

A Critical Appraisal Of The Concept Of Ecological Modernisation: A Case Study From New Zealand's Dairy Industry

M Jay¹, M Morad²

¹Department of Geography, University of Waikato, Private Bag 3105, Hamilton, New Zealand

²School of Earth Sciences and Geography, Kingston University, Kingston-upon-Thames, Surrey KT1 2EE, UK, E-Mail: m.morad@kingston.ac.uk

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

EXTENDED ABSTRACT

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 has taken some steps to improve the environmental management practices of dairy farmers. Despite significant effort, however, the dairy sector remains highly influenced by global competition, and continues to subordinate environmental sustainability to economic productivity. Furthermore, government institutions have had limited control over farm management practices, or the extent to which public policies militate against the relentless rise in land use intensification.

As a consequence of its environmental impacts, dairy farming has received widespread public criticism over the past decade. The dairy industry has responded by bringing environmental concerns within the ambit of dairy farm management. The aim of this paper is to assess the concept of ecological modernisation, as an environmental policy model, with reference to New Zealand's dairy industry. The focus of the paper will be on the management of dairy effluent and water quality, because environmental initiatives by the industry and policy actions by regional and central government have focused most strongly on these elements.

Ecological modernisation as a term has been variously applied to several separate phenomena. They include a growing body of theoretical literature in environmental sociology, political and industrial programmes concerned with improving the environmental performance of industry through rational environmental management, 'reconciling economic development and environment'.

Examples of representative practices include 'strategic environmental management', 'cleaner production', 'industrial life cycle analysis', and 'environmental quality assessment' systems such as ISO 14001. Some proponents of ecological modernisation view it as synonymous with sustainable development. According to ecological modernisation theorists, it as a social practice offers the means by which industrial society can hope to make a transition toward ecologically sustainable production. They espouse greener technologies, 'polluter pays', and 'ecological rationality'. Socio-political practices and policies that promote such change should be encouraged, including knowledge-based institutions, innovation and the application of sophisticated new technologies.

However, despite the promise of new environmental management policies and practices by the regional councils and dairy industry, the continuing decline of water quality in many parts of New Zealand suggests that ecological modernisation is unlikely to prevent the gradual, unremitting, environmental deterioration, so long as the main drivers behind agricultural intensification continue. New Zealand is also experiencing a fundamental and seemingly irreconcilable conflict between the economic dynamic of capitalist production for food, and protection of the nation's natural environment and habitats. As critics of official environmental policies have often argued, the current mismatch between green objectives and the planning approach has allowed politicians to claim the possibility of win-win solutions. Policy simulation modelling may thus become politically sensitive if it makes this mismatch between green agendas and the rational planning approach apparent. Set against this stark background, current trends suggest that the ecological modernisation of New Zealand's dairy industry is not likely to compensate for the environmental consequences created by the expansion of the dairy industry.

1. INTRODUCTION

This paper will critically examine some of the recent debates about ecological modernisation. It will briefly describe the nature and scale of New Zealand's dairy industry, the global economic pressures that drive the industry's focus on production, and the political and commercial pressures that prompted the industry to undertake action. It 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 authors will suggest that ecological modernisation practices may reduce environmental damage on a per-farm basis, but is less effective over whole regions or catchments.

'Ecological modernisation' as a term has been variously applied to several separate phenomena (Hertin and Berkhout, 2003). They include a growing body of theoretical literature in environmental sociology, political and industrial programmes concerned with improving the environmental performance of industry through rational environmental policy models, 'reconciling economic development and environment' (Gibbs, 2003). Examples of representative practices include 'strategic environmental management', 'cleaner production', 'industrial life cycle analysis', and 'environmental quality assessment' systems such as ISO 14001. Some proponents of ecological modernisation view it as synonymous with sustainable development (Buttel, 2000, 63); others provide a broader, more-confident discourse developed as 'story-lines'. As Hajer (1995, p. 64) put it:

"Ecological modernization is based on some credible and attractive story-lines: the regulation of the environmental problem appears as a positive-sum game; pollution is a matter of inefficiency, nature has a balance that should be respected; anticipation is better than cure."

