



AGRICULTURE RESEARCH GROUP ON SUSTAINABILITY



Research Report: Number 05/08

ISSN 1177-7796 (Print)
ISSN 1177-8512 (Online)

Sketch Maps: Features and Issues Important for the Management of ARGOS Orchards and Farms

Marion Read¹, Lesley Hunt¹, John Fairweather¹

August 2005



1. Lincoln University
PO Box 84
Lincoln, Canterbury
www.argos.org.nz

Contents

List of Tables	4
List of Figures	5
Acknowledgements	6
Summary	7
Chapter 1 Introduction: Background, Objectives, Methods and Outline	9
1.1 Background.....	9
1.2 Research objectives.....	9
1.3 Methods.....	10
1.4 Outline of report	13
Chapter 2 Kiwifruit Results	15
2.1 Kiwifruit sketch map analysis	15
2.2 Kiwifruit statistical analysis.....	18
2.3 Kiwifruit qualitative analysis	22
2.4 Conclusion.....	34
Chapter 3 Sheep/beef Results	39
3.1 Sheep/beef farm sketch map analysis.....	39
3.2 Sheep/beef statistical analysis	42
3.3 Sheep/beef qualitative analysis.....	46
3.4 Conclusion.....	62
Chapter 4 Comparison between Kiwifruit Orchards and Sheep/beef Farms	65
4.1 Introduction.....	65
4.2 Comparisons between the kiwifruit orchards and the sheep/beef farms...	65
4.3 Conclusion.....	69
Chapter 5 Conclusion	71
5.1 Introduction.....	71
5.2 Summary of results	71
5.3 Discussion	72
5.4 Assessment of sketch mapping.....	73
References	77
Appendix 1: Kiwifruit Orchard Maps	
Appendix 2: Sheep/beef Farm Maps	

List of Tables

Table 1: List of kiwifruit categories and features	15
Table 2: Division of kiwifruit features into 'contextual aspects' and 'management responses'	16
Table 3: Frequency of kiwifruit map features for maps (M) and transcripts (T).....	17
Table 4: Two-way ANOVA results for means of contextual, management response and total features for maps (M) and transcripts (T) across orchard types.....	19
Table 5: One-way ANOVA results for means of contextual, management response and total features for 'live on orchard'	21
Table 6: List of sheep/beef categories and features	40
Table 7: Division of sheep/beef farm features into 'contextual aspects' and 'management responses'	41
Table 8: Frequency of sheep/beef map features	41
Table 9: Two-way ANOVA results for means of contextual, management response and total features for maps (M) and transcripts (T) across farm types	43
Table 10: Total features (map + transcript) - management system by location	44
Table 11: Contextual aspects (map + transcript) - management system by location	44
Table 12: Management responses (map + transcript) - management system by location.....	45
Table 13: ANOVA comparisons between the kiwifruit and sheep/beef mean number of features per map	66

List of Figures

Figure 1: An example of a map of an organic kiwifruit orchard, showing minimal interpretative detail	11
Figure 2: Map of an Organic Hayward orchard	26
Figure 3: “The shed runs my business”	27
Figure 4: A map with boundaries as the only important features.....	47

Acknowledgements

This work was funded by the Foundation for Research, Science and Technology (Contract Number AGRB0301). The Research Team also acknowledges financial assistance from ZESPRI Innovation Company and Merino New Zealand Inc.

Thanks to all the ARGOS team members who have contributed to this report: Marion Read, Lesley Hunt and John Fairweather who prepared this report; Lesley Hunt who carried out the interviews and did the statistical analysis; and last but not least, Jayson Benge and Dave Lucock, the Field Research Managers, who kindly arranged many of the interviews, sometimes transported the interviewer to the orchards and farms, and provided backup which complemented our understanding of what goes on, on orchards and farms. Thanks also go to Marion Read, Lyn Minchington, Brendan Doody and Jim Woods for transcribing these interviews, and to Chris Rosin for taking the digital photos of the maps.

Summary

Primary research objectives:

- Analyse sketch maps completed by ARGOS kiwifruit orchardists and sheep/beef farmers to find what is important to their management.
- Compare production systems and sectors.

Method:

- Count occurrences of features on maps, group similar features into categories, test statistically for differences between management systems and sectors.
- Use discourse analysis to develop a deeper understanding of the map features.
- Develop an ideal type understanding of each management system.

Results:

Analysis of kiwifruit maps shows that these features were important:

- Aspects of the region and landscape in which orchardists operated – slope, lie of their land, water sources and streams, climate (including frosts and wind), altitude, soils and bush.
- Boundaries and impact of neighbours.
- Buildings and transport features.
- Organisation of the orchard - layout of the blocks and shelter belts.
- Mitigation of risks – climate managed by shelter, water for irrigation and frost protection, financial risk spread by growing other crops.

Comparisons:

- Orchardists using organic management of Hayward kiwifruit drew more map features, ahead of KiwiGreen Hayward than KiwiGreen Hort 16A.
- KiwiGreen Hayward orchardists were more likely to mention wind, Organic Hayward orchardists were more likely to mention biotic context and water and KiwiGreen Hort 16A orchardists were less likely to mention buildings, water and frost management.
- Those living on the orchard reported a higher mean number of features.

Ideal types:

- The Organic Hayward ideal type of orchardist was observant, saw the operation as complex, had a concern with water, saw their house as a home and as part of their lifestyle, had an affective relationship with their orchard, and had much to say about neighbours - in some cases this relationship was problematic.
- The KiwiGreen Hayward ideal type of orchardist was similar to the organic type but was concerned about wind and large animal pests, had a utilitarian approach, and a matter-of-fact relationship with neighbours.
- The KiwiGreen Hort 16A type of orchard manager has a simpler orchard, economic priorities, productionist orientation, and was concerned with climate and altitude.

Analysis of sheep/beef maps shows that these features were important:

- Aspects of the region in which they lived – terrain and the way the land lay, other morphological features of the landscape, soil, climate extremes (drought and snow), wind and water sources.
- Boundaries - marked by public roads and rivers, neighbours, neighbours' land use, public buildings.

- Farm organisation into blocks and fenced paddocks, served by tracks and lanes, infrastructure of farm buildings, houses and stock yards.
- Risks from weather mitigated by shelter belts and water for storage and irrigation.
- Financial risk spread by growing crops and small commercial forestry blocks.

Analysis also showed that:

- Farm maps had many more features than the kiwifruit maps, plus additional features, but there were no significant differences in the mean number of features for each management system.
- There were significant differences in mean number of features for some locations. Sheep/beef farms on flat land (e.g., Dunsandel/Leeston and Ashburton) had fewer map features than farms on hilly land (e.g., Outram area, Banks Peninsula or Marlborough).

Comparisons between sectors showed that:

- Sheep/beef maps had more features than kiwifruit maps but, out of the ten common categories used, only spatial organisation and water sources had higher frequency on sheep/beef farms, reflecting the larger scale of farms.
- Kiwifruit orchards had more transport features (largely because most maps included a driveway) and more weather features (indicating that weather is more important to orchardists). The other categories had similar means.

Chapter 1

Introduction: Background, Objectives, Methods and Outline

1.1 Background

The ARGOS project seeks to test the null hypothesis that there is no difference in the sustainability of organic, conventional and integrated production systems in agriculture and horticulture. To do this, clusters of farms and orchards have been selected at different locations throughout New Zealand with one farm or orchard in each cluster representing a particular production system. This design enables allowances to be made for locational effects, such as the physical environment and climate, to be accounted for in comparisons across management systems.

As a part of the first round of interviews for the social science objective of this project, all respondents were asked to draw a map (or alternatively in some cases a 'picture' or 'diagram') of their property illustrating the things that were important for the management of their property. They were supplied with coloured felt pens and A2-sized sheets of paper.¹ It was stressed by the interviewer that these could be positive or negative features, and that geographic exactness was not required. Participants were given the freedom to choose what sort of drawing they did, from a traditional map format to a mind map or conceptual-type drawing, with the idea that participants could choose what method suited them best. (All maps are presented in black and white in Appendices 1 and 2.) This map drawing exercise was used as a framework for the next questions in the interview – those on suggestions for indicators of economic, environmental and social sustainability and wellbeing. The results of the interview are presented elsewhere (Hunt, Rosin, McLeod, Read, Fairweather & Campbell, 2005) and since the interview data alone form a considerable body in their own right, presenting the sketch maps as a separate report allows for more detailed treatment of the data.

1.2 Research objectives

The primary objective of this research was to analyse sketch maps completed by ARGOS kiwifruit orchardists and sheep/beef farmers to find out what was important to their management of their properties, and compare production systems and sectors. The analysis was exploratory with no firm ideas about what the maps might show. The purpose of the sketch maps in the interview was to provide an avenue for orchardists and farmers to tell us by drawing a sketch map of their property, about what they saw as important to their management of that property, as an introduction and a supplement to the remainder of the interview.

