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Participatory approaches for sustainable agriculture: A contradiction in terms?

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Abstract. This paper examines the adoption and application of a participatory approach to the transfer of scientific research to farmers with the objective of supporting government policies for sustainable agriculture. Detailed interviews with scientists and farmers in two case studies in New Zealand are used to identify the potential and constraints of such an approach. One case study involves Māori growers wishing to develop organic vegetable production; the other involves commercial wheat farmers who want to improve their profitability and face major problems of groundwater nutrification. The paper concludes that while both case studies are characterized as successful by those involved, there is an inherent creative tension between the adoption of a participatory approach and its use to advance public policy goals.

Key words: Agriculture, Case studies, Learning, New Zealand, Participatory approaches, Policy, Sustainability

Abbreviations: CFR – Crop and Food Research; ECOP – East Coast Organic Producers Trust; FRST – Foundation for Research, Science, and Technology; FAR – Foundation for Arable Research

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Introduction

Participatory approaches have grown in popularity over the past 30 years and are now commonplace in development projects and rural research. While such approaches were originally advanced to facilitate positive change in marginalized communities (Park, 1993; Reason and Bradbury, 2001) they are now increasingly used in areas marked by contestation, complexity and/or uncertainty, such as public health, industrial relations, and sustainability. In particular, sustainability is seen to require participatory research methods, due to the failure of more conventional research methods to generate effective strategies for achieving environmental sustainability. This is equally the case in research for sustainable agriculture, where participatory approaches are currently being promoted internationally by a range of academics, policymakers, and research funding agencies. In line with this trend, New Zealand is presently employing participatory approaches usually in the form of research partnerships to improve the sustainability of agriculture, the country's largest land use and export earner. This paper, through an examination of two case studies (organic vegetable production on the East Cape and wheat farming on the Canterbury Plains) (see Figure 1) considers the potential of participatory approaches to realize a more sustainable agriculture.

Background

As the environmental effects of industrialized agriculture become more pronounced and pervasive, considerable attention is paid to what sustainable agriculture might mean and how it should be pursued (e.g., Röling and Wagemakers, 1998; Cary et al., 2002). Far from having solely biophysical properties as was previously assumed, most commentators now propose holistic, integrated models of sustainable agriculture. For example, Reijntjes et al. (1992) suggest that five conditions need to be met for an agricultural system to be deemed sustainable: it must be ecologically sound, socially just, economically

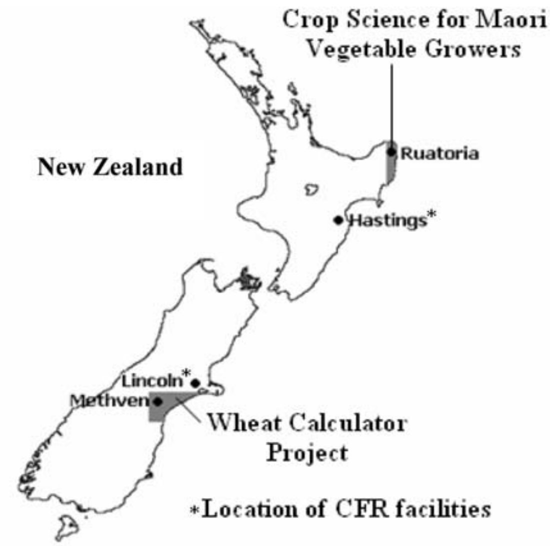

Figure 1. Location of case studies.

viable, humane, and adaptable. In line with this and many other similar descriptions, it is proposed that improving agricultural sustainability requires holistic and integrated strategies that are relevant and legitimate at the local level (Röling and Wagemakers, 1998; Allen et al., 2002; Leeuwis and Pyburn, 2002). Whereas governments have traditionally sought to achieve agricultural change through a combination of extension and subsidies, these methods are now considered poorly suited to the challenges posed by sustainable agriculture (Vanclay and Lawrence, 1995). As such, many governments have turned to participatory research approaches in an attempt to develop practical solutions to environmentally unsustainable agriculture. However, an understanding of the potential of such research to realize more sustainable agriculture requires an understanding of the nature and purpose of participatory approaches.

The increasing popularity of participatory approaches has seen a proliferation of "participatory" methodologies,[1] reflecting markedly different philosophical and methodological underpinnings. However, such approaches generally have a common recognition that in order to be successful, research participants must play a major role in shaping the research agenda. Indeed, the major difference between "collaborative" and "participatory" approaches is that while the former generally involve negotiation of the methods employed to meet a pre-determined outcome, the latter allow participants to determine and negotiate both outcomes and methods.

