cooperation.

References

Benton, T.G., Vickery, J.A., and J.D. Wilson, 2003. Farmland biodiversity: is habitat heterogeneity the key? *Trends in Ecology and Evolution*. 18 (4), 182-188.

Boothroyd, I.K.J., Crush, J.R., Ledgards, S.F., Huser, B., and N.Selvarajah. 2000. Impact of nitrogen flows from agricultural production environments on non-agricultural ecosystems in the Waikato region, New Zealand. In Craig, J.L., Mitchell, N., and D.A. Saunders (Eds), *Conservation in Production Environments, Managing the Matrix*, 236-245. Chipping Norton, Australia: Surrey Beatty and Sons Pty Ltd.

Buller, H., Wilson, G.A., and A. Holl. 2000. Agri-environmental Policy in the European Union. *Perspectives on Europe, Contemporary Interdisciplinary Research*. Aldershot, UK: Ashgate.

Burns, B., Barker, G.M., Harris, R., and J. Innes. 2000. Conifers and cows: forest survival in a New Zealand dairy landscape. In Craig, J.L., Mitchell, N., and Saunders, D.A., (Eds), *Conservation in Production Environments, Managing the Matrix*, 26-34. Chipping Norton, NSW, Australia: Surrey Beatty and Sons Pty Ltd.

Buttel, F., H. 2000. Ecological modernisation as social theory. *Geoforum* 31, 57-65.

Carolan, M. S. 2004. Ecological modernization theory: what about consumption? *Society and Natural Resources*. 17, 247-260.

Christoff, P. 1996. Ecological modernisation, ecological modernities. Environmental Politics 5(3), 476-500.

Collins, R. 2002. *Management Strategies to Mitigate Faecal Contamination Inferred from Analysis of Data from the Waikato Region*. MAF Technical Paper N: 2002/15. Prepared for Ministry of Agriculture and Forestry, Wellington, New Zealand.

Davies-Colley, R.J., Nagels, J.W., Donnison, A.M. and R.W. Muirhead, 2001. Faecal contamination of rural streams – implications for water quality monitoring and riparian management. *43rd annual conference of the New Zealand Water and Wastes Association*, 10th – 21st September, 2001. Wellington, New Zealand.

EW (Environment Waikato). 1998. *Waikato State of the Environment Report 1998*. Hamilton, New Zealand: Environment Waikato (Waikato Regional Council).

Fonterra, 2003. About Fonterra. Internet homepage, Fonterra, Auckland, New Zealand. http://www.fonterra.com/default.jsp (Accessed 18/8/03).

Fonterra, 2005. To Lead in Dairy. Annual Report 04/05. Fonterra Corporate Centre, Auckland, New Zealand.

Fonterra, 2006, Environment and Community. Fonterra, Auckland, New Zealand. http://www.fonterra.com/content/environment/casestudies/default.jsp

Gibbs, D. 2000. Ecological modernisation, regional economic development and regional development agencies. *Geoforum* 31, 9-19.

Gibbs, D. 2003. Reconciling economic development and the environment. *Local Environment* 8(1): 3-8.

Gouldson, A. and J. Murphy. 1996. Ecological modernization and the European Union. *Geoforum 27*(1): 11-21.

Gouldson, A. and J. Murphy. 2000. Environmental policy and industrial innovation: integrating environment and economy through ecological modernisation. *Geoforum* 31, 33-44.

Green, K., Harvey, M. and A. McMeekin. 2003. Transformations in food consumption and production systems. *Journal of Environmental Policy and Planning* 5(2): 145-163.

Hajer, M. 1995. *The Politics of Environmental Discourse: Ecological Modernisation and the Policy Process*. Oxford: Oxford University Press.

Hertin, J. and F. Berkhout. 2003. Analysing institutional strategies for environmental policy integration: the case of EU enterprise policy. *Journal of Environmental Policy and Planning* 5(1): 39-56.

Jamison, A. and E. Baark. 1999. National shades of green: Comparing the Swedish and Danish styles in ecological modernisation. *Environmental Values* (8): 199-218.

Published in *Society and Natural Resources*, 20 (5), 2006

Jokinen,2000. Europeanisation and ecological modernisation: agri-environmental policy and practices in Finland. In A.P. J. Mol, and D.A. Sonnenfeld (Eds.) *Ecological Modernisation Around the World*, 139-167. London: Routledge.

Kiel, R. and G. Desfor. 2003. Ecological modernisation in Los Angeles and Toronto. *Local Environment* 8(1): 27-44.

Larned, S., Scarsbrook, M., Snelder, T. and N. Norton. 2003. *Nationwide and regional state trends in river water quality 1996-2002*. NIWA client report CHC2003-051. Christchurch, New Zealand: National Institute of Water and Atmosphere.

LIC (Livestock Improvement Corporation). 2004. *Dairy Statistics 2003-2004*. Hamilton, New Zealand: Livestock Improvement Corporation Ltd.

Marsden, T. 2004. The quest of ecological modernisation: re-spacing rural development and agri-food studies. *Sociologia Ruralis*. 44(2): 129-146.

MAF (Ministry of Agriculture and Forestry). 2003. *Contribution of the Land-based Primary Industries to New Zealand's Economic Growth*. Wellington, New Zealand: Ministry of Agriculture and Forestry.

MfE (Ministry for the Environment). 1997. *State of New Zealand's Environment 1997*. Wellington, New Zealand: Ministry for the Environment.

MfE (Ministry for the Environment). 1999. *Resource Management Act Practice and Performance: Are Desired Environmental Outcomes Being Achieved?* Wellington, New Zealand: Ministry for the Environment.

MfE (Ministry for the Environment). *Dairying and Clean Streams Accord between Fonterra Co-operative Group, Regional Councils, Ministry for the Environment, and Ministry of Agriculture and Forestry.* Wellington, New Zealand: Ministry for the Environment.

Mol, A.P.J. 2002. Ecological modernization and the global economy. *Global Environmental Politics.* 2(2): 92-115

Mol, A.P. J. and G. Spaargaren. 2000. Ecological modernisation theory in debate: a review. *Environmental Politics*. 9(1): 17-49.

Mol, A.P. J. and G. Spaargaren. 2004. Ecological modernization and consumption: a reply. *Society and Natural Resources*. 17: 261-265.

Murdoch, H. 2002. Dairy farmers oppose accord. *The Nelson Mail*, Local News, 17th December.

PCE (Parliamentary Commissioner for the Environment). 2004. *Growing for Good, Intensive Farming, Sustainability and New Zealand's Environment*. Wellington, New Zealand: Parliamentary Commissioner for the Environment.

Potter, C. 1998. *Against the Grain - Agri-Environmental Reform in the United States and the European Union*. Wallingford, Oxford: CAB International.

Stoate, C., Boatman, N.D., Borralho, R.J., Rio Carvalho, C., and G.R. de Snoo. 2001. Ecological impacts of arable intensification in Europe. *Journal of Environmental Management*. 63: 337-365.

Vant, B., Taylor, A., and B. Wilson. 2000. Land use and river condition in the Waikato region*. Proceedings of Water 2000 Conference, March 2000.* Auckland, New Zealand: New Zealand Water and Wastes Association.

Published in *Society and Natural Resources*, 20 (5), 2006