A secondary objective was to provide documentation of the sketch maps because part of their value lies in the record of how each orchardist or farmers 'sees' their farm. We believe the maps are a concise record of the orchard or farm as seen by the orchardist or farmer. Further, it is important to have this base established so that other researchers in ARGOS can use it to give an insight into their results. Finally, such a record provides an opportunity to examine any changes in orchardists or farmers over time. For example, it would be possible to have the sketch maps drawn

¹ Some chose to draw in pencil so that they could rub out mistakes.

again by the same orchardists and farmers to see if the important factors in their management have changed in any way. Appendices 1 and 2 present all the sketch maps. Some minor amendments have been made to the maps, for example, removing road names and family names, in order to protect the confidentiality of the participants.

A third objective was to assess sketch mapping in general. The conclusion addresses this objective by discussing the strengths and weaknesses of the method.

1.3 Methods

Sketch mapping has been used in a number of action research methods known variously in the literature as Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA), Rapid Assessment Procedures (RAP), Rapid Participatory Appraisal (RPA), Rapid Community Appraisal (RCA), and, more simply, Participatory Appraisal (PA)! These methods have mainly been developed in the field of rural development in underdeveloped countries (Berardi, 1998: 439). The key feature of this family of methods is that while the field of research may be externally imposed, in this case by researching sustainable production systems, the aim is that the categories of information and the criteria for judging their importance within that field are determined by the respondents and not the researcher.

The methods used to analyse the maps are known as mixed methods (Rose, 2001: 202), in this case using content analysis, statistical analysis, and discourse analysis. This combination of methods should ensure that the results are robust. The use of quantitative methods was made possible by the relatively large number of cases studied ($n=35$ for the kiwifruit orchards, $n=37$ for the sheep/beef farms), and the overall research question examining potential differences across the management systems under study. We believe that quantitative analysis can provide insight into the sketch map results and usefully complement the larger qualitative component of the research.

The analysis proceeded, firstly, with content analysis. Maps were examined and the occurrence of features recorded in a spreadsheet. The coding of features implied by this process of recording was developed in an unstructured way, the range of features identified in the first map being added to sequentially as new features occurred on further maps. This was not done through a strictly visual interpretation only. The transcripts of the discussion which occurred while the maps were being drawn were read in conjunction with the visual examination of the maps. This was often necessary to help with the identification of features which had been drawn on the map as several maps were simply a series of black lines on the page (see Figure 1 for an example). Examination of the verbal exchange occurring while it was drawn was necessary to gain any understanding of the meaning of these lines. In a number of instances respondents talked about a feature but did not include it in an identifiable way on their maps. This reference to an unmarked feature was also recorded along with the drawn features in the tallies. The kiwifruit maps were analysed first, and provided a pilot for developing the method of analysis which was then applied in a similar way to the sheep/beef maps.

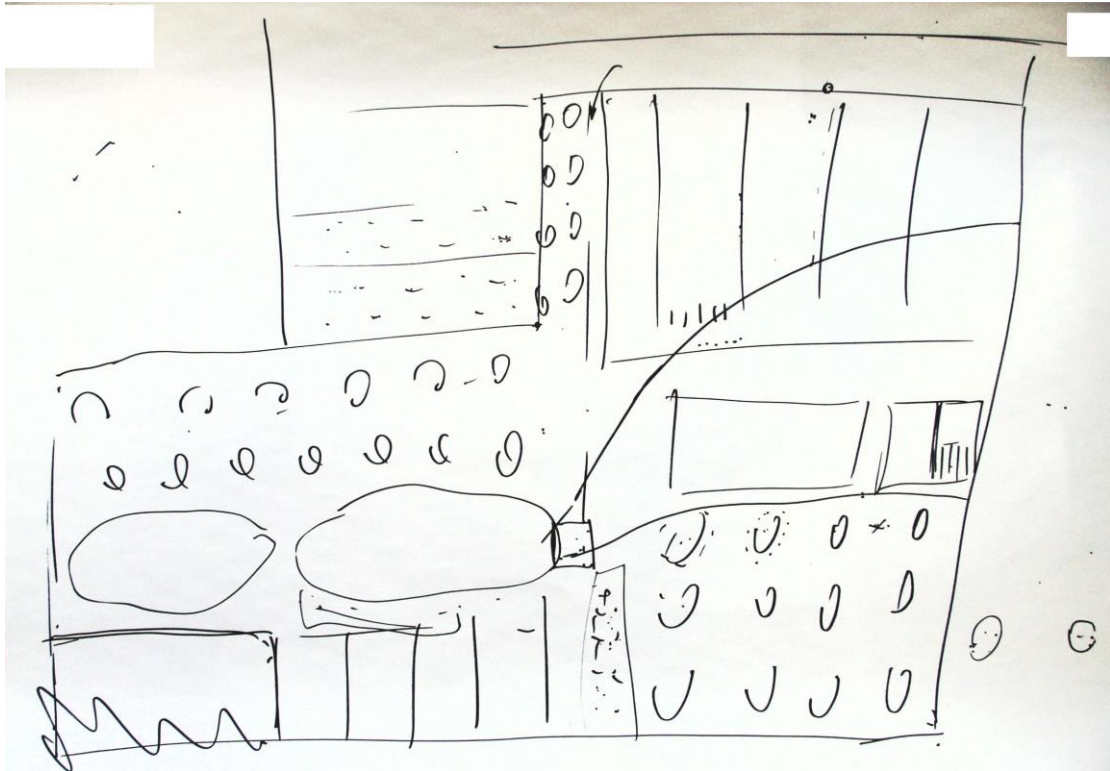


Figure 1: An example of a map of an organic kiwifruit orchard, showing minimal interpretative detail

Rose (2001) considers that three criteria should be fulfilled in the definition of coding categories for content analysis. These are: (1) that they should be exhaustive, covering every aspect of the images with which the research is concerned; (2) mutually exclusive; and (3) enlightening (Rose, 2001: 60). Developing the categories in a fluid manner ensured that they are indeed exhaustive. They are enlightening, in that they are the product of the interviewee's own perceptions of their property and the management issues they face. (They are also a product of the interviewee's own knowledge of the conventions of mapping and plan drawing.) They are not, strictly speaking, mutually exclusive, however. In some instances a feature drawn on a map may be coded in a number of different categories. For example, in one kiwifruit interview it became clear from the transcript that the ponds on the map were a feature in their own right (the interviewee sees them as an aesthetic feature by the side of which he plans to build a house); a result of drainage; and a source of water for irrigation and frost protection. Thus the same feature is coded under three categories. This is justifiable in terms of the goals of this part of the research process, which is to use the maps as a means of allowing the respondents to identify the issues of priority to them, rather than as simple pictorial images for analysis.

Secondly, this assembled frequency data were analysed statistically. The major part of this analysis was to compare the different management systems (organic, integrated management and conventional) using two-way analysis of variance (ANOVA) with location as a blocking factor. (The use of a blocking factor in a statistical design is a way of providing a means to remove the effect of common locations from the comparisons between the different management systems. For example, the effects of climate and environment associated with a particular location will not then be confounded with the differences between the management systems. In other words, it increases the precision of the statistical comparisons which can be made by reducing the uncontrolled experimental variation (Johnstone, 1994: 51).) If

this was not appropriate due to the data not conforming to a normal distribution, cross tabulations were used to see if any trends were apparent.

The third focus, using discourse analysis, examined the transcripts to provide an explanation for the features of the maps. True discourse analysis could be defined as being centrally concerned with language and, in a research task such as this one, with exploring how the images (maps) and talk about them construct specific views of the social world. While this is an aspect of the work, it is, at this point in the research process, a minor one. We use selected quotes from respondents to illustrate points in the interpretation and explanation of map features. The quotations are punctuated so as to reflect the actual flow of speech as it was recorded, not the conventions of written English.

In addition to reading the transcripts in conjunction with the visual analysis of the map, the text of the transcript was coded using the features which had arisen from the visual analysis. This part of the analysis provides the textural data; the means of assessing the importance of features and their interrelationships, as frequencies of occurrence can not be interpreted to directly imply importance. In Rose's words, 'Content analysis is a technique the results of which need interpreting through an understanding of how the codes in an image connect to the wider context within which that image makes sense' (Rose, 2001: 65).

This analysis is then drawn together by using the notion of 'ideal types'. Ideal types are an important conceptual tool originated by one of the founding fathers of sociology, Max Weber. Ideal types are constructs used for analysing qualitative data deriving from multi-case studies (Gerhardt, 2004). According to Coser (1977) an ideal type is an analytical construct that serves the investigator as a measuring rod to ascertain similarities as well as deviations in concrete cases. Weber said:

An ideal type is formed by the one-sided accentuation of one or more points of view and by the synthesis of a great many diffuse, discrete, more or less present and occasionally absent concrete individual phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified analytical construct (Coser, 1977: 223-224).

An ideal type is not meant to refer to moral ideals nor does it correspond directly to concrete reality even though it draws on it. Ideal types allow the construction of hypotheses linking them with the conditions that brought the phenomenon or event into prominence, or with consequences that follow from its emergence. Observed reality can be compared to the ideal type.