2. ENVIRONMENT AND ECOLOGICAL MODERNISATION

According to proponents, ecological modernisation does not assume that ecological sustainability and capitalist production and consumption are incompatible (Gouldson and Murphy, 1996; Spaargaren, 1999). On the contrary, a basic tenet is that, by means of environmental technologies and the transformation of modern institutions, capitalist structures can be transformed to avoid long-

term environmental damage; that ecologically sustainable economic development is not only possible but necessary in order to provide for the expected increase in the human population over the next 50 years (Green et al., 2003). Spaargaren (1999) argues that environmental crises are socially constructed, and as such, they are amenable to analysis and change. He describes ecological modernisation as "a general theory of environment induced social change" (Spaargaren, 1999, p.3). By this he means that environmental crises provide the impetus for social institutions to change. Spaargaren, Mol, and others agree that 'solutions to the problems caused by modernisation, industrialisation, and science can only be solved through more modernisation, industrialisation and science' (Buttel, 2000, p. 62).

For these theorists, ecological modernisation as a social practice offers the means by which industrial society can hope to make a transition toward ecologically sustainable production. They espouse greener technologies, 'polluter pays', and 'ecological rationality' (Carolan, 2004). Socio-political practices and policies that promote such change should be encouraged, including knowledge-based institutions, innovation and the application of sophisticated new technologies. For example, with respect to agriculture, Green et al. (2003) have argued that the environmental effects of agriculture must be judged not only on the basis of agricultural production, but in relation to the environmental impacts of the total 'food production and consumption system' and that in this light, the 'new industrial' agricultures involving technologies of crop management, genetic modification, and non-soil methods of production may impose fewer environmental costs than industrialised modern or traditional forms of production. As noted by Gibbs, (2003), these views fit well with the premise of profitable production, and hence are likely to win co-operation from the business sectors of society as well as political support. Thus, in the circumstances of modern society, ecological modernisation is a more realistic approach to winning environmental gains than the polarising efforts of 'deep green' environmental fundamentalists.

Gouldson and Murphy (2000) have noted the importance of distinguishing between analytical-descriptive and normative-prescriptive dimensions of ecological modernisation theory. As an analytical/descriptive enterprise, ecological modernisation theory is concerned with 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); how social institutions can be improved in their treatment of environmental issues (Jänicke and

Jørgens, 1999); 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).

Much of the analytical/descriptive ecological modernisation perspective is focused on environmental issues that are particularly relevant to industrialised urban societies such as those of Europe. It reflects the fact that European countries have been at the forefront in developing rational environmental practices to cope with such issues as energy development and energy saving technologies, air pollution, waste recycling and disposal, transport, and the development of cleaner technologies. Much less attention has been given to farming and agriculture by ecological modernisation theorists, although there is a significant literature by European scholars on the damaging environmental effects of intensive agriculture within the European Community (Benton et al. 2003; Buller, Wilson and Holl 2000; Potter, 1998a, 1998b; Stoate et al. 2001).

Ecological modernisation theory has been criticised for ignoring those dynamics of power which can (and frequently do) subvert environmental reform (Keil and Desfor), ignoring issues of equity (Gibbs 2000), and underplaying the nature and scale of social changes required to move to more sustainable forms of development (Blowers 2000; Gibbs 2000). As Christoff (1996, 497) points out, ecological modernisation “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”. Criticisms of ecological modernisation are well summarised by a critique of the concepts of sustainable development and environmental management by Escobar (1996, 50) who argues that they are a means by which capitalist institutions and global power structures find new ways to exploit nature under a progressive guise of environmental concern. As he put it:

“The narratives of planning and management, always presented as ‘rational’ and ‘objective’ are essential to developers. A blindness to the role of planning in the normalisation and control of the social world is present also in

environmental managerialism. As they are incorporated into the world capitalist economy, even the most remote communities of the Third World are torn from their local context, redefined as ‘resources’ to be planned for, managed.”

However, put in a wider context, in relation to the environmental impacts of agriculture, ecological modernisation may not necessarily be effective in practice, since the social, economic and bio-physical complexities of the real world often circumvent the rational planning procedures of ecological modernisation.”

