More Carrot and Less Stick
Lessons from Agricultural Extension in New Zealand

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I. Broad Trends

Criticism of agriculture's detrimental effects on the natural environment (Leeuwis, 2004; Leeuwis & Pyburn, 2002; Roling & Wagemakers, 1998) has led to calls for increased environmentally sustainability. In this, science and agricultural extension should both play central roles (Leeuwis, 2004) and participatory methodologies are now broadly accepted as the best framework within which these roles may be secured.

Issues of sustainability often impact on the values and preferences of groups that have traditionally remained outside the science and technology systems. Moreover their complexity means they cannot be answered in scientific and technical terms alone ((Dale, 2005; Robinson, 2004: 378; World Commission on Environment and Development (WCED), 1987). Participatory approaches allow the development of solutions that embody a diverse range of perspectives including farmers, scientists, industry representatives and policy-makers (Ravetz, 1988). They also allow the collective action and mobilization of people in local communities that is accepted as necessary for sustainability (Dale & Onyx, 2005; Pretty, 2003; Pretty & Ward, 2001; Robinson, 2004; World Commission on Environment and Development (WCED), 1987).

Critical to sustainability is the development of learning environments that provide opportunities for airing the viewpoints of multiple stakeholders and the integration of these into constructive solutions (Allen, Kilvington, Nixon, & Yeabsley, 2002; Keen, Brown, & Dyball, 2005; Pretty, 1995; Reed, 2008). It is argued that learning processes that incorporate interactive platforms and create collaborative equitable partnerships have the potential to change behaviours by enabling people to continuously and collectively learn about the context in which they work. The integration of changes in understanding within the wider network (community of practice) facilitated through social interaction, is described as social learning (Reed, et al., 2010 in press). To date, how such approaches have been applied in New Zealand agriculture remains poorly understood.

This paper draws on ongoing research, which compares six cropping projects that used science to support sustainable land management. All the projects received funding from the Sustainability Farming Fund, which supports partnerships between farmers, industry and scientists to "deliver economic, environmental and social benefits to New Zealand's primary industries" (Sustainability Farming Fund, 2008/2009). Insights are offered on those factors that facilitate or impede the fostering of participatory approaches and social learning in agricultural extension, and the extent to which empirical evidence deepens our theoretical understanding.

II. Agricultural Extension in New Zealand – A Fragmented System?

A. *The Demise of Government Funded Extension*

Until the late 1980s, New Zealand's agricultural extension services were funded as a public good, administered through the Farm Advisory Division of the Ministry of Agriculture and Fisheries (MAF). The neo-liberal reforms of the 1980s privatised these services and the responsibility for extension was largely taken up by private consultants. Journeaux and Stephens (June 1997) argued that this denied the public good benefits of extension, particularly those benefits associated with the management of natural resources. Some agricultural sectors also have taken direct responsibility for extension activities. The result is an extension system characterised by Massey (June 2004) as fragmented and primarily directed towards increasing farm productivity and profit maximisation (Black, 2000).

B. *Regional Councils*

The inclusion of sustainability in the 1991 Resource Management Act, gave regional councils a primary responsibility for environmental management. In response councils have developed both programmes and extension roles to encourage a transition to more sustainable land management. These activities, however, are primarily designed to support and ensure regulatory compliance (Stantiall & Paine, 2000). The resultant increase in regulations backed by fiscal penalties for non-compliance has been argued to be a direct consequence of the decline in taxpayer funded extension services (Hall, Morriss, & Kuiper, 1999).

C. *Science Research Institutions*

The reforms of the 1980s also led to the restructuring of New Zealand science, and in particular the establishment of the Crown Research Institutes (CRI). These are run as businesses and seek research funding through commercial ventures and from public funds in competition with the universities and other research agencies. Journeaux and Stephens (June 1997) argue that the CRIs' mandate favours extension activities that provide a commercial return, rather than a social benefit. While some argue that the 1980s policy changes created a more cost effective, transparent and client-focussed science system (Easton, 1997), while Smith and Saunders (1996) have argued that at least initially they had a detrimental effect on sustainable land management.