Typically, cases representing different stages or types of development can be constructed to allow comparison between cases. Then comparative analysis can allow the generation of paradigmatic cases built up by reference to clusters of similar cases. This results in descriptive ideal types where the pattern in each group is documented as well as for all groups. Finally, cases can be explained. Here the focus is on structural ideal types which address the question of why cases develop the way they do and includes structural dynamics. It is through this structural explanation that explanation of individual cases can be accomplished and an adequate account of why the case follows the structural pattern to a greater or lesser degree.

In this application of ideal type analysis we start with three management systems and propose that it is possible to construct an ideal type for each of them. We acknowledge that there may be other groupings for which ideal types could be

constructed. We found that it was necessary to construct an ideal type for orcharding and farming in general because there were many aspects of husbandry that were shared by each management system. The generalised type is 'ideal' in the sense that orchardists do see it as the ideal application of their production system. Our approach to ideal types is consistent with ideal type analysis as it is generally used following Weber, and the comparison between the general types and the ones for each management system allow us to show the similarities and differences across management systems.

1.4 Outline of report

The kiwifruit findings are presented first, followed by the sheep/beef findings, as separate chapters. The subsequent chapter provides some observations about similarities and differences between the kiwifruit material and the sheep/beef material. The concluding chapter summarises the results, and discusses and evaluates the usefulness of the mapping as a technique for identifying management priorities.

Chapter 2

Kiwifruit Results

2.1 Kiwifruit sketch map analysis

Three types of Kiwifruit production systems are being studied. These are Organic Hayward, KiwiGreen Hayward, and KiwiGreen Hort 16A which have equivalence to, respectively, organic and two integrated systems each growing different species of kiwifruit. The orchards are in clusters of three, one from each management system and are spread over locations from Kerikeri to Motueka, but most of the orchards are in the Bay of Plenty. Those interviewed were a mix of owners, managers and lessees of the orchards in question. They were all asked to draw a map of the property illustrating the things which were important to their management.

The analysis of the kiwifruit orchard sketch maps began with the tallying of features noted on the maps, and in the associated transcripts, on simple spreadsheets. Once the features noted on the maps had been identified, the transcript text was analysed using those same features as a way of locating the relevant text. Both statistical and qualitative analysis was undertaken on the material. The results of this analysis are reported separately for kiwifruit and sheep beef, but common categories are used.

In order to undertake any useful analyses of the data it was decided to summarise the data by grouping similar features into categories.² This was done in two ways. The categorisation was tried in a number of different ways, but the grouping finally settled on is shown in Table 1.

Table 1: List of kiwifruit categories and features

Categories	Features
Spatial organisation	Blocks, boundaries
Wind	Shelter, prevailing wind, wind damage
Buildings	Houses, sheds, packhouses
Transport	Roads, driveways, loading areas
Social context	Neighbours
Other biota based activities	Other crops, other trees, compost
Landscape morphology	Slope, aspect, gullies
Climate	Frost protection, frost areas, altitude ³ , climate
Water	Water sources, streams and rivers, irrigation, lakes and ponds, water tanks, drainage
Biotic context for management	Soils, bush, <i>Armillaria</i>

The second form of grouping divided all of the features into the contextual aspects of the orchard, and the management responses. The contextual aspects of the orchard were defined as those features which were a given; the landscape and environmental

² Otherwise the data just consisted of a simple presence or absence of a particular map feature. By making categories, we could then build up a data set of counts of how many times particular features appeared within a category, which, if of a reasonable range, could approximate a normal distribution, thus allowing ANOVAs to be carried out.

³ Altitude is included in the climate category as the impact of altitude is manifest through weather.

factors out of the immediate control of the orchardist which required, or impinged on, management. The management responses were defined as human actions or creations; things that were done or created in response to the wider environment. We wished to explore whether participants from different management systems drew or mentioned the same things which could be regarded as being outside their immediate control, and whether they had a similar array of responses within their management 'tool kit'. Table 2 shows this division of the data. This division of the data also provided a greater range of frequencies in each of these two groups, than for the smaller categories described in Table 1. Hence, there was a greater likelihood of having normally distributed data.

Table 2: Division of kiwifruit features into 'contextual aspects' and 'management responses'

Contextual aspects of the orchard	Management responses
Boundaries, wind damage, prevailing wind, neighbours, slope, aspect, gullies, frost areas, altitude, climate, water sources, streams and rivers, soils, bush, <i>Armillaria</i>	Blocks, shelter, houses, sheds, packhouses, roads, driveways, loading areas, other crops, other trees, compost, frost protection, irrigation, lakes and ponds, water tanks, drainage

Table 3 presents the frequencies of features and categories. 'M + T' refers to the number of features both on the map and in the transcript. 'T' refers to the number of features in the transcript only – that is, features not appearing on the map. 'M + T' was thought to be a better unit of analysis than 'M' only because the maps were being used as a tool to find out what was important to the participant for the management of the orchard and so what they mentioned, even if it was not drawn on the map, was an answer to this question. Hence, the 'T' only data is likely to indicate what some participants found difficult to represent on a map.

Analyses of the data were then able to be carried out. The first of these consisted of ANOVAs of the frequency of features within categories which were normally distributed. The second analyses were crosstabulations of the management system with the categories and individual map features which were not normally distributed.⁴

⁴ These crosstabulations were unlikely to have enough numbers in cells to justify statistical testing. Presence and absence of a feature crosstabulated against three management systems gives six cells or an average of six counts per cell over the 36 orchards or 37 farms in the ARGOS programme. Hence, there would be likely to be one or more cells with fewer than five counts, which means statistical testing would not be valid.

Table 3: Frequency of kiwifruit map features for maps (M) and transcripts (T)

Category	Organic Hayward (n=12)		KiwiGreen Hayward (n=11)		KiwiGreen Hort 16A (n=12)		Totals	
	M + T	T	M + T	T	M + T	T	M + T	T
Spatial organisation	22	1	20	2	21	0	63	3
Blocks	11	0	10	1	11	0	32	1
Boundaries	11	1	10	1	10	0	31	2
Wind	13	1	17	3	13	0	43	4
Shelter	9	1	8	0	9	0	26	1
Prevailing winds	2	0	7	3	2	0	11	3
Wind damage	2	0	2	0	2	0	6	0
Buildings	20	1	18	2	14	0	52	3
House	11	1	9	1	5	0	25	2
Sheds	9	0	8	1	8	0	25	1
Packhouse	0	0	1	0	1	0	2	0
Transport	19	4	17	2	17	4	53	10
Roads	8	2	9	1	8	3	25	6
Driveways	10	2	6	1	7	1	23	4
Loading Areas	1	0	2	0	2	0	5	0
Social Context	8	5	7	6	7	4	22	15
Neighbours	8	5	7	6	7	4	22	15
Other biota	13	2	7	2	7	2	27	6
Other crops	7	1	4	2	6	0	17	3
Other trees	4	0	3	0	1	2	8	2
Compost	2	1	0	0	0	0	2	1
Landscape morphology	13	6	10	1	10	5	33	12
Slope	5	2	5	0	5	2	15	4
Aspect	4	2	3	1	3	2	10	5
Gullies	4	2	2	0	2	1	8	3
Climate	11	5	11	8	11	5	33	18
Frost Protection	5	2	5	5	2	1	12	8
Frost Areas	4	2	4	1	3	0	11	3
Climate	1	1	1	1	4	4	6	6
Altitude	1	0	1	1	2	0	4	1
Water	20	8	12	7	6	1	38	16
Water Sources	4	4	4	2	2	0	10	6
Stream and rivers	6	2	1	0	2	0	9	2
Irrigation	3	1	3	2	0	0	6	3
Lakes and ponds	2	0	2	2	1	1	5	3
Water tanks	4	1	0	0	0	0	4	1
Drainage	1	0	2	1	1	0	4	1
Biotic context	10	2	6	3	4	2	20	7
Soils	3	2	3	3	2	2	8	7
Bush	4	0	2	0	1	0	7	0
<i>Armillaria</i>	3	0	1	0	1	0	5	0
Contextual aspects	62	23	53	19	48	15	163	57
Management responses	87	12	72	17	62	8	221	37
Total features	149	35	125	36	110	23	384	94

2.2 Kiwifruit statistical analysis

2.2.1 Differences between management systems

The ARGOS research was designed to focus on the difference between organic, integrated and conventional management systems. In the kiwifruit industry this was not possible because since the introduction of the KiwiGreen integrated management system there is no longer any conventional equivalent, hence the use of the Hort 16A variety as representing a third management system. In order to account for environmental differences between orchards, the orchards chosen were selected in groups of three (triplets or clusters) at a particular location comprising one of each management system. Twelve locations were chosen across kiwifruit growing areas in New Zealand – one in Kerikeri, ten in the Bay of Plenty and one in Motueka. Therefore there was a total of 36 orchards in the ARGOS research. For this analysis there were only 35 orchards as one of the KiwiGreen Hayward participants was selling and it was considered inappropriate to conduct an interview.

This design enables the null hypothesis of no difference between the management systems to be statistically tested using a two-way ANOVA with location as a 'blocking' factor and management system as the 'treatment' factor. Analysis carried out in this way takes account of any differences between management systems (panels) that may just be due to location. Features which occurred on only one orchard or farm, were removed from the data. For all analyses, mean occurrences of features were calculated in order to make simple comparisons and these were assessed for statistical significance.