The development of contemporary participatory approaches can be traced back to the mid-20th century. The methodologies involved grew out of theories in social psychology (Lewin, 1946) and were informed by the concepts of social change promoted by Friere (1970). These methodologies were among the first to be explicitly concerned with community participation in research, and their development is generally linked to two issues: (1) a growing dissatisfaction with the dominant positivist paradigm of academic enquiry; and (2) a belief that research should effect positive social change through the empowerment of communities. Both these methodologies assign primary decision-making power to participants (rather than researchers or funding bodies), allowing communities to identify and prioritize their needs on their own terms. Consequently, communities are assumed to be better positioned to ensure any research in which they participate is relevant to their needs and likely to further community goals. As any enquiry in the tradition of participatory research should be concerned with utilizing local knowledge, researchers tend to assume the role of facilitators, relinquishing the title of sole expert often assigned them in more conventional research methodologies (Park, 1993). Moreover, participatory research casts the researcher as an involved advocate for communities, rejecting the impartiality traditionally assigned to scientists.

However, many contemporary participatory methodologies, and certainly part of the motivation behind recent calls for their use, often stem from a view that end-user participation in research is more efficient and cost effective than traditional research methodologies. As Pretty (1995: 1251) notes:

> Two overlapping schools of thought and practice have evolved. One views participation as a means to increase efficiency, the central notion being that if people are involved, then they are more likely to agree with and support the new development or service. The other sees participation as a fundamental right, in which the main aim is to initiate mobilization for collective action, empowerment and institution building.

Yet regardless of which school of thought – and it is often both – has influenced the development and implementation of any given participatory approach, such approaches ultimately remain effective and popular because they afford participants the opportunity to partake in research designed to further *their* goals. According to the developers and protagonists of participatory approaches, all research guided by a participatory approach must focus primarily on the aspirations of participants, and not on pre-determined policy goals or advancing researchers' careers (Reason and Bradbury, 2001; Stoecker, 2005). Yet increasingly, participatory approaches are being designed and implemented specifically to help achieve policy goals, especially in complex, uncertain, and contested environments where more conventional research methods have been ineffective. While participatory approaches are held by many to be vastly superior to conventional research methodologies in complex environments (e.g., Campbell, 1998; Eshuis and Stuiver, 2005), the assumption that they can be used to further policy goals different from those of participants requires careful examination. The purpose of this paper is to consider this assumption through analysis of two participatory case studies in New Zealand.

Case studies

In August and September of 2005, the authors conducted semi-structured interviews with 18 farmers and 11 scientists, consultants, and farmer representatives involved in two case studies; Crop Science for Māori and the Wheat Calculator Project. The case studies each involve a participatory approach facilitated by a state-owned science provider, Crop and Food Research (CFR), and are concerned with improving the environmental and economic sustainability of cropping systems. The two case studies were deliberately chosen from many similar projects as they occur in significantly different social, economic, and cultural contexts.

Crop Science for Māori vegetables growers

The first case study examined involves a research partnership between the East Coast Organic Producers Trust (ECOP) based around Ruatoria on the East Cape and CFR based 350 km south in Hastings (see Figure 1). The East Cape is a remote and predominantly Māori region with traditionally high unemployment and low rates of economic development. In 2000, a joint local and central government taskforce was established to promote the development of the Tairawhiti region (of which the East Cape is part). This taskforce concluded that organic production (already practiced on a small scale by many landholders in the region) represented a viable use of under-utilized Māori land and recommended further research into how organics might be developed on the East Coast.[2]

Both CFR and ECOP were represented on the taskforce and took part in informal discussions held in 2001–2002 concerning the development of organic vegetable production on East Cape. ECOP subsequently produced a Strategic Plan which detailed their common agreement to develop their land for commercial organic vegetable production with the goal of increasing employment and improving the well-being of their East Cape community. A CFR staff scientist then worked with growers to develop an Implementation Plan and advised ECOP as to how CFR's expertise could be applied to help achieve some of their aims. Following this, ECOP and CFR jointly applied to the Foundation for Research, Science, and Technology (FRST),[3] though CFR's role in this process remained primarily administrative, providing computing and proposal-writing skills to assist ECOP growers who were responsible for the content of the application. This application was successful, and a project called "Crop Science for Māori" was funded to aid the development of a profitable and sustainable organic industry on the East Cape and to improve the ability of scientists to work with rural Māori communities.[4] However, the specific goals underwriting the project were jointly finalized by ECOP and the CFR science team at a *hui* (a formal meeting) in 2003 at Ruatoria.[5] At this *hui*, Crop Science for Māori accepted the following aims:

- to help East Cape Māori make the transition from extensive agriculture to intensive organic horticulture;
- to provide scientific, education, and extension services to assist the ECOP Trust to develop and implement best organic vegetable farming practices;
- to design research methods to promote beneficial change in rural Māori communities and production systems (in collaboration with the wider Māori community).

