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Primary Industry Management

THE OFFICIAL JOURNAL OF THE NEW ZEALAND INSTITUTE OF PRIMARY INDUSTRY MANAGEMENT INCORPORATED

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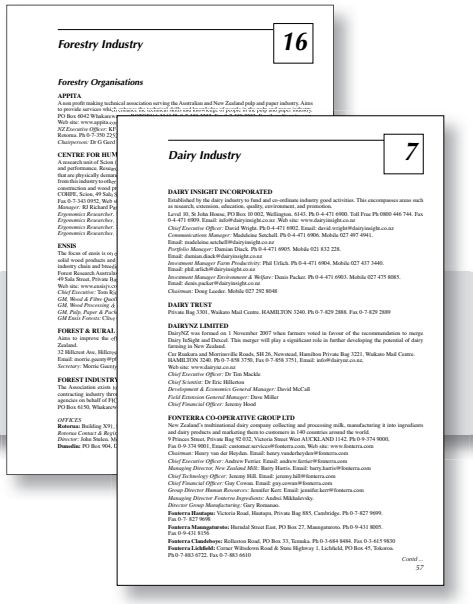
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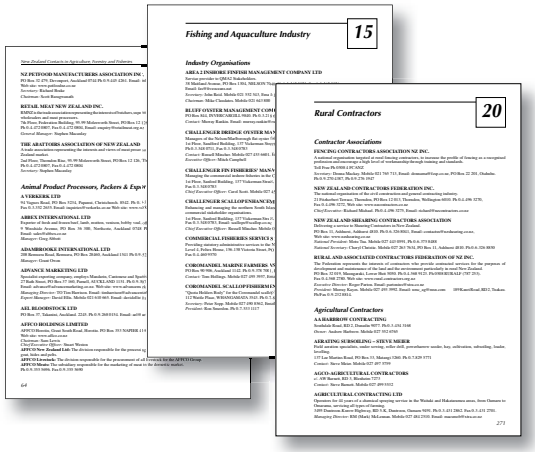
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Primary Industry Management is dedicated to the publication of original research findings and practitioner articles on all aspects of agricultural science and the management of primary industry resources. The opinions of the contributors are their own and not necessarily those of the publishers or editor.

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Editorial

A VOLATILE YEAR

The past 12 months has not been a year for the faint hearted. Volatility would best sum it up.

We have had drought, floods, hail and late frosts, all in a year. Venison and lamb came off unrealistically low prices into a strong recovery. Other rapidly escalating input prices are now undergoing a quick turn-round. Stubbornly high interest rates have dropped quickly. Record high prices for some commodities have been followed by falls of over 50 per cent. There has been a huge global drop in asset values and a record high New Zealand dollar/US dollar exchange rate, followed by a plummet. With record low unemployment and escalating layoffs around the world, we could soon see the highest New Zealand unemployment levels in recent decades.

The difficulty with all this is that most of the problems are beyond our control. Human nature being what it is, few can see the downside when markets are on a high. A period of denial exists when markets change, then few see the upside when we are at the bottom. I cannot remember a time in my 28 years in the industry where so many opportunities, threats and challenges all exist at one time.

As key members of the rural community, we have a critical part to play in helping our clients and associates meet those challenges and see the opportunities. It is our role to see through short term challenges and threats and show leadership in guiding our rural families and their business partners to calmer waters.

It is not just farming families who are feeling the stress. All parts of the supply chain from suppliers to processors are facing business conditions that will require experience, wisdom, vision and cool heads to work through. It is noticeable that products with shorter supply chains, where communication is more easily managed, are coping better with current trade conditions.

Just as critical is the need to talk amongst ourselves, and share advice with new ideas. We cannot give good support to clients, in whatever form, if we are under excessive pressure ourselves. Professional development, mentoring of younger members and support for each other falls into the important category.

I urge you to do the reading, communicate with other professionals, take part in NZIPIM field day organisation and attendance, and come to our national conference. Mentor a young member or potential member and support students looking to gain an understanding of our role. Encourage school age children to consider a Lincoln or Massey degree in agricultural science or commerce.

Our annual conference, celebrating 40 years in existence will be in Blenheim in October and will be both stimulating and social. We are working with the Partnership for Excellence, a joint venture between Lincoln and Massey, to produce a strategy to help bring young people into rural extension, science and management. Where appropriate, we continue our push into the universities to bring students greater value and we now have 250 student members.

We are working with decision makers, including at government level, to put forward views on issues of critical importance to the rural sector. The NZIPIM is continuing to build relationships with other rural organisations to achieve a more unified voice for agriculture.

A large group of members, under the chairmanship of Phill Everest, are putting into place the plans for the World Farm Management Conference which we are hosting in 2011. While it is two years away, the time passes quickly. This year's conference is in Illinois, USA from 19 to 24 July and a number of members of NZIPIM are attending. Given the global conflicts around availability and affordability of food and finance, I cannot think of a better place to get a strategic overview than the USA in 2009.

Despite these initiatives, the members and the provinces are the core of our Institute. The enthusiasm to organise and participate in field days or seminars is critical to the future of our professions. We are, after all, a self-help industry. Do not wait for others, do your bit and remember to welcome new members.

As we move into the year ahead there are a number of challenges. There is a greater need for sensible risk management. Relationships with processors and customers are one of the few substitutes for hedging, which is not generally an option available to most New Zealand producers. There is also a greater need to manage cash flow, so that correct management strategies are able to be implemented.

Communicate with financiers to ensure they can plan for funding needs. It is important to plan management strategies that mitigate climate risk and improve productivity gains. We need to use water wisely and more widely, by harnessing our ability to store, distribute and apply it for higher productivity without unmanageable environmental side effects.

Criticism of farmers, fair or unfair, can only be a result of misunderstood communication on our part of our values and management practices. We are the only ones who can fix that problem with better communication.

Remember that education starts with young children. Two programmes in the UK are proving particularly successful. One is Farmlink, which is a programme that brings all intermediate school age children on to a farm to study the source of their food, its nutritional value and good eating habits. The other, Open Farm Sunday, uses one Sunday each year where 440 farms across the UK are open to the public. Last year 2.5 million people went to farms on these visits. It is a great way for town people to see and understand working farms. Federated Farmers has adopted this programme for New Zealand, and ran the inaugural day on 1 March.

If you get an opportunity to help with better town and country understanding, or in the education of young people, take it.

Andy Macfarlane

President
NZIPIM

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Lead Article

New Zealand agriculture – looking beyond the present

Warren Parker

Contemplating 2025 New Zealand agriculture in the midst of a recession that ultimately may rival or exceed the Great Depression is a challenge. Imagining the new world that will emerge out of the present financial crisis is also difficult. But one thing is sure, it will be different from what we know now.

Paradoxically, it is in times of greatest uncertainty that the need for foresight and planning is also greatest. Formulating scenarios to tackle the range of outcomes that might unfold and developing a business response is the best way to cope. These pictures of the future must be reviewed regularly and not be overly prescriptive. Making the correct choices about the way the business is going is what counts rather than getting the exact detail right. The latter can readily flow through more certain annual farm operating and business plans.

At times like the present, the fundamental long-run trends for agriculture need to be revisited. Overall they are positive for New Zealand and this gives sound reason, apart from the pressures for increased trade protectionism, for optimism about agriculture's future. However, increased government debt, which will need to be repaid as economies recover, will moderate the situation over at least the next five years. New Zealand, with a robust banking system and reasonably sound natural resource base, is as well-placed as any nation to recover early.

Fundamentals for agriculture

Despite the present economic problems, the world's population is still becoming more urbanised and the demand for food continues to grow. Coincidentally, pressures on environmental resources, especially on water but also on land and essential plant nutrients, along with greenhouse gas emissions, continue to increase. Average household incomes are increasing and providing greater purchasing power for food and fibre. However, higher food prices and deteriorating economic conditions moved more than 70 million people into poverty in the last year .

Difficult economic times have increased the spectre of trade protectionism. The EU reintroduced dairy subsidies in late 2008 yet seems untroubled in protesting that the US may encourage 'buy made in USA' in their massive economic stimulus package. We have to take cautious hope from the rhetoric of the G7 and APEC leaders to keep trade open and the EU intention to remove agricultural subsidies in 2015.

New Zealand has a free trade agreement in place with China and negotiations are at various stages of development with South Korea, India, Japan and others. With their local natural resources under heavy pressure, food security is a critical consideration for all of these countries. While a WTO settlement may not be possible in the near-term, bilateral progress is being made. New Zealand is viewed favourably because of the high quality of its products and supply chain integrity. The unfortunate 2008 melamine scandal in China served to underline the absolute importance of maintaining the highest possible food safety standards.

In the next decade credentials in agricultural production will be much more visible and embedded than now and will cover a wider range of production and environmental attributes. Low-cost, third party-verified certification systems and inexpensive traceability, built on a rapid IT backbone, will be fully automated and normalised into farming activities. Much of the data for this will be from other activities essential for efficient farm management. Examples include, online real-time sensing of milk attributes and cow health.

Wildcards

Wildcards that could dim this optimism include a major biosecurity breach, an inadequate response to climate change, and a lack of confidence in agricultural careers. Recent events have reinforced how globalised the New Zealand economy has become.

With free trade agreements in place for the countries identified above, New Zealand faces a heightened risk of a biosecurity breech. This is not simply a matter of trade volumes. It also reflects the depth and sophistication of border controls and quality assurance systems in the developing economies that provide very large opportunities for New Zealand food exports. Mitigation of this risk requires a multi-pronged approach including much better pre-border intelligence networks and interception tools, and transfer of technology to trade partners.

Risk management

Irrespective of individual views about the reality of climate change, agribusiness needs to develop appropriate risk management strategies. Global warming, already on the upper level of the IPCC projections, will contribute to warmer, drier conditions in much of the East Coast of the North Island and wetter conditions for most western districts. More intense weather with flooding, and more extensive hill country and coastal erosion than at present are projected. Warmer weather conditions will enable the establishment and wider spread of infectious diseases, noxious weeds and harmful pests.

New Zealand's remote island geography will moderate some of the effects of climate change relative to continents, and mitigation actions to lower emissions will have some beneficial effect if acted on globally. However, it will also be necessary to act on adaptation plans. These include –

- Farm land-use plans to minimise erosion
- Placement and design of infrastructure such as farm bridges to reduce losses through hazards
- Adoption of more energy efficient technologies

- Less reliance on fertilisers from non-renewable hydrocarbon sources
- Considering livestock and plant genetic improvement programmes to account for a different heat stress and disease profile.

Even in the absence of climate change these steps are sound business practice.

Talent needed

Ensuring a steady flow of highly talented people into agriculture is vital. Competition for market access and shop shelf space will be no less intensive in 2030 than it is now. In fact, with the tyranny of distance and time defeated by IT and other communication technologies that make the transfer of expert knowledge easy, competitors will quickly be able to catch up. Although, fortunately for us, ultimately it will be much more difficult for them to overcome the biological limits to their natural resources, especially water. To counter this, New Zealand agriculture will need to be well informed, agile and adaptive – and that demands the capacity and systems to support rapid learning.

One in four New Zealanders are forecast to be of at least part-Maori descent by 2025. Maori, through the accelerated Treaty Settlement process set to conclude within the next decade, have control over huge land and other assets. Therefore it is essential that their participation rates in agriculture increase substantially in the current generation of secondary school students. No intentional strategy is yet in place but there should be.

Research and development

To compete in a rapidly changing world and in confronting serious local environmental challenges, New Zealand agriculture is going to have to innovate a lot more, and faster than in the past. Since New Zealand undertakes less than one per cent of the world's research, a good deal of this will come by capturing spillover benefits from offshore research.

A strong domestic capability of world standing is required to adapt this knowledge and technology to a local context and concurrently address New Zealand specific issues, such as the environment. Investment in research and development in New Zealand is low by OECD standards, particularly for the private sector. It has not grown as a proportion of GDP in real terms for many years. Not surprisingly national productivity growth has been at low levels and declining for almost a decade.

It is therefore important that the new National-led government, which has cancelled the research and development tax credits and disbanded NZ Fast Forward, find ways to increase research. This is needed to ensure that New Zealand agriculture remains internationally competitive, environmentally sustainable and publicly acceptable.

Based on the trends described earlier three areas merit further elaboration.

Fertilisers and nutrient management

Global sources of phosphate with low levels of contaminants are diminishing quickly. Hydrocarbon-derived nitrogen fertilisers contribute to greenhouse gas emissions and over the long run will become more expensive. Application costs, especially for hill country, will continue to increase. Technologies that improve nutrient use – more precision in placement, less run-off and better recycling – reduce costs, avoid soil contamination and are a good place to start.

Soil science needs to be substantially strengthened and re-energised. A systems approach should guide this research to account for interdependence, trade-offs, management needs and economics. This needs to be complemented by legume research, and the development of technologies to improve soil biological function and support its biodiversity and their roles. It will enable more productive organic systems, plant breeding to improve nutrient productivity and water-use, and the safe use of biosolids in food production. A doubling in nutrient efficiency and halving the dependence on non-renewable nutrients sources is not an unreasonable 2025 target.

Water management at the catchment scale

Water, alongside climate change, poses the most difficult policy issue confronting agriculture in the next decade. Much can be learnt from the mistakes made in Australia and elsewhere. But far better local understanding is also required of the cumulative effects of land-use change, the stocks and flows of water, and methods to allocate water to the most efficient economic use while maintaining essential services and ecological flows.

This demands a catchment-level approach within which farm plans are integrated, and is guided by a consistent national policy framework. Management at this scale also aids more effective management of biodiversity than at the farm enterprise level.

The NZ Business Council for Sustainable Development has proposed a rigorous policy framework consistent with this for water management. If 2030 agriculture is to flourish in already dry regions that will become drier, serious work needs to start now on testing a framework such as this. Rapid advances in geospatial information decision support tools, real-time sensor networks and shared data architecture, together with some new governance and institutional arrangements, should make water management much simpler and efficient in 2025 than at present.

Climate change

By 2020 a global agreement on greenhouse gas emissions 'Kyoto II' should be entering its eighth year. Formal markets for trading carbon units will be well developed and functioning through the major stock exchanges. New Zealand may emit less than one per cent of the world's greenhouse gas emissions but this is not a sufficient reason for inaction. It is more difficult, for example, to seek progress on freer market access on one hand if we are intransigent in doing our part in protecting the world's environment on the other.

Climate change is symptomatic of unsustainable resource use as well as concerns about energy supply and security. Besides, as noted earlier, adaption and mitigation steps for greenhouse gas emissions are good business practice in their own right. Almost always they will generate co-benefits – improved water quality through better use of nitrogen fertilisers and less erosion and more biodiversity on areas reforested for carbon sequestration are two examples.

Unfortunately most analyses of Emissions Trading Scheme options have focused only on the downside without including improvements in technology and management practice that will become available in the next two decades. Farmers should anticipate substantial gains in energy efficiency from plant and

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machinery, co-generation from effluent and heat exchange, doubled irrigation watering efficiency and lower greenhouse gas emissions from fertilisers.

Genetic selection of livestock for low methane output and improved techniques to manipulate the rumen through diet and genetic modification should be into the proof-of-concept stage by 2020. This confidence is based on the enormous investment in biotechnology, nanotechnology, personalised medicine, clean technologies and environmental remediation. If the progress of the last 10 years is doubled over the next decade, spillover benefits for low carbon agriculture will be large. New Zealand needs to ensure it is able to capture these advances and the value from emergent markets in environmental technologies.

Other areas that merit increased research and development attention in agriculture are low-cost, environmentally benign, specific pest and weed control, on-farm automation and better incentives and rewards for improving environmental performance.

Rural leadership

Agriculture over the next decade will be in transition. First, this will be from a hydrocarbon-dominated energy supply towards renewable sources. Secondly, to navigate beyond biological limits and degradation of natural resources while increasing outputs, in other words, farm system redesign for sustainable production. Thirdly, to an exporter servicing predominantly Asian markets and from being largely a provider of data to others for compliance purposes to an active participant in shared information networks. Finally, to new governance arrangements for resource management including for ecosystem services such as water, carbon and nutrients.

Negotiating agriculture through this transition will require skilled and visionary leadership. Adversarial advocacy will not be sufficient even though the sector will continue to dominate the New Zealand economy. Expertise to assemble high quality evidence to support policy formation, negotiation skills and the ability to resolve seemingly intractable problems will be essential. 'Success is intentional' is a truism. Agriculture must foster a new generation of leaders to take up this challenge if it is to avoid more regulation, maintain its social licence to operate, and enjoy non-rural political support.

Conclusion

Peter Drucker, the widely respected management writer, sagely observed: 'The future is shaped by today's decisions.' More difficult financial times are anticipated later in 2009. Decisions with respect to the financial sector will influence the speed of economic recovery. The Emissions Trading Scheme legislation will define agriculture's response to climate change

Reform of the Resource Management Act will address water policy and an environmental protection agency will be established to strengthen environmental monitoring and performance, and Crown investment in research determined. Collectively, these decisions will profoundly affect 2025 agriculture. Input to them over the next six months has special significance in ensuring these strategies are successful.

Warren Parker is the Chief Executive, Landcare Research

Restoring science to its rightful place

Jacqueline Rowarth

In his first speech as President of the United States, Barack Obama promised to 'restore science to its rightful place'. He believes that the critical goals for the United States can be met only if science, technology and innovation flourish. His pre-election science and innovation policy was entitled 'investing in America's future', and set out an impressive plan to ensure a new era of scientific innovation.
Similarly, talking with Kim Hill in February, Sir Harry Kroto, Nobel Laureate and Professor at Florida State University, suggested that without first-class science graduates 'how will we understand and deal with the crises…?'

In New Zealand, where we have little from which to make money except applied biological science, it is not only the global crises we need to solve, but also the local ones to do with intensive production systems. We need both a new era of scientific innovation and an increased number of excellent graduates in the areas which drive our economy – science and agriculture.

Leaders but no followers

New Zealand is hailed as a leader in having removed agricultural subsidies. As there are no followers, the leadership acclaim has something of a hollow ring. Furthermore, the removal of subsidies was only part of the general move towards supporting what were thought of as sunrise industries. The support reached its zenith in the early part of this century with the Knowledge Wave conferences – biotechnology, information technology and the creative and performing arts were hailed as the future.

Through the past 30 years, far from sliding down over the horizon, agriculture has risen in productivity and contribution to the economy. However, despite attempts by universities to reposition the applied science degrees to meet student requirements, numbers graduating in agriculture, environment and related studies have fallen. In 1999, 1.8 per cent of the graduates in New Zealand were in this category. By 2006 the latest data available, the proportion was 1.5 per cent – a mere 355 of them. In contrast, those in the performing and creative arts had risen from 5.4 per cent to over 9 per cent.

Perhaps of even more concern is that the numbers of students staying on to do honours and postgraduate qualifications in agriculture halved during that time.

The issue is, of course, that being in demand the top students are being offered attractive salaries, often with car and mobile telephone, at the end of their three-year degree. A grown-up salary or another year on the student loan is a question with a rapid answer, particularly as the honours route is towards a doctoral qualification for the requirement to be a research scientist.

After the extra years on scholarships, the most lucrative of which is under $30,000, the salaries are only approximately $10,000 more than after a three-year degree. There are no cars and mobile phone as part of the package, and the science system with bidding and reporting is conducive neither to creativity nor career building.

Science policies

President Obama's new science policy addresses many of the issues of concern in New Zealand –

- Federal investment in basic research will be doubled over the next 10 years with 'a special emphasis on supporting young researchers and backing high-risk, high-return research'
- Innovation will be encouraged by making the research and development tax credit permanent, and eliminating the capital gains tax on start-ups and small businesses. Next generation broadband networks will also be deployed.
- A national commitment to science education and training is being reflected in a promise to treble the number of graduate research fellowships
- Integrity will be restored to science policy by appointing a director of the Office for Science and Technology Policy reporting directly to the President – this will ensure decisions that can be informed by science are made on the basis of the strongest possible evidence.

All this is in a country where total investment in science is already over twice that of New Zealand as a proportion of each country's GDP.

Less risky research

In the United States the concern is that the science budget has been steadily losing buying power for the past five years and so the science agencies are often able to support no more than one in five of the proposals they receive. In New Zealand the rate is more like one in ten. In both countries this means interruption to careers, as well as to advances in understanding. It also means that scientists are less likely to pursue the ambitious, but often risky, research that often leads to the most important breakthroughs.

These problems were acknowledged in National's pre-election science policy. The comments about the current system's focus on instant gratification, and the funding accountability where 'scientists seem to spend more time applying for funding and reporting on it that actually doing science – leading to issues with capability and retention of scientists…' was followed by a rather more positive list of what National would do in power.

Important statements

First on the list was ensuring that excellent science is performed in stable, high quality institutions, properly resourced and financially

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viable. The policy also stated that bureaucracy and compliance costs would be minimised, resources would be directed towards areas of importance to New Zealand, and a good supply of research-trained scientists, engineers and technologists would be created.

These statements about change are extremely important and have yet to come into being. In the meantime, the research and development tax credit and NZ Fast Forward have been disestablished. The first was aimed at encouraging research in industry, and is being locked in place in the United States. The second was designed to boost the agricultural sector and help with research at all levels. Perhaps of most importance it signalled where the country's leadership was placing value.

President Obama's science policy included agriculture with the positive comment that 'Blessed with natural resources, a heritage of world-class research and technology, and the hard work and ingenuity of generations of American farmers, the United States has seen sustained increases in agricultural productivity for many decades'. He added that because of challenges, specifically energy costs and climate change, to this vital sector of national productivity more research is required. President Obama has declared that he will fund basic research that underpins crop and forest productivity, livestock health, and ecosystem stability, and also improves understanding of how agricultural systems will respond to such things as changes in climate, and the introduction of pests and diseases.

Unique environment

New Zealand has the same requirement, and, because of the country's unique environment, cannot simply import results from other countries and expect the same outcome. Research similar to that identified in the United States is required on top of the new commitment to fund research in reduction of on-farm greenhouse gas emissions ($20 million a year), boost research funding overall for primary sector and food research ($25 million a year), and increase funding for public-private research consortia ($25 million a year).

Perhaps the best indicator of the new government's regard for the importance of science is the fact that the science policy includes the establishment of the position of Prime Minister's Science Adviser. This was a recommendation from 'A Science Manifesto – or plan for the recovery of New Zealand science' released by the National Science Panel last year. This vital new position will ensure that decisions that can be informed by science are made on the basis of the strongest possible evidence. They will guide ministers on the range of policy options available to them in the light of understanding of any policy issue, not just science policy. Australia and Britain already has people in this position.