A two-way ANOVA on the data in Table 3 shows a significant difference ($p=0.01$) in the total map features noted (on the maps and in the transcripts) between Organic Hayward growers and Hort 16A growers. Organic Hayward growers noted a mean of 12.8 features compared with 9.6 for KiwiGreen Hort 16A growers. KiwiGreen Hayward noted an average of 11.5 features. Similarly, there was a significant difference ($p=0.01$) between these two management systems in regard to the average number of management responses noted, Organic Hayward noting a mean of 7.3 features and KiwiGreen Hort 16A growers noting a mean of 5.2 features. In this instance the figure for the KiwiGreen Hayward growers was 6.5. The difference between the average number of contextual aspects of the orchard for Organic Hayward and KiwiGreen Hort 16A was not quite significant ($p=0.10$). Overall the pattern was that Organic Hayward participants drew and mentioned more features than KiwiGreen Hort 16A with KiwiGreen Hayward somewhere in between (see Table 4).

Two-way ANOVAs were also carried out on the number of features mentioned in the transcript data only (see Table 3). This replicated the patterns found in the map plus transcript data, but did not show any significant differences (see Table 4). They probably demonstrate aspects that are either too detailed to fit on a sketch map, such as roads, driveways, and water sources, or things are very difficult to draw, such as, wind, slope and aspect, frost protection and soils. Drawing in neighbours could either take too much detail or be too difficult, because it is easier to tell a story about them.

Table 4: Two-way ANOVA results for means of contextual, management response and total features for maps (M) and transcripts (T) across orchard types

Category	Organic Hayward (n=12)		KiwiGreen Hayward (n=11)		KiwiGreen Hort 16A (n=12)		Statistical significance	
	M + T	T	M + T	T	M + T	T	M + T	T
Contextual aspects	5.2 ^a	2.3 ^a	4.9	1.8	4.0 ^b	1.3 ^b	'a' compared with 'b', p=0.10	'a' compared with 'b', p=0.06
Management responses	7.3 ^a	1.0	6.5	1.5	5.2 ^b	0.7	'a' compared with 'b', p=0.01	Not normally distributed
Total features	12.8 ^a	2.9	11.5	3.1	9.6 ^b	2.0	'a' compared with 'b', p=0.01	n.s. ⁵

Note: The means presented here may sometimes differ a little from those obtained from Table 3 as the two-way ANOVA corrects the data for differences between locations, there only being 11 KiwiGreen Hayward orchards compared with 12 for each of the other management systems. This, along with rounding up errors, also accounts for the fact that the 'contextual aspects' and the 'management responses' do not always add up to the 'total features'.

Two-way ANOVAs were not able to be carried out for the categories in Table 1 because the data were not normally distributed, zeros being over represented. Instead the data were cross tabulated with orchard type, as this analysis technique was more suitable. Table 3 shows how the frequencies vary across management systems and the crosstabulation analyses showed some relationships of interest, however, none were statistically significant because of the small numbers involved. These analyses suggest that: KiwiGreen Hayward orchardists may be more likely than Organic Hayward or KiwiGreen Hort 16A orchardists to make references to wind (shelter, wind damage and prevailing wind) as a feature impacting on management; Organic Hayward orchardists may be more likely than KiwiGreen Hayward or KiwiGreen Hort 16A growers to make references to the biotic context of their orchards, to other biota based activities on their orchards, and to water sources; and respondents from KiwiGreen Hort 16A orchards may be less likely than the others to refer to buildings, water or frost management. These results show trends that were usually represented in the map plus transcript data, and were sometimes backed up by the transcript only data.

Individual features were cross tabulated with orchard type to see if any relationships were apparent. Because of the low numbers only tendencies can be shown and these cannot be attributed with any statistical significance, but they may help explain some of the categorised results above. There are suggestions that: respondents from Organic Hayward orchards were more likely to include driveways, gullies, *Armillaria*, water tanks and compost; respondents from KiwiGreen Hayward orchards were more likely to mention wind, and less likely to include other crops; and KiwiGreen Hort 16A orchardists were more likely to include climate and less likely to include houses, other trees, frost protection and irrigation.

These crosstabulations help to provide possible explanations for the differences between management systems for the contextual aspects and the management responses. There is only a certain number of contextual features that can appear on an orchard, but the number of potential management responses (the tools in the tool

⁵ Not significant.

kit) available to deal with these features can vary with the orchardist. So where do the differences lie between the Organic Hayward and the KiwiGreen Hort 16A orchardists? (See Table 3.) Organic orchardists feature more different things to do with 'water', in particular 'streams and rivers' (included in 'contextual aspects') and 'water tanks' (included in 'management responses')⁶ and they mention other biota ('management responses') more frequently. The KiwiGreen Hort 16A participant shows a house on the orchard fewer times than the others, indicating that they may be more likely to live off the orchard. Also, the organic participant appears place a greater importance on some of the natural features of the orchard such as 'bush' in the 'biotic context' category and 'gullies' in the 'landscape morphology' category, compared to a KiwiGreen Hort 16A participant. They also mention *Armillaria* more often. Participants who grow Hort 16A being a new variety, may feel that so far they have fewer tools available to deal with its differences from Hayward Green, or the opposite, they may just simply feel that there is less to manage. Organic participants may have chosen their orchard because of its natural features such as streams and bush. The emphasis on water tanks is hard to explain. Perhaps they relate to their manufacture and spraying on of their own compost teas? It would appear that the KiwiGreen Hayward participant is more like the Organic Hayward one than the Kiwigreen Hort 16A one.

2.2.2 Differences between living on or off the orchard

Two-way ANOVAs were used to test the significance of living on, or not living on, the property (see Table 5), using management system as a blocking factor to account for the influence of this factor and thus making the comparison more precise. The mean number of features noted by those who live on the property (12.2) was significantly different at the ten percent level of significance compared with those who do not live on the property (9.9). However, when this data is broken into the different management systems it appears that most of this difference can be accounted for by the difference between the organic orchardists who live on (14.3) or off the orchard (9.8). The mean number of contextual aspects was also different at the ten percent level of significance for those living on the property (5.3), compared with those not living on the property (3.6) and, as for the total features comparison, this difference can be explained by the difference in the means for the organic orchards (6.3 compared with 3.0). There appears to be no differences between the means of the 'management responses'. These results are also reflected in the 'transcript only' data with one addition, the KiwiGreen Hayward participants mentioned significantly more features (not drawn on their maps) if they lived off their orchard.

It would make sense to think that those who live on the property are more aware of the contextual features on it, and that this contributes also to the significant difference in the total features mentioned. However, the fact that this is only showing up for the organic orchard maps is very interesting, particularly alongside the additional information that the organic orchardists living on their property appear to note more features than those from any of the other management systems whether they live on or off the orchard. It demonstrates that organic orchardists living on their orchard are more immersed in the landscape and environmental detail of their properties, than any of the other orchardist participants.

⁶ Organic registration with BioGro entails mapping water sources and this may be why organic orchardists see it as an important feature of their orchard.

Table 5: One-way ANOVA results for means of contextual, management response and total features for 'live on orchard'

Group of features (no. live on, no. live off property)	Transcripts only			Map + Transcript		
	Live on property		Statistical significance	Live on property		Statistical significance
	No	Yes		No	Yes	
Contextual aspects						
Organic Hayward (4, 8)	1.3	2.8	p<0.05 ⁷	3.0	6.3	p<0.05 ⁵
KiwiGreen Hayward (2, 9)	2.0	1.9	n.s.	4.5	4.9	n.s.
KiwiGreen Hort 16A (6, 6)	1.3	1.2	n.s.	3.3	4.7	n.s.
Average (12, 23)	1.5	1.9	n.s.	3.6	5.3	p=0.06
Management responses						
Organic Hayward (4, 8)	0.8	1.1	not normally distributed	6.5	7.6	n.s.
KiwiGreen Hayward (2, 9)	3.5	1.1	not normally distributed	7.0	6.4	n.s.
KiwiGreen Hort 16A (6, 6)	0.7	0.7	not normally distributed	4.7	5.7	n.s.
Average (12, 23)	1.6	1.0	not normally distributed	6.1	6.6	n.s.
Total features						
Organic Hayward (4, 8)	1.8	3.5	p<0.05 ⁵	9.8	14.3	p<0.05 ⁵
KiwiGreen Hayward (2, 9)	5.0	2.9	p<0.05 ⁵	11.5	11.6	n.s.
KiwiGreen Hort 16A (6, 6)	2.0	2.0	n.s.	8.5	10.7	n.s.
Average (12, 23)	2.9	2.8	n.s.	9.9	12.2	p=0.08

Note: Again the 'total' means will not be the sum of the 'contextual' and the 'management responses' means, nor will the averages within each of these groupings give the overall average. This is because of the correction going on for the unbalanced nature of this analysis – that is, the uneven numbers who live on and off the orchard, and the slight difference in the numbers in each management system.