In addition, ECOP also remained guided by its strategic plan, which detailed further goals growers hoped to achieve through organic vegetable production. These goals stem from the original reason for which the Trust was founded, to promote the values of *tino rangatiratanga*, *kaitiakitanga*, and *whanaungatanga* (approximately translated as independence, guardianship, and relationship, respectively) in the East Cape community by reviving the declining cropping tradition among Ngati Porou.[6] Growers' motivation for undertaking organic cropping reflected this through a mixture of belief in the cultural importance of cropping (particularly *kumara*[7]), a desire to provide a positive social and economic example in order to attract back the youth of the community to the region and a belief in the health and environmental principles of organic production.

Crop Science for Māori involves members of the CFR science team working with ECOP growers in an ongoing 5-year project. The science team, consisting of two crop scientists, a technician, and a manager from CFR as well as a local agricultural consultant, provide agronomic advice to ECOP members while carrying out various organic crop trials on members' land to determine which crops are most appropriate for East Cape conditions. However, the project is also designed to improve the ability of scientists to work with rural Māori communities, and as such ECOP members provide formal and informal advice and training to CFR regarding Māori protocol and traditions. Most project interaction takes place during field days held on members' farms and workshops and at meetings held at *marae* (Māori meeting houses) around Ruatoria. As the project has developed, field days and workshops have become more practical (rather than theoretical) and each generally focuses on a particular topic relevant to the season in which they occur, such as planting workshops in spring.

Despite considerable enthusiasm generated at its inception, Crop Science for Māori progressed more slowly than hoped or planned. ECOP's membership has dropped from an estimated 50 at its founding to a current active membership of 10–20 growers, yet at the same time the project has (as planned) attracted other community members not formally attached to ECOP, to its activities, so that overall levels of participation might best be described as having been consolidated. Certainly, members of the CFR science team describe a slow and sometimes frustrating period of trust-building and "proving ourselves to the growers." During this time, growers were often reluctant to participate fully in the project, with attendance at workshops and field days often so low that scientists outnumbered growers. This was particularly frustrating for science team members, as workshops were a costly and time-consuming undertaking involving travel times in excess of 5 hours each way. However, interviews with members of the science team also reveal some empathy for the initial reticence of growers, with scientists cognizant of a history of unpopular research projects on the East Coast and conceding that many of the early workshops were too technical for effective communication of agronomic know-how.

However, the biggest challenge described by members of the science team was operating a research project in an unfamiliar and difficult environment. Whereas most project scientists had experience conducting research and providing advice on large, highly capitalized farms, Crop Science for Māori involved farmers with small plots, little available capital, and low cropping skills. This meant that many growers could not afford the organic fertilizers, winter crops or crop varieties recommended by the science team to improve the profitability of their cropping operations. This also proved a source of considerable frustration among some growers, many of whom described some measure of embarrassment at not being able to implement the scientists' recommendations.

Growers also expressed frustration at the large sums of money spent on the project, primarily through the provision of agronomic advice by the science team, when it was felt that a much smaller expenditure on farming equipment (the purchase of a communal tractor, for example) would have provided much greater benefit to them. That direct expenditure on private farm infrastructure was strictly outside the bounds of this (or indeed any) research project seemed illogical and frustrating to many growers.

In spite of the considerable challenges faced by Crop Science for Māori and its sometimes painstakingly slow progress, both scientists and growers characterize their involvement with the project as profoundly positive. All growers feel the project has greatly improved their ability to grow vegetables commercially, with one noting: "Our people have always been known to grow a spud, but only for dinner. These guys [CFR] have given us a chance to compete [commercially]." Similarly, most science team members describe the project so far as an invaluable addition to their professional and personal development. This is encapsulated in the comments of the lead project scientist, who states: "This whole thing is pretty new for me, the whole Māori thing is totally new for me. But it is one of the very few projects where I grew as a person. I have got a lot of personal satisfaction out of it."

Both parties characterize the understanding, trust, and respect that have developed between them as the most important achievement of the project. The trusting relationship between CFR and ECOP is often contrasted with other research projects on the Cape where growers claim that trust was frequently eroded by researchers who did not show respect for participants and by projects that delivered few tangible benefits to the community. As one ECOP member describes of the CFR team:

> This is the first bunch that I've liked. You know that they are here to help you, not here to use you... Without their help where would we be? No one else would help us like they do. If it wasn't them, it'd be some other scientists muscling in and maybe just doing it for themselves, not to help us.

Progress towards most of the agreed goals of Crop Science for Māori has been slower than expected, and this partly reflects an overestimation by both parties of what a research project could achieve in a limited time frame. However, both parties are confident the project will produce increasingly positive results and note that the growing strength of their relationship should facilitate continued progress.