Invest in innovation

Time will tell how many of these American and New Zealand policies come to pass. New people in power always have the challenge of matching the vision with what is actually possible. But for both countries, not going ahead with the investment would lead to a slide in innovation – the very thing that is needed to counteract economic depression.

In an economic downturn, history shows that benefits exist for organisations prepared to invest in innovation in good people and research. Underperforming companies die, there is release of capital from fading sectors to rising and strong industries, and there is movement of high-quality skilled workers toward stronger employers. For organisations with money and ideas, an article written by Tom Nicholas, Associate Professor at Harvard Business School, and published in the December 2008 *McKinsey Quarterly* under the title 'Innovation lessons from the 1930s' shows that downturns can prove to be positive.

Obama recognises this. His pre-election comment was that reducing support for scientific research at a time when many other countries are increasing it has threatened leadership in many critical areas of science. He understands that development cannot be funded from unsupported debt, that scientific research is paramount in wealth generation and improvement of societal well-being.

Science solutions

In New Zealand the first two steps in restoring confidence in the science sector do not involve large investment. One is to ensure that bureaucracy and compliance costs are minimised for the individual scientist, and the other is to appoint the Prime Minister's science adviser. Minimising the paperwork would give more time for scientists to think and be creative.

Teresa Amabile, Edsel Bryant Ford Professor of Business Administration and head of the Entrepreneurial Management unit at Harvard Business School, has done a considerable amount of research on the conditions which allow creativity. She has reported that people were the least creative when working against the clock. People became risk averse and less creative when they thought they might lose a reward for not being creative. Competition reduces information exchange which decreases creativity. Fear of punishment does not allow creative thought, in fact people are most creative following a day when they were happy.

In the New Zealand science funding system, restoring stability of funding, and reducing bureaucracy would enhance creativity. This would occur within the strategic science programmes, not be peripheral to it. It would allow scientists to follow up ideas as they occurred, not be tied to milestones and objectives set months in advance in a manner antithetical to the process of excellent research. Changing the system would also decrease the number of people required to manage and administer it. The benefits in all of these changes would more than pay for the new position of Prime Minister's science advisor.

Agriculture solutions

Excellent science is of little benefit until it is used. A critical issue is having great people in the industry to put that excellent science into operation. Achieving genuinely sustainable production systems requires people who understand soil, plant, animal, water and atmosphere, as well as engineering, mechanics and technology. They must also understand biological interactions with climate, and how to run a business – with all the incumbent requirements of accounting, human resource management and communication.

Farming in New Zealand is a complex multi-million dollar business. It meets the declared career requirements of the younger generation – challenge, variety, excitement, remuneration, responsibility, teamwork, environmental protection, doing good for society.

Lack of understanding

However, within the last 40 years the number of possible occupations has increased from 600 to approximately 2,700, and the number of qualifications available in New Zealand has increased from 900 to over 11,000. As quantified earlier in this article, the creative, rewarding and exciting careers available in primary production are not being oversubscribed. At least part of the problem is ascribed to the fact that with 86 per cent of the population living in urban environments, people no longer understand what agriculture entails and what opportunities it holds.

Concern for the environment has also played its part. It is very easy to point at production systems and show that they are having an effect on the environment, while forgetting that it is the consumer requirement for food of high quality but which is not expensive that is reason for this.

There is also the perspective that for bright students, a life in town will be more rewarding. What many of the university students say is that they were told at school that they were 'too bright' to do agriculture. To counteract this, agricultural employers must build up a reputation as being great employers enabling great careers.

Peter Sheehan, author of *Generation Y: Thriving (and surviving) with generation Y at work*, who is himself a Y-generation member, identifies motivators for generation Y employees. They are culture, team, management style, flexibility, conditions, and salary. The key is inclusion. McCrindle Research has reported that 97 per cent of the generation Y members surveyed valued a leadership style that involved empowerment, consultation and partnership and would resign if they did not get it.

For the new generations, coaching will be very important in the workforce as a way of achieving performance. This means listening, supporting, encouraging and giving positive feedback, serving as a guide, but encouraging the employees to direct their own progress. Employers must learn to ask open-ended questions and offer information to clarify a situation and helping the employee to identify possible actions. Inclusive approaches to problem-solving have been used by their parents, and they expect it with their boss.

Regular informal and meaningful feedback is another requirement and is reported to be associated with a nearly 40 per cent increase in performance and a 20 per cent rise in discretionary effort. In contrast, annual feedback which focuses on goals and objectives and tells employees when something has gone well or wrong, results in a negative effect of almost 30 per cent in productivity.

Rewards

A Friday night review of the week with beer might serve the purpose – what went well, what could have gone better, and what the goals are for next week. Letting the employee talk and give ideas is vital, as is showing how good performance contributed to the bottom line. Rewarding instantly is also important. Consider a double pass for the movies, a voucher for a local restaurant, or sending them to an appropriate field day or conference on work time.

Key points are –

- Work-life balance and negotiating time priorities
- Workplace culture with a fun team atmosphere
- Varied job role ensure that the days are not spent just hoeing thistles
- Management style – communicate, listen, listen, check up and then communicate with feedback that is praise
- Training with regular goals.

Conclusions

Implementing all that has been suggested could allow New Zealand to regain its position as leader in the sectors vital to the economy – environmentally sustainable primary production. Applying the McKinsey comments in the current context of a global economic downturn suggests that benefits exist for countries prepared to invest in innovation through good people and research. For New Zealand, economic dependence on farms and food gives a clear direction for that investment.

Economic growth depends upon capitalising on a comparative advantage and turning it into a sustainable competitive advantage. It takes access to excellent scientific research, skilled creative product development teams, strong sales teams and a superb reputation for innovation and quality.

New Zealand had all of these components last century, and can have them again. The key is excellent researchers working with excellent primary industry professionals.

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New Zealand agriculture
Where it has been and where it is going

Rob Davison

New Zealand agriculture, particularly its pastoral agriculture, is unique in the world as around 90 per cent or more of its production is exported. For this reason alone it is the world price that dominates New Zealand's agriculture, not the domestic market as in most other countries.

New Zealand has a population of 4.2 million with 15 per cent living in rural areas. Pastoral agriculture generated 41 per cent of the country's merchandise exports in 2007-08 and the wider agriculture sector, including horticulture and processed primary products such as wool carpets, lifted this to 53 per cent of exports.

The 1970s

A brief recent history of the pastoral sector starts with Britain joining the European Community in January 1973. This heralded the end to open and practically tariff-free access for New Zealand sheep meat exports to Britain. In 1970-71 New Zealand shipped 87 per cent of its lamb exports to Britain, a total of 287,000 tonnes which is in contrast with the 71,700 tonnes shipped for 2007-08. This situation, along with the US introducing counter-cyclical beef import formula in the late 1970s, saw New Zealand taking a strong and passionate position in world trade negotiations and forums relating to agriculture and market access.

Before the 1970s, the New Zealand government gave some support to agriculture mainly through input subsidies on fertiliser and concessionary interest rates. Low profitability for sheep and beef farms in 1970 and 1971 saw a one-off stock retention incentive scheme introduced that paid farmers a dollar for every sheep wintered. This was almost immediately eclipsed by the world boom in commodity prices in the early 1970s which saw record sheep and beef farm profits reported.

This commodity boom came to a sudden halt following the 1973 oil shock and its aftermath saw farm profits fall in 1974-75 to a record low level at that time. Various price support mechanisms were put in place with the meat industry using its reserve funds to help with farm payments for beef and government supplementing a dollar per head on lamb.

Subsidies turned on

As a result of the first oil shock, the government of the day saw that New Zealand needed to increase exports to pay for higher priced oil and other imports. Agriculture was seen as a major contributor to export receipts and the sector received incentives to increase livestock numbers along with land development loan concessions to also increase export production. In addition, supplementary minimum prices were put in place to provide minimum floor prices that farmers would receive for meat and wool. This was the start of significant government subsidy to New Zealand's agriculture in 1976-77. Dairy, in contrast to meat and wool, received little assistance.

These minimum prices were initially seen as conservative relative to the world market prices that New Zealand farmers were receiving and were above the minimum prices operated by the Meat Board and Wool Board from the mid 1970s. The Producer Board minimum price schemes were funded when prices exceeded a trigger point, leaving market prices to operate freely between the trigger price and minimum prices.

In 1979 the second oil crisis hit and weak commodity prices followed for meat and wool. This saw supplementary prices added to beef payments to farmers from 1979-80 and for wool, lamb and mutton from 1981 to 1985. Within this period market prices fell below the government's supplementary minimum prices, and for periods below the lower Producer Board minimum price levels, so that producer owned and funded reserves were also used. These supplementary payments became untenable and the government announced the phase out of the scheme after 1984-85.

Subsidies turned off

In November 1984 the new Labour government announced deregulation of the economy which included the rapid phase-out all agricultural support measures, including interest rate concessions. Government services such as meat inspection and farm advisory services were put on a user pays basis.

In this period of assistance sheep numbers increased 25 per cent from 56.4 million in 1976-77 to peak at 70 million in 1982-83. Beef cattle in contrast decreased 26 per cent while dairy cattle numbers increased seven per cent.

Compared with 1976-77, the increase in sheep numbers saw wool production peak in 1980-81, up 26 per cent in four years. Most significantly the lamb slaughter peaked at 40 million in 1984--85 which was up 57 per cent on 1976-77. In the same period, the sheep slaughter was up 56 per cent and beef slaughter with lower cattle numbers was down 13 per cent. The announcement that supplementary payments would be removed in the following year without doubt helped boost the lamb and sheep slaughter in 1984-85.

No help

The fact that government would not help sheep and beef farmers as they faced the winds of global market prices for wool, lamb, mutton and beef in 1985-86 was met with disbelief by many farmers. Lamb prices halved from $24 a head in 1984-85 to just over $12 in 1985-86, mutton prices fell from over $14 to just over five dollars.

While beef prices were not supported in 1984-85 the market price to farmers in 1985-86 fell 27 per cent to compound an already bad situation. The beef price decrease reflected weaker global beef prices and a stronger New Zealand dollar that further reduced global prices in New Zealand dollar terms. The New Zealand dollar was floated in March 1985 as part of the deregulation process. As a result of these factors sheep and beef farm profit before tax in the first year of deregulation fell sharply to a record low.

The lesson for New Zealand and for every government is that subsidies allow production to occur at a level for which there is no natural market. For New Zealand this was particularly true for lamb and mutton.

Quotas

Around the time of deregulation in New Zealand the EU introduced milk production quotas. These caused surplus dairy cows to be slaughtered which in turn contributed to the EU's one million tonne beef stockpile. The beef mountain was reduced via export subsidies which effectively lowered prices in markets outside the EU where New Zealand also traded. Fortunately under the so-called Kerin/Andriessen accord, the EU agreed to abstain from applying export subsidies to exports of beef to the most important markets in Asia.

In the later part of the 1980s wool was seen as the saviour and there was talk of all-wool farming as lamb prices were particularly weak. However in 1989, after the fall of the Berlin Wall and subsequent failure of Eastern European communism, international wool prices tumbled. This was largely because these countries had accounted for around 10 to 14 per cent of New Zealand's wool exports.

Open market

By 1990-91 effectively all of New Zealand's residual subsidy effects had dissipated and the New Zealand agricultural sector was an open market driven totally by trends in global prices. Since March 1985 farmers and exporters have had to cope with changes in global market prices and also adjust to the added effect of overseas prices being passed back through the exchange rate filter.

Changes in the exchange rate can have a significant effect, either adverse or advantageous, on farm profitability despite global price trends. For example a currency depreciation of 10 per cent adds 18 per cent to the farm price received for a prime lamb. Conversely a 10 per cent appreciation of the currency subtracts 14 per cent from the prime lamb price.

Two recent extremes demonstrate this volatility. In June 2007, the lamb trade-weighted exchange rate was up 20 per cent on the previous June, decreasing overseas prices in New Zealand dollar terms, much to the exasperation of farmers. In contrast the January 2009 lamb trade weighted exchange rate was down 23 per cent on January 2008 boosting prices in New Zealand dollar terms. High exchange rates in 2007-08 made it an extremely poor year for New Zealand exporters and particularly for sheep and beef farmers who experienced their lowest farm profit in at least 50 years, in inflation adjusted terms.

A tough time

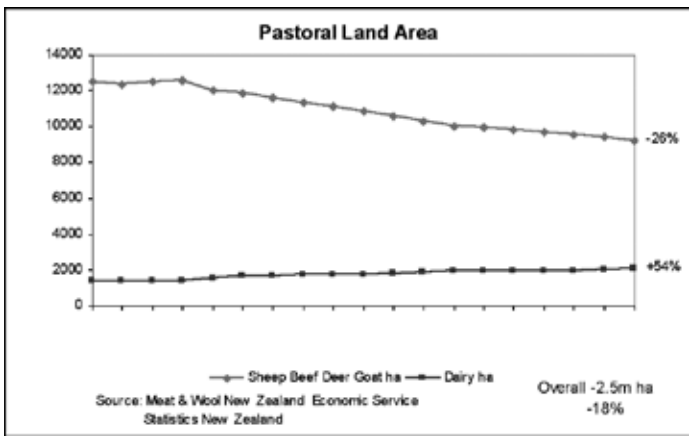
Following deregulation in 1985-86 there was hardship from the adjustment which was largely managed commercially by farm lending institutions. Where there were mortgagee sales these were handled in an orderly manner over the following five years. However, in 1985-86, the first year of deregulation, sheep and beef farm land prices fell 24 per cent on prices that prevailed in the last year of subsidies. This largely reflected low confidence from the sudden withdrawal of subsidies. Five years after deregulation in 1989-90, land prices were back to the 1984-85 level in nominal terms and three years later in 1992-93 were ahead in inflation adjusted terms.

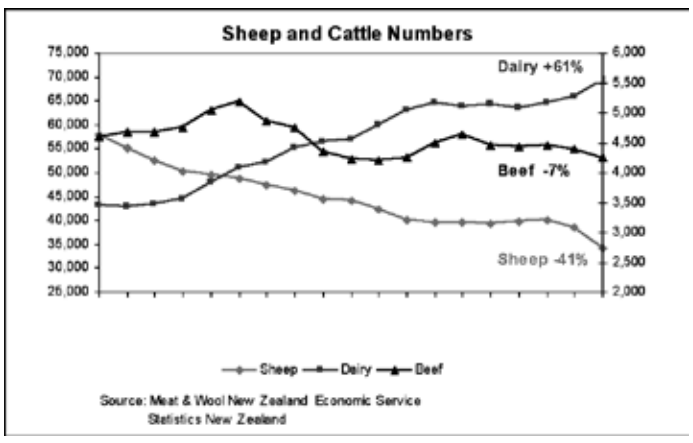
Given the open market situation that farmers face, the factors under control of the individual farm business centre on containment of expenditure and improving animal performance. At the time of deregulation the Meat & Wool New Zealand's Economic Service coined the phrase 'competition never sleeps' and the focus has to be on continual improvement in an open market environment.

This is exactly what happened in the New Zealand context. The 1990s proved to be the toughest decade to farm since the World War II, particularly for the sheep and beef farm sector. However, during this period there was a focus on animal production from improved management systems and practices. One of the key factors improving breeding ewe performance was the increasing adoption of scanning ewes to identify dry ewes for culling from the flock and those with multiple lambs for preferential treatment. The result has been significant, with 2007-08 sheep numbers down 34 per cent from 1990-91 yet lamb production on a weight basis was one per cent higher.

This change is linked to greatly increased lambing percentages coupled with a shift to producing heavier lambs than before. At the same time, poorer land that was farmed under subsidies has reverted to scrub and in some instances in the early to mid 1990s whole hill country farms were planted in blanket forestry. These factors have all contributed to improving overall animal performance.

One positive during the 1990s was the conclusion in 1994 of the Uruguay Round negotiations which established a tariff-free quota for New Zealand sheep meat entering the EU at a level that equates in volume terms to approximately 50 per cent of





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New Zealand's total sheep meat exports. In addition our largest market for beef, the US, created a substantial quota at a low tariff and there were significant improvements in access conditions in Japan and Korea.

Land use change

From the 1990s to today the amount of occupied pastoral grazing land has declined by 2.5 million hectares. This is due to reversion, blanket forestry, the closing of some country into the government conservation estate and the conversion of farmland near towns and cities to small holdings and lifestyle blocks.

Within this, sheep and beef pastoral land has declined more sharply by 26 per cent from 12.5 million hectares to 9.6 million hectares. A total of 600,000 hectares of this decrease was prime sheep and beef land converted to dairy farm land. The most significant increase in dairy farms was for the season starting in the spring of 2008 when an estimated 330 new dairy farms started.

The 2007-08 dairy season was a boom year in terms of global dairy product prices but the individual farm business decisions to convert to dairy would have been made before the dairy price boom, in the previous season or earlier. Much of the reasons behind conversions to dairy was disenchantment for three consecutive years of poor lamb prices. Even before then there was an underlying small but steady conversion of sheep and beef land to dairy of around 50 to 80 farms a year over the past decade.

The rationale for this land use change is largely centred on converting sheep and beef land to large scale dairy farms that average 500 or more cows. These new dairy farms with new rotary dairy sheds and farm layout in terms of raceways designed for large herds all give economies of size to the new dairy businesses. The average dairy herd in 2007-08 including the new larger herds was 351 cows.

Since 1990 sheep numbers have declined 41 per cent to 34 million and beef cattle declined seven per cent to four million. In contrast dairy cattle increased 61 per cent to reach just under six million. In the 12 months from July 2007 to July 2008 sheep numbers declined 11 per cent and beef cattle three per cent. Of this decrease, 60 per cent is attributed to drought and the remaining 40 per cent to land use change to dairying and dairy support. An increase in cash cropping also contributed to the decline in sheep numbers. Expectations are that sheep numbers will show some recovery from the drought but there will be a continuing offset from further but slower changes in land use than in recent years.

Market forces

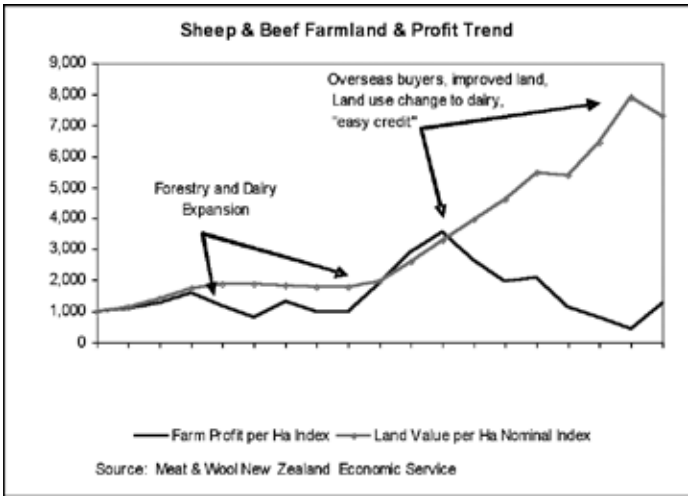
One key point to note is the change in land use and the stock number changes have all occurred from individual farm business owners responding to their perceived outlook for global prices. Nothing else has caused this change.

For sheep and beef farming the available pastoral area has become squeezed, as easy to flat land is changed to other more intensive land uses. At the other extreme, poorer hill country has reverted to scrub or has been closed to farming and put in the conservation estate.

The graph on the right and on the next page show the trend in sheep and beef farm and dairy farm profit per hectare changes on an index basis along with the corresponding trend in per hectare farmland prices. Sheep and beef farm profitability was at a low for much of the 1990s and then improved towards the end of the decade. Improving productivity and improving off-shore prices, further underwritten by a significant depreciation of the exchange rate, boosted profitability to a peak in 2001-02. The same general comments apply to the trend in dairy farm profit per hectare trend.

Land prices

The trend in sheep and beef farmland prices ran ahead of the sheep and beef farm profit trend for much of the 1990s. Demand for land initially for forestry on hill country, and later for finishing land to convert to dairying, boosted sheep and beef farmland prices. Profitability was excellent in the late 1990s and early 2000s allowing a catch-up in deferred maintenance on many farms. This in turn improved land values and then the percentage trends in farm profit were more closely aligned with the rate of land price increases.



After 2001-02 the exchange rate appreciated, farm input prices increased and off-shore prices eased. This situation saw sheep and beef farm profit fall to a 50 year low by 2007-08 yet sheep and beef farmland prices continued to increase.

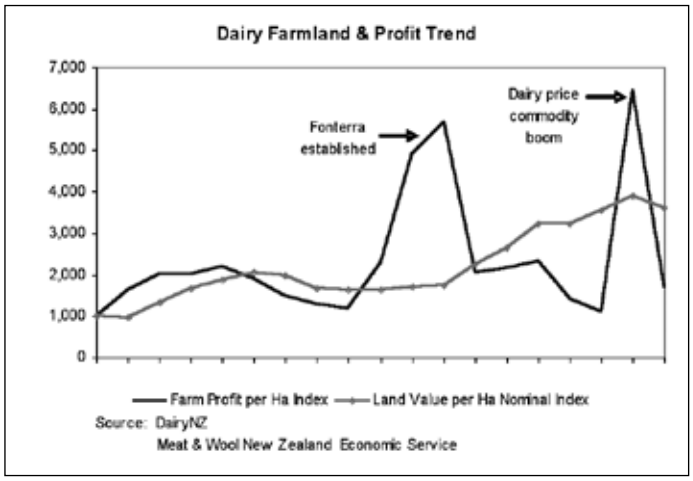
The increase in sheep and beef farmland prices through to 2007-08 was largely due to the underlying demand to convert land to other uses, particularly dairying. With the hindsight of the global debt bubble bursting in August 2008, easy credit sources coupled with the willingness of banks to lend on farmland helped underwrite this increase.

The trend in dairy land prices is more moderate than for sheep and beef farmland. This is because dairy farmland was already relatively expensive especially relative to sheep and beef farmland. For a dairy farmer to expand or buy a larger farm, economic forces dictated a move in the direction of buying and converting sheep and beef farmland to dairy rather than bidding up the already high price for established dairy land.

This created a new external demand for sheep and beef farmland and underwrote much of the increase in sheep and beef farmland. To a lesser extent buyers from offshore added to this pressure along with the relatively easy path to finance these land purchases.

Dairy farm profitability spiked in 2007-08 due to a global boom in dairy prices. This boom reversed abruptly in 2008-09 as the indexed profit fall shows in the graph above.

The speed of the decline in demand for sheep and beef farmland for alternative land uses will influence the rate that the land price trend converges with its ability to generate profit. However, farmland is a diminishing resource and the reduced supply will be a significant consideration underpinning the longer run outlook for land prices.