Eleven Organic Hayward, nine KiwiGreen Hayward, and five KiwiGreen Hort 16A respondents drew a house or houses on their map. Interestingly, the actual number of interviewees living on the orchards varied little between management systems (eight Organic Hayward, nine KiwiGreen Hayward, six KiwiGreen Hort 16A). This discrepancy between the number of maps with houses drawn on them and the number of respondents living on the property can be explained in a number of ways. In some cases the owner lived on the orchard, but the respondent was a manager who did not. In other cases, houses drawn on the map were ones built on land which had been part of the orchard but which had been subdivided off. In some instances

⁷ We cannot produce a more accurate p number here because SPSS would not do this test of the interaction between panel and living on or off the orchard.

the orchard which was the focus of the map was, more accurately, part of a larger orchard, and the respondent's residence could have been on the part not included.

It is tempting to conclude from the relationship between living on the orchard and the increased number of features noted, that living on the orchard makes the manager/operator more intimate with the place. As the features they were asked to draw are those important for their management of the property, it would also be tempting to conclude that more intimacy and more features might indicate more sustainable management. However, it was also the case that when a house was drawn on the map it was more likely that there were two participants interviewed (39% as opposed to 25%). It is logical to assume that two people are likely to come up with more features than one on their own (see next section). Further, it is entirely possible that living on the orchard and being more intimate with its conditions and processes may lead to higher levels of non-sustainable interventions. For example, it is striking how many orchardists mention their pet cats and, in passing usually, the impacts they have on the local bird and lizard life! In addition, the values held by the orchardist to measure the quality of their management are central in the decisions they make about such practices as mowing and weed control. For an orchardist with strong values promoting neatness, for example, living on the orchard may lead to more spraying and mowing than might occur if they were not living there. The examination of environmental data is necessary to assess the sustainability of these practices.

2.2.3 Differences between other parameters

One-way ANOVAs were also used to see if there were any significant differences in the map data according to other parameters. Few instances of any significance were found. Where only a man was interviewed he was likely to note fewer total features than when a male-female couple was interviewed (10.5 compared with 12.8), and to note fewer contextual aspects (4.1 compared with 5.7). This could be explained by the fact that two people are more likely to generate map features. Those who mow their own orchard were less likely to talk about contextual aspects without drawing them on the map (i.e., transcript only data) than those who do not (1.6 compared with 2.6). However, these statistical relationships are not strong (statistical significance between 5 and 10 percent) and it would be unwise to attribute too much significance to them.

From cross tabulations it was apparent that when a man alone was interviewed he was less likely to refer to spatial organisation, transport, buildings and the biotic context for management than if a couple were interviewed, and more likely to refer to climate. Those respondents who lived on the orchard were more likely than those who did not, to feature buildings, landscape morphology, and other biota based activities. However, again, these relationships only show trends in the data and were not statistically significant.

2.3 Kiwifruit qualitative analysis

The material focused on in this section is from the interview transcripts and in most cases this information clearly elucidates the reasons for the inclusion of a feature, and in many cases, explains its importance. In some instances the discourse clearly varies between production systems, and in others the discourse about highly ranked features offers little elucidation as to their significance. Both these findings underline the importance of examining the wider context of the feature in order to understand its significance, rather than relying simply upon its frequency as an indication of importance.

2.3.1 Spatial organisation

(i) Blocks (30 maps, 29 transcripts)⁸ (11, 10, 11)⁹

Blocks were the most frequently noted features across all three orchard types. Clearly blocks are the primary means of organising the space of the orchard, and of dividing the larger orchard into manageable chunks. However, the boundaries of blocks are usually also contiguous with the provision of shelter, so there is a secondary aspect to the spatial division. In fact, it is not possible to tell from the data whether it is the case that the division into blocks follows from the necessity to provide and position shelter, or the shelter is placed along the boundaries of the blocks. Where shelter and block boundaries do not coincide, it is not possible from the maps, to ascertain what does actually, delineate the blocks.¹⁰

Blocks were identified by numbers or by letters, and there was no consistent spatial orientation discernable from the maps regarding this. These labels do seem to ‘stick’ however. One Organic Hayward orchard had blocks, which were identified by numbers left over from the time when their orchard was part of a larger one. Similarly another Organic Hayward orchard had a block named M/N which had been two blocks prior to a shelterbelt being removed. Rows were usually numbered within blocks also, which a KiwiGreen Hort 16A participant said was, “... for me to explain to my workers where to go”. An Organic Hayward participant, instead of numbering rows, used an aerial photo and a highlighter pen to identify where they have been working.

(ii) Boundaries (28 maps, 21 transcripts) (11, 10, 10)

Boundaries were the second most commonly noted feature for all three production systems. It is clear that the boundaries of the property as a whole, and the blocks within those boundaries, are the primary spatial organisers, the delineations of the directly manageable from the unmanageable neighbouring spaces. The shape of these boundaries can impact on management. A KiwiGreen Hort 16A participant pointed out that his orchard was “... basically a square” and that this was positive as the ends of the rows are not angled at the boundary.

2.3.2 Wind

(i) Shelter (26 maps, 25 transcripts) (9, 8, 9)

Shelter rated in the top three ranked features noted on the maps by orchardists from all three production systems. Shelter clearly has two types of function. Shelterbelts, whether ‘natural’ or ‘artificial’, are almost always contiguous with block boundaries and usually contiguous with orchard boundaries also. Thus, they provide a three dimensional division of the orchard space and, in terms of the maps when rendered

⁸ This format is used to show the number of times that the feature occurred on the maps and in the transcripts. In many cases the numbers do not match the frequency reported in Table 3 because a feature was noted more than once on one map.

⁹ These figures are in the order: Organic, KiwiGreen Hayward, KiwiGreen Hort 16A. They represent the number of times this feature occurs on a map and/or in the transcript for each management system. This order differs from that used in the ARGOS report *Understanding Approaches to Kiwifruit Production in New Zealand: Report on First Qualitative Interviews of ARGOS Kiwifruit Participants* (Hunt et al., 2005) but has been done in this way in order to be consistent with the sheep/beef material.

¹⁰ Blocks in the ARGOS kiwifruit orchards vary in size from 0.5ha to 3ha, so there is no uniformity (pers. comm. 10/08/05, Jayson Bengé, ARGOS Field Research Manager).

in two dimensions, are generally a feature which overlays the information about blocks and boundaries discussed above.

The management impacts of shelterbelts are several, and do not appear to vary much between the three production systems. The primary function is, of course, wind protection. However, there are two separate aspects to this. The first is quite simply to protect the plants and fruit from the effects of the force of the wind. To this end, as a KiwiGreen Hayward participant pointed out, the shelter protects for a distance of six times its height. If the block is wider or longer than this the wind tends to 'dump' and cause damage to the area out of range. The second aspect of this wind protection is temperature control. Protecting the orchard from the chilling effects of cold winds was important according to a KiwiGreen Hort 16A participant who was concerned that a previous owner had removed a shelterbelt and they had, so far, not replanted it. He said:

I'm going to the field days [to learn about management techniques]. You hear that wind is a - can be a big factor in your tray numbers, 'cause if you get a cold orchard - gets chilled - you don't perform the same.

There are clearly fashions in shelter. An Organic Hayward participant noted, "It's funny. Years ago shelter was the all important thing in orchard[s] and now people are all pulling them out". A number of respondents, none organic, mentioned that they had taken out shelter (three KiwiGreen Hayward and four KiwiGreen Hort 16A). However, a number also said that they had put in, or were considering putting in, new shelter and in some cases these were the same people (two Organic Hayward and one KiwiGreen Hort 16A). In one instance this was to replace shelter that was removed, which was described as "massive trees", and to replace it with a "nice cryptomaria hedge". A KiwiGreen Hort 16A participant had installed artificial shelter around the only part of the orchard not previously sheltered and said, "I mean, it's an integral thing where every part of it's there for a reason. It's been set out as a production block". One KiwiGreen Hort 16A orchardist had removed a bamboo shelterbelt because of complaints about it from his local power board!

Shelter as protection from spray drift was also mentioned. Interestingly, this was not only an issue for organic producers. While one Organic Hayward participant did note that as they were surrounded by conventional producers the boundary shelters were important to protect them from spray drift, the role of boundary shelter was also noted by a KiwiGreen Hort 16A orchardist as protection for his neighbours from his spray drift. A KiwiGreen Hayward participant also pointed out the importance of his boundary shelter as a protection for his other crops, particularly his citrus, from the risk of his neighbour's Hicane™ drifting onto his property. Thus boundary shelter is not only a perceptual boundary marker but also a very real barrier.

Shelter can also cause problems in addition to the wind dumping phenomenon mentioned above. Some are related to temperature. One KiwiGreen Hayward participant had removed some shelter as a means of mitigating the risk of frost, and was trimming the lower branches off other shelterbelts to allow cold air to drain through. A related problem was shading, both of the kiwifruit and of other shelter plants, and a number of respondents had removed shelter in order to relieve this problem. Shading by shelterbelts was mentioned as a problem by members of all three production systems. On the organic orchards, shelter was related to two additional problems. *Armillaria* was associated with shelterbelts, particularly those that were willow. Removing the shelter did not solve the problem as *Armillaria* lives on in the decaying root matter. The other problem particularly associated with the organic orchards was the sapping of nutrients from the ground close to the

shelterbelts. A KiwiGreen Hort 16A participant described the “massive trees” mentioned above as a “scale factory”.