The Wheat Calculator project

The second case study concerns wheat farming on the Canterbury Plains (see Figure 1), where many large, highly mechanized wheat farms produce a large proportion of the New Zealand wheat crop. However, while this area is amenable to wheat production with high soil fertility and a favorable climate, it is also susceptible to nitrate leaching. As Canterbury's aquifers provide drinking water to a large number of communities, including the city of Christchurch, their preservation is considered important by both local and central government. The last decade has seen land use on the Plains intensify significantly as fertilizer application and irrigation have increased and large areas of land formerly in extensive agriculture are converted to dairy farming. This intensification is placing considerable pressure on the region's freshwater resources, with both ground and surface waters recording increasingly elevated nitrate levels and groundwater no longer suitable for drinking without treatment in some areas (Parliamentary Commissioner for the Environment, 2004). In order to address this growing threat to regional water supplies, local and central governments have been investigating ways of reducing nitrate leaching without introducing unpopular and potentially costly nitrate-restricting legislation. One such attempt involves the development of a decision support system for wheat farmers called the Wheat Calculator.

The Wheat Calculator is one of a series of software models which aim to optimize the timing of fertilizer and irrigation applications with respect to the physiological demands of various crops, in this case a range of wheat cultivars. In 2001, the Sustainable Farming Fund granted funding for a research project to examine and quantify the effects of arable and vegetable growing practices on nitrate leaching and to develop a software program that would enable farmers to utilize CFR's existing wheat expertise when making on-farm decisions.[8] Whereas the first of these goals was envisaged as a straightforward research project involving minimal farmer participation, the transformation of the wheat calculator from a complex scientific model into a "farmer-friendly" software program was explicitly designed to be participatory. Accordingly, the Wheat Calculator Project involved a partnership between CFR and a compulsory levy-funded arable growers' association, the Foundation for Arable Research (FAR), both based at Lincoln, near Christchurch. The project was jointly run by an experienced scientist from CFR and a project manager from FAR, with both parties providing extra staff for various parts of the project (e.g., software designers from CFR and a farmer liaison/training officer from FAR). FAR, which had been kept aware of the development of the calculator and its potential value to wheat farmers, advertised the project to its members and selected 20 local farmers to participate. These farmers were given a prototype of the software, trained in its use and asked to contribute their recommendations towards making the calculator more relevant and accessible to farmers. While farmers were able to volunteer their recommendations at various workshops and field days facilitated by CFR and FAR, most interaction occurred through the liaison officer. This officer periodically visited participating farmers to discuss their recommendations, install software updates, and help them obtain the maximum benefit from the calculator.

Prior to the project, CFR scientists had identified the two major benefits provided by the calculator as: (1) a reduction in the amount of excess nitrates in the soil at risk of leaching and (2) potentially increased profitability through optimized productivity and reduced expenditure on fertilizers. However, interviews with participating farmers revealed that while increased profitability was the major reason they became involved in the project, many also saw the calculator as a pre-emptive defense against the implementation of nitrate-restricting legislation by the regional council. Farmers felt that if by reference to the calculator, they could show that all nitrates they applied were utilized by wheat and thus not at risk of leaching, then restrictive legislation was less likely. However, the actual reductions in nitrate leaching offered by the calculator did not in themselves motivate any of the interviewed farmers to participate in the project. Given this, and on the advice of FAR, most advertising and interaction with farmers emphasized how the calculator could improve the profitability of wheat farming and reduce the chance of legislation. The environmental benefits conferred by the calculator were thus largely implicit in the project and seldom discussed directly with farmers.

Despite an ostensible focus on the goals of participating farmers, many respondents remarked that participation in the project was sometimes frustrating. Respondents noted that the project went through several periods of inactivity where progress toward project goals seemed to stall and communication between parties was greatly reduced. In these times, both farmers and FAR felt that farmers' recommendations were not being incorporated into the model and that the project was at risk of not meeting the goals agreed at the outset. At such times, FAR claimed it was necessary for them to provide closer project supervision in order to ensure that farmers' goals were being served by the project. Both FAR and several of the farmers interviewed commented that the CFR scientists seemed to be guided by different goals than those supposedly informing the project. While noting that this problem is by no means limited to the Wheat Calculator project, FAR lament:

> [A]t times the project has been at risk because of differences in what people are trying to deliver. Basically, their [CFR] objectives are quite different from ours. Their objectives are around developing new science and a model, not delivering something that is going to benefit New Zealand farmers and something that farmers can actually use... To get that shift in thinking from "I'm going to deliver something new in nitrogen management for wheat," to "I'm going to deliver something that's of value to the farmer" is often problematic. And that has been one of the problems here.

FAR (and some farmers) claimed that scientists worked on timetables different to those of commercial wheat farming, often not delivering promised improvements until too late in the growing season, or holding workshops during particularly busy periods for wheat farmers. Some farmers also commented that scientists often seemed reluctant to implement certain recommendations, or would agree to recommendations which were never actually implemented. However, in spite of these problems, when the project concluded in August 2005 it was judged to be a success, with all respondents concluding that participation in the project had been a positive experience and that the final version of the calculator represented an important innovation. Most participating farmers describe the final version as a valuable decision-making aid, able to contribute to farming efficiency and profitability. Comments ranged from effusive ("The Wheat Calculator is pretty bloody accurate, surprisingly accurate. I pretty much base my nitrogen [application] on it") to cautious approval, with only one farmer rejecting the calculator as too complicated. FAR also saw the project as a success, but drew a distinction between adoption of the calculator itself which was viewed as secondary, and adoption of the management principles underwriting the calculator such as the timing of fertilizer applications and reductions in the quantities applied. FAR's project manager observes:

> If they gain knowledge from the calculator without actually using the calculator itself, we don't really care. Our estimate from earlier this year is that 60 percent of farmers have already taken up knowledge that is encapsulated within the Wheat Calculator. But very few of them are using [the calculator itself], but it is delivering 6 million dollars extra into farmers' pockets this year.