In a recent attempt to create a less competitive research-funding environment, the Government has announced new science priorities. These include "driving knowledge transfer to businesses and other research users" (MORST, 2010) and an understanding that knowledge transfer will become a core purpose of the CRIs. As yet, however, there is no clear statement as to how this will be achieved. What is apparent, is that New Zealand agricultural extension is once again at a crossroads.

D. *Science Funding Agencies*

In the absence of any coherent publicly funded extension service, research-funding agencies have challenged scientists to adopt more participatory approaches. MAF established the Sustainable Farming Fund (SFF) to support partnerships between science providers and farmers. All projects are required to demonstrate evidence of extension activities. At face value all SFF projects are consistent with the participatory paradigm. How effective the participatory approach is being implemented into these projects and the affect this has on learning outcomes is the focus of the remainder of this paper.

III. EARLY INSIGHTS

The six projects examined in this research are described in Table 1. A review of the literature on participatory approaches and social learning identified eight key components for investigation in the projects. These are Policy Framework, Project Processes, People, Power Relations, Partnerships, Platforms, Project Outcomes, and the long-term sustainability of those outcomes and together these provide a framework for the research. They were the focus of discussion in 70 in-depth, semi-structured interviews undertaken with scientists, industry representatives, government officials and farmers drawn from across the projects from which four features stand out:

1) *Traditional approaches to agricultural extension remain integral to many participatory approaches.*

Despite recognition of the importance of participatory learning (Allen, 2001), and its support by funding agencies, the level of incorporation of participatory approaches varies. Using Probst et al's (2003) four levels of participation and ownership in projects (contractual, consultative, collaborative collegiate), the analysis shows evidence of all four levels, ranging at one end from the contractual relationship of the potato project, succinctly described by one farmer as "the main drawing up of that was their doing - in those days it use to be a concept that came through from the scientists", through to the collegiate relationship of the Walnut project, expressed by one farmer as "we were engaged all the way with the researchers." Projects that are farmer-initiated and include active farmer experimentation and engagement (Walnut project, Wheat Calculator and LandWISE) are generally found to be the most 'collaborative' or 'collegiate'.

Interestingly, while farmer participation in a project does not appear to determine technology uptake, higher levels of engagement by farmers do appear to result in deeper learning, which is sustained long after the project has ended. One wheat farmer described this stating, "It's changed my thinking … having been around in the early stages of the project. I think about the consequences of certain actions." A walnut grower expressed similar sentiments explaining that,

> I don't think that we really realised how cutting edge of science we were until we got into the project and then discovered that there were whole layers of complexity there that we didn't have the tools for…."

On the other hand projects with little farmer engagement evidenced shallower levels of farmer learning. One potato farmer stated bluntly

> The project influenced me at the time to use chess (a new biological insecticide) but that's too damn expensive now, so you go to the cheap ones but that kills everything, you don't know which way to turn because you don't want to kill everything but you want the control.

Industries now decline to support projects that are built on a 'contractual' approach, as these no longer meet farmers' research needs. "What we are doing", one representative explained

> is turning it around the other way, we go to our growers and say - what's important to us and we then turn to scientists and say well this is what we want researched. (Potato Farmer on Industry R&D Committee)

While the move to farmer-initiated projects can be seen as positive change, industry recognition of the need for greater farmer-scientist interaction remains focussed on the initial 'concept' stage leading up to an application for funding and the 'technology transfer' stage that typically occurs in a project's final year. In-between these stages project governance is often ambiguous. This is cause for concern. As Allen (2001) and van de Fliert et al (2002) have shown, action to address an environmental issue is driven by an iterative and collaborative process that is itself informed by effective feedback loops. Evidence from the projects discussed here supports the argument that to maximise effectiveness, a research project needs to be viewed in its entirety and involve close interaction between farmers, scientists and other researchers at every stage. This ensures a wider base of expertise necessary to promote both a deeper understanding of the problem and a clearer definition of solutions.

