Farm systems and the environment: pragmatic solutions to an ethical issue

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Introduction

The last thirty years have seen an increase in the attention paid to the environment by society. In particular the focus has been on the effect human activities on water, air, endangered species and eco-systems. High profile environmental cases have focussed on mining, what nuclear waste and industrial pollution, but farm systems have also been under scrutiny and have changed in response to this. Major change New Zealand in the last thirty years include;

- the banning of pesticides such as DDT
- a requirement for treatment of dairy shed and piggery effluent before discharge to surface waterways
- stricter controls on chemical drift from spraying operations
- introduction of legislation to better control introduction of new organisms.

Overseas, programmes such as the Nitrogen Sensitive Areas (Britain), LandCare (Australia) and the Swampbuster and Conservation Reser Programmes (USA) focus on changes to farm management driven by environmental concerns.

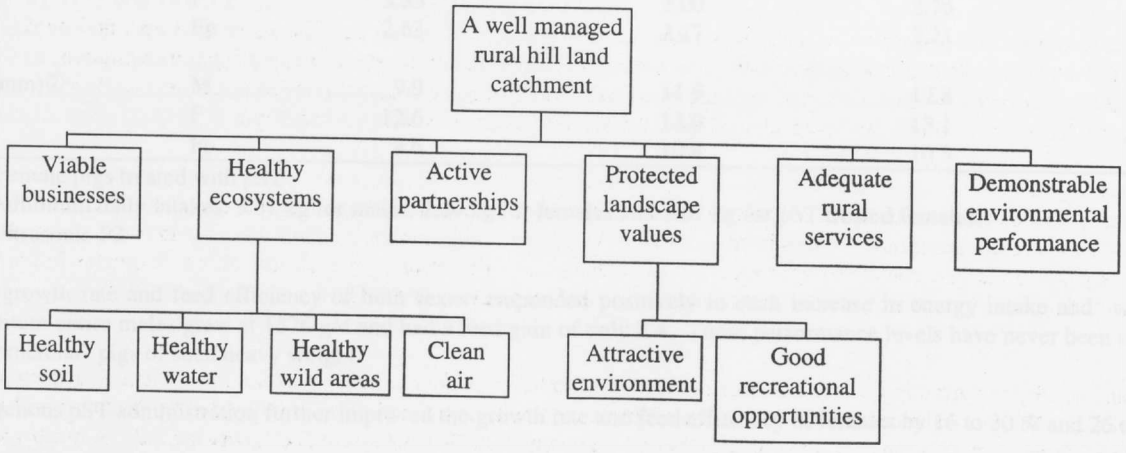
While the response to these concerns is focused on legislation and actions, the environmental debate is driven not by rules of nature but by values that humans place on things. This includes both tangible things such as trees and owls as well as intangibles such as wildness naturalness. Attempting to understand and respond to the environmental debate without understanding this dimension will lead to frustrati These values are not constant within parts of society or over time. Wolves were considered a threat to life and financial survival by Americ settling the west, now wolves are being re-introduced to Yellowstone Park as a valued part of the natural eco-system. The ranchers who live the borders of Yellowstone, however, still view wolves as a threat. From the 1840's to the 1950's reversion of hill country pastures to bush forest was a major threat to New Zealand farming and the nation. As late as the 1980's government subsidies were available to clear this again. Today I suspect a significant part of the population sees this process as regeneration of native bush and a rather desirable thing.

The rules of nature haven't changed for wolves or native bush - but the attitudes of people towards them have. The nature and wilderness pioneers subdued by rifle, fire, four wheel drive and air-conditioning is now seen as a fragile thing requiring protection and nurturing. In than 100 years we have gone from being fearful of nature to being fearful for nature. Environmental legislation in New Zealand has follow this trend towards environmental values by moving away from regulating **activities** to regulations that are concerned with **impacts**. Resource Management Act (1991) allows people to meet their social and economic needs, but requires them to do so in a way that:

- sustains the potential of natural and physical resources.
- safe-guards the life-supporting capacity of air, water, soil and eco-systems.
- avoids, remedies or mitigates any adverse effects on the environment.