Project scientists also comment favorably on the project, noting it afforded them the chance to apply years of wheat research and develop a software package that they felt would greatly aid in improving the economic and environmental performance of wheat farming. They acknowledge this would have been largely impossible without the participation of wheat farmers, whose contributions transformed the calculator from a complex scientific model into a relevant and accessible software package.

Discussion

Many of the themes presented in the case studies corroborate theories already established in the participation and sustainable agriculture literature. This is particularly evident in terms of the role and importance of farmers' groups in facilitating successful research projects. Groups afforded many benefits to both projects, with local knowledge and local credibility being prime examples. In the Wheat Calculator project, FAR's standing among wheat farmers and its knowledge of their goals allowed it to attract more participants to the project than CFR could have by recruiting farmers individually. Illustrative of this is the initial advertising for the project, which FAR advised should emphasize optimization of wheat yields rather than the development of a crop model (i.e., the Wheat Calculator) if farmers were to be interested. A focus on yield was seen to afford farmers confidence that participation in the project would contribute directly to their farming goals, rather than simply refining a scientific model. Similarly, in Crop Science for Māori, ECOP provided much needed credibility to the project in a community that harbored considerable mistrust towards researchers and their motives. By using ECOP, CFR was able to develop a partnership with an established and trusted group of locals, thus facilitating a mutually beneficial research project in an environment where effective research would otherwise have been constrained by suspicion and non-participation.

The value of groups

Both the Wheat Calculator and Crop Science for Māori farmers' groups were able to imbue the research with an added impetus and focus. A frequent comment from farmers and scientists alike was that the success of a participatory research approach was contingent on participants possessing a strong drive to effect change in their situations. An established farmers' group is often demonstrative of a desire within the community for change, as groups generally form with the intention of effecting positive change around an issue of importance to a significant portion of their community. As such, groups can provide a clear mandate for researchers intending to work in the community as they act to distil the large range of objectives and priorities present in a community into an achievable set of core goals.[9] This was particularly evident in Crop Science for Māori, where ECOP represented common ground for local growers, many of whom hold markedly different motivations and goals for cultivating organic crops. From the perspective of CFR, partnering with ECOP provided both a coherent agenda for the project and a membership dedicated to realizing this agenda. As CFR's project leader for Crop Science for Māori contends:

> It's very important to have a dedicated farmer group who have drive and a clear vision. That maybe is the secret to making things happen. If they don't have the drive, then nothing you do is likely to work... you get a group of committed people who want to achieve something; that is 80% of the success of something.

Farmers' groups also proved crucial in terms of the environmental component of each of the case studies. In the Wheat Calculator project, few farmers saw value in the environmental benefits offered by the calculator, with most maintaining that nitrate leaching was a minor problem to which their own contributions were negligible. In this, the attitudes of the wheat farmers are characteristic of those associated with many cumulative non-point source pollution problems, which are perceived as only problematic at the collective level. Such pollution requires ownership and management at the collective level and attempts to address contamination via individual polluters are unlikely to yield meaningful improvement. The only major variation between the expressed goals of farmers and those of FAR was that the latter saw significant value in the potential environmental benefits conferred by the calculator. As FAR's project manager for the Wheat Calculator explains:

> The average farmer is probably not hugely concerned with losing a little bit of nitrogen out of the bottom of his soil profile and on an individual paddock basis, his contribution to nitrate levels in the aquifers is going to be relatively minor. We've [FAR] got a broader responsibility than that, we've got 1800 farmers in Canterbury, that if all of them manage their nitrogen poorly, could have quite a whack on the nitrates in the water. Therefore this project hopefully will mean that farmers are in a better position, either knowingly or unknowingly, to reduce the amount of nitrogen that is at risk of leaching.

From this perspective, farmers' groups are essential in attempts to address such problems. The absence of a farmer group in this or similar situations will inevitably constrain the ability of researchers to develop and implement an effective response to non-point source pollution. To this extent, the Wheat Calculator project corroborates Röling and Pretty's (1998: 10) assertion that "all successful moves to more sustainable agriculture have in common coordinated action by groups or communities at the local level."