2) *Participation alone does not lead to social learning.*

While participation may lead (as point 1 indicates) to deeper learning by individuals, this does not necessarily equate with or result in social learning. As Reed et al (2010 in press) argue, social learning requires a change in understanding in the wider community (communities of practice) through a process of social interaction.

Social learning is evident in three of the projects examined – the Wheat Calculator, LandWISE and Walnuts. In these projects the processes and platforms used enabled the engagement of members of the wider community through interactive workshops, farmer experimentation, fieldtrips and farmer-initiated conferences. These provided opportunities for collective learning, even where the research did not necessarily involve each individual farm. Processes were built on a 'learning by doing' (Allen, et al., 2001) framework that enabled interaction to occur. Social learning became an emergent property of that interaction.

While technology uptake occurred in five of the six projects, uptake alone is an inadequate measure of social learning. This is illustrated in the Wheat Calculator project where uptake of the technology has significantly declined over time, yet there is strong evidence of social learning. In this example, the underlying environmental knowledge highlighted through the technology and communicated to farmers through interactive 'extension' activities, is now embodied in wheat farming practices. Their industry manager illustrates this in the following statement:

> Current usage of the model is low, but we know that 80% of people going into wheat have changed their fertilizer practices as a result of the information that was contained in the model.

Farmers who are opinion leaders are fundamental to social learning. Such farmers are innovative, confident, articulate, eager to experiment and learn, understand trial failure, have a strong sense of community and most importantly are willing to share and let others see what they are doing or as one farmer described, "be prepared to be on display". In the Wheat Calculator and Walnut projects and in LandWISE, such farmers acted as role models. In these projects social learning is evident. In the projects involving highly competitive sectors (squash, potatoes) the use of such role models is necessarily limited because of their unwillingness to share information in case they lose their competitive advantage.

Interactive platforms – that group of activities designed to promote collaborative learning - are critical for social learning. Platforms need to be learning opportunities that can lead to collective action. In the case studies, such activities were best initiated by farmers or their industry groups. The least effective activities for collective learning were those organised without full inclusion of the farmers' voice. In these, traditional top-down teaching approaches dominate with few opportunities for true interaction. As one scientist himself acknowledged, "It is death by PowerPoint." Although there are exceptions, many scientists continue to have difficulty recognising the needs of varied audiences and to communicate in a way that is accessible to a non-scientific audience. One potato farmer, describing his participation in a scientific institution's 'farmer workshop,' bluntly said, "Why on Earth would a scientist think that I would be remotely interested in the DNA structure of an aphid?"

3) Science and industry objectives are often poorly aligned

In applying for SFF funding scientists must identify an industry collaborator, yet the objectives of each party may be quite different. Industry commonly wants applied knowledge designed to meet farmers' needs. This may require the science to be narrowly focused and easily communicated. Scientific reports and publications rarely fulfil this need. As one industry representative described it:

> We said [to the scientists] stick your manual…what I want you to give me is a guideline for IPM. We then gave the manual to a company… and then the scientist who thinks he is the bees' knees, says, "You can't rewrite that". I said nobody is rewriting it; we are putting it in English that growers can understand (industry body).

For scientists, the main driver is innovation and a publishable output. Many feel ill equipped to engage in conversation with stakeholders, at least until they have a reasonable level of confidence about their findings. This was emphasized by one of the participants, "The type of person who does science is like that. They want to know the answer with a statistical confidence before they make a statement. (LandWISE Manager)"

Scientists commonly agree, and also point to the limited skills they possess for engaging with communities. As one scientist explained "…for scientists the main driver is the question and that is why they go into science. They do want to see it make a difference, but it's a whole new ball game that needs a whole new set of skills."