A short history of the future

The launch base for looking into the future is one of the finance sector credit bubble bursting and leading developed countries into a deepening recession and lack of confidence to spend. Recessions do not last for ever and some key fundamental trends apparent before the recession remain relevant for the future.

Population growth alone sets the scene for a very different world than last century. From 1970 to 2009 the world human population grew from 3.7 billion to 6.9 billion, an increase of 3.2 billion in 40 years. Much of this increase was made possible by increased productivity in agriculture but this productivity globally has tapered off.

Back in 1970 there were around 0.37 hectares of agricultural land per capita. Today there are around 0.22 hectares and the outlook to 2030 is for the global human population to increase further by 1.4 billion to 8.3 billion. Agricultural land per capita will fall to around 0.17 hectares. Without increases in agricultural land areas being possible this means increased agricultural productivity is required.

Efficiency of resource use

This topic largely encapsulates the following four key areas of importance for the future. Efficiency of resource use is about the development of future management systems that meld together farm production, excellent stewardship of our land resource and profitable farm businesses. Here are some of the issues farm production systems will need to address in future.

Energy and bio-fuels

West Texas Crude was US$27 a barrel in June 2001 and peaked at US$133 in June 2008 but then dropped steeply to US$38 a barrel in February 2009. A larger world population will place an increasing demand on energy which is likely to be met in part from bio-fuels. However it is likely that government incentives will be required to encourage the production of bio-fuels particularly if oil prices remain around their current level.

Bio-fuels have less calorific energy than hydrocarbon fuels but have the advantage of being greenhouse gas friendly. The trade-off then becomes between land for food production and energy production. Where New Zealand sits in this equation with our pastoral production systems will most likely to see our pastoral production systems remain in place, particularly in our hill country.

Climate change and greenhouse gas emissions

Agriculture accounts for 48 per cent of New Zealand's greenhouse gas emissions. Most of these are from ruminant livestock that produce methane from their natural digestion process. Methane is currently ranked as having 21 times the global warming potential of carbon dioxide emissions, based on 100 year time frame. There are no economic technologies known to reduce methane from the natural digestion process of ruminants, although research is underway on this topic and other potential mitigation technologies.

Water

With the increasing intensity of land use and population growth water has become a key resource for which agriculture has to compete with other users. In the New Zealand context nearly all meat and wool production is derived from non-irrigated land. Irrigated land in dry regions is generally focused on high value dairy and crop production.

In general the majority of New Zealand's pastoral production systems rely on rainfall. In northern hemisphere countries the water footprint of producing one kilogram of lamb is 6,100 litres and for beef 15,500 litres. On this basis it is calculated that New Zealand meat exports are equivalent to using 11 trillion litres of virtual water or in other words water that importing countries would not need to use. On the input side this exported virtual water is less than 0.1 per cent of the rainfall that falls on New Zealand sheep and beef farmland.

While water is becoming a scarce resource in many parts of the world, New Zealand's farming systems have a natural comparative advantage from rainfall compared with many other countries. This comparative advantage is likely to be of increasing importance.

Genetics

Genetics and gene marker research and the applied development from this research provide key opportunities to improve pasture and animal efficiency on a continuing basis. These technologies are already starting to allow faster genetic improvement and are expected to be one of the leading improvement tools in food production this century.

Conclusion

New Zealand farmland is a shrinking resource. This logically links to the importance of continuing research to evolve and develop new efficient and profitable farm production systems. Similarly improving access to global markets is important along with the continuous development of products to meet consumer needs. For the foreseeable future, agriculture, its exports and its performance in world markets will continue to define this major aspect of who and what New Zealand is in the global community.

Rob Davison is an Executive Director for Meat and Wool New Zealand

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The global financial crisis and its effect on the agricultural sector

David Tripe

The onset of the current global financial crisis was a long time coming, and a number of us had been expressing concern about its potential for a few years. We also argued that the longer the slow-down was delayed, the worse it would be when it actually occurred. We therefore watched with trepidation at the steady rise in house prices in the US, in New Zealand, and in many other countries during most of the current decade, and at the looseness in monetary policy which helped this process.

A bubble

In the US, the looser monetary policy was persisted with because the then Chair of the Federal Reserve Board thought that asset prices were not a particularly important indicator, a view he now admits to have been in error. At the same time, the role of easier credit in boosting house prices was also being stimulated by some easing in credit standards, and by the psychology of bubbles.

If you think that prices are going to rise, you want to get in and buy now, so that you can make money from holding assets while their prices rise. We saw the same psychology in New Zealand. I recall a discussion with some fellow academics in Dunedin in January 2006. We noted the steady rise in house prices, and that it would therefore be rational and more lucrative for us all to cease work and concentrate our efforts on investing in residential property. We could recognise a bubble that would sooner or later have to burst, so we all kept on working as academics. It is arguable that the same sorts of processes were driving share prices, which rose strongly in international markets for much of the decade.

The other side of a bubble, however, is that when it bursts, the same process occurs in reverse. Why should you buy that house or that parcel of shares now when in three months' time, you are likely to be able to get it significantly cheaper? We are therefore seeing a steady decline in the prices of both shares and residential property in New Zealand and in many other countries around the world.

Real assets

Although the psychology around the bursting of the bubble is a factor driving the current crisis, it is not the only one, and we also need to take note of some specifically New Zealand factors. One of the factors affecting the current crisis is the operating structure of the financial sector itself, where banks have a relatively small amount of equity capital relative to their assets. This means that any losses that banks suffer have a much more significant effect on their capital base, and on bank solvency. A loss that might be equivalent to five per cent of assets would immediately render a bank insolvent if it had equity only of five per cent of assets, a figure that would not be unusual in international terms.

Against this background, a challenge for depositors in banks and other financial institutions is that they do not know what the real value of a bank's assets is. They do not know what losses have actually been incurred, but which have not yet been reported in financial statements. This uncertainty has been a major contributor to the crisis, in that those who are putting money on deposit with banks, particularly the large wholesale depositors, are uncertain as to the bank's financial condition. They will demand a higher interest rate than they might have in happier economic times, while they will also restrict themselves to much shorter terms when putting funds on deposit.

Margins

These effects have led to the crunch in the inter-bank credit market, and have caused interest rates on loans to be significantly higher relative to benchmark interest rates, such as the OCR in New Zealand, than they were in former times. Even though banks are now targeting holding higher levels of capital than they might have previously, this is a necessity to allow them to raise funds. It does not reduce the actual costs of funds to the sorts of levels the banks enjoyed prior to the crisis.

This is why the margins apparent on floating rate mortgages, and for bank base lending rates, are much higher than they were in earlier times. The blanket deposit guarantee schemes that governments around the world have offered to their banks, including New Zealand, have mitigated these effects, but not eliminated them.

Current account deficits

In the New Zealand situation, there are further complications in the setting of interest rates, relating to the balance of payments current account. From the beginning of 2000 until the September quarter of 2008 New Zealand ran up a cumulative balance of payments deficit on current account of $83.7 billion, which is the equivalent of roughly two years of export receipts.

These current account deficits have had to be financed by an inflow of funds into New Zealand, which has occurred, mainly through foreigners buying up New Zealand land and businesses, and by increased non-resident funding flowing into New Zealand banks.

Over that same time period, from the beginning of 2000 until the September quarter 2008, net non-resident funding of the New Zealand banking system increased by $63.7 billion, to a total of $104.1 billion. Because almost all of this is either denominated in New Zealand dollars or hedged into New Zealand dollars from foreign currencies, the banks do not face any significant foreign exchange risk in relation to this funding, although the country as a whole depends on the willingness of those foreign providers of New Zealand dollars to continue to do so.

As international financial markets have become more edgy during the crisis, there has been some concern at the sustainability of New Zealand's position with a net international investment position showing a deficit approaching 100 per cent of GDP. These concerns are likely to have been a reason for some of the

fall in the value of the New Zealand dollar during the later part of 2008, while pressures relating to this exposure have kept New Zealand interest rates higher than they might have otherwise been. This is also why the government has been so concerned about possible downgrades of New Zealand by the international credit rating agencies.

Implications for the agricultural sector

The global financial crisis will have a number of economic effects for the world as a whole, and for New Zealand, and these will in turn have effects on the New Zealand agricultural sector. There are also some warnings for problems which have yet to have their effect.

Reflecting its export focus, the New Zealand agricultural sector always regards a depreciation in the exchange rate as a good thing, as it should increase relative returns. We have therefore seen sheep and beef farmers enjoying improved conditions in the current season relative to the previous one. But we should be aware of what has been happening with the dairy sector, where the international economic slowdown has seen a reduction in returns from overseas markets. However, international economic conditions suggest that the New Zealand dollar might, and ought to, depreciate still further.

When this article was being written in early February 2009, the New Zealand dollar stood at a little over 53 cents against the US dollar and at around 53.4 against the trade-weighted index (TWI). When the New Zealand dollar was at its low point in recent years, in 2001, it fell below 40 cents against the US dollar and to 46 against the TWI. Even then the balance of payments current account was still in deficit. If New Zealand is to start running balance of payments surpluses on current account, so that its net international investment position can start to move back towards balance, a much lower exchange rate is likely to be necessary.

Exit strategy

Non-residents still hold substantial exposure to the New Zealand dollar. Attempts to exit from these positions, perhaps because of their recognition of the riskiness of holding New Zealand dollar assets which might depreciate, could lead to a significant shift in the dollar's value. In the current global economic climate with significantly lower interest rates it is hard to see that foreign investors would suddenly get sufficiently enthusiastic about the New Zealand economy that they would want to increase their investments. The major protection against a more severe depreciation in the value of the New Zealand dollar is that investors may not want to crystallise losses by leaving their positions at current or lower exchange rates.

If foreign investors were to run against the New Zealand dollar, it is likely that there would be significant upward pressure on interest rates, regardless of the level of the OCR and despite the capability of the Reserve Bank to intervene by acquiring assets from banks. It is unlikely that we will see much in the way of upward pressure on interest rates from other sources until such time as the economy starts to grow again.

This is likely to be several months away as we have yet to see any dramatic growth in unemployment from the slow-downs in the retail and building-related sectors of the economy in particular. We should acknowledge that we ought to see slow-downs in these sectors of the economy. The balance of payments deficit that we have been running on current account suggests that we have as a country been spending more than our income, something which cannot be sustained indefinitely. Getting spending and income back into balance can only occur through a reduction in spending, the major effects of which will be observed in these two sectors of the economy.

Willingness to lend

Although the interest rate as the price of money may not be a problem for the agricultural sector, noting that the sector is a substantial net borrower from the banking system, banks' willingness to lend may pose more of a challenge. New capital rules and the need to show high capital levels to be able to borrow from other banks both mean that banks have to conserve capital and will be less willing to put that at risk by lending. Routine borrowing may not be affected, but funding for new projects is likely to be rather more difficult to obtain.

Growth in funding for the agricultural sector is both a symptom of what has gone on in terms of the crisis, and an indicator of what may be expected in the future. The introduction to this article mentioned a bubble in the price of residential property, including in New Zealand. This can be related to the growth in overall lending on housing.

Between the beginning of 2000 and the middle of 2008, lending on housing increased from $62.3 billion to $160 billion, an increase of 157 per cent. It is interesting to contrast this with growth in lending to agriculture over the same period, which was from $12.2 billion to $40.2 billion, an even greater increase of 229%. Moreover, although housing lending growth has more or less stopped since June 2008, the same cannot be said for agricultural lending, which has grown by a further $3.3 billion through until December 2008.

This data would suggest the possibility of a bubble in rural land prices, which might pose significant risk of a price downturn once the growth stops. This could easily be triggered by reductions in Fonterra's projected payout, particularly as it is likely that much of the growth in lending has been financing the dairy sector. The bursting of a bubble would also make banks much less enthusiastic than previously in lending to the agricultural sector.

Easing the risks

We do not know for certain that there is a bubble, and we do not know that a bubble is going to burst, but there appear to be risks around the rise in rural lending. These might be eased by a further fall in the exchange rate, but if land prices were on a downward path that might not be enough to remedy things for the dairy sector, especially as a sharp fall in the exchange rate could easily be accompanied by a sharp rise in interest rates.

A sharp fall in the exchange rate would also be accompanied by higher prices of imports, which would increase input costs for all farm types. Things may not be going to be easy for the agricultural sector, although there may be some comfort in that other sectors in the economy may suffer more from the financial crisis.

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The transformation of New Zealand's kiwifruit industry

Mike Chapman

The meltdown of the world economy and plunging commodity prices, aptly demonstrated by Fonterra's falling payment, have focused attention on how premium products will perform. Zespri branded New Zealand grown kiwifruit in recent years has transformed itself from a commodity into a premium product. The question now facing the kiwifruit industry is whether the current industry structure and marketing will sufficiently insulate it from declining sales volume and price.

Grower control

The recipe that has been used to transform New Zealand grown kiwifruit into a premium product has, as its core ingredient, grower control of the industry. This is through grower ownership of their marketing company, Zespri International Limited, and the growers' brand of the same name.

But how has Zespri managed to make the transformation on behalf of its grower owners? This has been achieved by Zespri on behalf of the New Zealand kiwifruit growers enjoying the benefits of an export monopoly, technically known as a monopsony and often referred to by the kiwifruit industry as the single point of entry. The benefits from the monopoly are the ability to effectively promote branded kiwifruit in key markets, maintain consistent quality, give the consumer what they want, commercialise new varieties and to operate an integrated supply chain.

As volumes have increased so have returns, but at a greater rate. This is due to the industry's transformation as the table below shows.

Recent history

To fully understand the rapid growth of the New Zealand kiwifruit industry, its recent history needs to be reviewed. As with most dramatic change poor results were the catalyst. After the disastrous 1987 season's results, there was strong pressure from kiwifruit growers to reform the marketing system. The New Zealand Kiwifruit Marketing Authority commissioned a report on kiwifruit marketing from Coopers and Lybrand. It was published in May 1988 and confirmed that the structure in 1987 was costing growers dearly.

Seven licensed exporters competed for growers' crops, but ownership of the crop was retained by the growers, who carried all costs and risks until the fruit was sold. These costs included packing, transport, insurance, storage, wharf costs, interest on advances, shipping, as well as overseas wharfage, transport and storage. Exporters sold through importers and wholesalers, paying commissions of eight to12 per cent of the wholesale price and exporters took commissions of 10 per cent of the return.

Exporters often sold to importers in competition with each other with no effective price discipline. There was no one overall New Zealand brand. When crops were smaller and demand high, prices had remained high, but a ten-fold increase between 1981 and 1987, with a 60 per cent increase between 1986 and 1987, meant flooded markets and a sharp fall in returns.

Unified marketing

A unified, disciplined, one brand, single-seller marketing strategy was essential for the survival of the industry. New Zealand kiwifruit had to become a premium product. Grower pressure resulted in the New Zealand Kiwifruit Authority taking responsibility for marketing and laying the foundations for today's industry.

Further financial problems were faced by the industry in 1992. The industry led its own recovery without government assistance. This was the impetus for devising a new market strategy and the establishment of a three-step industry review. The industry review and report recommendations were endorsed by a significant majority of growers in late 1995. This review resulted in the setting up of New Zealand Kiwifruit Growers Incorporated as the grower representative forum and grower decisions being made on the appropriate structure for the industry. This included defining the role, functions and commercial and capital structure of Zespri International Limited which was formed in 1997.

One key result was that the single point of entry was continued. Other recommendations included providing more

Export returns for apples, kiwifruit and other fruit from 1975 to 2007

Year	1975	1985	1995	2005	2007
Apples	$19.3 million	$108.2 million	$343.6 million	$387.0 million	$343.3 million
Kiwifruit	$2.9 million	$171.9 million	$320.8 million	$720.2 million	$765.1 million
Other fresh fruit	$0.8 million	$28.4 million	$57.6 million	$79.6 million	$88.8 million

flexible supply options for growers, the creation of greater supplier responsibility for fruit quality out-turn, the testing of collaborative marketing and the corporatisation of the New Zealand Kiwifruit Marketing Board's assets.

Future strategies

In November 1998 the government asked all the producer boards for their strategies for the future. The kiwifruit industry developed a strategy entitled 'Pathway for prosperity – The continued evolution of the New Zealand kiwifruit industry'. It included year-round marketing and direct contracts with suppliers. The strategy built on the success of the Zespri brand and integrated orchard to market supply chain.

The Kiwifruit Industry Restructuring Act 1999 outlined a process for implementing a restructuring plan for the industry and needed a grower referendum. The restructuring plan brought into effect the corporatisation and full commercialisation of the kiwifruit industry structures and defined ownership by allowing growers, for the first time, to become shareholders in their industry organisations.

The key element of the plan, which involved extensive consultation with growers, was the conversion of the New Zealand Kiwifruit Marketing Board into a public company, Zespri Group Limited. Eligible kiwifruit producers were issued shares. Under the new corporate structure the Zespri Group Limited subsidiary, Zespri International, remained the main marketer of New Zealand kiwifruit overseas. They operated the single point of entry for the supply of export kiwifruit, other than to Australia.

Industry transition

The industry at this time was in transition as it was moved to being market focused. The industry over the previous decade had built and refined a set of values. It was built from the marketplace back to the orchards, leveraging the value of the unique single point of entry and market entry structure. It established the following cornerstones, which still form the basis of business strategy today –

- In-market structures built on direct customer and retail relationships with dedicated teams of locally recruited sales and marketing experts to provide tailored support and services
- Branding to build a reputation with consumers to secure supermarket shelf space
- Year-round marketing to provide category management and control shelf space and positioning.
- Innovation in research, development and commercialisation of new products, varieties, quality standards, market information and intelligence to enable growers to supply product to customer needs.
- Consistent quality so that retailers and consumers can rely on Zespri branded fruit to give them the same eating experience.

Marketing

Zespri markets its products in around 60 countries, employing in all key markets highly skilled teams of people who understand local conditions, speak the language and know the business, and most importantly are passionate about service to customers. There are the following three products with more under development –

- Classic, fresh-tasting green-fleshed kiwifruit, Zespri green kiwifruit.
- Tropical flavoured, golden-fleshed variety, Zespri Gold kiwifruit
- Zespri Organic kiwifruit.

The Zespri kiwifruit brand was one of the underpinning strategic platforms developed in the early 1990s to move the focus of the business to customers and consumers. That move was designed to help combat the challenge of rising pressure from consumers who did not differentiate one kiwifruit from another.

The pressure was also coming from supermarket retailers, the real power brokers. They wanted all inclusive service, consistent quality of product and service, always delivered to their specifications, and tailored promotions to ensure that they earned maximum revenue in minimum time for the retail space they allotted to kiwifruit.

The current aim is for the Zespri brand and system to become category managers for retail partners in chosen markets for all 12 months of each year. For continued growth Zespri must be the preferred supplier to supermarkets, must maintain the influence which comes from holding that market share and to keep market share, and must stay relevant to the current market and the next generation of consumers. This has meant moving to 12-month supply by procuring and marketing from offshore suppliers who meet strict brand and quality criteria.

Single point of entry

The industry's success has been based on grower control of Zespri the marketer and success based on the industry's single point of entry. For the New Zealand kiwifruit industry, the Kiwifruit Export Regulations 1999 require that Zespri be authorised to export kiwifruit from New Zealand, excluding kiwifruit for the domestic market and for consumption in Australia. In return Zespri can produce the benefits of a single point of entry to growers.

Zespri is a corporate company that has shareholders and independent accountability. The corporate pays returns to growers less sales commission, marketing costs and supply chain costs. This corporate model has worked well. Shareholding is voluntary, although restricted to growers, and dividends paid

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have given good returns to shareholders since the company was formed. One of the biggest advantages however, is the discipline the industry model imposes, which is healthy for the kiwifruit industry. These obligations are set out in the Kiwifruit Export Regulations 1999.

Focusing interests

Zespri has been set up with the right to export under the regulations with the purpose of focusing on the interests of kiwifruit growers. The company earns commission only from kiwifruit and looks after kiwifruit markets and growers as the reason for its existence. The marketer in turn invests in research and development of new varieties, on orchard practices, and supply chain procedures to improve the industry's competitiveness and ultimately grower returns. Large sums of money are spent each year on innovation, and kiwifruit's single point of entry provides a valuable mechanism to coordinate the sharing of this information within the industry.

Kiwifruit's single point of entry has allowed Zespri to grow its market share in the industry's key markets and allowed it to develop the brand. One result is that Zespri is the largest marketer of kiwifruit in the world. The most important result is that branded kiwifruit is no longer a commodity product. It is a premium product that earns returns that are higher than its competitors. This is the most important benefit of the single point of entry to the New Zealand grower.

Consistent quality

Kiwifruit's single point of entry allowed commercialisation of Gold kiwifruit in record time with developing markets making top returns for growers. As other new varieties are developed, kiwifruit's single point of entry and strong distribution channels will allow for effective and timely commercialisation and market development.

Another important marketing advantage that comes from kiwifruit's single point of entry is consistent quality for customers. Only an integrated and cohesive industry can achieve this. Customers and consumers alike will pay a high price for quality and they will re-purchase that premium product because they know they will get the same eating experience. Consistent quality underpins kiwifruit's single point of entry.

Markets are becoming more sophisticated and customers are putting more pressure on the industry. Zespri deals with large offshore customers who want a company that has a strong brand and can produce the quality and quantity retailers are looking for.

Customers want a choice and retailers want to keep their shelves stocked 12 months of the year at the best prices. Growers need clear communication from the markets so that the market needs can be met. New Zealand's single point of entry within the kiwifruit industry allows market signals to flow back to growers in an accurate and timely manner.

Sustainability

A challenge the industry faces in the international marketplace relates to sustainability of the industry. Issues such as responsible employment practices, carbon footprint, food miles, surplus fruit, and strong grower support for environmentally sound practices are some of the important issues to the industry's customers. Only as a unified and cohesive industry can the growers face these challenges and maintain the high quality standards that earn us the premiums in the market.

As noted earlier the single point of entry came as a result of the failings of the multi-exporter model and was supported by the vast majority of growers, and that support continues today. Kiwifruit's single point of entry provides essential advantages in a year like the current one when grower returns are under extreme pressure.

It is not hard to imagine what returns would be like if competing marketers had all marketed the increased volume of fruit to the highest paying markets in the current season. Zespri need to produce competitive returns to the grower to maintain their support for kiwifruit's single point of entry.