Mutual trust

Interviews with farmers from both case studies revealed the attitudes of researchers to be a critical factor in the success or otherwise of a participatory approach, a theme stressed by other participatory practitioners and commentators (e.g., Chambers, 1994; Biggs and Smith, 1997; Keen and Mahanty, 2005). Indeed, in Crop Science for Māori, growers proposed that the attitudes of the science team members were the single most important determinant of project success. A flexible, open-minded, and above all honest approach allowed growers to overcome their mistrust of researchers and participate in research they felt would generate tangible benefits to themselves and their community. This has not always been the case elsewhere (see for example, Bentley, 1994) and is much to the credit of those involved. Scientists and farmers in both case studies emphasized that trust between partners was a key factor in progressing the projects.

From the perspective of growers, it was critical that any research into kumara cropping provide for and incorporate *matauranga* (Māori customary knowledge). A desire to employ this traditional cropping knowledge (ranging from planting times to crop storage techniques) handed down via grandparents and elders had motivated many ECOP members to undertake organic production in the first place. Thus growers expressed their appreciation of the fact that the CFR science team was willing to incorporate this knowledge into the project and they themselves were eager to learn about and merge this knowledge with the scientists' own technical knowledge. It is worth noting that recognition on the part of scientists that growers wished to supplement *matuauranga* with technical knowledge, rather than simply replace it with technical knowledge, required a basic understanding of growers' goals and motivations for participating in the research.

An understanding of the goals of participants often reveals objectives different from those of scientists or policymakers or research funding bodies. This has significant implications for the types of research likely to attract the interest and buy-in of participants and, ultimately, for the success of those policies for which such research is commissioned. In Australia, for example, Vanclay and Lawrence (1995: 162) contrast national policy goals and those of individual farmers, noting:

> It has been questioned whether the nation could ever achieve environmental sustainability when it is incapable of solving the problem that most rural people want solved: how to create and maintain a quality of life in rural regions which is commensurate with that in urban Australia.

Today, this question could equally be applied to New Zealand where the two case studies examined reveal similar concerns to those of rural Australia. In Crop Science for Māori, most participants were specifically concerned with realizing better community outcomes by providing positive examples of the economic possibilities on the East Coast, and so (it was hoped) attracting back those young people who had left the community and had moved to urban areas in search of employment. Realizing the health and environmental benefits of organic production, when mentioned at all, were represented as secondary and tertiary (respectively) to this. Such goals clearly correlate with a desire to improve the quality of life on the East Coast. Similarly, with the Wheat Calculator, the prime goal of greater profitability stressed by farmers also suggests a desire to increase the quality of life obtainable through wheat farming. Although most farmers were aware of the potential environmental effects of their farming activities, minimizing these effects, while desirable, constituted a lower, long-term priority than addressing more immediate issues of profitability. Vanclay and Lawrence (1995) argue that research must *first* address the primary concerns of rural communities before significant progress towards agricultural sustainability is possible. This illustrates the potential clash between policy goals and those of research participants which is at the heart of the tension inherent in designing participatory approaches to further any agenda other than that of participants.

Constructive tension

Pain and Francis (2003: 46) remind us "participatory approaches did not originate as a methodology for research, but as a process by which communities can work toward change." The efficacy of participatory approaches is closely linked to the ability of participants (often in the form of community groups) to control the research agenda, which allows participants to be confident that research is contributing to their goals. This in turn allows for enthusiastic participation in research projects that often require a considerable commitment of time and effort from participants. Although participatory research can (potentially) clash with the goals of environmentally sustainable agriculture, this is rarely the case. Farmers may be very concerned about environmental degradation (Paolisso and Maloney, 2000) and sometimes identify this as the major threat to their livelihoods (Tilt, 2006).[10] Where this is not the case, a participatory approach that aims to realize more environmentally sustainable agriculture is likely to generate a tension between the desired outcomes of participants and those of policymakers (and researchers who are commissioned to achieve the goals of the latter). This tension presents problems both conceptually and at a practical level.

Conceptually, reconciling a participatory approach with an overriding policy goal is problematic, no matter how "worthy" or necessary that policy is perceived to be (e.g., more sustainable agriculture). The virtual absence of discussion of this conflict in the wider debate surrounding participatory approaches is puzzling.[11] Whereas many trenchant critiques of participatory approaches now exist (Cooke and Kothari, 2001; Pain and Francis, 2003; Hayward et al., 2004), few of these engage with the contradiction inherent in employing participatory approaches to realize policy goals. This failure is not merely a theoretical weakness, but one that may be contributing to the perception held by some policymakers and research funding bodies that participatory approaches are a means of reducing research costs and legitimating pre-determined agendas (see Kothari, 2001).

At an operational level, project facilitators (generally scientists or researchers) must attempt to reconcile and prioritize different goals. On one hand, farmers must feel that research will contribute to their goals before they consider participation. On the other hand, facilitators are obliged to ensure that research is in line with that stipulated by the research funding body. As addressing the environmental effects of agriculture becomes an increasingly higher priority for many governments, researchers are increasingly required to show that their research will contribute to agricultural sustainability in order to secure funding. Simultaneously, they are increasingly required to show that their research actively engages and directly benefits farmers, thus implying the need for methodologies which allow for farmer participation.