Scientists also frequently claim that the competitive funding model has limited their ability to engage with stakeholders, and that 'extension' is difficult to budget and account for in a system they perceive as biased towards reports and scientific publications.

> Because no one sits down with growers they may say 'oh research isn't adding any value to us', just because scientists don't really have that time and space. Most scientists write the report and it goes on the shelf and they tick it off - DONE. (Scientist)

4) *Relationship building is critical at the early stages of a project*

The main inhibitors to the development of trusting partnerships were identified as:

- Power differentials
- Past experience
- The competitive nature of the industry.

Participatory approaches inherently imply and require that traditional hierarchical power structures be replaced by more equitable relationships. Scientists as experts giving "top-down" advice to farmers who are passive recipients are replaced by networks of stakeholders each bringing their own expertise to the table. Of course power relationships also exist within the science community just as they do among farmers and there are further power differentials between farmers, processors and supply groups. Each of the projects examined exhibited different power structures. To some extent these were highlighted with the Māori growers and their unique culturally based relationships, but the contract relationships which typify the squash and potato growers reflect distinctive power structures, very different from the more open relationship found among the small walnut growers.

Past experience of working with scientists and perceptions of having been exploited or having benefited from the experience coloured the development of new relationships and trust. This experience was strengthened (and weakened) where the stakeholders had themselves a broad understanding of science as a development tool (e.g. the walnut growers, wheat farmers and LandWISE farmers) compared to other groups less informed about the nature of science and its limitations. Where the sector was highly competitive, highlighted by relationships dominated by processor driven contracts, sharing of information and the development of partnerships was fraught.

Addressing these issues and building good relationships takes time and may require significant facilitation. Scientists expressed concern over the lack of resources commonly provided for such endeavours. Tangible outputs that meet measurable Key Performance Indicators are commonly favoured over intangible outcomes such as trust building. Indeed although funding agencies support participatory approaches, scientists claim that the science system limits long-term relationship building with communities, as one scientist explained:

> I can relate to a lot of the stories on the coast. But trying to explain it to the science system is … and spending the money – you have to spend it before the end of June. I was fighting this – asking for just a little bit more time and I think I don't want to rush this thing because the system forces me to. It is a real struggle to merge – and it is something I cannot escape, I am not a Maori I am a scientist. (Scientist).

This raises questions as to both the capability and capacity of scientists and research institutions to embody participatory approaches into their research.

Where there are low levels of trust or significant power differentials it is necessary to identify key local individuals who can work across the boundaries between science and the community. This is essential for capacity building. Industry bodies such as FAR (Foundation for Arable Research) have adopted a progressive stance and now from the start include "boundary crossers" (Veitch, Taylor, Kilpatrick, Farmer, & Chesters, 2007) in projects to build good feedback loops between farmers and scientists.

IV. CONCLUSION

Rural communities in New Zealand face pressure to address wide concerns about the detrimental environmental effects of their farming practices. At the same time they face legislative requirements for sustainability. As argued in this paper meaningful responses must be built on a collaborative learning approach to agricultural extension that facilitates change and enables collective learning and action.

New Zealand's research agencies support participatory approaches. This is a positive initiative and could allow a move away from the big stick, which centres on regulation and fines to promote change, an approach intensely disliked by farmers (Allen, Du Plessis, Kilvington, Tipene-Matua, & Winstanley, 2003) and one that has had only limited success. The findings presented here support the value of participatory approaches. They also however, raise significant questions, both about how such approaches are implemented, and the capacity and capability of New Zealand research organisations for this task. This is of particular importance in light of the Government's recent signalling of agricultural extension as a core purpose of the CRIs.

Participatory learning offers a 'carrot approach' to improve land management and is a powerful means to achieve social learning. The need to address the fragmentation of New Zealand's agricultural extension system remains an ongoing debate. As part of this debate and as this paper has shown, the need to successfully address complex environmental problems requires a stronger focus on extension as an integral part of the research process. This is equally important as the restructuring of the larger system.