Ranking Zespri

In a recent survey growers were asked how they ranked Zespri's operating and marketing performance. The results were a 92 per cent rating of either good or very good. A large majority of growers (84 per cent) believed that kiwifruit's single point of entry was critical for the future success of the industry. And 81 per cent of growers believed their return would decrease if kiwifruit's single point of entry was removed.

Kiwifruit's single point of entry has transformed the kiwifruit industry and turned what was a commodity into a premium branded product that is valued by consumers. However the kiwifruit industry cannot be complacent and needs to continually innovate to maintain its position. Simply put, without kiwifruit's single point of entry the industry would not be where it is today. It underpins the industry's success.

Conclusion

The overall affect of the industry structures and marketing system has resulted in Zespri being able to command a premium over competing kiwifruit that in some markets can be as much as 30 per cent to 70 per cent. Price fluctuations suffered by the competitors' kiwifruit and other fruit do not affect Zespri's price points to the same degree. Zespri backed by the brand, its marketing, consistent quality and the support of the integrated industry has been able to maintain price stability.

As the kiwifruit industry prepares for the 2009 season, with picking due to start in March, the five cornerstones of the industry underpinned by the single point of entry will be tested. The industry has evolved and through tough times so as to make the industry resilient to the current challenges, but how resilient only the future will tell.

Mike Chapman is the Chief Executive NZ Kiwifruit Growers Incorporated. The views expressed in this article are those of the author and not of this company.

Growing global: The multi-nationalisation of New Zealand agriculture

Richard Meade

What is the source of New Zealand's comparative advantage in agriculture, and from where can growth in agriculture-sector returns be expected? Our distance from markets, the growing concerns over food miles, risks from climate change, rising land values, competitive pressures from lower-wage countries, and failure to secure breakthroughs in agriculture-trade liberalisation all present challenges to growth. An important response of the New Zealand agriculture sector to these challenges has been 'multi-nationalisation'. This is the increasing international diversification of supply by New Zealand primary producers and processors through ownership and other means.

New Zealand know how

Increasingly, New Zealand producers are buying land in other countries and adding New Zealand know-how to boost productivity. Or they are buying overseas agriculture processors to gain from New Zealand's processing and exporting know-how. They are even combining New Zealand know-how in production, procurement, processing, exporting, and branding with the complementary skills of overseas companies involved in some or all of these activities, to broaden their global footprint in all of them.

Examples abound. Fonterra now has billions of litres of milk supply from Australian, US and Latin American dairy farms to complement the 14 billion litres it sources from New Zealand farmers. It uses its knowledge to process products for local markets and its export expertise to take milk products from these countries to others. While New Zealand lacks a free trade agreement with America, Chile does not – so Fonterra's Chilean production can then side-step trade barriers and access the US market more easily than its New Zealand production. The profits are then channelled back to its New Zealand owners.

Other problems

Fonterra is not alone. New Zealand's horticultural producers have already seized on a useful model to overcome problems of uncoordinated southern hemisphere marketing of apples and kiwifruit in key European markets. However with better storage technologies undermining the seasonal marketing advantages they previously enjoyed in Europe, these producers face other problems.

One answer to all this is to invest in new apple and kiwifruit varieties with New Zealand producers controlling the intellectual property. Both Zespri and Seeka are licensing overseas production of the trademarked and successful kiwifruit Gold. ENZA is doing likewise for the popular Jazz apple. Suddenly they are not just New Zealand producers, but international ones.

The 'food miles' argument becomes less valid – Europeans might be buying a New Zealand-controlled variety whose intellectual-property returns are shared with New Zealand producers. But the actual fruit is produced locally by local growers. There is also a prospect of side-stepping Australia's phytosanitary obstacles to New Zealand apple exports. Perhaps New Zealand growers should license Australian ones to grow these premium varieties on their behalf? Or set up their own orchards in Australia to grow them themselves?

Meat sector

Multi-nationalisation in New Zealand's meat sector has been slower, which may reflect coordination and over-capacity problems. However, prominent examples present themselves. Rissington Breedlines now contracts farmers in New Zealand and Britain to produce lamb of consistent year-round quality based on its knowledge of in breed lines and farming techniques – and it has designs on Latin America as well. Soon it will be the sole supplier of New Zealand lamb to British supermarket chain Marks & Spencer. Whether or not the food miles argument has any merit, it suddenly becomes a lot less important when the produce is locally sourced for at least half the year.

Meanwhile New Zealand Farming Systems Uruguay (NZFSU) has taken a different tack, buying relatively cheap pastoral land in Uruguay and boosting its productivity by adding New Zealand farming expertise. New Zealand-Chilean joint venture Chilterra is doing the same to increase productivity on Chilean dairy farms. Similar strategies are being adopted by non-agricultural concerns. Whiteware manufacturer Fisher & Paykel retains its design focus in New Zealand but has relocated an increasing amount of its production to lower-cost countries closer to markets. The model is not New Zealand's, and not confined to agriculture, but New Zealand agricultural producers are embracing it all the same.

Diluting he brand?

So far so good, but what new questions do these strategies raise?

An obvious one is how multi-nationalisation squares with the Pure New Zealand brand. It may dilute the brand, since the New Zealand producers mix products from a variety of countries. But these producers can now claim local branding advantages in each of the countries in which they operate. They can legitimately point to 'home grown' produce made by local producers especially where licensing and contracting are used to secure local supply instead of outright ownership.

Another question is whether New Zealand producers want to see their growth coming more from securing overseas supply than from expanding it in New Zealand. With increasing competition for land use in New Zealand, and with growing concerns about environmental degradation from intensified farming, agriculture in New Zealand could become increasingly specialised while commodity production grows offshore.

In addition, if adverse climate change cannot be responded to by a relocation of domestic production to other parts of New Zealand, local producers will need to consider shifting the balance of their production to more favourable climates overseas. While this retains some role for those in New Zealand who wish to work on the land, an increasing share of their returns will be

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from beyond the domestic farm gate – and from beyond New Zealand.

Control

Whether and how New Zealand producers take advantage of that growth, or whether they leave it to non-farmer investors, depends on ownership structures, capital requirements, risk appetites and the need or desire for control. Where producers have the advantage of intellectual property rights to new varieties, they can enjoy returns from offshore growth through royalties and other such licensing fees.

Fonterra's cooperative farmer owners receive returns from the company's operations through their cooperative ownership stakes. The benefits of NZFSU's activities in Uruguay flow to its shareholders who are not necessarily New Zealand meat producers. Whether or not New Zealand producers can access the returns from offshore growth in production will largely hinge on their willingness to risk capital in downstream organisations. They will also depend on the extent to which they are prepared to cede control in either their domestic or offshore downstream activities if such is the price of securing capital.

Fonterra's farmer owners recently signalled their preference to preserve control, but it remains to be seen whether this will significantly diminish its ability to continue its multi-nationalisation. A more pressing question is whether the ailing meat processing industry will be able to reinvent itself and take advantage of the strategy in some shape or form, regardless of capital constraints on cooperatives.

Important elements of the multi-nationalisation strategy include offshore investment and the use of New Zealand agricultural know-how. Is the local institutional framework right? Provided that domestic agricultural and other commercial institutions are flexible and not biased in favour of particular approaches, producers can take some comfort that things will work themselves out.

Already they have seen recent changes that align more usefully with the strategy. For example, in 2007 New Zealand moved to align its taxation treatment of active income from offshore companies with that in other developed countries. Local companies no longer face a tax-based obstacle to expanding their business offshore.

After many years of supporting foreign direct investment in New Zealand, New Zealand Trade and Enterprise now has an increased focus on supporting outbound direct investment by New Zealand companies offshore. So perhaps the Ministry for Foreign Affairs and Trade should have an increased focus on securing investment access and intellectual property right protections in target countries, in parallel with its advocacy of agricultural trade liberalisation at the World Trade Organisation. And perhaps MAF could support the multi-nationalisation strategy by exporting some of its regulatory expertise to less developed countries, and so help to improve productivity growth in countries beyond the farm gate, as well as on the farm?

Research and development

Finally, with increased weight being placed on know-how in New Zealand's offshore production expansion, questions arise about the country's research and development framework. New apple and kiwifruit variety breakthroughs have come from industry collaboration with Crown Research Institutes such as HortResearch. Breakthroughs in new grass varieties to reduce greenhouse gas emissions from farming are likely to require the involvement of others. Local opposition to the planting or growing of genetically modified produce is likely to remain and even intensify. Therefore multi-nationalised New Zealand producers may wish to see continuing breakthroughs in genetic modification technologies which they can then control and use in countries less opposed to growing and consuming such produce.

Whether or not New Zealand producers have the resources to fund such research while retaining control of the breakthroughs, will remain a challenge. Crown Research Institutes are becoming an increasingly critical part of the New Zealand producers' supply chain. Perhaps there is a case for those producers to collectively own them, rather than have them sell their expertise to the highest bidder.

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Turning the tide on hill country erosion

John Greer and Parnell Trost

Soil erosion takes a number of forms in the hill country and is evident to a greater or lesser extent in most catchments. In the majority of cases, landowners are dealing with localised erosion, such as soil creep or minor slipping. In more extreme cases landowners can be confronted with slumping and earth flows. These larger events have long-term implications for the carrying capacity of a property. After hill-country slip erosion, for example, pasture production takes approximately 20 years to recover to within 70 to 80 per cent of its pre-erosion levels.

'Hill-country erosion is estimated to cost New Zealand between $100 million and $150 million each year through the loss of soil and nutrients; loss of production; damage to houses, fences, roads, phone and power lines; and damage to waterways and aquatic habitats. (Ministry for the Environment, 2007: 213)'

A natural problem

The principal causes of hill country erosion are natural in origin, a combination of steep terrain, active geology and periodic storm events. Landowners have a range of management tools to mitigate the severity of the damage to their property and downstream infrastructure. The key to this work is identifying the environmental limitations of a property and tailoring interventions to suit the specific location.

Some of the management tools employed by landowners have been the maintenance or establishment of vegetative cover on banks and gullies, building up the root mass of paddocks which are susceptible to erosion, and where appropriate, changing land use practices to reduce or eliminate grazing pressure. An important avenue of help for landowners in developing mitigation practices has been regional council land sustainability officers. They have provided technical advice on how to tailor management practices to mitigate erosion.

Erosion prone areas

An estimated 1.14 million hectares of hill country pasture is classed as erosion prone. Of this, 70 per cent of the vulnerable area is in the North Island, and the two regions with the most significant erosion problems are the Manawatu with 223,500 hectares and Gisborne with 158,400 hectares. The current programmes to treat erosion prone land in the North Island are reaching approximately 15,000 to 20,000 hectares a year, or two to three per cent of the vulnerable area.

Accelerating the rate of treatment is important at a number of levels. A higher rate of treatment would reduce the long-term cost of recovery measures, ensure sustainable production on hill country properties and address one of the critical environmental challenges facing New Zealand as a country.

High Country Erosion programme

To help regional councils in their efforts to tackle hill country erosion the government has established the Hill Country Erosion programme. The programme was set up in 2007 and focuses on building the technical capacity of regional council officers, facilitating landowner discussions and providing targeted funding for catchment initiatives. Regional councils are able to make funding applications to the programme for new initiatives in severely eroding catchments. The programme complements the existing East Coast Forestry Project, which provides grants for plantings on erosion-prone land in the Gisborne District, and the recently established Afforestation Grant Scheme. This is a contestable fund with the goal of promoting new forestry planting and environmental co-benefits. The East Coast Forestry Project, has been a long term government initiative to address the risk of soil erosion in one of New Zealand's most vulnerable regions. In the sixteen years since the project was established, 33,000 hectares of erosion prone land has been treated.

Hill Country Erosion programme

The Hill Country Erosion programme was established in response to calls from a number of regional councils for additional resources to target catchments with severe or developing erosion

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problems. These calls were given added weight by the costs incurred in restoring infrastructure and pasture following the lower North Island storm of February 2004. A total of $162 million was contributed by central government for infrastructure repairs and agricultural recovery measures, while the insurance industry paid out on claims totalling $112 million.

The programme is administered by MAF and has two principal work streams, which are aimed at building capacity in land management and supporting on-ground initiatives. The funding for mitigation work is available through a contestable fund of $2 million a year. The fund is open to regional councils, and is aimed at supporting new initiatives for the treatment of erosion-prone land or the reduction of sediment into rivers.

The intention of the fund is not to replace existing regional council financing, but to co-fund new projects that would normally be beyond the financial resources of councils. In assessing proposals, priority is given to initiatives that can show strong community support for the work programme and which combine an appropriate mix of education, research, financial assistance and regulation.

Land sustainability officers

In developing the programme MAF was conscious of the critical role regional council land sustainability officers play in providing information to land owners and managers. These officers are one of the primary sources of material to the farming community on new land management practices. This workforce is geographically dispersed and has a varied range of skills from farming and forestry through to ecology and environmental science.

This variety of skills is an asset but it also means that land sustainability officers may not be fully conversant with all the issues affecting property management. In reviewing this situation, MAF considered there could be potential for targeted training courses. MAF is currently investigating the options for developing and delivering targeted training packages, on a regional basis.

In a similar vein, MAF received advice that funding should be made available to establish catchment facilitation groups in high priority catchments or sub-catchments. The aim of this capacity building would be to advance the adoption of remedial management practices, provide a forum for dialogue and promote the concept of total catchment management. The The Hill Country Erosion programme would support these groups by funding facilitators through the relevant regional council. Funding of $0.3 million a year has been allocated to the management of these facilitation groups and to developing training and skill packages for regional council land sustainability officers. Three projects have been financially supported since the establishment of the programme in 2007.

Sustainable Land Use Initiative

The initial project was signed off in December 2007, and involved a partnership with Horizons Regional Council. The Hill Country Erosion programme is partially funding the Council's Sustainable Land Use Initiative, which is targeting erosion prone areas in the Manawatu-Wanganui region. A sum of $6.6 million has been allocated to the project over a four year period.

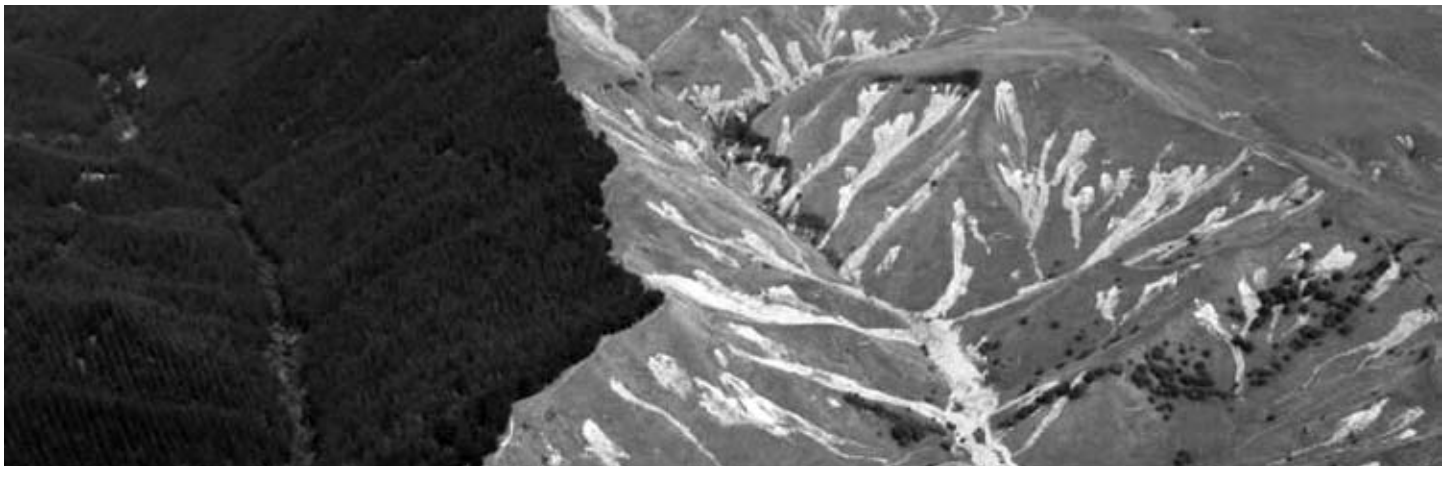
The Sustainable Land Use Initiative consists of advice and education, whole farm business planning, financial incentives, regulations and monitoring. The initiative is seeking to achieve long-term behavioural change in land use management. This will involve assisting landowners to better understand the topography and soils of their properties, and to introduce management systems that better suit these conditions. This is likely to include a greater use of tree planting from wide-spaced willows through to commercial forestry and native bush reversion.

Another two projects were approved in October 2008 with $675,000 allocated to a catchment initiative with the Greater Wellington Regional Council. The funding will be allocated over four years and will help the Council and landowners in preparing sustainability plans for properties in five priority catchments and in specific parts of the Wairarapa hill country. The funding is conditional on the Greater Wellington Regional Council contributing a similar amount through their long term Council Community Plan.

The third grant supports a collective application from the regional councils involved in the Willow and Poplar Research Collective. A total of $735,000 has been allocated over a four year period to support an active poplar and willow breeding programme that aims to generate new and improved stock for erosion prevention and flood protection. The aim of this work is to breed stock with improved soil stabilisation qualities and which is more resistant to known diseases.

MAF is currently receiving applications for the second funding round of the HCE Programme. The round closed in February 2009, and new funding initiatives are likely to be announced in June, following discussions with the relevant councils.

John Greer and Parnell Trost work for MAF Policy



Securing water resources futures for New Zealand

Terry Heiler

New Zealand's two main islands are, in general, blessed with plenty of precipitation in the form of rain, snow and ice. The west coasts of both islands are generally very wet with flooding and land stability being the main water issues. The east coast rainfalls are much less and agricultural drought is common. The North Island average annual rainfall, at around 1,000 mm to 1,500 mm, is generally higher than in the east of the South Island which has 350 mm to 700 mm.

There is also less spatial variability than in the South Island. The spatial variability in the South Island is extreme. A transect from the west to east coasts will encounter annual rainfalls that range from 7,000 mm in the west to 350 mm in Central Otago. Rainfall is generally about the same in winter as in summer, but seasonal evapo-transpiration differences are great from around a millimetre a day in winter and as high as 10 mm a day in summer in the hotter parts of the South Island.

On the eastern seaboard of both islands, growing season rainfall totals are also highly variable. In the drier inland valleys of Central Otago, the rainfall between growing seasons can range from 100 mm to 600 mm. Most run-off from rivers fed by rainfall occurs in winter, and snow-fed alpine rivers in early spring. Irrigation demand peaks in December and January when most of the run-off has passed.

Rich in water

Compared to Australia, New Zealand is water and run-off rich. The average annual run-off from the New Zealand land surface is about 300,000 million cubic metres. The comparable figure for Australia is about 340,000 million cubic metres, although the land area of New Zealand is only 3.5 per cent of the land area of Australia. The average annual run-off from two South Island rivers, the Buller and the Clutha, is 30 per cent greater that of the entire Murray Darling Basin, which has a catchment area about four times the area of New Zealand.

It is therefore surprising to note that the irrigated area of New Zealand, at about 750,000 hectares, is more intensive on a per capita basis than many other parts of the world. The comparable figures for Australia are about half of this figure.

Irrigation

Irrigated agriculture is now big business. In New Zealand the annual net farm gate contribution to the economy of some 500,000 hectares of irrigated land in 2002/03 was $920 million. Based on analyses carried out by MAF, likely irrigation developments by 2013 under two scenarios – 210,000 hectares and 470,000 hectares – would create additional annual net farm gate contributions to the economy of between $330 million and $660 million respectively. This is more than the rugby World Cup is expected to bring into the economy in 2011, and it is for every year. Off-farm benefits could double these existing and possible developments. Irrigated agriculture is clearly a matter of national significance.

Water enhancement by use of dam storage has been identified as a key element in any future irrigation development, and also for restoring environmental flows. The realities facing large scale water enhancement proposals for irrigation is that the pathway to identification of optimum water resources development is not clear, resource consents are expensive, and the financial hurdles are formidable, despite attractive long term economic returns.

These are large scale community projects involve inter-generational issues – large costs lumped on to the present generation with benefits continuing for an unlimited period into successive generations. The beneficiaries are not just the farmers, but we have yet to work out how to manage the equity aspects of this issue.

A time of nation building

The main concerns of the early settlers and government, even in relatively recent times, was not the use of water for irrigated agriculture. It was protecting riparian settlements from flooding, improving agricultural land by drainage, providing for stock and domestic water, and protecting land from water erosion.

It is instructive to journey back in time to the first recorded example of irrigated agriculture. In 1865, the Warden's Court approved the application by a French national, a Mr Feraud, to irrigate a market garden near Clyde to provide vegetables for sale to the gold miners. This was the first formal irrigation water right in New Zealand.

Early Days

The irrigation story starts in Central Otago around the mid 1880s. During the gold-rush times, water rights for sluicing were issued initially by the Wardens Courts as property rights and then under the Mining Act of 1898. Water taken from small burns, creeks and water races diverted from larger streams became the so-called mining rights of New Zealand folklore.

When land use changed from mining to pastoral agriculture, these rights were used by private individuals to flood grasslands as a form of drought mitigation in a semi-arid environment. They became an essential and fiercely protected property right. The Crown purchased or appropriated many of these rights and developed larger irrigation schemes, often involving conservation storage. The current rights based on these entitlements do not expire until 2021. In parts of Central Otago, when accumulated,

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they exceed available river flow. Further north, irrigation trials were started in the mid-Canterbury region as early as 1880, but any real development of large scale irrigation was delayed until well into the 1930s.

During the period to the end of the 1920s, the government helped local farmers to improve the use of the water resources of Central Otago by constructing storage dams and basic distribution infrastructure. The facilities were owned and operated by the government, with minimal financial contributions from water users for operation and maintenance. By about 1933, the total irrigated area was dominated by the government schemes in Central Otago and probably totalled some 45,000 hectares.

The Great Depression and unemployment

In the early 1930s through to the post-war period, irrigation development was justified under a policy that considered irrigation development to be a legitimate and economic activity of government. It was also a scheme to find gainful work for unemployed people using public good works programmes.

Works associated with several small schemes in Canterbury were carried out by this policy. These activities had increased the total irrigated area under government schemes to about 80,000 hectares by the mid-1950s. The key Central Otago irrigation schemes were also begun at this time. Two storage dams were built in the early years of the century, the remaining seven storage dams were all constructed in the period 1931 to 1937.

Increasing agricultural exports

In the latter part of the post-war period, up to about 1960, there was a clear policy position that irrigation for increasing production was a good thing, was in the national interest and should be supported by the government. This was very much in line with policy to increase production across the rural sector in a number of areas.