To assess the impacts that farm systems have on the environment requires some more definite identification of the criteria against wh environmental performance and legislative compliance is likely to be judged. As part of a catchment project at Whatawhata Research Cen we are involving a group of stakeholders in rural hill country to determine what the goals of improved management should be. We asked the to express these as the components of a well managed catchment, the top level of descriptors is shown in Figure 1. These components cover range of economic, ecological and social values. Beneath this level we need to describe in more detail each of these components. This shown in Figure 1 for the healthy ecosystems and preserved landscape values components. Consistent with the New Zealand context, there is lot of emphasis on water, wildlife, erosion and landscape. Air and soil quality were given lesser attention. At another level below that sho the details of how clean water is measured, and how clean is clean enough are still to be debated.

Figure 1 Attributes of a well managed rural hill land catchment



How do farming and farm systems affect these components of the well managed catchment? Two benchmarks need to set to answer this question adequately. Firstly, the answer depends to a large extent on the reference against which farming is compared. In New Zealand farming means grassland, and the comparison is usually made with native or plantation forest. A large body of evidence shows that, compared to native or plantation forest, grassland farming leads to greater soil erosion, poorer water quality and less diverse aquatic ecosystems (Maclaren, 1996). However, compared with other land uses, grassland farming can be seen as beneficial. Data from the US Midwest show that water quality is better in grassland areas than areas in row crop cultivation (Smart et al., 1985). Some urban practises such as the discharge of sewage with minimal treatment also have undesirable effects. In this paper farming is compared mainly with other rural land uses. Secondly, discussion of the effects of farming on the environment often gets confused within 2 areas - land use (what we do) and farm practises (how we do it). For the purpose of this paper farming is divided as follows:

- Land use - dominant land use activity e.g. pasture, arable, forestry, urban.
- Farm practises - the way in which specific parts of a farm are managed or specific tasks performed e.g. management of riparian areas, methods of fertiliser application, method of waste disposal.

Farmers may have little control over the effects of land use, but can exert a large degree of control over farm practises. In this paper the extent to which better farm practises can influence the environment is outlined where possible.

The definition of the environment used by the New Zealand government includes (amongst many other things) eco-systems, people, communities, amenity values, land and energy. The purpose of this paper is not to conduct an extensive review of all these factors (see Maclaren, 1996) but to highlight a range of factors and discuss responses. In the next section the impacts of livestock farming on water, soil, atmosphere and biodiversity are considered.

Environmental impacts of farming

Water

The effects of farming on water include water yield, water quality and aquatic ecosystems. At a land use level it is clear that pastoral farming has higher water yields, lower water quality and less diverse aquatic ecosystems than forestry (either indigenous or planted). Maclaren, 1996; Wilcock, 1986; Quinn et al., 1994). Conversely, cropped areas usually have poorer water quality and less diverse aquatic ecosystems than areas in pasture (Smart et al., 1985). Reasons for these impacts include the input of contaminants to water and the modification of the riparian and aquatic environment.

The input of contaminants from pasture may sometimes be proportional to the intensity of land use. This is clearly so for nitrate-N inputs to groundwater where large areas of a farm contribute nitrate, and losses increase as N fertiliser inputs increase (Ledgard et al.,1996; Scholefield et al., 1993). Good management of N fertiliser will lead to less leaching than bad management, but even good management will not avoid the farm intensity effect.

In a contrasting case, underlying geological or soil properties control the rate of soil erosion from steep hill country. More management-intensive systems involving the planting of spaced trees for soil conservation can reduce erosion rates (Hawley and Dymond, 1988). but stocking rate, stock type or fertiliser input have little primary effect on sediment input from mass erosion. On a smaller scale of erosion, Lambert et al. (1985) report slightly greater erosion from cattle than sheep grazed areas, and observation indicates that deer farming causes erosion from specific sites within a paddock. In arable systems, conservation tillage techniques lead to a large impact on sediment yield and but often increase herbicide concentrations in runoff and surface waters (Clausen et al., 1996).

The extent to which aquatic ecosystems are modified apparently increases as land use intensity increases (Ryder, 1995). This correlation is not solely related to stock intensity, but also to the more intense physical manipulation of the environment that tends to occur in low land, highly productive environments. These activities include drainage of wetlands, straightening and channelisation of streams, removal of riparian vegetation and frequent disturbance by maintenance of these improvements. Added stress comes from non-farm activities such as point source pollution (Ryder, 1995) which tend to associate with areas of high land use intensity. Activities and pollution associated with large urban areas can also lead to poor water quality and reduced ecosystem health (Smith et al., 1993; Snelder and Williamson, 1997)

A number of studies have shown that permanent or temporary retirement of streambanks can reduce losses of sediment and nutrients from pastures to waterways (Smith, 1989; Williamson et al., 1996). Direct access of cattle to waterways can cause input of contaminants via dung and urine and accelerate stream bank erosion. Higher stocking rates will lead to higher inputs. However practises such as provision of alternative water sources (Godwin and Miner, 1996) can change animal behaviour and reduce contaminant inputs.