REFERENCES

Allen, W., Du Plessis, R., Kilvington, M., Tipene-Matua, B., & Winstanley, A. (2003). Involving the Public in Science and Technology Decision-Making: A Review of National Initiatives. Wellington, NZ.

Allen, W., Kilvington, M., Nixon, C., & Yeabsley, J. (2002). Sustainable Development Extension. Wellington, NZ: MAF Technical Paper No.2002/03.

Allen, W., Kilvington, M., Oliver, J., & Gilbert, M. (2001). Benefits of Collaborative Learning for Environmental Management: Applying the Integrated Systems Knowledge Management Approach to Support Animal Pest Control. Environmental Management, 27(2), 215-223.

Black, A. (2000). Extension Theory and Practice: A Review. Australian Journal of Experimental Agriculture, 40, 493-502.

Dale, A. (2005). Social Capital and Sustainable Community Development: Is there a relationship? In A. Dale & J. Onyx (Eds.), Social Capital & Sustainable Community Development: A Dynamic Balance (pp. 13-30). Vancouver: UBC Press.

Dale, A., & Onyx, J. (Eds.). (2005). Social Capital & Sustainable Community Development: A Dynamic Balance. Vancouver: UBC Press.

Easton, B. (1997). The Commercialisation of New Zealand. Auckland: Auckland University Press.

Hall, M., Morriss, S., & Kuiper, D. (1999). Privatisation of Agricultural Extension in New Zealand: Implications for the Environment and Sustainable Agriculture. Journal of Sustainable Agriculture, 14, 59-71.

Journeaux, P., & Stephens, P. (June 1997). The Development of Agricultural Advisory Services in New Zealand, MAF Policy Technical Paper 97/98. Christchurch, NZ: Ministry of Agriculture and Fisheries.

Keen, M., Brown, V. A., & Dyball, R. (Eds.). (2005). Social Learning in Environmental Management: Towards a Sustainable Future. London: Earthscan.

Leeuwis, C. (2004). Communication for Rural Innovation (Third ed.). Oxford: Blackwell Science Ltd.

Leeuwis, C., & Pyburn, R. (Eds.). (2002). Wheelbarrows full of frogs: Social Learning in rural resource management. Assen, The Netherlands: Koninklijke Van Gorcum.

Massey, C., Morriss, S., Alpass, F., & Flett, R. (June 2004). A Framework for Building Learning: Evidence from the New Zealand Dairy Industry. Journal of Extension, 42(3).

MORST. (2010). Establishment of new Ministry

Statement to the Research, Science and Technology sector on 1 June 2010. Retrieved July 15, 2010, from http://www.morst.govt.nz/about/News/Establishment-of-new-Ministry/

Pretty, J. (1995). Participatory Learning for Sustainable Agriculture. World Development, 23(8), 1247-1263.

Pretty, J. (2003). Social Capital and Collective Management of Resources. Science, 302, 1912-1914.

Pretty, J., & Ward, H. (2001). Social Capital and the Environment. World Development, 29(2), 209-227.

Probst, K., Hagmann, J., Fernandez, M., & Ashby, J. (2003). Understanding Participatory Research in the Context of Natural Resource Management - Paradigms, Approaches and Typologies. Agricultural Research and Extension Network (AgREN), Network Paper No. 130.

Ravetz, J. (1988). Usable knowledge, usable ignorance: incomplete science with policy predictions. In W. Clark & R. Munn (Eds.), Sustainable Development of the Biosphere (pp. 415-434). Cambridge: Cambridge University Press.

Reed, M. S. (2008). Stakeholder Participation for Environmental Management: A Literature Review. Biological Conservation, 141, 2417-2431.