Subsidised support of agriculture was seen as justified to balance the restrictive import policies of the day. By 1960, the irrigated area had increased under government constructed schemes to about 95,000 hectares.

The period from 1960 through to the late 1970s saw rapid increases in government supported irrigation development, the emergence of substantial private irrigation development and increasing concerns from the community about the primacy of development objectives at the expense of environmental values. Various subsidy plans were applied during this period to encourage farming communities to agree to government sponsored irrigation schemes. This was also the period when the large hydro-electric schemes were constructed.

Land degradation concerns

In 1967 the government passed the Water and Soil Conservation Act. For the first time this recognised the emerging community concerns about land degradation – water and wind erosion – and the need to have minimum flow constraints on certain rivers. Water takes had to be registered and fixed term permits issued. The focus of the Act was still primarily soil conservation, despite the formalisation of historic water takes. An amendment to the Act in 1971, promoted by environmental interests, provided for the needs of wild and scenic rivers and introduced the concept of National Conservation Orders. The irrigation communities of the time were unaware of the implications of the new NCO instrument for their future plans.

By 1970, the total area under government irrigation schemes was still about 100,000 hectares, but new schemes were about to come on line. Private developments had increased dramatically over the period mostly based on groundwater resource developments in Canterbury, but the total area involved in private development is not known precisely. The rapid increase in private irrigation investments reflected the increasing importance of irrigation as an essential input to modern farming systems and fundamental changes in the needs of a global market.

Environmental factors considered

The proposal to raise Lake Manapouri as part of a hydro-power project in 1968 galvanised and focused the emerging environmental lobby in New Zealand and led to massive debate over the Clyde Dam development later in 1977. Because of these issues the government formalised its support of the environmental interest with the creation of the Department of Conservation in 1987.

The government-supported process of developing community irrigation schemes disappeared with the demise of the Ministry of Works and Development in 1988. This coincided with a dramatic reform of the public sector and was influenced by the prevailing economic rationale of the time and the increasing power of the environmental lobby.

This effectively left New Zealand without any formal agency responsibility for soil and water matters at government level – a situation that continues to the present day. At about the same time the government disposed of their interests in all of the schemes that they had developed under earlier policies. These were eventually sold to irrigation interests over the period 1991 to 1995.

By 1985, the total area surveyed under irrigation was about 260,000 hectares. Private developments, which had continued apace over the period, represented about half of the total.

Environmental values

The first real test of the altered balance of power in the water resources development area was the granting of a National Conservation Order on the Rakaia River in 1988. This order is still operative and has so far confounded the efforts of the farmers south of the Rakaia to develop scheme proposals affordable to farmers. This is despite them being economically attractive at the regional and national level, and the clear availability of substantial unused water resources.

The large number of statutes governing water allocation, management and use disappeared with the enactment of the Resource Management Act (RMA) in 1991. This legislation was interpreted by the courts to give priority to environmental values, and has been the source of much debate since its enactment. Earlier proponents of the RMA had not considered that this would be the result of the legislation, but court decisions since that time have reinforced the earlier legal interpretations.

The period from 1985 through to the present time has seen two community irrigation schemes developed by farmer interests – the Opuha Dam and the Waimakariri Scheme. Private developments have continued mainly from groundwater. The total area under irrigation in New Zealand has trebled in the period 1985 to 2007, almost entirely from private initiatives, and almost all experiencing coordinated objections from environmental interest under the RMA processes.

Virtually all irrigation proposals put forward since the 1980s, both private and communal, have met with vigorous opposition from environmental NGOs, fishing and recreation interests, local interest groups, and by the Department of Conservation. Expenditure on consulting and legal services under the RMA processes have been considerable.

Results of previous policies

The current situation is that the total area under irrigation has increased to about 750,000 hectares, a trebling since 1985, and accounting for 77 per cent of all water allocated in New Zealand. Canterbury alone has over 400,000 hectares of the total. The area under private developments is now substantially greater than the total area of the old government schemes and new community developments.

We have seen a rapid increase in farmer initiatives to get new community schemes off the ground. These have been championed by farmers who do not have the opportunity to develop privately, and who would have to depend on communal development of water sources. It has been estimated that the area involved in early stage community proposals could exceed 400,000 hectares. Whatever else is concluded, the strong interest of farming communities in additional irrigation development is indisputable.

In hindsight, much of what has happened with irrigation development since the 1880s until the early 1980s has been the result of the changing but development-friendly policy objectives of successive governments, influenced by the economic and social imperatives of the time. In terms of political influence, the political power of the irrigation farming lobby has not been a dominant feature in what happened – government led the charge.

Since the mid-1980s, the irrigation development story has been very different. Farmers have led the charge, in an environment characterised by the increasing influence of non-development interests, environmental NGOs, community concerns about water quality and under new policies related to resource development – a complete reversal of the situation that existed up until 1970.

What of the future?

Sustainable Water Programme of Action

We are currently in the process of changing the way in which water is managed. A new policy environment developed by the last government has seen new policy instruments. A National Environmental Standard on water measurement is in the final stages of government consideration. A discussion document on environmental flows is awaiting approval to be released for submissions.

In April 2006, the government of the day announced an accelerated Sustainable Water Programme of Action (SWPoA). Effectively, it called for substantial progress to be made by 2007 on a number of important issues confronting the sector including –

- A national policy statement on water allocation framework
- A national environmental standard on water measurement
- Identification and protection of iconic water bodies
- Protection of water quality from unintended consequences of urban and agricultural land use
- Role of water user groups in water resources management
- Development of tools to assist regional councils to achieve the objectives of the SWPoA.

Government's actions recognise that all is not well in the sector. National studies have shown a serious water quality problem developing in some streams and lakes, largely attributed to intensive land use. Concerns have been expressed about nitrate contamination in groundwater resources resulting from irrigated land use, particularly under intensive dairying.

In contrast to water resources management reforms in many other jurisdictions, the SWPoA as proposed deals with action to address current environmental concerns. But there is no long term water resources development planning based on identification of the national interest for goals and objectives in regard to a balance of social, economic and environmental issues.

The change of government has seen a new interest in strategic planning with regard to infrastructure. It is to be hoped that this may see a related change in the SWPoA or its successor, as the immediate focus seems to be on environmental quality with little attention to social and economic matters.

At the same time, individual regional councils responsible for administering current policy under the terms of the RMA are in the process of developing regional natural resources management plans or modifying previous plans. These plans generally reflect the environmental concerns of the day, rather than any long term development focus.

Focus on the regulatory environment

Regardless of any change in policy under the new government, it is clear that the current arrangements that control the use of water for irrigation will change.

- Measurement of individual water use from water sources will be a requirement within five years under the National Environmental Standard at the national level, and perhaps sooner under regional plans. The investment required is currently proposed to be the responsibility of the consent holder, and individual costs will vary from $3,000 to $10,000 per installation depending on circumstances. This is a significant national investment, and a serious one for the consent holder.
- Individual resource consent conditions will be reviewed, and a typical set of conditions may include a maximum seasonal volume, restrictions during periods of low surface flow or groundwater pressures, requirements for measurement and data transfer to regional authorities, commitment to best practice irrigation standards, regular evaluation of irrigation system performance and restrictions on land use under irrigation.
- A greater proportion of regional council costs attributed to regional resource studies, monitoring and investigations will be the responsibility of consent holders, and away from the general rate.
- Systems will be developed to facilitate the temporary or permanent transfer of resource consents where this is compliant with regional council requirements.

All of the indicators are that the future will present more difficulties for water users than they have at present. Operating under the current regulatory environment is becoming more difficult.

Future for irrigated agriculture

The impact of current regulations is most apparent in Canterbury, where we have the largest irrigated area and annual volume of

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consumptive water use consented. Two things are clear. Current allocations and entitlements will be targeted for reduction as consent reviews are undertaken and new applications to take water for irrigation will face perhaps insurmountable difficulties. Otago water resources are heavily over-allocated where traditional miners' rights are in place, and when these expire in 2021, more water will probably be allocated for assessed in-stream needs.

It is not generally known that almost all of the regions where irrigation is an issue will be into a full allocation situation within five years, and other drier regions within 10 years. The problems that we are seeing in Canterbury now, and in Otago very soon, will be the general situation across the irrigated regions of New Zealand in the near future.

Unless there are changes to current and planned water management scenarios, new irrigation operators will find it increasingly difficult to gain access to irrigation water with a level of reliability that justifies irrigation system investments. Existing and new irrigation operators will also be subject to more onerous consent conditions than are currently imposed. These will be directed to improvements in water quality, more efficient use of water, more measurement, monitoring and reporting requirements, more constraints to the exercise of consents, higher charges imposed by regional councils and probably a tougher environment in terms of penalties for non-compliance.

The over-allocation problem

Whereas we have a good handle on water allocated for irrigated agriculture, we have a lesser understanding on what is actually used. Preliminary case studies suggest that actual use is between 50 and 70 per cent of allocations. As a consequence, supply-demand modelling over-estimates the seriousness of resource allocation status. Mandatory measurement is therefore a sensible move.

Since the enactment of the Water and Soil Conservation Act in 1967 and the Resource Management Act in 1991, resource consents have been issued for the use of irrigation water. This represents some 70 per cent of all the water allocated for consumptive use in New Zealand on a first-come, first-served basis. Whilst appropriate in areas where water resources are not limited, this approach is inadequate where the summation of allocations reaches or exceeds resource availability, such as in Canterbury and Otago.

Quick-fix solutions based on free water transfer markets are being promulgated at academic and government levels, without much experience down on the farm. Water allocation is a key topic of interest to all, and the results of any recommendations will be of long term significance to irrigator investors. The way forward will clearly involve mechanisms to transfer resource consents on a permanent or temporary basis, based on market mechanisms, where this is appropriate.

Limited thinking

In Australia, where water trading is relatively mature, water markets operate under some internally imposed constraints for economic, social and environmental reasons. We need to be very clear in New Zealand about the implications of any proposals that a completely free water market will meet all of our needs. Under inappropriate market arrangements control of key water resources could pass to players with deep pockets without regard to wider social and equity issues. The current lack of national direction for the social and economic aspirations of the nation in regard to water resources use is not helpful.

The thinking so far is quite limited. The basic problem is that fixed allocations based on four years out of five peak needs are not fully taken up in most years, yet they constrain new entrants even when resources are available. We need to think beyond the desire to fix things in concrete and move to a more adaptive management system of allocation, based on a robust understanding of resource availability. This has been signalled as a future development in Canterbury, and is to be applauded.

So a new plan is needed to get away from the idea that water resources are best managed by fixed resource consent entitlements – use the tools of technology to manage rather than monitor for compliance.

Infrastructure for water enhancement

It is worthy of note that the current annual allocation of water for all purposes in Canterbury – our most heavily committed water resources – represents about nine per cent of the total resource. With all likely future demands accounted for, this would rise to about 13 per cent. So it is clear that total water resource availability is not the issue.

A major omission from current thinking is a complete lack of any consideration of the way in which improved water availability may be improved by harvesting and storing water, with the multiple objectives of continued economic development and environmental enhancement. It is generally accepted by both environmental and development interests that water storage has the potential to remove some of the current problems in the sector. There is, of course, the risk of introducing new challenges in regard to environmental quality. This is where the focus should be – removing the constraints of water availability in water-short areas, and addressing the externalities involved using our best science and technology.

What might be required

It is clear that irrigation investment has clear national and regional economic benefits. But there are indications that the annual increase in irrigated area, which has been about six per cent a year over the last 10 years, is slowing and will stall within two to three years. This assumes that some of the irrigation consents under process are successful. The reasons for this are related to full allocation of major groundwater resources in Canterbury and restrictions on river access through National Conservation Orders. It is accepted that any further developments will require infrastructure investments for storage facilities and in distribution systems.

There has been no public investment in rural water infrastructure since the 1980s and the three completed community schemes in the period – Downlands, Waimakariri and Opuha – have depended on local government assistance or keystone investors in one form or another. A number of attractive community water resource development investments have stumbled and failed to proceed because of the financial difficulties associated with the large upfront investments required. These include Barrhill-Chertsey – 40,000 hectares with resource consent, and Waihoa with 30,000 hectares.

The need is not just for irrigation development, it is for enhanced availability of water for a myriad of community purposes. Much of the rural eastern seaboard is serviced by community water supply schemes that are now inadequate in

terms of water quantity and cannot meet the Ministry of Health water quality requirements. In addition, significant water-related environmental restoration and enhancement opportunities will require investments in infrastructure.

The logic of beginning a new round of rural water infrastructure investment is clear, but the implementation and financing mechanisms are not in place. Instead of the single focus initiative being left to farming communities, the developments need to be planned with clear community objectives in a multiple purpose framework, with appropriate cost-sharing.

Securing water resources

Long term planning

Central Government interests and capabilities are focussed on environmental initiatives, without any comprehensive and long term water resources policy. The time has come to re-establish a strong and dedicated soil and water capacity at the government level.

Short term and pure market solutions have been adopted as a way to handle the developmental agenda. These need to be dismissed and long term water, multiple purpose resource development planning must enter the agenda, divorced as far as possible from short term political considerations.

The way forward

New Zealand needs a new round of infrastructure investment that will clearly require dam storage. The government has the opportunity and the associated problems on the radar and some officials promote the opportunities, but there are serious barriers within the bureaucracy to getting any initiatives identified, let alone implemented. The problems in the 1980s related to economic rationalism and political concerns about environmental externalities have effectively prevented the rational consideration of opportunities. There are a number of useful initiatives identified that the government could take without any long term cost. In fact, appropriate short term investments are likely to be financially rewarding to government, if the initial share value increases in recent schemes are any indication.

If we pursue the opportunities for large scale water infrastructure investments, there are a number of issues that we need to resolve –

- They require significant up-front capital investments, often outside a community's ability to arrange without support
- They need to be long-term with appropriate maintenance, and will need to operate successfully over periods that cover a number of generations of the communities they service
- They should have a restricted direct-user market as it is difficult to involve wider beneficiaries in financing the schemes. This is an example of market failure, the transaction costs and administrative difficulties in applying beneficiary-pays policies are substantial.
- They should generally involve multiple objectives but rely upon single interest financing
- They should be a catalyst for significant land use and social changes
- They require access to private land for associated infrastructure, which may present as much of a problem as resource consenting.

To move forward, some of the features that we need to recognise are –

- These projects must be seen as multiple objective interventions for the good of the whole community, and be designed to attract wider community support
- Without sustainable development of large scale water infrastructure many regions have hit the wall in terms of maintaining economic primary sector growth and in addressing current environmental and social well-being issues
- They result in social transformations of rural communities, and have the potential to correct the unintended environmental consequences of past land and water use
- Without a strong and clear position of central government, the much needed infrastructure will not be developed
- These are very long term projects in excess of 100 years plus and implementation need to reflect the inter-generational issues
- Properly designed and implemented, they will generate multiple economic, environmental and social benefits
- Ideally they need to be community driven in partnership with government, not identified with single interest groups such as irrigation farmers, but without involvement of a strong economic contribution from irrigation development they are not bankable.
- Farmer participation needs to be financially affordable for the projects to be sustainable, and allow a mix of farming enterprises to be viable to avoid limited land use focus that may be environmentally unsustainable.
- The 'in the national interest' development opportunities that are now being developed in the energy and transport sectors, with central government involvement, are urgently needed in the rural water sector.

Summary and conclusions

The current New Zealand circumstances in regard to water resources developments are a result of a number of factors. There was an early history dominated by government policies and regulations, focused on soil conservation and irrigation development deemed to be in the national interest. Added to this was an emergence of environmental concerns in the 1980s that have become the major issue in addressing water resources matters. The government withdrew from support of irrigation as a social and economic objective and a current activity to review and reform the national policy agenda on water quantity and quality, mainly to achieve environmental sustainability objectives.

These activities have slowed and may have stopped worthwhile water resources development, unless additional actions are taken. These include a return to long term water resource development planning within a multiple objective framework, re-establishment of water resource developmental expertise at government level, and a commitment to a new programme of rural water infrastructure investment. The latter is needed to improve availability of an adequate total water resource to serve both the developmental and environmental interests of the country.

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The New Zealand irrigation scene in 2009

Bob Engelbrecht

History of irrigation development

The earliest irrigation trials in New Zealand were carried out in the Ashburton District in the 1880s at Elgin, just east of Ashburton. Following various field trials, the project was abandoned, at least temporarily. Since that time, a number of irrigation schemes both large and small have been planned throughout the mid-Canterbury district. Some have progressed, usually with the help of central government. For example, the three schemes based on the Rangitata Diversion Race – namely the Ashburton Lyndhurst Scheme, the Mayfield Hinds Scheme and the Valetta Scheme.

Subsequently, other schemes have failed between the planning and development phases, mainly as a consequence of the fact that the economic benefits of irrigation are long term, particularly for the farmers themselves, compared with other projects with better short term economics. Also of course, there is the influence of the three year political cycle.

The Rangitata Diversion Race project was built for political, rather than economic reasons, so was mainly designed for the poorer and shallower soils. Rangitata Diversion Race construction began in April 1937 with the water flowing first in November 1944.

Insurance

In the 1950s, irrigation was used for insurance purposes against drought conditions of various extremes. There was at that time limited knowledge on irrigation management. Surface flood irrigation was difficult and demanding work as a manual operation. This technology resulted in very high water application rates. Dr Jim Stewart, subsequently a Vice-Chancellor of Lincoln University, reported in 1974 that irrigation was uneconomic in these schemes. This was largely the result of a lack of knowledge and experience of those concerned with irrigation, and the lack of skills that today we now take for granted.

During a number of serious droughts in Canterbury, particularly during the 1970s and 1980s, millions of government dollars, were paid to farmers to compensate them and their communities for their drought losses in extreme circumstances. A greater investment in irrigation by central government, complemented by individual farmer investment would have been more beneficial for both drought prone districts and New Zealand as a predominantly primary production country.

Increased efficiency

During the early 1970s the semi-automated flood irrigation system was developed, using clocks and gates from elevated headraces. This technology increased water use efficiency and was much more kindly on farmers and their staff, basically substituting capital for labour.

While, originally, spray irrigation was developed on the deeper soils and border dyke surface flood irrigation on the shallower soils, this contrasts significantly with the approach we would take with our knowledge today. Nowadays, we would irrigate shallow soils via spray irrigation, applying limited amounts of water, a little and often, mostly via centre pivot or lateral irrigators. While flood irrigation could be more efficient on deeper soils compared with shallow soils, controlled overhead spray irrigation is the standard today on almost all soil types.

In relatively recent times, computer technology has developed rapidly, particularly with overhead spray irrigation systems compared with flood irrigation. Most systems installed are based on overhead spray irrigation in its various forms – centre pivots, rotorainers or big gun irrigators. Occasionally in new developments even more specific application systems are seen, such as sub-surface drip irrigation and solid set sprinklers, particularly where high value and permanent crops are involved.

Limited constraints

In the late 1960s and 1970s, irrigation development from underground aquifers started especially, but not exclusively, in the Seafield, Pendarves and Dorie districts. Individual on-farm schemes developed progressively from that date, apart from the period of almost no farm development between 1985 and 1995.

In the 1970s there was some further surface flood irrigation in Canterbury, mostly aided by central government funding and one or two individual farmer schemes using pumped water, mainly from underground aquifers using spray systems. During this period, there were limited constraints on access to water for individual farmers for irrigation purposes and even fewer constraints on the use of irrigation water. In recent times, as a result of perceived shortages of easily accessible water, both regional and central government agencies have quite rightly placed more constraints on irrigation water use. This has along with other technical developments, led to more water use efficiency.

Ashburton District

Ashburton plains land, the area between the Rangitata and Rakaia Rivers, and between the Pacific sea coast and the foothills, represents an effective area of almost exactly 250,000 hectares. Currently, between 70 per cent and 80 per cent of that area is irrigated by either overhead sprinkler irrigation or surface flood irrigation. However, surface flood irrigation is rapidly being replaced with sprinklers. These are predominantly centre pivot systems, supported in many cases by on-farm buffer ponds, storing between seven and 10 days water supply for the individual irrigation system.

It is difficult to be precise about the percentage of the Ashburton plains-land that is irrigated. Some farms have schemes that can command the whole or the majority of the farm's land area, but have less water than desirably required, whereas other farms have adequate water but on-farm schemes command less than could be irrigated by the available water.

The computer controlled technology available today is significantly ahead of the irrigation technology of 40 years ago. This means there is a requirement for less water, less energy and less labour to effectively and efficiently operate the irrigation system, with capital substituting for the other components of the system. On the deeper soils particularly, many farmers are now using as little as half the water they would have used five years ago with other overhead spray irrigation systems, and probably less than 20 per cent of water used in the earlier surface flood irrigation systems.

As a consequence, many farmers have adequate irrigation water supply from the Rangitata Diversion Race that was originally designed to provide water for two-thirds of the farm area. In some cases they are able to irrigate additional land areas or have surplus water made available for previously dry land farms.

We are all still learning

Even those of us who have been involved in irrigation planning, development and management for 40 years or more, are still learning. Every week, perhaps almost every day, there are new developments, technologies or processes from which we are able to improve the efficiencies of irrigation water use, without decreasing, and often improving, farm physical and financial performance. Some of the factors that have arisen or been identified in recent years include –

- Usually the beneficiaries of rainfall, particularly low falls of five to 10 mm, are the irrigation farmers, where the rain adds to the soil moisture. In a dry land situation, these showers are of limited value to the parched soils on a dry land farm.
- The quality of soils on an irrigated farm are almost always higher than the previous perception of those soils when they were in a non-irrigated environment.
- Low quality soils, or soils of variable quality or depth, have become economic in many circumstances as a consequence of modern irrigation application systems, mainly from the ability to use a little and often water application approach, more closely related to having rain showers on a regular basis.
- The development of computer-controlled, precision application, overhead spray irrigation systems has added a new dimension to the objective of efficient on-farm irrigation
- Under irrigation the soil develops, with increasing soil organic matter available to retain more nutrients and more water, both for the benefit of the farm programme and as a means of reducing contamination risk of the groundwater, streams and other water bodies.
- The complementary benefits of irrigation are frequently available to other adjoining or local dry land farmers, by providing them with a ready and reliable outlet for store stock or a source of reliable feed for their livestock during periods of drought.
- The use of irrigation water frequently enhances the efficiency of rainfall in terms of productivity and profitability per cubic metre of water. This is because of the ability to complement rainfall when required, compared with the options for dry land farmers where this is not possible. Well managed irrigation has created the opportunity for efficiency of water use that adds to the value of rainfall.
- Increasingly, in localities where irrigation is reasonably common, irrigated farm land or land able to be irrigated, has realised a premium in value, compared with those farms that are unable in the short term, to be provided with irrigation.