In practice, this inevitably means tradeoffs must be made between the competing goals of policymakers and farmers. In the two case studies examined for this paper, the specific goals of farmers constituted the primary focus of research and discussion. Consequently, the environmental benefits of each project were generally confined to the background, with farmers seldom expressing interest in the environmental benefits of the projects and project facilitators seldom explicitly promoting these benefits. While significant progress was achieved towards the environmental objectives of each project (and agricultural sustainability furthered as a resulted), treating these objectives as incidental to the main research focus precluded meaningful discussion among scientists and farmers around the need for improved environmental management (and of the scientific *rationale* for improving management). In contrast, the desired economic and cultural objectives of research were informed by farmers, and continuously discussed throughout the project. This afforded farmers an appreciation for the rationale underlying the recommended modifications to farming practices and thus the potential application of new knowledge.

Thus, in each of the case studies there is little to suggest that the environmental knowledge and attitudes of farmers (or scientists) were challenged or ultimately enhanced by the research. This is not to invalidate the important environmental benefits deriving from each project, rather it highlights the fact that an opportunity for environmental learning on the part of farmers (and all the associated down-stream benefits this may have accrued) may not have been fully exploited.

Learning and change

Common to both the participatory approach and to the growing body of scholarship concerned with realizing more environmentally sustainable agriculture is the fundamental requirement for learning on the part of all parties. In the participatory literature, learning is often characterized not as a by-product of research but as a *key* outcome of any research project which affords participants and scientists the chance to apply new skills and reap benefits well beyond the tenure of the project (Forester, 1999;

Stoecker, 2005). Moreover, the knowledge and experience acquired by participants in working with researchers to further a community's goals are viewed as fundamental elements in community empowerment. Learning is afforded similar status in the literature concerned with realizing more environmentally sustainable forms of agriculture (e.g., Pretty, 1995; Leeuwis and Pyburn, 2002; Wilkinson and Cary, 2002). The transition towards more sustainable agriculture is seen as a function of learning about (and working within) economic, social, and ecological complexities and uncertainties. As each agricultural production system in a given location presents its own unique complexities and uncertainties, most commentators posit that attempts to promote sustainability must first involve learning about the local context and then integrate this knowledge into research. Learning about a given environment and the ability to utilize all relevant knowledge is increasingly viewed as the most important attribute of any attempt to improve the sustainability of agriculture (Röling and Pretty, 1998; Röling and Wagemakers, 1998; Allen et al., 2002; Eshuis and Stuiver, 2005).

Learning was an integral and essential part of each case study with both scientists and farmers increasing their knowledge in many areas. Farmers in the Wheat Calculator project (and if FAR's estimates are accurate, 60% of wheat farmers nationally) have benefited from an improved understanding of fertilizer and irrigation optimization techniques. For their part, growers participating in Crop Science for Māori have not only been able to improve their current growing operations through the project, but have learned many agronomic principles that may be applied in different circumstances with different crops to accrue production and efficiency gains well beyond the tenure of the project. However, a consequence of an almost exclusive focus on the primary goals of farmers was that neither project emphasized *environmental* learning on the part of farmers. Thus the environmental benefits of each of the projects will almost certainly be limited to those realized within the (necessarily) narrow scope of each project, with little chance of farmers applying a new environmental understanding to their wider farming practices. This was particularly clear in the Wheat Calculator project where the calculator only reduces nitrate leaching because it simultaneously increases the *profitability* of wheat farming. While the Wheat Calculator is undoubtedly a positive example of a participatory approach furthering the goals of farmers while improving the sustainability of a given land use, it raises questions about the ability of a such approaches to yield similar results in the absence of (a) a direct relationship between increased profitability and improved sustainability or (b) any change in the environmental attitudes and practices of farmers.

Curry and Winter (2000: 112) note in their analysis of European state-sponsored initiatives to improve the sustainability of agriculture that such schemes often leave "farmers' attitudes to the environment tactical rather than substantially reoriented." In their example, farmers willingly adopted environmental practices where there was a clear financial benefit, but there was no evidence this resulted in any fundamental longer term change in their environmental values or practices. When employed in the manner described here, participatory approaches for sustainable agriculture are likely to produce similar results, with some environmental gain, but little change to the underlying environmental attitudes or knowledge of participating farmers. This is ultimately unlikely to be sufficient to promote the kind of fundamental changes in agricultural production systems advocated in the sustainable agriculture literatures. As Pretty (1995: 1255) concludes "a more sustainable agriculture, with all its uncertainties and complexities, cannot be envisaged without a wide range of actors being involved in continuing processes of learning."