Reed, M. S., Evely, A. C., Cundill, G., Fazey, I., Glass, J., Laing, A., et al. (2010 in press). What is Social Learning? Ecology and Society, from http://homepages.see.leeds.ac.uk/~lecmsr/whatissociallearning.htm

Robinson, J. (2004). Squaring the circle? Some thoughts on thr idea of sustainable development. Ecological Economics, 48, 369-384.

Roling, N., & Wagemakers, M. (Eds.). (1998). Facilitating Sustainable Agriculture: Participatory learning and adaptive management in times of environmental uncertainty. Cambridge: Cambridge University Press.

Smith, W., & Saunders, L. (1996). Agricultural Sustainability: The Cost of the 1984 Agricultural Policy Reforms. New Zealand Geographer, 52(1), 21-28.

Stantiall, J., & Paine, M. (2000). Agricultural Extension in New Zealand - Implications for Australia. Paper presented at the Australia Pacific Extension Network 2000 National Forum. Retrieved from http://www.regional.org.au/au/apen/2000/4/stantiall.htm

Sustainability Farming Fund. (2008/2009). Sustainability Farming Fund: Funding From The Grass-Roots Up: http://www.maf.govt.nz/sff/apply/sff-brochure-2009.pdf.

van de Fliert, E., Dilts, R., & Pontius, J. (2002). Farmer research teams, farmer field schools and community IPM: Different platforms for different research and learning outcomes. In C. Leeuwis & R. Pyburn (Eds.), Wheelbarrows full of frogs: Social Learning in rural resource management. Assen, The Netherlands: Koninklijke Van Gorcum.

Veitch, C., Taylor, J., Kilpatrick, S., Farmer, J., & Chesters, J. (2007). Understanding Community Capacity: Community, Professional and Government Perspectives. Paper presented at the Second International Conference on Interdisciplinary Social Sciences, Granada, Spain.

World Commission on Environment and Development (WCED). (1987). Our Common Future. Oxford: Oxford University Press.

TABLE I. TABLE 1: PROJECT CASE STUDY OUTLINES

Project	Objectives
Crop Science for Maori East Cape North Island (5 year project) CRI scientists working with the East Coast Organic Producers (ECOP) Trust	To help Maori communities make the transition from extensive agriculture to intensive organic horticulture. This involved establishing a reciprocal learning network and providing scientific, education, and extension services to develop and implement 'best' practices.
Kabocha Squash Rot Gisborne, Manawatu, Hawkes Bay (3 year project) CRI scientists working with farmers, the Kabocha Council and Squash Pack-houses.	To assess factors that influenced the extent of storage rot in Kabocha squash (buttercup). Scientists aimed to model weather influences on squash growth and yield to help define the factors impacting on fruit yield and maturity.
LandWISE East Cape to Hawkes Bay Self-funding agricultural extension group involving farmers, researchers, process industries and suppliers	To co-ordinate on-farm research and development, primarily in the vegetable and arable cropping industries. They focus on soil health, minimum tillage and irrigation efficiency.
Walnut Project Canterbury (3 year project) Scientists working with the Walnut Industry Group and Walnut Farmers	To determine whether bacteriophages could be used to control bacterial blight on walnuts and develop an environmentally benign agent for blight control.
The Wheat Calculator Canterbury (3 year project) Collaboration between CRI scientists, wheat farmers and their industry body – FAR (Foundation for Arable Research)	To examine and quantify the effects of arable and vegetable growing practices on nitrate leaching, involving the development of a "user-friendly" software package, the Wheat Calculator, to identify the response of different wheat cultivars to nitrogen and irrigation
Potato Aphid Project Canterbury (3 year project) CRI scientists working with potato farmers and processors	To develop a resistance management strategy to delay or prevent the development of aphid insecticide resistance in potatoes, and help maintain options for pest control and potato quality. It also sought to determine 'best practice' for the control of aphids and viruses in seed, process and fresh potato crops, and provide growers with up to date information on aphid flights and infestation.