Some basic principles of irrigation

The continuing price squeeze demands that farmers become more and more efficient in their businesses. If the variability and unpredictability of climate, especially rainfall, that we seem to have experienced in recent times, continues, then we may anticipate an increasing demand for irrigation development and availability. This will not only be in the traditional dry land plains of Canterbury, Otago and perhaps Hawkes Bay, but increasingly in farming districts that were, in the past, seen as having adequate and reliable rainfall. Our experience in Canterbury now is that many localities that 10 or 20 years ago were considered not to require irrigation, except on very rare occasions, are increasingly seeing irrigation as the most positive way to develop and progress their individual farm businesses.

Many people see irrigation as a system where water is applied to the land, plants grow and certain outcomes are possible. In practice, while the individual components of irrigation are basically very simple, the interaction of these components, one with another, are usually very complex, much more so than the average dry land farmer perceives to be the case. Irrigation enables the desirable outcome that the market generally demands – increased quantity, improved quality and delivery on time.

Ashburton District irrigation

The availability and use of irrigation is the fundamental reason why Ashburton District is such a dynamic farming locality. It is not only the increased productivity that is of value, but the diversity and consistency of farm production, creating an environment of reliability and confidence, both in the farming catchment area as well as in the town itself. As a consequence, we have a confident and productive population, as well as low unemployment.

What happens in Ashburton District is reasonably representative of what happens over the whole of the Canterbury plains land area which has 70 per cent of New Zealand's irrigation development. The only difference is that in Ashburton District there is a higher percentage of irrigated farm land than is available to the north and south.

There are three defining factors that make Ashburton District a very desirable farming area. Firstly, the availability of irrigation. Secondly, a range of very shallow to deep alluvial soils of relatively consistent quality that, enhanced by irrigation, provides a wide diversity of land use options. Thirdly, a farm servicing town that in relative terms has a very competitive range of skilled farm servicing businesses.

These same possibilities exist for the remaining plains land area of Canterbury and North Otago, as well as other lower rainfall areas throughout the rest of New Zealand. They exist as long as water for irrigation can be made available in adequate and reliable volumes, with a high degree of certainty. Already we see irrigation development progressing around parts of New Zealand that previously were considered reliable production areas without

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the benefit of irrigation, for example, Northland, Southland, Waikato and even the West Coast of the South Island.

Official records show that only seven per cent of the water available in Canterbury from its various sources is used consumptively. The *Economist* magazine claims that, second to Norway, New Zealand has the highest volume of fresh water available per head of population, these two countries being well ahead of the country third in line. Many of our New Zealand's authorities see irrigation as an optional extra, not necessarily a desirable development that we know could enhance this country's productivity and export income potential from a wide range of opportunities.

All being used

Much, if not most, of New Zealand's available irrigation water that is easily accessible, at a realistic cost is now being fully used. Therefore we need to look for options for water storage for irrigation and a range of other complementary uses for many farming districts, to further develop and advance their economies but with an improved degree of reliability and certainty. If climate change is occurring then this option for further irrigation development becomes even more critical for rural New Zealand's future progress. There are a number of examples of excellent multiple water use developments, such as the Opuha Irrigation Scheme in South Canterbury. The development of water for multiple uses usually has the advantage of a lower cost of water and use for everyone concerned.

With both individual and community irrigation development, the servicing community generally achieves the greatest early benefits from the planning, development and construction periods of new schemes. This is addition to the management of such schemes, and from the provision of additional farm inputs and the processing of increased farm outputs These are both very significant increases in many cases. On the other hand, the individual farmer developing irrigation, with his costs of on-farm development and management, along with increased debt servicing, usually has to wait a number of years before his and his family's financial rewards are achieved.

Irrigated dairy farming

The progressive and increasing development of dairy farming on the Canterbury plains land has been a consequence of the principle that land will always move to its highest and best use, a valuation principle accepted for many years. Official dairy statistics show that milk solids production, both per cow and per hectare, mostly on the irrigated plains land of Canterbury and North Otago are now consistently the highest in New Zealand.

Compared with intensive arable cropping and seeds production, dairy farming is a relatively simple farming system to operate, with only a limited number of tasks in which the individual farmer must develop his management skills. For example, once the milk is in the silo, the processing and product development is in the hands of those who will carry out their tasks on behalf of the individual farm businesses. In most arable systems, post-harvest is often the beginning of the most difficult part of the farming business with the need for product delivery, processing to adequate quality standards, marketing and obtaining payment, all within a reasonable period of time. There is no doubt that the recent profitability of dairy farming with irrigation has aided the economic development of shallow soils throughout Canterbury and other similar localities.

Even taking account of recent events, dairy farming provides a satisfactory and regular cashflow, compared with regular difficult seasons for intensive mixed farming with the continuing cost and price squeeze, and the even more frustrating, climatic conditions. This all adds to the desire by many farmers to change for a little less stressful system and lifestyle.

Water quality

Scientific monitoring and measurement, combined with individual and group farmer experience is demonstrating that in many cases, water quality may be preserved or enhanced if high standards of on-farm management are consistently applied, particularly in relation to fertiliser applications and animal effluent management. We still have much to learn and there is more detailed and continuing research to be undertaken. Farmers are as committed and enthusiastic to learn and understand the guidelines and rules for maintaining water quality in their own localities, as any other sector of the population, so that further farm irrigation development may be undertaken in the future.

Everyone associated with farming have a role to play and positive outcomes are best achieved by education. This means a sharing of experiences and knowledge, rather than adversarial negotiation and through local, regional or central government regulation, except as a last resort.

The carrot approach is almost always more effective than the big stick. In other words, the co-operation of all people involved, in whatever their role, will achieve the most positive and desirable outcomes.

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In summer, shade rules
The science behind why trees help maintain dairy productivity

Gwyneth Verkerk

Cows feel the heat of summer more than many farmers realise. However they do not need to use the energy normally required for physiological processes to cool down, so if they can be protected from the effects of hot weather, their appetite and intake will be maintained and productivity conserved.

Effective heat management for dairy farms requires an integrated approach. This needs to assess overall farm risk, explore ways to reduce heat loading and employ short term management changes during high risk hot weather. On farms with moderate to high risk of heat exposure, the best way to reduce overall heat loading is to provide shade, and natural shade from trees can be very effective.

What is heat load?

Cows need to maintain their core body temperature at around 39°C with a normal fluctuation of about 0.7°C every 24 hours. This is the cow's thermo-neutral or thermal comfort zone. Core temperature is the result of balancing heat loading and heat dissipation, a continuous process.

Dairy cows generate heat as their food is digested and as they make milk. This makes them quite resistant to cold, but during hot conditions it can overload their system. Large food intakes and high production rates also mean more heat is generated.

Walking to and from the dairy, to the water trough and grazing all increase heat generation by muscular activity. Radiant heat from the sun contributes to heat load and when the summer sun is intense this contribution can be large. Cows with dark-coloured coats absorb more radiant heat than cows with light-coloured coats.

Losing heat

Cows unload heat in several ways. There is convective heat loss to the air around them which is increased by air movement and wind. Mature and heavy cows have a lower surface area to volume ratio so their convective heat loss is less effective than younger lighter cows. Cows can also sweat a little, especially the more heat tolerant breeds, such as Jerseys, and will drink more water when hot to help unload the heat.

Once core temperature gets above the thermal comfort zone, the cow will use the evaporative cooling system of her lungs and air passages and will increase her rate of breathing. Unfortunately high air temperatures and humidity reduce the efficiency of this cooling system. Under such conditions a cow may not unload effectively and can have prolonged periods when core temperature is outside her thermal comfort zone.

Cows also display a number of behavioural strategies that assist heat unloading. They actively seek shade, and may gather in groups to get shade from herd mates if other shade is not available. They also look for places where air movement is high, such as rises and hilltops. When hot they stand to maximise the body surface area that is exposed to the air. A hot cow will stop eating, will hang around the water trough and may splash or stand in the water.

An increased respiration rate above 60 breaths a minute is amongst the first behavioural evidence that cows are developing heat stress. If behavioural tactics do not allow her to manage heat load, she will start to pant, breathe through an open mouth, drool and hang out her tongue.

Heat load and production loss

Temperature and humidity influence the cow's ability to deal with her heat load. They can be combined in a temperature-humidity index (THI) which is a good predictor of whether cows will develop signs of heat stress. Signs of mild heat stress, such as increased breathing rate and shade-seeking behaviour, appear when the THI is in the range of 68 to 75 – lower for high producing Holstein-Friesians and higher for Jerseys. A THI of 72 is generated when air temperature is 26°C and relative humidity

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Dairy cow showing signs of heat stress

is 40 per cent, but when relative humidity is 80 per cent it is generated with an air temperature of only 23°C.

Even mild heat stress can cause production loss. Using data from across New Zealand, Jeremy Bryant showed that production is reduced by 10g milk solids per cow for each unit increase in THI above 68.

The value of providing shade to reduce summer production loss in pasture-fed cows in Waikato was demonstrated in work published in 2006. The weather conditions were relatively moderate with a THI greater than 72 during only 2.4 per cent of the observation period and a mean THI of 63. However, cows provided with artificial shade structures in their pasture area produced 1.7 per cent more milk solids a day than cows without shade. Shaded cows had lower core temperatures between midday and afternoon milking and spent more time grazing at night.

The DairyNZ website has a simple THI calculator which you can use to assess your risk of production loss from unfavourable thermal comfort conditions for your cows.

Shade helping cows manage heat load

Shade protects cows from the additional heat load of solar radiation. Good shade can reduce radiant heat in half. Behavioural studies show that cows place a high value on shade. In a recent study cows were prevented from lying down and then observed for an hour after they were offered the choice of lying in the open or standing under shade.

Cows that had not lain down for 12 hours spent 25 per cent of the observation period lying in the open when conditions were less than 25°C. However when the air temperature was above 30° they were more restless and did not lie down in the open area at all, preferring to stand in the shade. In another study, cows spent more time in the shade on days with higher solar radiation and ambient temperature, and preferred shade that offered more than 50 per cent reduction in solar radiation. Mean core temperature was lowest in cows that used shade providing the greatest reduction.

What can I do when my cows get hot?

There are a number of short-term management options available when signs of heat stress occur. These include including –

- Putting cows into paddocks that are closer to the dairy or that have more natural shade
- Changing milking times away from the heat of the day
- Moving cows at their own pace
- Providing drinking water at the dairy
- Providing shade in yards
- Sprinkling cows so their coat is wet to the skin
- Making dietary adjustments to provide feeds that are more slowly fermented.

Managing heat load is an energy cost for the cow, so prevention is more productive than trying to manage the consequences once cows are heat-stressed. Proactive reduction of heat load by protecting cows from solar radiation will result in production gains. Providing good access to shade is the simplest means of proactive management to reduce heat load. Providing natural shade with trees is a relatively cheap option that also benefits your farm's landscape and supports biodiversity.

If you farm in an area where THI regularly exceeds 70 during summer months, or your herd is more susceptible to heat stress, then you should consider ways to reduce overall heat load on your cows. Such plans will inevitably include increasing the amount of shade provided.

The case for trees

Trees are a good low cost option to increase available shade on the farm, even though they do take time to establish and grow if they are to cater for herds of cows. Cattle will generally choose trees over artificial shade if both are available. It is thought that evaporative heat loss from leaves also cools the air around trees. Trees are more effective at blocking radiant heat than most artificial shade structures which may even increase ambient temperatures.

Wide-crowned trees that produce dense shade but are open around the trunk are preferable to minimise wind speed reductions. Tree lines should be established on the northern and western edges of pasture so that shade is accessible during the hotter afternoon hours. A shade area allowance of around four square metres per cow will ensure ready access for all.

Deciduous is better

Deciduous trees are most useful as they reduce the effect of pasture shading and root competition on pasture production. Planting along laneways provides protection as cows walk to and from the dairy, and deciduous trees are preferred to reduce mud on lanes during winter. Planting native species and flowering trees within tree lines encourages birdlife. Trees such as poplars and willows grow quickly and can be coppiced to provide feed during drought and woodchips for bedding on stand-off areas.

Trees should be fenced off and protected from damage. Where they will provide shade for large groups of cows. Fencing should be at the root margin to prevent damage to the root system from treading and soil compaction.

Cows may be exposed to more mud and dung under trees and this should be considered in mastitis management plans. Where air flow is diminished by trees, microclimates may be established that increase facial eczema risk, so these paddocks should be carefully managed with grazing restricted in these areas during conditions that favour high spore counts.

Gwyneth Verkerk is a scientist with DairyNZ.

The changing face of the New Zealand dairy farm employee

John Fegan

I first became involved in the New Zealand dairy farm labour market on a professional level in the early 1990s and have been heavily involved ever since. Over this time I have seen what can only be described as dramatic and sustained change – a revolution rather than an evolution.

The 1980s and early 1990s were characterised by small farms that employed either no external labour or just one employee. That employee was usually a farm cadet, between 16 and 21 years old, and they lived-in with the employer. The farm milked 300 to 400 cows.

During this time the biggest challenge was to encourage employers not to make their cadet redundant in February once the employer had taken their Christmas break. Employers were unable to see the long-term damage caused by making a 16 to 21 year old redundant in February. The reality was those employees would not be able to find another farm job at that time of year, so ended up going to work in town and invariably did not return to farming.

Then along came the conversion wave. It started in Canterbury in 1992/93 and in Southland a year later and has not really stopped. There was a brief respite for one season when the NZ Dairy Group put a moratorium on conversions. But from a staffing perspective since 1992 the industry has had a demand for staff greater than supply. It has only been the size of the shortfall that has changed each year. To add to this challenge we also now have a drain on the New Zealand farm staff supply to overseas dairy farms, some as a result of New Zealand farmers converting in Australia, the Americas and to a lesser degree, Asia.

Junior shortfall

Initially the greatest shortfall was at the junior level, then the shortfall spread into medium and senior levels. However the pull overseas has now generated a real shortfall at farm manager and operations manager level.

With this rapid and sustained growth we have encountered some real challenges when it comes to staffing issues, the bigger ones being –

- Desperation, leading to employing undesirables in the industry. The whole industry now has a much higher crime rate and real drug issues. Farmers are slowly sorting this out and starting to impose some strategies to protect their business, but they have been slow to react.
- A phenomenon I call cheque book recruitment. Employers are prepared to pay above a realistic reward for the level of responsibility and skills, sometimes by as much as $20,000.
- Over-promotion as people are put into roles they are not ready for, in both experience and knowledge.
- Mediocrity as employers have accepted below average performance, citing the fear that the 'next one might be worse'.

None of these situations is sustainable. The industry has also had to come to terms with the fact that the best employer of more than three staff may not actually be the best farmer in the context of ability to turn grass into milk. Up until this explosion of conversions, New Zealand had a dairy industry full of very good farmers defined by their ability to turn grass into milk. Today the best farmers are those who are the best at getting their staff to turn grass into milk. As an industry we have been slow to identify the difference in the skills required.

Immigrant labour

New Zealand has had no choice but to help fill the supply gap with staff from overseas. Farmers are picking up some labour-saving devices, but the reality is it still takes one person for every 200 cows to run a dairy farm. The international staffing market has gone through three distinct phases since 1997, when we brought in our first internationals:

Phase 1

This dates back even to the 1980s when the majority of people who came to work on farms in New Zealand were from Ireland or England. Their profile was 18 to 22 years old, mainly single males, who had just graduated from agricultural college and came to New Zealand for a one or two year experience before going home to start their career.

Phase 2

In the late 1990s the political unrest in South Africa and Zimbabwe saw a surge of these people coming to work on New Zealand dairy farms. Their profile was significantly different. They were from 20 to 50 years old, and wanting to immigrate with their family and make New Zealand home.

Many of them were farm owners or managers back home, who were very experienced, but often had little or no formal qualifications, which created some immigration challenges. However many of these people are now successful farmers here in New Zealand even if in a previous life they were crocodile or emu farmers.

Phase 3

The most recent phase has been those from Asia, predominately the Philippines. This started in the 2005/06 season and their profile is different again. They tend to be 25 to 40-year-old males, who leave their wife and children at home and come here to earn money to send home to improve the life of their family.

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Summary of the market today

The labour market today on dairy farms has changed dramatically. It is still less than perfect and history tells me we will never get it totally right. It takes three to five years for the market to adopt change, and will only start to do so when it is virtually forced on them. Employers have not been proactive in adopting new or different practices. Immigrant labour is part of the solution, but it is not the solution on its own. New Zealand agriculture is well placed to promote a career opportunity to the labour market. There are many opportunities to carve out a career in the industry, with the options today far greater than 10 years ago.

Evolving

Employers need to be more proactive around employment practices rather than reactive. If there is no technological breakthrough in the next ten years, and the scientists tell us there is not going to be, then New Zealand dairy farmers are going to continue to need to staff their farms at or around that one person per 200 cows. For that to work and to be sustainable, the industry needs to continue to evolve its employment practices.

My experience tells me the future picture might look something like this –

- Employers no longer talk the language of one employee per 200 cows – they talk the language of number of man hours per year to run the farm
- The employer buys blocks of time off their employees. For example they may buy 2,500 hours off one employee and 1,000 hours off another. The employer keeps buying hours until they have sufficient time at the right times of year to staff their business.
- Staff are employed on annualised hours agreements and they record actual hours worked.
- There will be a range of employees who live on the farm and those who drive in. So a 1,000 cow farm that traditionally employed five full-time staff and maybe one or two part-timers may now employ ten staff, but no more hours are worked each year.
- There will be a staff facility on the farm where drive-in employees can shower before going home and have their breaks. It is likely to also be the farm's office where staff meetings are held.

This is a practice that is more appealing to the employee market as they are more focused on work life balance. It does not prevent those who want to work long hours from doing so, and with annualised hours they actually get fairly rewarded for it.

There will continue to be a mix of international and New Zealand staff and we will now employ everyone on a cash basis. By that I mean that the reward employees get will be totally cashed up.

If they live in a house on the farm they will pay rent for it, there will be no non-cash benefits that are not treated accurately regarding fringe benefit tax. This enables our industry to compare ourselves to others, without fear of feeling the wrath of the tax man. The reality is that non-cash benefits are happening less and less as herds get larger, but there are still some people out there doing it and it actually does the industry no favours.

John Fegan has worked in the rural sector since graduating from Lincoln in 1986. He formed the rural recruitment and HR management company Fegan & Co in 1997. In 2007 Fegan & Co merged with ATR Solutions, to form ATRFegan Ltd.

Muhummad Huda (Huda) from Indonesia, an assistant herd manager in the North Island.

Effective biosecurity is vital for our long term economic future

Bill Dyck

Effective biosecurity is key to the success of New Zealand's primary production industries, both for protecting what we grow in this country, but also for ensuring that what we export is safe. Trading partners do not want to import raw produce contaminated with unwanted organisms that could have damaging impacts on their primary industries, native vegetation or parks and gardens.

Threats increasing

Biosecurity threats exist in many forms from large ones, like snakes, spiders, ants and moths to those that are invisible to the naked eye, such as fungi, bacteria, viruses and other micro-organisms with names that are often new to science. The threats are increasing in number and frequency as the world gets smaller because of increased trade and travel. New Zealand alone imports over half a million sea containers annually, and this is a drop in the bucket compared to worldwide trade.

Air passengers are screened on an individual basis as they arrive in New Zealand. Each arrival is asked to declare what they are bringing in, their luggage is screened for organic matter, beagles crawl all over their luggage sniffing for apples and other fruit, and even shoes and camping gear are cleaned for possible soil contamination.

Container problems

The same rigour is not applied to sea containers, which by comparison are daunting both in size and also in the risk that they potentially pose. Until recently we, as a country, were downright shocking at controlling biosecurity threats arriving on sea containers.

This was highlighted in an Office of the Auditor-General report in 2006, which found 'that it was possible that the sea containers had been responsible for several pest incursions in recent years – including the southern saltmarsh mosquito and the painted apple moth'. I understand you can probably add other incursions to the list as well, such as the varroa mite, which has been a curse to the bee industry.

Fortunately, since the report was released, MAF has done a lot to reduce the risk of biosecurity agents arriving on sea containers and have pushed much of the risk offshore. Sea containers are much cleaner than they used to be, especially on the outside. Consequently we have had a major reduction in new incursions in recent years compared with a few years ago when MAF had to spray Auckland and Hamilton for the likes of painted apple moth, fall webworm and Asian gypsy moth.

Self inspection

However, biosecurity threats can also arrive inside sea containers, and one has to question if the current system of self-inspection of sea containers is really rigorous enough to keep the nasties out. To import a sea container the importer pays $20 as a levy. Almost all sea containers, except the designated high-risk ones,

Container ship bringing in pests and diseases as well as trade goods

Wooden packaging with heat treatment stamp on crate, but contaminated wood on top

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are inspected by one of 25,000 Accredited Persons who have passed the $100 course required to be on the list.

Once qualified, an Accredited Person can inspect their own sea containers at one of the country's 6,000 certified sites. If a biosecurity threat is found in a sea container when it is opened it is supposed to be reported to MAF who will then take action. But realistically, what is the chance that an Accredited Person, who after all is importing the sea container, will want to slow down their operation and bring in government officials?

If an apple or other accidentally imported high-risk vector is found in a sea container it is simply destroyed and no-one is charged. Compare that to accidentally bringing in an apple off a Qantas flight. If an insect is found flying out of a sea container hopefully it is killed, although live insects are to be reported to MAF. But are they? How many get away, or are simply not reported?

Accredited Person and even MAF inspectors are not required to go through all the packages in a sea container. They are mainly inspecting the packaging material for stamps indicating that the packing meets world standards, or looking for dirt or other signs of biosecurity threats on the outside of packages. However wood packing material that has an approved stamp is passed, despite the fact that the crate with the approved packing material may have had contaminated wood added. The wood may have initially been dried to meet the standard and therefore received a stamp, but it may subsequently have become wet and the home for fungi or even insects.

The speed of commerce

Biosecurity technology for sea containers must work at the speed of commerce. This mantra gets chanted anytime anyone suggests that sea container inspection be stepped up a notch or two. Thoroughly inspecting all sea containers for possible contaminants is very challenging, but there could be an answer and it could be sitting at our doorstep.

SYFT Voice 200

SYFT Ltd is a small start-up technology company located in the industrial area of Christchurch. The company is the first in the world to have taken SIFT – selected ion flow tube mass spectrometry – technology from the lab in Canterbury University to commercial applications. It has done so by miniaturising the technology to go from room-size to dishwasher-size analytical units, while still being able to detect volatile organic compounds at levels of parts per trillion.