3. 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. As Figure 1 illustrates, New Zealand is the world’s largest exporter of milk and milk products (MAF 2003, p. 17). The average New Zealand dairy cow produces 315 kilograms of ‘milksolids’ per annum (LIC 2004), and as much waste as 14 people. In relative terms the 3.8 million dairy cows at the end of the 2003/04 milking season produced as much waste as a human population of 54 million, a striking fact given that New Zealand’s human population was less than four millions in the 2001 census.

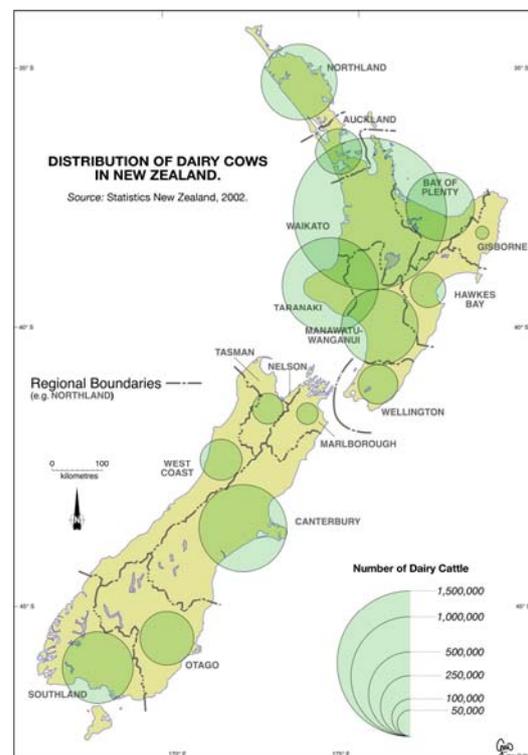


Figure 1. Distribution and density of dairy cows

The environmental consequences of dairying in New Zealand 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 and that this is particularly so in areas of heavy dairy farming (Larned et al. 2003, as cited by PCE 2004; MfE, 1997). Within the Waikato region, 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 (Boothroyd et al. 2000; Davies-Colley et al. 2001; EW, 1998; Vant et al. 2000) as is also true of the pattern of faecal contamination (Collins 2002). Contaminants in some parts of the country exceed World Health Organisation standards. Reasons for the poor quality include faecal contamination from livestock, and nutrient pollution by phosphorus and nitrogen from pasture run-off. In most parts of the country, the main pollution is from non-point sources (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.

As a consequence of its environmental impacts, dairy farming has received widespread public criticism over the past decade (PCE 2004). The dairy industry has responded by bringing environmental concerns within the ambit of dairy farm management. The aim of this paper is to assess the concept of ecological modernisation as it applies to New Zealand's dairy industry as an example of intensive agriculture. The focus is on the management of dairy effluent and water quality, because environmental initiatives by the industry and policy actions by regional and central government have focused most strongly on these elements. However, it is important to note that from a broader environmental perspective there are other issues of equal long-term importance, for example, dairying impacts on soil resources and native biodiversity.

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 of North America, Europe, Australia and Japan, and the rest to predominantly middle income countries of Asia, central America, the Middle East and elsewhere in the world (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 (Ferrier, 2004, pp. 2-6).

Fonterra Co-operative Group, is the largest of New Zealand's three extant dairy companies, with more than 12,000 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 leverage 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. As described later, the company has initiated a series of environmental initiatives to encourage better environmental management by its farmer suppliers and is careful to promote these as a measure of its concern and good citizenship (Fonterra 2003). Environmental and animal welfare consequences of intensive production by the dairy industry during the 1980s and 1990s brought growing consumer and public concern about animal welfare and environmental degradation. The response by different levels of government and the public has developed in stages as the effects became more widely recognised. Responses in the early 1990s tended to be local and mainly involved regional government agencies charged with regional environmental management. As the effects became more widely recognised by the public, and as recreationists, environmental groups, and public health officials noted the impacts of dairy pollution to water-based recreation, native habitat, and public

health, criticism of the industry grew. Threats to the nation's overseas trade and tourism image, as a 'clean, green environment', prompted central government to express its concerns to the industry, until finally, there was action by the dairy industry itself.