(ii) Prevailing winds (8 maps, 11 transcripts) (2, 7, 2)

While the prevailing wind on the orchard was marked quite frequently by respondents, they did not have a lot to say about it. Two Organic Hayward participants mention it only in passing. One KiwiGreen Hort16A participant described the prevailing, sou’ westerly wind as “a very important feature” but did not elaborate, and another also identified the sou’ westerly as the prevailing wind and noted that it made certain shelter “more essential”.

One KiwiGreen Hayward participant managed the impact of the prevailing wind by pruning the vines more heavily in the areas prone to damage, while another laid down more buds where the vines were exposed to the wind to allow for losses.

(iii) Wind damage (6 maps, 5 transcripts) (2, 2, 2)

An Organic Hayward participant noted that rows either side of the hedges did not do as well as those at the middle of the blocks as “... they take a bit of a hit with the wind.” A KiwiGreen Hort16A participant remarked that he had an area of potential wind damage because of wind dump over the shelter. His solution was to transfer his vines onto pergolas instead of T-bar supports. Another KiwiGreen Hort16A participant described wind as “... the biggest limiting factor on this orchard”.

2.3.3 Buildings

(i) Houses (23 maps, 19 transcripts) (11, 9, 5)

Houses were noted by 11 organic orchardists. They were noted slightly less often by KiwiGreen Hayward orchardists, and less often still by KiwiGreen Hort 16A orchardists. However, there are qualitative differences in what the respondents said about the houses on the orchards, depending on the orchard type. Six KiwiGreen Hayward transcripts included comments about a house. Three of these merely mentioned the house as a feature. One commented that the presence of the house on the orchard makes the orchard more secure than if it was just a “production block”. One female partner expressed surprise that the orchard had been better cared for by its previous owners than the house had been. Another of the KiwiGreen Hayward participants explained that they were building a house “so a hundred percent of the property is utilised and there’s no wastage whatsoever”. This sort of strong productionist ethos can be contrasted with that of the Organic Hayward orchardists.

The comments of the Organic Hayward orchardists about their houses all reflect a domestic, or lifestyle, focus. One had built an “eco-house” on his orchard. Of this he said:

My basic idea initially was that I wanted to complete the whole package, and in doing that I decided we would build this house as an eco-house to complement the rest of the orchard.

Clearly for this organic orchardist the application of his philosophical perspective is very important. One drew the house on their orchard in red saying that this was the appropriate colour because, “Home is where the heart is”. Another, after mentioning the ponds which his son had built on the property, said that he wants to build a house by them. This reflects an intersection between aesthetics and lifestyle which is absent in the KiwiGreen Hayward orchardists’ comments about their houses. As one

noted in the interview, their house was in a corner of the orchard, and said, “We also have our lifestyle as it were, off to one corner, a home site, with a separate environment from the orchard, so we’re not living on the job”. While lifestyle is clearly important to this interviewee, a productionist view of the orchard as the site of work is also evident.

Fewer than half of the KiwiGreen Hort 16A orchardists included a house on their maps (5 out of 12). Three of these orchardists spoke of their houses, two only mentioning it in passing. The third, however, spoke at some length. They had decided to build a house on their orchard, he said, “rather than the other orcharding option, build a flat onto the end of a shed”. Building a house would be a sensible option:

... because if it all went belly up and we had to sell it we could sell the plan, we could sell the ... idea that we had for this block of land as ... part of its attraction.

This is interesting as this participant clearly distinguishes himself from other orchardists. Other aspects of this interview suggest that he can be seen as an outlier in the KiwiGreen Hort 16A group because of he and his partner’s focus on the lifestyle aspects of their property and enterprise. It is still notable that the construction of the house was motivated by a desire to mitigate potential economic risks, rather than for lifestyle reasons alone.

(iii) Sheds (24 maps, 20 transcripts) (9, 8, 8)

The Organic Hayward orchardists had more to say about their sheds than the any of the KiwiGreen orchardists. One commented that the shed looked larger on their map than the house to which his wife responded, “It is dear” (see Figure 2).

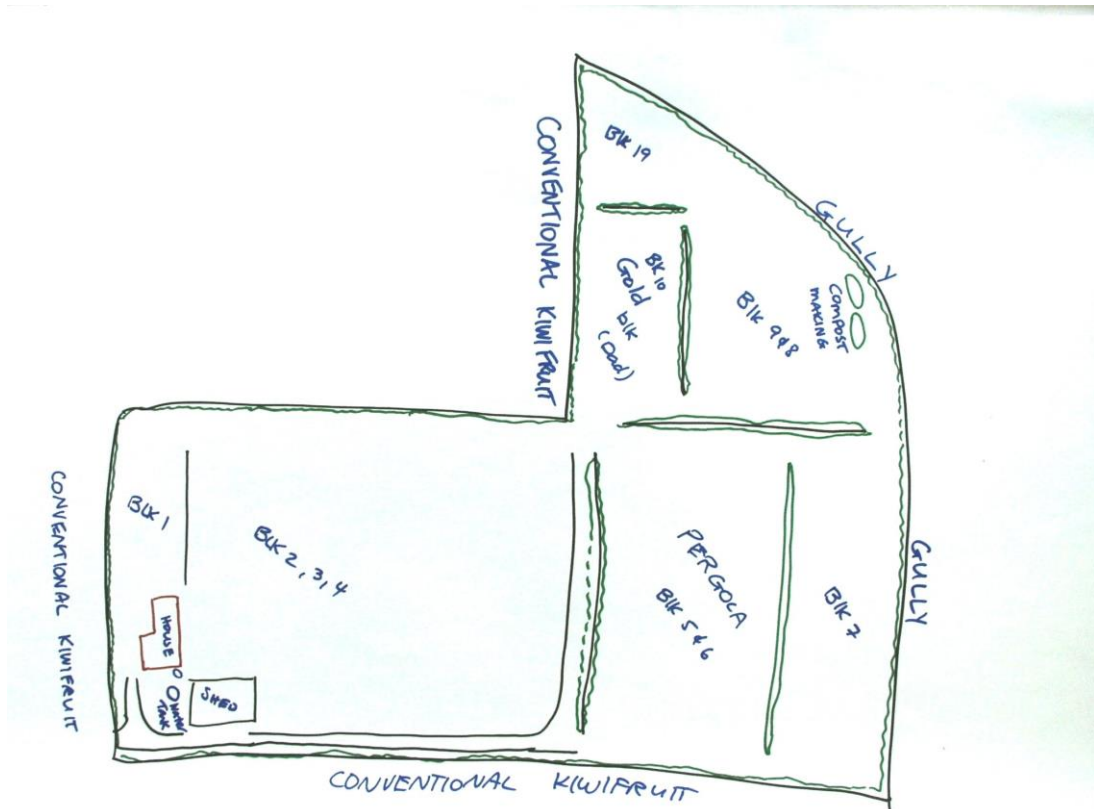


Figure 2: Map of an Organic Hayward orchard

An Organic Hayward participant complained that they built a big barn, but that it was not big enough. Another pointed out that some sheds have "... all the facilities in them" and others are just used to "... park the tractor in", while another said that his shed runs his business (see Figure 3). While he runs an organic fruit wholesaling business, much broader than just kiwifruit, it does, none-the-less, underline the importance of the shed for kiwifruit orcharding.

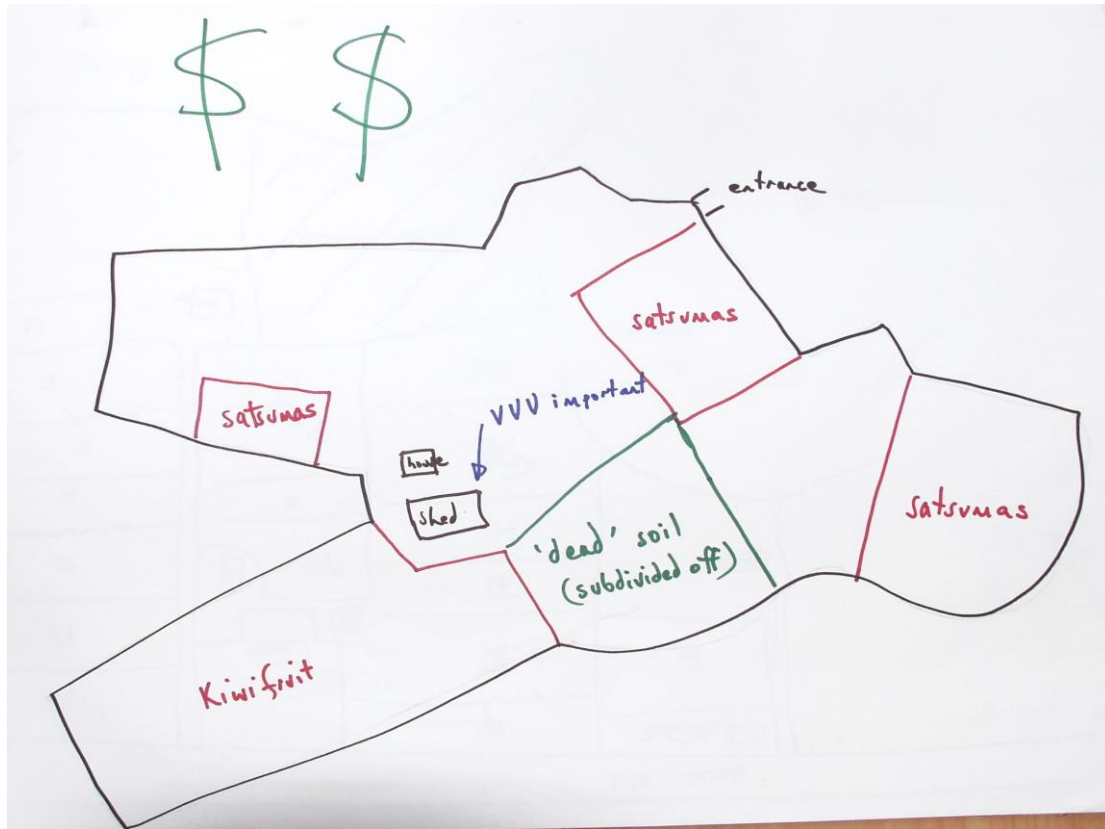


Figure 3: "The shed runs my business"