SYFT has sold its technology in Europe and North America and is testing it in Australia for many applications. These range from medical research as it can smell diseases on human breath, detecting fumigants in sea containers, inspecting for explosives, tobacco and other contraband. The technology can even be used sniff out humans and disrupt people-smuggling operations.

The opportunity is to test and potentially use SYFT technology to sniff sea containers in New Zealand for biosecurity threats. Not necessarily all containers, but perhaps those that are high risk and a percentage of those not placed in the high-risk class. Indications are that the technology can be used to detect ants and other bugs, possibly sniff for fungi, and probably detect the presence of moist untreated) wood in sea containers. The next step is to test the technology in a port setting.

Surveillance needed

Even if we do step up vigilance at the border we are still going to need in-country surveillance and solutions to plant diseases that do manage to sneak in – and of course we already have plenty of those. Our usual solution to plant diseases or insects is to spray them with some sort of pesticide. Genetic engineering is currently off the radar as a potential solution to biosecurity problems. However it is somewhat difficult to comprehend the attitude of preferring sprays to what may prove to be a more environmentally friendly technology.

However, we do not necessarily need to spray chemicals, and we do not need to go down the genetic engineering path. There are other quite exciting biocontrol technologies that are being developed primarily by the partners in the NZ Bio-protection Centre, which is directed by Professor Alison Stewart at Lincoln University.

One such research area, that has direct application to plantation forestry, is the work being undertaken by Dr Robert Hill on the use of beneficial organisms. Dr Hill has already commercialised one trichoderma-based product, ArborGuard. This is used to enhance the health and vigour of radiata pine as the selected trichodermas are applied in a seed coat.

New research is focused on injecting beneficial organisms directly into small radiata pine plants and encouraging a healthy microflora of good organisms that can keep out the nasty ones and not only make trees more disease resistant, but also reduce the amount of chemicals that need to be applied. This work is being done in conjunction with a commercial partner, The Tree Lab, and shows promise to produce enhanced radiata pine stock for application against diseases and insects already in New Zealand, along with those not yet here.

New Zealand needs to invest much more effort, not only in keeping pests out, but also in developing solutions for the ones that are already here or that might get here. Effective biosecurity is extremely important for the long-term economic future of the country.

Benefits and risks of new technologies in possum control

John Hellstrom

Effective large-scale possum control in New Zealand is almost totally dependent on the use of a small range of poisons. These all have some disadvantages, such as lack of target species specificity, causing pain and suffering in poisoned animals and potential harm to the environment, trade and human health.

The most widely used toxin is 1080, the poison of choice for most large-scale control and the only poison that can be used in aerial applications. In spite of the 2007 review and approval for use of 1080 by the Environmental Risk Management Authority, there is continued and even growing widespread public concern against the toxin. Examples include –

- Increasing strength of protest actions over 1080 operations
- High quality opposition websites such as kaka1080.co.nz
- The fact that the Kiwi party, campaigning exclusively on a 'ban 1080' platform, gained over 12,000 votes in the 2008 general election.

Flashing amber

Most of this opposition is directed at stopping the long-term use of 1080. In addition, long-term access to 1080, which is manufactured in only a single plant in the United States, is not secure. Additional controls placed on the use of 1080 following last year's review have also increased the costs of using this poison.

The Environmental Risk Management Authority review of 1080 stated: 'We do not give the aerial application of 1080 a green light so much as a flashing amber light – proceed but with caution'. It recommended more research into soil and water persistence of 1080, noted the lack of carcinogenicity studies for the toxin and recommended more research into alternative methods of possum control.

None of the other currently available toxins specifically target possums and all can cause loss of valued species such as wild game, dogs and native birds. Most are potentially harmful to humans and some, such as Brodifacoum, are particularly inhumane. There are also market access issues with Brodifacoum.

Solutions

There are a number of groups working on solutions to overcome these problems. They include –

- A Lincoln university consortium working on reducing problems with current toxins other than 1080 through incremental improvements of formulations and baiting strategies. They are also working on the development of replacement toxins that are safer, less persistent, more targeted and more humane.
- Landcare Research is working with the Department of Conservation (DOC) and the Animal Health Board (AHB) with Foundation for Research Science and Technology (FRST) funding to develop techniques to minimise amounts of 1080 used and baiting strategies to minimise non-target effects. They are also carrying out research into alternative toxins
- The National Research Centre for Possum Biocontrol, funded by FRST, which is working on the development of novel possum specific toxins.

The National Research Centre for Possum Biocontrol was established in 2005 to bring together various strands of research into a single programme. It is almost entirely funded by FRST, which provides about $2.5 million annually. There is some additional funding from the AHB and an expectation that potential end-users will contribute towards product development costs. Landcare and AgResearch are conducting the research under the direction of a governance board of end-users and researchers. The programme has a critical decision point on 30 June 2009. If the programme meets that challenge successfully FRST will fund four more years of research into product development.

Biological control

Over the last three-and-a-half years the programme has followed a multi-stranded approach for biological control of possums. The research has set out to identify potential targets and possible delivery mechanisms, both non-transmissible and transmissible, leading to identification, testing and refinement of developed methods for the biological control of possums.

The first four years of research has been focused on the highly technical aspects needed for developing biological controls. The approaches that have been explored are –

- Oral protein-based possum vaccines to attack proteins in possum eggs
- Oral toxins to interrupt reproductive hormone production in the possum
- Oral toxins to disrupt possum gut ion transporters and kill possums by ion and fluid loss
- Development of a genetically modified possum-specific nematode or virus to carry the infertility vaccine spread amongst possums.

This work was supported by a number of programmes to identify potential target proteins unique to possums, model how the various approaches may behave in the environment, and to explore the ethical and social science issues raised by the research. The overall goal for the first four years of the programme is to develop a model system that consists of a toxin or vaccine that targets a biological molecule to disrupt a specific physiological process in possums. The aim is to reduce fertility by 60 per cent for at least one year or kill more than 60 per cent of possums.

The programme was reviewed late in 2007. As a result the programme has become focused on enteric toxin and fertility control studies. This will continue to be supported by the social science and ethics studies. However work on transmissible infertility vaccines based on a parasitic vector and its associated further modelling studies have been suspended. Work on the development of a hormone toxin, the search for a potential viral vector and the incorporation of a toxin into transgenic plants have all been abandoned.

Enteric toxins

The objective of this work is to identify a humane possum or marsupial-specific toxin that is at least as effective as current poisons and comparable in cost. The approach has been to identify a unique aspect of essential possum physiology which, when disrupted, kills the animal.

The work has focused on proteins controlling intestinal fluid secretion for two main reasons. Firstly, uncontrolled intestinal secretion is lethal and secondly, the underlying mechanism in the possum is markedly different from that of non-marsupial mammals, potentially providing a specific solution.

The programme has identified three target transporter proteins involved in intestinal secretion in possums that are either not present, or function differently, in placental mammals. One of these transporter proteins is currently being tested by an assay system that allows rapid testing of about 100,000 potential toxins, to identify compounds that will modify its activity. By the end of June it is planned to use one of the compounds identified to try and achieve a kill rate of at least 60 per cent. This appears to be a very promising line of research to develop a humane, marsupial specific oral toxin.

Fertility control products

The objective of the reproductive control programme is to develop humane, publicly acceptable, cost-effective and if possible, possum-specific methods of fertility control. This fits in well with the strong public support for fertility control highlighted in the Parliamentary Commissioner for the Environment Report *Caught in the headlights* published in 2000.

The approach has been to incorporate key molecules that disrupt reproduction in possums into vaccine delivery systems and a form suitable for possum control in New Zealand. The programme has focussed on three target antigens that have been shown to be able to stimulate an immune response resulting in better than a 60 per cent reduction in possum fertility by injection –

- Possum zona pellucida proteins ZP2 and ZP3 – these are egg coat proteins produced in the ovary involved in fertilisation;
- Possum coat protein 4 – a mucoid coat protein secreted by cells that line the uterus and is involved in embryonic development
- Gonadotropin releasing hormone – a hormone that plays a pivotal roll in controlling the secretion of other reproductive hormones. It is not possum or marsupial specific but the GnRH of birds is very different and it is unlikely that this vaccine would cause infertility in birds.

These antigens are being assessed as vaccines using –

- Bacterial ghosts or empty cell envelopes of bacteria
- Virus-like particles or recombinant virus envelope proteins
- Lipid matrix formulations.

Vaccines

The vaccines will need to work by stimulating an immune response from contact with mucosal surfaces of the digestive or respiratory systems. This presents additional problems as any bait will have to protect the vaccine from being inactivated in the stomach. Aerosols are helpful as a research tool but they are

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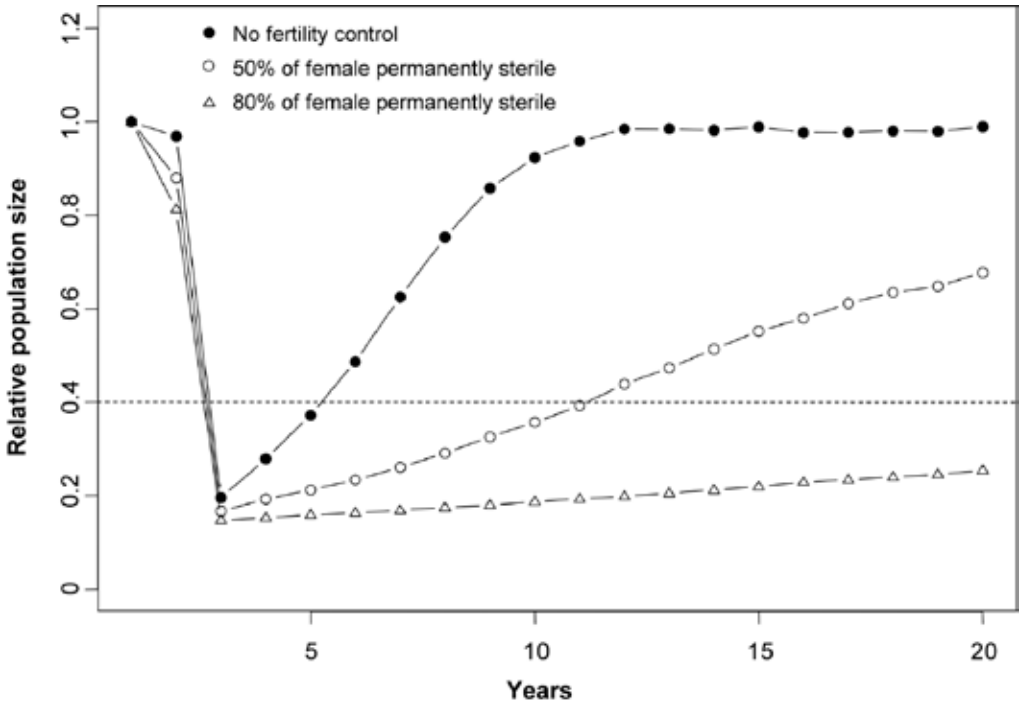
The effect of fertility control on a poisoned possum population



An example of reduced poison usage when combined with fertility control is shown in the graph. Solid circles signify the recovery of possum population following a one-off, 80 per cent reduction by poison baits. Open circles show the recovery of possum population following a one-off 80 per cent reduction and application of fertility control resulting in 50 per cent of females permanently sterile.

Open triangles show the recovery of possum population following a one-off 80 per cent reduction and application of fertility control resulting in 80 per cent of females permanently sterile. Dotted line indicates an example target threshold density desired by management.

Regulating at the speed of commerce

Bruce Knight

The importance of ensuring biosecurity in trade will not change. Neither will the need for international standards to promote fair, safe trade based on sound science. And the strong relationship between the United States and New Zealand will not change.

Technology, science and innovation will, without a doubt, continue to play a critical in role in biosecurity. I want to share with you a number of the latest initiatives of the US Department of Agriculture (USDA), both technological and regulatory, to ensure US biosecurity. Our goal is always to implement new technologies and new approaches that operate at the speed of commerce.

The importance of the US-New Zealand relationship

New Zealand is a steadfast partner with the US on biosecurity. When it comes to bio-protection we essentially share the same world view. We understand that when prevention fails, the magnitude of the effort and cost, in terms of eradication programmes and lost markets, can be enormous.

Our direct bilateral relations remain close and cordial, even under difficult circumstances. For example, in September the USDA was forced to suspend New Zealand imports of cut flowers and greenery grown outside certified greenhouses or screen houses due to recent interceptions of light brown apple moth in shipments at US ports of entry.

Since then, we have been actively working with the Ministry of Agriculture and Forestry (MAF) to create a new protocol to reopen the US market to these products. I am pleased to report that it has been resolved, and we are allowing field-grown cut flowers and greenery produced under the MAF Biosecurity New Zealand Phytosanitary Compliance Programme to enter the US. The fact that together we resolved this issue in just seven weeks demonstrates the calibre of our trade relationship.

We in the US have especially benefited from our close cooperation with New Zealand, as well as Australia and Canada, the other quadrilateral countries (QUADs), for plant and animal health and food safety. Through the QUADs, we are sharing resources and information on emergency responses to plant and animal disease outbreaks. This allows us to be better prepared for future crises. The QUADs have proved to be a particularly effective tool, giving all four nations a unified front to influence international standard setting.

Commitment to science-based international standards

I cannot overstate the importance of our cooperative work on international standard setting. In my view, international standards are a form of biosecurity technology because they are effective tools developed with most current science. Standards also promote transparency.

Like New Zealand, we recognize that the the International Plant Protection Convention (IPPC) plays a central role in biosecurity by promoting safety, predictability and fairness in trade and improved global management of pests and diseases. When trade issues become contentious, as they sometimes do, international standards provide governments with agreed frameworks so they can make correct, scientifically supportable decisions.

North American perimeter approach

These same global principles also work on a smaller scale with bilateral and regional trade. We are actively looking to harmonise our regulations with bilateral and regional trading partners. An excellent example of this effort is our recent initiative with our largest trading partner, Canada.

Through the North American perimeter approach we are working to increase consistency between US and Canadian import requirements related to plant health risks. This will also improve cooperation and communication between us and ideally lead to the development of a shared plant quarantine system. Close US and Canadian collaboration on biosecurity is crucial for both countries. We both share serious pest risks from shipments that arrive from other countries, and pests that enter one country could easily spread to the other.

There is another significant, complicating factor. Shipments arriving in North America can transit through Canada on their way to the US, or through the US on their way to Canada. Because of differing geographical and environmental factors, the pest risk to the country of destination may be vastly different from that risk to the country of transit. That is why it is imperative that each country take into consideration the phytosanitary risk to both countries for all commodities we import.

Ship inspection

We enjoyed a major success in this area when we harmonised our Asian gypsy moth import regulations. We now require ships departing from Japan, Korea, China and Russia to be inspected for the moth before departure, and the ships are subject to inspection upon arrival in any country's ports. So far in 2008, the United States and Canada have detected 21 infested vessels from Japan, Korea, and China.

We are also developing a permit system to ensure that commodities grown in other countries entering either the US or Canada comply with the phytosanitary import requirements of the destination country. An equally important piece of the programme is the electronic certification systems each country is developing that will allow us to exchange phytosanitary information efficiently and securely.

Animal identification and trade

Animal identification is another area where we are collaborating very closely with Canada, as well as Mexico, to advance and to harmonise animal identification in North America. We have been participants in the activities to develop specific guidelines for animal identification and traceability. The reason is simple. Individual animal identification is one of the most important applications of technology for biosecurity today.

Our goal with our national animal identification system (NAIS) is to create a modern, up-to-date way of responding

to outbreaks of serious animal diseases. NAIS is designed to cut losses, reduce delays, and retain markets, which protects a producer's herd health and economic vitality. This system will enable us to significantly reduce the time needed to conduct disease investigations. Ultimately, we hope to put traceability data in the USDA's hands within 48 hours of an outbreak.

NAIS has three components – premises registration, animal identification and animal tracing. The system covers cattle, swine, sheep, goats, horses, poultry, bison, deer, elk, llamas and alpacas.

Our initial focus has been encouraging farmers and ranchers to register their premises, and more than 488,000 are now registered out of 1.4 million. That is more than a third of all premises in a few short years. Premises registration is continuing even as we are promoting animal identification and animal tracing.

Increasing traceability

We have made big strides in animal identification. We have approved 24 devices that can trace an animal to its herd of origin, and so far millions of these devices have been issued to livestock premises. In addition, we have worked out the protocols for group lot movements of poultry and swine that are not likely to receive individual identification.

To increase traceability, we are doing a great deal of behind-the-scenes work building the information technology infrastructure that supports NAIS, approving identification tags, and encouraging farmers to use them and participate in tracing animal movements in animal tracking databases. We now have 17 USDA-approved State and private animal tracking databases established.

These are critical systems, but they are practically invisible, tucked away on computer servers across the US. But building them and connecting them represents tremendous progress in creating the IT structure and links us with our partners.

During an animal disease event, the USDA can 'ping' State and private animal tracking databases and receive crucial information to assist in our traceback efforts. Six of the 17 databases I mentioned are fully functional with the animal tracing system, and all the others fully comply with NAIS data standards.

We also launched a new system this summer using Google mapping technology that will enable our staff to quickly map locations near a suspect herd. With this programme, we can draw a ring around an infectious herd and quickly find neighbouring herds within a specified distance, another enhancement for tracing. This will not replace boots on the ground, but automation will cut days off the current paper-based system.

The Lacey Act

I understand that participation and cooperation by industry and the public are the keys to success for any government initiative. Most people want to participate and comply with all requirements, but they just do not know what they are. Unfortunately, a few others are simply bad actors.

The US passed farm legislation, known as the Farm Bill, that took aggressive action against bad actors who try to import illegally logged lumber. The legislation amended a 108-year-old conservation law called the Lacey Act that is designed to combat illegal trafficking in wildlife, fish or plants. The amendment expanded the Act's protection to a broader range of plants and plant products, with some limited exceptions, taken or traded in violation of any US law and most foreign laws.

As of 15 December 2008, it became unlawful to import any plant or plant product covered under the Act without a declaration. The Lacey Act now covers a wide variety of products, including lumber, wood pulp, paper and furniture, among many others. The US is serious about enforcement. The Lacey Act provides for both civil and criminal penalties.

To address the new requirements, we formed an inter-agency group to develop a reasonable, feasible implementation plan. This will allow us to enforce the law while giving those who are affected time to make the necessary adjustments. Based on the group's work, we are proposing a plan for phased-in enforcement of the declaration requirement. We are also holding a series of public meetings near key port locations throughout the US to inform our stakeholders about the new requirements.

The Lacey Act amendments are a new tool that will help the US to support the efforts of other countries to combat illegal logging and other threats to biodiversity.

Securing borders with new technology

Remote monitoring of quarantine treatments

To reduce biosecurity risks while they are still offshore, we are developing a system to remotely monitor and track quarantine treatments. Our commodity treatment information system will be capable of collecting, analysing and reporting data from quarantine treatments performed on fresh fruits and vegetables at remote locations or in transit, including ships at sea.

The system integrates specialised data recording and transmission equipment, satellite communications and advanced software architecture to allow the USDA to track treatments, such as cold and hot air, irradiation, hot water and vapour heat. The result will be enhanced biosecurity and faster cargo movement and release at the port of entry. The system will also include a reporting database we can use to electronically audit irradiation treatments.

Irradiation

On the subject of irradiation, the USDA has advanced this technology as a phytosanitary treatment. Irradiation is an extremely effective method of mitigating a wide array of pests without compromising a commodity's food quality. We made it an official pest mitigation option under our regulations in January 2006, after we established a standard radiation dose for fruits and vegetables. In March 2007, we published the first final rule allowing irradiated fruit, mangoes from India, to enter the US.

We have pioneered irradiation programmes in India, Thailand, Vietnam and Mexico, with many more countries waiting in the wings. Just last month the United States received the first shipment of irradiated dragon fruit from Vietnam. The programme has been so successful that Thailand has already had a second facility certified. Our pre-clearance staff operates on site at USDA-certified irradiation facilities, monitoring the treatment and verifying that it is mitigating all intended pests.

This process has interested many countries, especially those with small economies. Sometimes, this is the only way they can mitigate pests. We are also exploring the idea of building a certified irradiation facility close to the Mexican border for importers and exporters moving commodities from quarantined areas.

Trace element analysis

To enhance biosecurity at the border, we are developing chemical sniffer equipment to identify commodities, pests, noxious weeds, diseases and pathogens. Although in the developmental stage, we hope to make significant progress for some commodities, including the ability to identify propagative citrus material.

Enhanced molecular diagnostics

We have also deployed new diagnostic tools to address the increasingly complex challenge of pest detection and identification. Our use of molecular diagnostics has allowed rapid, sensitive and specific identifications that previously could not be realised.

We want to take this technology to the next level. One of our goals is to adapt and develop molecular diagnostic tools for rapid identification of immature fruit fly species of economic importance.

We have a similar project aimed at economically important, but very difficult to identify, thrips species such as the chilli thrips. We are also exploring DNA variations in the Mexican fruit fly, which we hope to use in identifying the origins of these pests when they are intercepted. All of these molecular diagnostic innovations will mean higher throughput for screening material passing through our plant inspection stations and more accurate trace out when we have a find.

Remote sensing insect traps

We are also developing new technologies to combat pests that slip through our offshore and border defences. We know that early detection is the key to successfully eradicating exotic pests. The USDA, along with Pennsylvania State University, is developing remote-sensing insect traps that make early detection much easier.

Once an insect enters the trap, a sensor measures the acoustic signature of its wing beat. In many cases, an insect's frequency shift in wing beats is unique and can serve as a species fingerprint for remote identification. Our next step is to give the trap the ability to send the detection information right to the computer screens of the monitoring staff, who can be anywhere in the US.

New insecticide treatments

Insecticides remain a potent weapon in combating exotic pests. In our fight against the light brown apple moth, the USDA, in cooperation with researchers in Australia at the South Australian Research and Development Institute, has begun to develop novel insecticide treatments on nursery stock.

The project aims to identify alternatives to the current treatments that are equally effective but less acutely toxic. Work to date has shown promising results for treatments using foliar applied oils, insect growth regulators, and some newer, softer synthetic organic insecticides.

In pursuing all of these technologies, we are protecting our biosecurity on three fronts – offshore, at the border and in-country. Technology clearly allows us to do more with less, an important factor in today's global economic climate.

Revising trade regulations

Innovation is not confined to technology. We have been pursuing a number of regulatory innovations to revise and streamline our import regulations. .