4. CONCLUSION: WINNING SOME, LOSING MANY?

Despite the promise of the new environmental management policies and practices by the regional councils and Fonterra, the continuing decline of water quality in many parts of New Zealand suggests that ecological modernisation is unlikely to prevent the gradual, but unremitting, environmental deterioration, so long as the main drivers behind agricultural intensification continue. Controls on point-source effluent discharges can go some way towards militating pollution, and farm management practices by farmers can reduce the nutrients that leach into water from the paddock. But these measures are not sufficient to offset the cumulative environmental consequences of agricultural intensification and land use change. Given the difficulty and complexity of dealing with cumulative non-point source environmental effects, and the fact that it may not be in the interests of private landowners and resource users to incur the cost of controlling these, it may be necessary for the state to introduce measures that reduce the incentive for land use intensification.

Ecological modernisation theorists (Gouldson and Murphy, 1996; Gibbs, 2000; Gibbs, 2003) propose that environmental management needs to 'ecologise the economy and economise the ecology': It is concerned with developing criteria and policy models for 'internalising the externalities' of growth. If we consider this in the light of the NZ dairy situation, 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 onto land versus discharge into effluent ponds), and to the fact that environmental consequences may take many years to become manifest. Buttel and others (Buttel, 2000; Kiel and Desfor, 2003) have suggested that ecological modernisation as practice (i.e. as applied to improvements in

environmental management) is particularly appropriate for urban environments and manufacturing processes. This would suggest that it may be problematical as an answer to sustainable development of rural areas and regions.

The movement of nutrients into water is highly complex and diffuse, and include cumulative effects which may take decades to become evident. The amount of nitrogen that leaches into groundwater, for example, can depend on the temperature and moisture content of the atmosphere, the chemistry and biological condition of the soil, the quality and quantity of herbage on the ground, and the amount of nitrogen already in the soil. Furthermore, it may take nitrogen several years to move from the spot in which it was deposited to a nearby lake or stream. This difficulty is further compounded by the fact that farmers often assess the consequences of management on the basis of what happens within their property rather than on the basis of the cumulative effect to the catchment as a whole.

Put in a wider context, New Zealand is also experiencing a fundamental and seemingly irreconcilable conflict between the economic dynamic of capitalist production for food, and protection of the nation's natural environment and habitats. This conflict arises because, contrary to the views of some ecological modernists, there are bio-physical limits to the environment. Both bio-physical limits and the local and regional variations mean that communities, settlements and society as a whole need to make choices about how the environment will be used. New Zealand society currently confronts very difficult choices: it can continue to benefit from the wealth brought by the dairy industry and tolerate the environmental effects for as long as possible; or it can limit production in favour of protecting native biodiversity, and suffer a much reduced export income. Whatever choices made will undoubtedly have significant lifestyle consequences for New Zealand citizens. Also, as critics of official environmental policies have often argued, the current mismatch between green objectives and the planning approach has allowed politicians to claim the possibility of win-win solutions. Policy simulation modelling may thus become politically sensitive if it makes this mismatch between green agendas and the rational planning approach apparent.

At the risk of foreclosing optimistic serendipities, the authors are of the view that the New Zealand economy is too dependent on the export income from dairy produce (as a low cost system of commodity production) to opt for radical programmes of contraction and reclamation. As a

co-operative, Fonterra is obliged to find markets for the milk which its 12,000 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 for the foreseeable future. In stark practical terms, minimising dairy production costs often comes down to minimising the environmental component of cost.

5. AKNOLEDGMENTS

The authors wish to thank Fonterra and MAF for their cooperation. Thanks also to the cartographic teams in the University of Waikato and Kingston University for their input and advice.