(iii) Packhouse (1 map, 1 transcript) (0, 1, 1)

One KiwiGreen Hayward participant has a packhouse on the property which is no longer functional that will be converted into a house.

2.3.4 Transport

(i) Roads (19 maps, 17 transcripts) (8, 9, 8)

While external roads were a feature commonly drawn on the maps, those interviewed had little to say about them. The inclusion on many maps of the bounding roads and their names suggests that they are simply part of the connection of the orchard to the larger landscape. This connection is, of course, quite literal, as it is by these roads that the orchards and orchardists connect to the rest of the community and economy.

The roads can, in some instances, take on the role of an annoying neighbour. An Organic Hayward participant complained that the road outside his property drains runoff onto his property whenever it rains. The local council has been unhelpful in dealing with this problem. A KiwiGreen Hayward participant complained that his bordering road created a dust nuisance, while a KiwiGreen Hort 16A participant owns a large property bisected by a road which, he said, "...can be an irritation".

(ii) Driveways (19 maps, 16 transcripts) (10, 6, 7)

Driveways were an identifiable feature in sixty percent of the maps. Little was said about the driveways as features in the interview transcripts, past noting their existence.

(iii) Loading areas (5 maps, 4 transcripts) (1, 2, 2)

Remarks regarding loading areas were minimal in the transcripts. A KiwiGreen Hayward participant commented that his was adequate. More interestingly one KiwiGreen Hayward participant mentioned that he had a conflict between needing an adequate area for loading, and needing to install more shelter.

2.3.5 Social context

(i) Neighbours (7 maps, 22 transcripts) (8, 7, 7)

While only seven maps (three Organic Hayward, one KiwiGreen Hayward and three KiwiGreen Hort 16A) specifically noted neighbours, much more talk about the impacts of neighbours occurred during the map making process. Twenty-two out of the 35 interviews included some reference to neighbours at this time. These discussions can be divided into a number of categories. On a broad scale this talk about neighbours referred to (1) practical, and (2) social issues, and within each of these categories, positive and problematic assessments of the roles and impacts of neighbours were made.

All but one of the Organic Hayward respondents who mentioned neighbours spoke of them as in some way problematic. For three, this was primarily because of the threat of spray drift. One had gone to the extent of buying an extra block of land to act as a buffer between him and a neighbour who sprays by helicopter. He did say, however, that his motivation was to ensure a buffer between his house and the neighbour for the good of his children, rather than for the good of his kiwifruit. Another had actually had their produce tested for residue from their neighbour's sprays but had not found any traces. For another Organic Hayward participant spray drift was also mentioned as problematic, but the neighbour problem was mainly explained in terms of the bush-filled gully on their boundary. As this was on the neighbouring property they were unable to manage it for the pests which it harboured, and these affected the management of the orchard.

Social relationships with neighbours figured for three Organic Hayward participants. One had used smoke as a means of frost protection and was indignant when their neighbours complained about it. One female partner described some of their neighbours as "aggressive" and "disrespectful" but did not explain this assessment. Another, while not actually mentioning resident neighbours, discussed having visitors in what sounded like orchard tours. He described in detail (and drew) a sign he had commissioned for his orchard which incorporated symbols important to him in defining the nature of the orchard.

Five KiwiGreen Hort 16A respondents mentioned neighbours during the map drawing process. For two, positive benefits were gained from their neighbours. In the case of one of these, this was largely a social benefit with the male partner saying that "friendly neighbours ... doing the same thing" was one of the reasons why they stay there. The positive impact for one was purely the shelter they gained from their neighbour's shelterbelts. For one, neighbours were more problematic, particularly a primary school neighbouring his property. The presence of this school impacted on

his spraying for bird control, and on the transporting of his bobby calves (the property incorporates a dairy farm as well as kiwifruit and avocados). He complained about having to deal with the perceptions of people who have come into the countryside to live. For another, neighbours were problematic also but, ironically, because of spray drift from their kiwifruit operation causing a problem for his citrus operation.

The tone of most of the comments about neighbours made by the KiwiGreen Hayward orchardists differs from that of both the Organic Hayward and the KiwiGreen Hort 16A growers. They were more “matter of fact” and did not tend to evaluate the neighbour’s presence. For example, one noted that a neighbouring orchardist manages his property quite differently because of the different altitude of his orchard. Another noted that his neighbours are well protected from his spray drift. For one, his orchard was “not isolated” and was “close to a packhouse”. One participant made an aesthetic judgement saying that “it’s quite nice” having farmland next door.

However, neighbours were much more problematic for one KiwiGreen Hayward participant. His orchard was close to a town and he felt the impact of peri-urban development. This he described as “a real big one” which impacted on his management decisions. This is a similar, but more extreme, experience to that of the KiwiGreen Hort 16A participant mentioned above. However, this participant saw the solution as educating his neighbours about his orchard practices.

2.3.6 Other biota

- (i) Other crops (14 maps, 16 transcripts) (7, 4, 6)

There does not seem to be a strong relationship between the growing of other crops, as reported by the Field Research Manager, and their presence on the maps. This may, in part, be due to a very loose usage of the term ‘crop’ in the analysis of the maps. Any other potentially commercial activity recorded, which included grazing sheep and growing walnuts, was counted as an ‘other crop’. While it was clear sometimes that the orchardist grew another crop commercially, it was not always clear that commercial rather than personal use was intended. Thus the impact of these ‘other crops’ on the management of the properties is not always clear.

- (ii) Other trees (6 maps, 7 transcripts) (4, 3, 1)

Other trees featured in the data as fruit trees, overlapping with the category ‘other crops’; forestry; overgrown shelter, overlapping with the category ‘shelter’; and as aesthetic elements. In the latter grouping one Organic Hayward and one KiwiGreen Hort 16A participant specifically mentioned native trees, the former having planted natives on his property, the latter including cabbage trees on their map in what was referred to as their ‘native zone’, by the female partner.

- (iii) Compost (1 map, 2 transcripts) (2, 0, 0)

Two Organic Hayward participants both described compost as important on their orchards. Compost was a feature only on these two orchards.

2.3.7 Landscape morphology

- (i) Slope (14 maps, 13 transcripts) (5, 5, 5)

The term ‘slope’ is used here to focus on sloping or hilly ground and the impact this has for management. This is to be distinguished from ‘aspect’ which is taken to be

an overall slope, the way that the whole orchard lies, rather than referring to the internal topography. The term most used by the respondents to refer to this hilly ground is the word 'contoured'. Non-contoured was, in contrast, used to describe level ground. However, one respondent also used the term 'contoured' to refer to ground that had been levelled with bulldozers.

Contoured land was problematic for orchardists in all three production systems. There were a number of reasons for this. For an Organic Hayward participant the problem with contoured land was that water collects in the hollows. For another organic participant and two KiwiGreen Hort 16A participants, the hollows on their contoured orchards caused frost problems. For one Organic Hayward participant and one KiwiGreen Hort 16A participant the contoured nature of their orchards was problematic because of the consequent variation in the depth of topsoil. Another KiwiGreen Hayward participant found that the slope led to fertilisers washing away so he had modified his regime to one of "little and often" in order to minimise runoff. For another KiwiGreen Hayward participant the contoured nature of his orchard caused problems for tractor work and spraying.