In the wake of lower tariffs, World Trade Organisation agreements, and increased interaction through free and bilateral trade agreements, many countries now have heightened expectations for access to US markets. In addition, our consumers are demanding fresh goods in any season. The result is that import petitions have quickly outstripped our rulemaking capacity, which typically involves a time-consuming pest risk analysis for each commodity from each country.

In response to this new international environment, we have developed two major regulatory streamlining initiatives in the plant community. Progress requires leaving behind the idea of promulgating rules one commodity, one country at a time. Our goal is to find a way to use the rulemaking process to establish general standards for the international movement of animals, plants, and their products and then act on individual country requests at an administrative level. This frees up the USDA resources to focus on more complex import issues.

Quarantine 56 regulations

In July 2007, we revised our fruit and vegetable regulations by implementing a new risk-based process for approving the importation of certain fruits and vegetables. The revised regulations, commonly referred to as Quarantine 56, expedite and streamline the rulemaking process.

The Quarantine 56 revision eliminates the need to publish a proposed rule followed by a final rule to approve the importation of each new fruit or vegetable from each individual country. This is acceptable as long as the risk for that import can be mitigated by one or more of five designated plant health measures –

- Port-of-entry inspection
- Use of approved post-harvest treatment
- A phytosanitary certificate accompanying the commodity, attesting that it originated from a pest-free area
- A phytosanitary certificate accompanying the commodity, attesting that it is free from a specified pest or pests
- The fruits or vegetables are imported only as commercial consignments.

However, if the criteria cannot be met, the commodity must undergo the full rulemaking process, which consists of a proposed and final rule. We still conduct a pest-risk analysis for new fruits or vegetables, just as in the rulemaking process, so we have not sacrificed protection, only paperwork. However, if the risk analysis shows that the plant pest or disease risk can be sufficiently mitigated by one or more of these five measures, we approve the import through a notice-based process.

In that case, we simply publish a notice in the *Federal Register* announcing the availability of the pest-risk analysis to allow for public comment. Barring substantive comments that disprove the findings of the pest-risk analysis, we publish a second notice announcing that the USDA will begin issuing import permits for the commodity.

The Quarantine 56 revisions do not change which fruits and vegetables are approved for importation or alter how the associated risks are evaluated or mitigated. The revisions simply reduce the time involved in the approval process for those fruits and vegetables that are safe for importation under one or more of the five measures. This process should also help to expand market access for US agricultural exports as other countries recognise our efforts to encourage trade.

We have also launched a searchable, online database to

make it easier for importers to check the entry requirements for authorised fruits and vegetables, including those approved using the notice-based process. The database will include emergency pest notifications to alert users of changes in a commodity's import status. It will also allow US agricultural inspectors to quickly determine whether a commodity is authorised to enter the US as well as the general requirements for importation.

Quarantine 37 regulations

We are also revising our regulations pertaining to living plants, plant parts, seed and plant cuttings for propagation - commonly called Quarantine 37. This should be of interest to New Zealand exporters, who shipped live plants to the value of more than $3 million to the US in 2007.

Currently, Quarantine 37 prohibits or restricts the importation of certain plant and plant parts from designated countries. We spell these out in the regulation. Plants or plant parts that are not specifically listed can enter the US as long as they undergo inspection at our ports of entry. The problem is that we have intercepted a number of pests during these inspections. To strengthen our biosecurity, we want to publish a rule that creates a new category of regulated plants whose importation is not authorised pending pest-risk analysis.

We recognise that once we have those restrictions in place, we will need to create a streamlined regulatory process for authorising imports listed in this new category. We are looking very closely at modelling this new process after the fruits and vegetable regulation.

Conclusion

The USDA's goal is to implement technologies and approaches that safeguard biosecurity while operating at the speed of commerce. The US and New Zealand are on the right track to achieve it. We are applying technology to accomplish this on all three biosecurity fronts – offshore, at the border, and on the final battleground: within our borders if a pest or disease somehow slips in.

Perhaps the most important biosecurity measure we can take is building strong relationships and maintaining constant communication with our trading partners That is certainly the case with the US and New Zealand. Clearly, when one nation improves its biosecurity, all of the trade partners benefit. In the age of globalisation, there is no doubt that we are all in this together.

Bruce Knight is Under Secretary for Marketing and Regulatory Programmes, US Department of Agriculture Animal and Plant Health Inspection Service. This article is an abridged version of his keynote address to the recent Biosecurity Summit.

>>Benefits and risks of new technologies in possum control continued from page 37

unlikely to be a cost-effective technology for field use. While there has been some success in reducing possum fertility by aerosol administration of vaccines none has yet achieved a 60per cent reduction by that route. None has been shown to cause infertility in any non-target species that have been tested so far. This year further fertility trials will be started to test the latest formulations.

More efficient results

The original concept of fertility control by vaccination was based on efforts to develop a genetically modified virus to transmit the infertility antigen to the target species. A significant amount of research has been conducted over the past 20 years to try and develop a virally transmitted infertility vaccine for the control of mice, rabbits, foxes and possums, without success. There are also significant social and ethical issues with the development of such products.

However, the vaccines have significant theoretical benefits, particularly the lack of painful side-effects and high levels of host specificity. Population modelling studies also demonstrate that the use of infertility vaccines, in conjunction with lethal toxins, are likely to result in much more efficient long-term control results.

In summary the potential benefits of these technologies are –

- Much greater specificity for possums
- Reduced reliance on continuing large-scale access to and use of 1080
- More humane effects through reduced suffering of and reduction in overall possum numbers
- Reduced or more acceptable control costs.

Programme faces risks

The very tight timelines have meant that the researchers have had to pick winners before any of the technologies have met performance targets and there are no proven delivery technologies yet. The challenges of product development and scale-up are enormous and the regulatory issues to be addressed are substantial. To achieve all these hurdles time is short. Funding is only guaranteed till mid-2009 if the target is achieved and thereafter for only four further years to turn the compound into a product.

Addressing public concerns with the new technologies will be also be challenging. The risk communicator Peter Sandman famously developed the equation

Risk = hazard + outrage.

He has identified a number of factors that generate public concern or outrage, including some relevant to the development of new possum control technology.

- Controversy – where there are strongly held and conflicting beliefs or interpretations of facts
- Unknowns associated with a new product will have to be addressed such as persistence in the environment, toxicity with non-target species, carcinogenicity, and chronic effects
- Risks and benefits will not be evenly shared as many of those exposed to the control measures may not value reduction in possum numbers
- There is a lack of trust in science and the end-users.

These issues will all have to be addressed effectively if the new technologies are going to replace 1080.

John Hellstrom is chair of the National Research Centre for Possum Biocontrol

Consultancy with Maori organisations Key points for consultants

Gareth Baynham

Many consultants find working with Maori organisations a rewarding and satisfying experience. However consultants need to be aware of some important differences between Maori organisations and single-entity farms. For the purposes of this article Maori organisations are Maori trusts and incorporations with farmland subject to the Te Ture Whenua Act 1993.

Past research projects have indicated that Maori farms in multiple ownership do face additional challenges compared with single entity farms. These include variation in governance skills and ability, extended decision-making process, limitations accessing development capital and general aversion to risk. Some of the major issues are outlined below.

Governance

A key difference between single-entity farms and farms under multiple ownership is the committee system. Organisations with land under multiple ownership generally have a team of people elected or appointed as representatives of all the shareholders – trustees – which make up the governance team. This team is typically chaired by an individual.

Most Maori organisations will also have a management team, often including one or two trustees, farm manager, consultant and other professionals such as vets or accountants. This management team has responsibility for implementing plans agreed to by the governance team. Governance has oversight and control of the management team, but the management team are responsible for the day-to-day running of the operation. Some of the challenges a committee system presents to consultants are outlined below.

Changes to the governance team

Generally trustees are elected for a three-year term at the AGM. This means new people are coming on to the board, often with little knowledge of farming systems or the organisation's farm. In addition there may be changes in the farm staff. Practical implications for consultants include –

- The need to cater for variable technical knowledge among trustees
- There may be little awareness of general farming issues
- There is a need to transfer information to new staff and trustees
- Agreeing and documenting the strategic direction is important
- There may be a need for documenting operational procedures for new staff
- Decisions need to be ratified by the governance team so it can take longer for decisions to be made.

Leadership and strategic direction

Because trustees change there will always be fresh thinking coming on to the board. In the committee system, getting agreement on a unified vision for the future can be challenging. These factors make it important that organisations develop a documented vision and a strategic plan to provide direction to new trustees, the management team and shareholders. Having a strategic plan helps prevent sudden changes in strategic direction and provides more certainty to staff and shareholders. It also makes assessing progress simpler and helps communicate the vision and direction to new trustees.

Blurring between governance and management

This is often the major issue for Maori organisations, especially in Northland, where the small size of many farms means there may not be sufficient scale to employ a farm supervisor. Governance should set the direction for the organisation, help develop the strategic plan and monitor progress. Once the strategic plan had been agreed, the management team should be responsible for implementing the plan and reporting progress to the governance team. In some cases a member of the governance team will be part of the management team.

When governance becomes actively involved in management it can lead to conflict. There can be problems with accountability, especially when assessing progress against targets or objectives. A common area of governance blurring into management is the appointment of farm staff.

In Northland the relatively small scale of many Maori organisations makes it financially difficult to employ a farm consultant to provide supervision and day-to-day management of the farm. Often some members of the governance team feel they need to take some management tasks themselves to reduce the burden on the farm manager.

In these cases the roles and responsibilities of the trustee should be clearly defined and performance monitored as if they were part of the management team. In most cases it is preferable to employ outside contractors wherever possible. Consultants have a key role to provide independence in decision making and to help maintain boundaries between governance and management.

Business acumen

Consultants working with Maori organisations have a key role in providing information to governance at scheduled meetings. Often there will be little awareness of business principles and practices amongst the governance team. This means the consultant needs to work with the accountant to provide some simple measures of farm performance. In many cases there should be a balance between raising the ability of the trustees to interpret information and presenting too much information. As with any audience, using graphs and diagrams can make complex messages easier to absorb.

Administration costs on Maori organisations tend to be higher than on single entity farms, reflecting the importance of getting a good balance in the role of the consultant. Many consultants provide administrative support to their clients, to

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assist with the additional burden of communicating with trustees and shareholders.

As mentioned earlier, Maori organisations often have less knowledge of farming systems. They are more reliant on independent advice for making informed decisions. Having a good technical understanding of farm systems with the ability to critically analyse opportunities and summarise the potential risks and benefits is a key role for consultants. This is especially important when undertaking development projects.

Maori organisations in Northland tend to be less profitable than comparable non-Maori farms. Often conservative livestock policies contribute to poorer profitability. As with any client, the appetite for risk will vary between organisations. Consultants have a role to challenge conservative stock policies, but it is important to understand changes may need to be made more slowly than they would on single-entity farms. Gaining the confidence of the governance team can be a slow process and consultants should consider the risk that failure of the policy will have to the relationship with the governance team.

Costs and capital gain

Maori farms have an inherently higher cost structure than on owner-operator farms. Much of this higher cost comes from the costs associated with running the governance team and providing higher level reporting. These administration costs provide a valuable and necessary purpose, but the higher costs need to be considered when completing financial budgets.

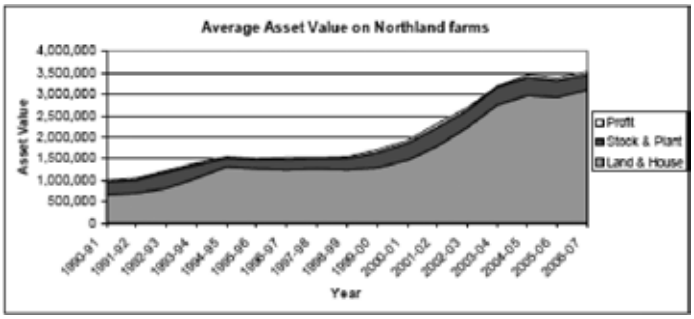
Rapid growth can be a threat if it exposes farms to high levels of debt. Debt can become an issue for Maori organisations because the capital gains seen on single-entity farms may not apply to Maori land. The Te Ture Whenua Act 1993 protects land from being sold. This means Maori organisations are unlikely to realise capital gain from their land and consequently are more reliant on generating a profit from their farms to repay debt. If the farm makes a loss it is difficult to capitalise this loss against any capital gain.

The graph below highlights the importance of capital gain to wealth creation on a typical Northland farm. The ability to realise this capital gain makes cash profitability less important with free-hold land, compared with Maori organisations where there is no capital gain.

Restrictions on borrowings

A key difference between Maori organisations and typical owner operators is the ability to borrow against land. Much of the land assets held by Maori organisations in Northland are subject to the Te Ture Whenua Maori Act 1993, which protects land from being sold. A consequence of this Act means most financial lenders will not lend against the value of the land, so organisations cannot use their land as security. This reduces the ability of organisations to borrow money for development, but it also reduces the risk of organisations forfeiting their land if they default on the loan.

Change in asset value and profit from Northland sheep and beef farms 1990 to 2007



In most cases, Maori organisations looking to access funds for development will need to use security in the value of their livestock. Lenders will generally lend a certain amount of an animal's value. If the organisation defaults on the loan, the bank will have the opportunity to take the stock and sell them to recover the debt.

Part of a longer term strategy may include purchasing freehold land to add to existing operations. Lenders tend to be more comfortable using freehold land as security, which means it can be easier for Maori organisations to access additional finance, which can then be used to develop land subject to Te Ture Whenua Act. Freehold land is also a source of capital gain.

Maori organisations are often driven by social and cultural outcomes rather than financial results. It is important for the strategic plan to consider the organisation's social and cultural objectives as well as financial objectives. Maori organisations often have a longer term horizon, sometimes over 25 years, compared with the shorter term objectives more common on single entity farms.

Consultancy models

Consultancy models also differ from single-entity farms. Advisors tend to work with trustees to provide independent advice and guidance, especially in technical areas. Activities advisors might undertake include –

- Strategic planning
- Staff recruitment
- Monitoring and reporting finances
- Technical issues such as feed budgeting, fertiliser and cropping.

Advisors tend to visit the farm regularly, often every month, and tend to work with trustees and farm managers. Supervisors are more involved with the farm, and are generally involved in day-to-day decision making on behalf of the trustees. Supervisors are often charged with carrying out the strategic plan developed by the governance board, and are accountable to trustees. Supervisors tend to visit the farm more regularly, once or twice a week, and are much more involved with day-to-day operations.

Which role is the best? This is going to be a decision each organisation needs to make based on their circumstances. Farm supervision releases the trustees from day-to-day decision making, leaving them free to focus on strategic direction. However, supervision can be expensive and the relatively small scale of many Northland Maori organisations means they may struggle to support this level of consultancy. In general, Maori organisations in Northland will choose some form of advisory service, with visits and reporting decided according to the level of input required by the governance team.

Relationships

Consultancy relationships with Maori organisation are often longer term than with single-entity farms. It takes time to develop the trust of the organisation. Listening is an important skill

and, as with any client, being sensitive to non-verbal feedback. Maintaining a strategic approach will help prevent the governance getting bogged down in operational issues.

Another task for consultants is facilitating and leading the business team. There is a natural tension in the role between being a technical expert for the management team and meeting the operational needs of the governance team. The relationship with the farm manager can also be critical, with the consultant acting as a link between the governance and management teams. There is a balance between challenging the organisation to achieve better performance and reducing exposure to risk.

Some of the key roles of a consultant include –

- Providing independent advice or guidance to the governance team
- Developing the relationship with the farm manager
- Providing information on farm performance including benchmarking
- Keeping the board focussed on the business and expanding the vision
- Evaluating the organisation
- Building a team.

Successful consultants have developed expertise in improving the capabilities of committees to carry out their governance responsibilities, acting as an educator and mentor of the board.

In addition to the traditional skills necessary for a consultant, an understanding of cultural protocols, tribal dynamics and Maori values in relation to farming and the environment are also required.

Tools and technology

A key role of the consultant is to monitor performance and report to the governance team. In most cases consultants report a combination of physical and financial performance. A general recommendation is to keep technical reporting to a minimum where possible and use the 'keep it simple' approach.

Generally using a cashbook programme such as cash manager will provide updates of actual financial performance versus budgeted performance. Physical reporting is generally either by collating monthly reports from the managers or using a tools such as Farmax. Farmax is a popular option amongst consultants, giving the ability to evaluate different options, monitor performance against actual, physical measured performance, build a database of growth rates and farm performance for the future and communicate easily with the non-farming team.

Gareth Baynham is a consultant with AgFirst in Northland. For more information go to the full report: Building Capability on Maori Owned Farms in Northland – Consultancy Guidelines, available from the MAF Sustainable Farming Fund.

Maori owned farms in Northland: Special issue

The report *Building Capability on Maori Owned Farms in Northland – Consultancy Guidelines* sets out to identify the important attributes of a consultant in working with Maori organisations, and provides guidelines and checklists to assist these organisations in their strategic planning. The report was funded by the Sustainable Farming Fund and Te Puni Kokiri and facilitated by Enterprise Northland, with input and feedback from a number of consultants, rural professionals, scientists, trustees and chairs.

Additional challenges

Maori farms in Northland tend to be less productive and less profitable than comparable Northland farms. We also know that Maori owned farms in Northland have the potential to make big productivity gains by applying existing knowledge on their farms. So what is holding these farms back? As discussed, Maori farms in multiple ownership do face additional challenges compared with single-entity farms. However multiply owned Maori farms in Northland also tend to –

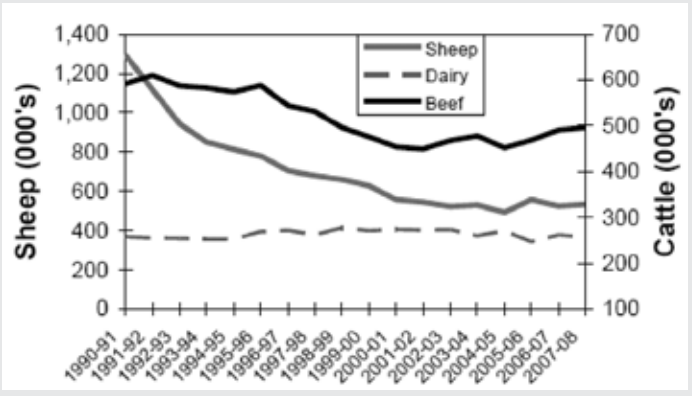
- Be smaller than Maori farms in other regions
- Have limited access to independent advice
- Have some regionally specific soil and pasture production issues.

In many cases the first step in a farm development programme is to get independent advice to assist with planning and implementation. This document aims to help Maori farmers make better use of independent advice and understand the important steps in building farm capability. While the focus of this report is Maori organisations in Northland, there may be relevance to single-entity farms or organisations outside of Northland.

Background on pastoral farming

Pastoral farming – grass farming associated with dairy, sheep or beef industries – is the largest sector in Northland, estimated to contribute around $1.3 billion dollars to the Northland economy. In the past 18 years there has been a dramatic shift in land use with 24 per cent of the pastoral land converted into alternative land use, mostly forestry. This has seen a reduction in sheep and cattle numbers as outlined in the graph.

Changes in stock numbers in Northland 1990-2007



This changing land use has forced farmers to become more productive and profitable, often through the application of new tools and technology. As a result of applying these tools, inflation adjusted farm revenue has increased by more than 30 per cent, in spite of losing a quarter of the pastoral area.

Changes in the Northland pastoral industry from 1990 – 2007

	Change in numbers	1990 to 1991 million dollars	2007 to 2009 million dollars	% change
Sheep	-59%	38	25	-35%
Beef	-16%	248	220	-11%
Dairy	0%	157	600	+282%
Deer	-	1	0.8	-43%
Region total		444	845	+34%

Maori farm performance in Northland

Farms under Maori ownership have been more insulated from these changes, applying new technology selectively and continuing with relatively conservative stock policies. A comparison of the performance of Maori owned farms relative to non-Maori owned farms was undertaken in Northland in 2002, the comparison showed some concerning trends.

Factors contributing to this poor performance include –

- Conservative stock policy contributing to low productivity
- Lower productivity contributes to a lower gross farm income
- Farm expenses are similar across the sector groups
- Expenses are a much higher percentage of farm revenue
- Effective farm surplus is a measure of profit, which is significantly lower on the Maori owned farms.

There are 133,009 hectares of Maori owned land in Northland, representing around 11 per cent Northland's total land area. As outlined in the table below, approximately 30 per cent of this land is in developed pasture, 20 per cent in exotic forestry, 20 per cent in scrub or poor quality pasture with the remainder either undeveloped or Nga Whenua Rahui title.

Financial performance of Maori owned sheep and beef farms compared with European owned

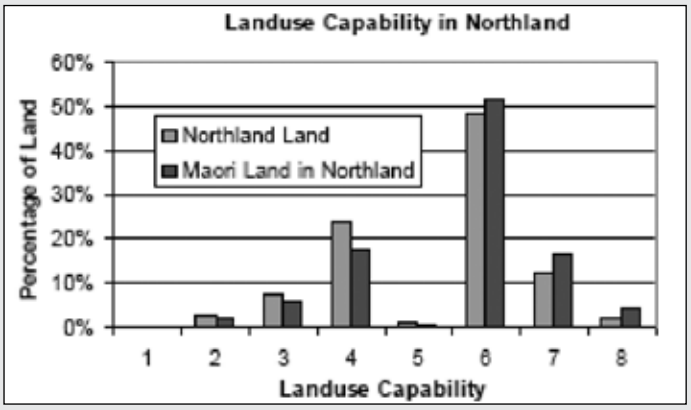
	Maori owned	European owned	Northland model
Production kg product per hectare	146	243	203
Gross farm income Dollars per hectare	521	766	746
Farm cash expenses dollars per hectare	345	382	352
Expenses as percentage of gross farm income	66%	50%	47%
Effective farm surplus dollars per hectare	141	394	199
Effective farm surplus dollars per stock unit	15.7	40.9	18.09

Maori owned land area in Northland

Maori owned land in Northland is generally representative of the type of land in the region. The graph below uses GIS data Landcare Research Information comparing the Land Use Capability of Maori owned land with the land use capability of Northland land generally. On the Land Use Capability scale, class one land is the most productive and class eight is the least productive.

A limitation of Maori owned land in Northland is the relatively small size of the blocks, most of which are located in the Far North and are less than 50 hectares.

Land Use Capability of all Northland land compared with Maori owned land



Maori owned land area in Northland

	Total area	Developed	Exotic forest	Scrub/poor pasture	Undeveloped
Far North	73496	24992	18327	10528	19649
Rest of Northland	59513	16489	8017	15930	19077
Total	133009	41481	26344	26458	38726

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