Conclusions

When project goals are carefully negotiated by flexible, honest researchers and supported by dedicated community groups, the participatory approach presents a potent methodology for furthering the goals of research participants. This is clearly evident in each case study, where genuine participation afforded positive project outcomes that could not have been realized through more conventional, top-down research methods. In this sense, the case studies examined for this research corroborate the growing consensus that in many (if not most) cases, participatory approaches represent the most effective and equitable methodology available to researchers, especially where research aims to foment positive change in the lives of participants. However, consideration must be given to the fact that participatory approaches *for* sustainability will often contradict the principle that such approaches should allow participants to determine the research agenda. As described above (and by many other authors), participatory approaches were not developed to promote sustainable agriculture or indeed any other policy objective; they were developed to empower communities to effect positive change. Whether or not practitioners of contemporary participatory approaches subscribe to the notion that research should be primarily concerned with the empowerment of communities, such approaches acquire their popularity and efficacy by allowing participants to further *their* goals as they themselves define them. Any attempt to limit the influence of participants in determining the goals of a participatory approach risks limiting the effectiveness of the project. Consequently, while participatory research approaches are a powerful methodology for increasing the relevance and effectiveness of research for communities, their application to *policy* goals can be contradictory in principle and problematic in practice.

The researchers in each of the case studies examined here employed participatory approaches that facilitated significant progress towards the goals of participants and created learning opportunities that allowed participants to apply new knowledge in other areas and beyond the term of the projects. Accordingly, the case studies help to substantiate the growing body of scholarship that views participatory approaches as the most effective way for researchers to engage with communities and realize participant goals. However, a focus on the primary goals of participating farmers has meant that these farmers were in most cases not specifically engaged on environmental issues. Thus, the contribution of these projects to agricultural sustainability is limited in the short term to improvements in environmental management that are incidental to farmers' primary goals (e.g., reductions in nitrate leaching as a consequence of optimized irrigation and fertilizer application, a process that grants significant savings to farmers). It is of course possible, indeed necessary, to engage communities in projects that aim to further goals different from those of participants themselves; however, whether such approaches should be considered "participatory" rather than "collaborative" demands further debate.

In practice, there is little doubt that collaborative methods are wholly necessary if meaningful progress is to be made towards more sustainable forms of agricultural production. The locally specific nature of agri-ecologies, economies, and farming communities mandates that strategies for sustainable agriculture must also be both locally specific and legitimate. Insofar as farmers identify other priorities for research, and participatory approaches do not challenge the environmental understandings and practices of farmers, the ability of the participatory approach to further sustainable agriculture is likely to remain limited to those improvements that can be realized in the context of farmers' primary goals. However, the mutual trust and understanding engendered between scientists and farmers as demonstrated in the work presented here provided a solid platform for longer term change and reconciliation of goals.

As with any valid research approach, participatory theory and practice have been subject to the trenchant critiques of a range of authors (e.g., Cooke and Kothari, 2001; Hayward et al., 2004), and these critiques have helped to develop a more realistic and effective methodology. Extending these critiques to consider the implications and limitations of employing participatory approaches to further policy goals would greatly strengthen the ability of participatory approaches to further participants' goals while establishing the conditions from which more sustainable agriculture may develop. To this end, promoting forms of mutual learning that encourage environmental learning without disaffecting participants will be essential if participatory methodologies are to contribute further to the development of more environmentally sustainable agriculture.

Notes

1. Action research, participatory action research, rapid rural appraisal, participatory rural appraisal, participatory research, participatory development, participatory community development, farmer first, farmer participatory research *inter alia* all refer to different but related research methodologies. These methodologies generally have in common the acknowledgement of the fundamental importance of the views and goals of research *participants*.
2. Māori land is often classed as less developed and less profitable than the land of white New Zealanders for a complex assemblage of contemporary and historical reasons (see Durie, 1998).
3. FRST is the key government agency charged with funding research in New Zealand.
4. Although the existing small-scale organic crop production is not considered environmentally "unsustainable," it is considered vulnerable to supplantation by less environmentally sustainable land uses.
5. The science team was composed largely of CFR crop scientists, but also included two weed experts from AgResearch (another state-owned science provider) in Hamilton and an extension expert.
6. Ngati Porou is the tribal grouping of Māori from the East Coast region of New Zealand.
7. A type of sweet potato.
8. The Sustainable Farming Fund is administered by the Ministry of Agriculture and Forestry and aims to "support projects that will contribute to improving the financial and environmental performance of the land-based productive sectors" (see http://www.maf.govt.nz/sff/).
9. Kothari (2001) contends that intra-group power relations often result in the legitimate concerns of some participants being relegated in favor of those championed by more powerful members of the community or group.
10. It should be noted that the environmental degradation cited in Tilt's paper derives from industrial sources, not through farming practices. As Tilt's analysis suggests, the fact that farmers in this case do not benefit from the process that generates this pollution is likely to have influenced their negative perceptions of it.
11. One exception is Patricia Murray (2000) whose excellent paper briefly considers this contradiction in an analysis of evaluative methods in participatory approaches.

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