Atmospheric - greenhouse gases

Emissions of methane and nitrous oxide from ruminant pasture systems is probably the major greenhouse gas contribution that New Zealand makes (Maclaren, 1996). These contributions are greater than forestry, which may be a net greenhouse gas sink in some cases. Ruminant emissions of greenhouse gases are largely controlled by stock numbers, although research efforts are aiming to reduce losses (and improve feed efficiency and nutrient cycling). Farm practises, other than the use of non-ruminants, have little impact.

Soil

Defining soil health and quality is currently consuming large scientific resources in many countries. Despite the current debate some useful indicators can be identified. Nutrient balances are one indication of impacts on soil, as any deficit must be funded by depleting soil reserves. Given adequate fertiliser, forestry, pasture and arable land uses can all maintain a nutrient balance. The inputs needed are much greater for pasture and arable, simply due to the amount of nutrient export (Hedley et al., 1991). Farm practises impact on the nutrient balance through the

increased nutrient export from high stocking rate systems and systems with high per hectare production of meat and (Metherell et al., 19
Hence these systems require more fertilser to maintain a balance.

Soil physical properties under pasture respond to management depending on the soils inherent properties. Intensive stocking can lead
decline in soil physical condition on sensitive soils (Greenwood and McNamara, 1992). Farm systems which limit soil damage by use of on
grazing for dairy cattle and indoor housing over winter for deer are now common in parts of New Zealand. In general, soil physical proper
would be regarded as superior under forestry than pasture or cropping. This comparison is management sensitive though. Poor management
forest soils during harvesting and re-establishment can lead to poor physical properties (Maclaren, 1996). Similarly, the physical properties
cropping soils are highly responsive to management (McLaren and Cameron, 1990).

Bio-diversity

The conversion of forest and native grassland to pasture and arable land use generally leads to a reduction in the diversity of non-farm
species. This may represent a response to habitat loss, or an additional response to other factors such as increased predation (hunting, domes
animals, introduced species) or environmental modification through various farms of pollution. Because of the habitat impacts the degree
diversity will be influenced by the farm practises chosen. Retaining or creating key habitat areas (wetlands, hedgerows, wood lots) can b
increase bio-diversity within a farmed landscape. Management of weeds and pests is required to ensure that the result is desirable bio-diversi

Responses

In summary then, there are clear social pressures and legislative requirements for farming systems to consider the environmental effects of l
use and management practises. It is clear that the choice of both land use and farm practises has a large effect on environmental indicators
that many of the effects are undesirable. As individuals and organisations involved in the meat industry how do we respond to this situatio
The response depends on the values and priorities of individuals and organisation - just as the environmental concerns are driven by values.
one extreme of the value range Roger Kerr of the Business Roundtable suggests that the only responsibility that companies have is to be
profitable as possible while complying with the law. At the other extreme, 'ethical' funds invest in companies on the basis of th
environmental and social actions. Ultimately the decision as to how far beyond legal compliance we go as individuals and organisations
based on values. My personal view is that humans are now so influential in nature that we are 'de facto' the managers - even though we do
understand what all the levers and knobs are for. We are no longer in the position to let nature take its course. The stewardship responsibili
we accepted when we domesticated livestock now apply to whole ecosystems.

To improve the environment requires change in the way that people and organisation act. Assuming that we wish to act to improve
environment how do we do this? I wish to advance three themes:

1. Avoid environmental schizophrenia.

The history of New Zealand land use has involved separation of land into protected (national parks) and managed (the rest). Over time it
become apparent that the protected areas do not hold all our environmental values. Managed areas such as harbours, beaches, farms and tow
also contain things of environmental concern such as clean air, abundant desirable bird life and healthy aquatic ecosystems. Critical issues
possum control, water quality and aquatic ecosystems, invasive weeds and conservation of native bird species cut across the boundaries
protected and managed areas.

On a global scale, atmospheric pollution can produce acid rain hundreds of miles away from the urban-industrial sources. Similarly,
possible ozone depletion and climate change effects of anthropogenic gas emission bear no geographical relationship to the sources. W
adaptations to farm systems are required to address these concerns? The first requirement is to analyse the consequences of manageme
systems outside the farm boundary. This involves an mental acknowledgement that the farm is part of the environment, and that the farmer
responsibility for consequences beyond the farm.