6. REFERENCES

- Benton, T.G., Vickery, J.A., and Wilson, J.D. (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 Selvarajah, N., 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 Saunders, D.A., (Eds), *Conservation in Production Environments, Managing the Matrix*, pp. 236-245. Nature Conservation 5. Surrey Beatty and Sons Pty Ltd., Chipping Norton, NSW, Australia.
- Buller, H., Wilson, G.A., and Holl, A. (2000) *Agri-environmental Policy in the European Union. Perspectives on Europe*, Contemporary Interdisciplinary Research, Ashgate, Aldershot, UK.
- Burns, B., Barker, G.M., Harris, R., and Innes, J., 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*, pp. 26-34. Nature Conservation 5. Surrey Beatty and Sons Pty Ltd., Chipping Norton, NSW, Australia.
- 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 Muirhead, R.W., 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.
- Escobar, A. 1996. Constructing nature, elements for a poststructural political ecology. In Peet, R., and Watts, M, *Liberation Ecologies*, 46-114. Routledge, London.
- EW, 1998. *Waikato State of the Environment Report 1998*. Environment Waikato (Waikato Regional Council), Hamilton, New Zealand.
- Ferrier, A., 2004. The need for commodity and value added products to sit side by side in Fonterra's Future. Address by Andrew Ferrier, CEO, Fonterra, to Waitoa Field Rep Open Day. <http://www.fonterra.com>
- Fonterra, 2003. About Fonterra. Internet homepage, Fonterra, Auckland, New Zealand. <http://www.fonterra.com/default.jsp> (Accessed 18/8/03).
- 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 Murphy, J. 1996. Ecological modernization and the European Union. *Geoforum* 27(1) 11-21.
- Gouldson, A. and Murphy, J. 2000. Environmental policy and industrial innovation: integrating environment and economy through ecological modernisation. *Geoforum* 31, 33-44.
- Green, K., Harvey, M. and McMeekin, A. 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 University Press, Oxford.
- Hertin, J. and Berkhout, F. 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 Baark, E. 1999. National shades of green: Comparing the Swedish and Danish styles in ecological modernisation. *Environmental Values* 8, 199-218.
- Jänicke, M. and Jörgens, H. 1999. National environmental policy planning in the face of uncertainty. In Kenny, M. and Meadowcroft, J. (Eds.), *Planning Sustainability*. Routledge, London.
- Kiel, R. and Desfor, G. 2003. Ecological modernisation in Los Angeles and Toronto. *Local Environment* 8(1), 27-44.
- Larned, S., Scarsbrook, M., Snelder, T. and Norton, N. 2003. Nationwide and regional state trends in river water quality 1996-2002. NIWA client report CHC2003-051. Prepared for the Ministry for the Environment by National Institute of Water and Atmosphere, Christchurch, New Zealand.
- LIC (Livestock Improvement Corporation) 2004. *Dairy Statistics 2003-2004*. Livestock Improvement Corporation Ltd, Hamilton, New Zealand.
- MAF (Ministry of Agriculture and Forestry), 2003. *Contribution of the Land-based Primary Industries to New Zealand's Economic Growth*. Ministry of Agriculture and Forestry, Wellington, New Zealand.
- MfE, 1997, *State of New Zealand's Environment 1997*, (Taylor, R., and Smith, I., principal authors). Ministry for the Environment, Wellington.
- MfE, 1999, *Resource Management Act Practice and Performance: Are Desired Environmental Outcomes Being Achieved?* Ministry for the Environment, Wellington, New Zealand.
- MfE, 2001, *Valuing New Zealand's Clean Green Image*. Ministry for the Environment, Wellington, New Zealand.
- Mol, A.P. J. and Spaargaren, G. 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.
- NZH, 2004. CHH tags 9500ha for dairy. *New Zealand Herald – business-forestry*. October 20th.
- PCE, 2004. *Growing for Good, Intensive Farming, Sustainability and New Zealand's Environment*. Parliamentary Commissioner for the Environment. Wellington, New Zealand.
- Potter, C. (1998a) *Conserving Nature: agri-environmental policy development and change*. In Ilbery, B., (ed.) *The Geography of Rural Change*, pp. 57-84. Addison Wesley Longman, Harlow, Essex, UK.
- Potter, C. (1998b) *Against the Grain, Agri-Environmental Reform in the United States and the European Union*. CAB International, Wallingford, Oxford, UK.
- Spaargaren, G. 1999. *The ecological modernisation of domestic consumption. From the Reader distributed for the 'Consumption, Everyday Live and Sustainability' Summer School 1999*, Lancaster University, UK.
- Stoate, C., Boatman, N.D., Borralho, R.J., Rio Carvalho, C., de Snoo, G.R., and Eden, P. (2001) *Ecological impacts of arable intensification in Europe*. *Journal of Environmental Management*, 63, 337-365.
- Vant, B., Taylor, A., and Wilson, B., 2000. *Land use and river condition in the Waikato region. Proceedings of Water 2000 Conference, March 2000, New Zealand Water and Wastes Association, Auckland, New Zealand.*