Specific actions that farmers can take:

- Protect waterways and water quality
  - ⇒ keep cattle out of streams
  - ⇒ control soil erosion
  - ⇒ enhance wetlands and riparian areas
- Enhance desirable wildlife habitat
  - ⇒ plant and preserve vegetation
  - ⇒ control pests (including the family cat)
- Control weeds
  - ⇒ prevent spread of weeds outside the property.

2. Treat environmental management as an ethical issue

Farmers are currently being encouraged to regard environmentally acceptable farming as a means to increase profitability (Salmon, 199
There is a danger in this bundling of environmental and economic goals. Quality assurance may become the price of entry to markets rat
than a means to extract a premium from them (NZGIB,1996). Promoting environmentally better farming practises to farmers under
profitability goal blurs the stewardship ethic. Removing the market premium doesn't remove the environmental stewardship duty. Putting
stewardship plan into action takes time, effort and money.

Specific actions that farmers can take:

- elevate stewardship up the priority list.

- fence and plant erodable stream banks before buying a boat.
- form a local possum control group and kill possums instead of building mai-mais and shooting ducks.

Specific actions that industry can take:

- be clear and realistic about the benefits of quality assurance.
- match talk of environmental concerns with action throughout the pasture-plate chain.
- support farmer initiatives to improve environmental performance.

3. ***Consider technology and processor requirements in a wider context***

The environmental consequences of technology being developed in the animal industry today seems almost irrelevant given the huge debate over the ethical, animal welfare and human health consequences of technology such as cloning, genetically modified organisms and animal feeding practises. This debate should reinforce the message to scientists that new technology and production systems need to consider issues beyond biological and processing efficiency. Examining new technology in a wider context also allows an assessment of the acceptability of the technology to the farmer, and may help to fine tune the development of the technology and its supporting systems. Parminter (1997, this conference) discusses the many criteria used by farmers to evaluate beef breeding technologies, and compares these with the much simpler criteria promoted by researchers. The requirement for WX grade lambs by Waitaki International in the early 1980's was a market driven request. The response of some farmers to produce these lambs by using weight loss to produce leaner carcasses was probably unexpected, and would today raise welfare and meat quality questions. Farmers do not seem to respond to stimulus as the models developed by scientists, economists and perhaps meat processors suggest they should.

The development of frozen meat technology revolutionised New Zealand farming and freed it from the constraints of local markets and seasonality of feed supply. Now, technology to take chilled meat around the world seems likely to re-impose some of these constraints as continuous supply and tightly specified product quality become necessary for high market returns. This implies that a farmer will need to have a more predictable performance. The ultimate in control resides with confined animal systems, but economics will encourage farmers to attempt more control with pasture based systems. The challenge to farmers and the processing industry is to develop the systems that allow high quality product to be produced without the negative environmental effects that may be caused by high N fertiliser use, large inputs of supplementary feed or confined animal systems.

To complete the context of this paper two further points need to be made. Firstly, it is unrealistic to expect environmental issues to be a high priority in the face of insecure tenure or low profitability. These are ongoing concerns for the meat industry. Secondly, emphasising the ethical responsibility of farmers and the meat industry to change the way they act does not ignore the responsibility of other groups in society to also act. The nature of an ethical response, however, is that it is justified not on the actions of others but on a judgement of what is right.

Summary

To summarise the situation:

- Human values related to the environment are placing pressure on all land use and human activity to improve environmental performance. These values relate both to use of the environment by humans and to the protection of ecosystems for their intrinsic value.
- Grassland farming, for the production of meat in particular, has modified the environment immensely over the last 150 years.
- In comparison with native forest, most of the environmental attributes of grassland farming detract from the concept of a well managed catchment. In comparison with row cropping or urban land use, grassland farming will often enhance the environmental attributes of a catchment.
- There is a lot of scope for better farm systems to improve the environmental performance of grassland farms.

Three themes are advanced as guides to the response that all participants in the meat industry can make to improve the environment. These responses are based on acceptance of an ethical requirement for environmental stewardship.

- Avoid environmental schizophrenia, consider the wider environmental issues of all decisions. The environment is where we live and work, not a place we visit on the weekend.
- Treat environmental management as an ethical issue, applying only an economic justification to management decisions undermines the stewardship ethic.
- Consider technology and processor requirements in a wider context than biological and processing efficiency. This is likely to improve adoption as well as limit environmental consequences.

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