(ii) Aspect (5 maps, 8 transcripts) (4, 3, 3)

Most of the orchardists who mentioned the aspect of their orchards did so in a positive light. The only variation was a KiwiGreen Hort16A orchardist who noted that their orchard sloped the "wrong way" to the south. A northerly aspect was definitely considered desirable, but the reasons for this were not stated, but would relate to the importance of sunlight as a driver of the accumulation of dry matter in fruit.¹¹

(iii) Gullies (5 maps, 8 transcripts) (4, 2, 2)

Gullies were closely related to bush as a feature of the orchards as, in most cases, possibly all, the gullies and the bush were actually contiguous. Gullies had a number of conflicting attributes articulated in the transcripts. Commonly, however, they were presented as problematic features to the extent that a KiwiGreen Hort16A participant, after commenting that his map was "not very interesting", said, "I don't have a tremendous gully in it somewhere or a ... particular area where the plants are dying or ... or ... or whatever". An Organic Hayward participant identified passionvine hopper as a pest which was hosted by the "bush and scrub" in the gully bordering their property. One KiwiGreen Hort16A participant said, "One of the biggest things that restrict us in the gold is possums out of the gully. That is a major [restriction]". He also had a problem with *Armillaria* in the outside edge of the blocks next to the gully, and commented that the gully was also a cause of concern for the safety of their workers and machinery, and the centre of an erosion problem.

Two Organic Hayward participants both commented that their gullies offer them the positive benefit of natural frost protection. However, for both orchards this also had a downside of reducing winter chilling to a problematic level (see next). Both commented that the gullies had positive aesthetic impacts, one said that it made it "... a nice place to be" and the other that "... having the native birds and animals encroaching from the surrounding bush is a feature that I really enjoy".

¹¹ Jayson Bengel, pers. comm. 10/08/05.

2.3.8 Climate

- (i) Frost protection (4 maps, 12 transcripts) (5, 5, 2)

A range of methods of active frost protection were used. Four orchardists used, or intended to use, sprinklers for frost protection (three Organic Hayward and one KiwiGreen Hort 16A). In some instances these sprinklers doubled as irrigation in dry weather. One Organic Hayward participant had used smoke as frost protection in the past, and intended to put in a wind machine. A KiwiGreen Hort 16A participant used helicopters. For one Organic Hayward participant the gullies on their property provided natural frost protection “because the cold air drains away into the gullies. [In] fact it drains too well as we struggle sometimes to get an adequate winter chill”.

- (ii) Frost areas (8 Maps, 10 transcripts) (4, 4, 3)

Orchardists from all three production systems made it clear that late spring frosts were a relatively new problem. As a consequence, systems to manage it were in the process of being put in place in many instances. An Organic Hayward participant noted that the area prone to frost on his orchard was “... the worst bit we’ve got ... our critical area at the moment we’ve gotta work on”. One KiwiGreen Hort16A participant and one KiwiGreen Hayward participant both intended to remove the lower branches of key shelterbelts to allow cold air to drain downhill. Another Hort16A participant had put in a sprinkler system for frost protection and noted that frost was a bigger problem for gold than for green kiwifruit as gold flowers three to four weeks earlier.

- (iii) Altitude (3 maps, 4 transcripts) (1, 1, 2)

Altitude was a problem in two of the four transcripts which mentioned it. Interestingly, the main issue was reduced sunlight hours due to more cloud cover than is found at lower altitudes, hence its inclusion under ‘climate’. A KiwiGreen Hort16A participant, while describing the orchard as “an altitude orchard”, considered that altitude was not a problem for gold kiwifruit as they crop more heavily than green anyway. One KiwiGreen Hort 16A participant noted that altitude impacts on management in that “I think, maybe, altitude orchards, you’ve gotta be sharper in what you do. You’ve gotta get your timing more accurate”.

- (iv) Climate (0 maps, 6 transcripts) (1, 1, 4)

A number of climatic factors were discussed in the transcripts. These strongly related to geographic factors, particularly altitude and proximity to the sea. For an Organic Hayward participant summer cloud was a problem, reducing sunshine hours, and sea breezes were relied on to disperse this. Temperature was also seen to relate to altitude with one KiwiGreen Hort 16A participant noting that for his orchard its altitude led to cooler summers and warmer winters¹². An Organic Hayward participant speculated that the late frost experienced in 2003, the first since 1968, was possibly a result of global warming.

Levels of rainfall attracted both positive and negative characterisations. For a KiwiGreen Hort 16A participant the perceived high rainfall of his area was seen as bad for people but good for kiwifruit. Another KiwiGreen Hort 16A participant noted

¹² We can think of no explanation for this but packhouse employees had taken some temperature measurements and found this to be the case on this particular orchard.

that the level of rainfall they experienced was a good attribute of their orchard, while another, on the other hand, blamed excessive rainfall for splitting and damaging fruit the previous season.

It is interesting to note the preponderance of comments on climate from KiwiGreen Hort 16A growers. Any explanation of this would be entirely speculative. However, as one KiwiGreen Hort 16A participant noted, his orchard had hugely varied microclimates which increased the challenge of growing the gold fruit. This was something he appreciated.

2.3.9 Water

- (i) Water source (4 maps, 10 transcripts) (4, 4, 2)

Water was clearly important to kiwifruit orchardists. A KiwiGreen Hayward participant said that water was the most important thing for management, but did not elaborate as to why this was the case. One KiwiGreen Hort16A participant began his map by saying, "I'll start off with putting the river down here. So that's our water source." However, it may be significant that, as well as a large horticultural operation, this participant also runs a dairy farm. Overall, water came from bores on a property, rivers or streams, or private water schemes.

- (ii) Streams and rivers (9 maps, 9 transcripts) (6, 1, 2)

Streams or rivers were marked on nine of the 35 maps. These features appear to function in two ways. Firstly, they function as spatial features, in three instances being contiguous with part of the actual orchard boundary. Secondly, they function as a water source. Three of the seven interviews mentioned streams as potential or actual sources of water for irrigation or frost protection. The transcript data do not offer any explanation of the high frequency of this feature on organic maps.

- (iii) Irrigation (3 maps, 6 transcripts) (3, 3, 0)

Three Organic Hayward and three KiwiGreen Hayward orchardists mentioned having, or being in the process of developing, irrigation systems. In at least three instances these irrigation systems can double as frost protection systems. One Organic Hayward participant had recently changed their system from drippers to sprinklers which had, at the time of interview, only been used for frost protection. He noted that he considered over watering to have been a problem on other neighbouring orchards.

- (iv) Lakes and ponds (2 maps, 3 transcripts) (2, 2, 1)

Two Organic Hayward participants have both developed lakes on their properties. In both instances water was drained into low lying areas to create these lakes. One had planted natives around the lakes and had built a house beside them emphasising an aesthetic function as well as the practical. The other also intended to build a house next to the lakes on his orchard. In addition to these functions the lakes also provided a water source for irrigation and frost protection.

Two KiwiGreen Hayward participants intended to develop ponds on their properties to provide water for irrigation and frost protection. One KiwiGreen Hort 16A participant had a duck pond on his property, "with a few pheasants and we can get, get away and um, enjoy that".

- (v) Water tanks (3 maps, 3 transcripts) (4, 0, 0)

Three maps recorded water tanks and all were Organic Hayward orchards. Two simply mentioned that they have water tanks. One said that they had a tank. It was not working at present “as there hasn’t been a need for irrigation for five or six years.”

- (vi) Drainage (3 maps, 3 transcripts) (1, 2, 1)

One Organic Hayward participant used Novaflo to drain his land, forming the ponds discussed above. He had problems with runoff from the neighbouring road, which the local council refused to help him with. A KiwiGreen Hayward participant who mentioned an open drain on his property also used Novaflo to drain wet areas. He was planning to dam a drain to create a pond as a source of water for frost protection.

2.3.10 Biotic context

- (i) Soils (1 map, 8 transcripts) (3, 3, 2)

An Organic Hayward participant commented that soil fertility was a constraint on his orchard. Another noted an area in which the soil is “stuffed” and “dead” that he was subdividing off. He blamed irrigation “... all its orcharding life before we got it six years ago” for its condition. On the other hand, another Organic Hayward participant described his soils as “... wonderful, free draining, volcanic soil ... possibly the best growing soil in the world ... for growing this kiwifruit vine”. Another positive attribute he noted was that the soil was “... quite rich in natural nutrients”.

The three KiwiGreen Hayward respondents who talked about their soil all did so in the context of explaining the methods they used to improve it. Two talked about this in terms of the application of fertiliser, the other one about the “deep tillage” which they had been using to prepare an area for the future planting of kiwifruit vines. A KiwiGreen Hort 16A participant simply mentioned that a good attribute of the orchard is the soil type. Another KiwiGreen Hort 16A participant commented that the soils in the gold area of the orchard “aren’t incredibly rich”. He went on to say that the reason for planting the gold vines in this particular place was because it was their poorest land, and the more vigorous Gold vine makes it more profitable than Hayward vines on this sort of land.

- (ii) Bush (7 maps, 5 transcripts) (4, 2, 1)

Seven of the 35 maps identified areas of bush. Two distinct constructions of bush were evident from the transcripts. These could be loosely categorised as “bush as a source of pests” and “bush as an aesthetic feature of the orchard”.

Bush was clearly seen as a source of pests and, in fact, an Organic Hayward participant described the bush itself as “a pest”, “a struggle” and “probably our main problem”. The pests residing in the bush were mainly largish mammals including possums and hares (KiwiGreen Hayward), and deer and wild pigs (KiwiGreen Hayward)! Elsewhere bush was also mentioned as a source of passionvine hopper and scale insects.

Bush as an aesthetic feature of the orchard is a construction clearly in direct conflict with the construction of bush as a source of pests. This conflict was even evident in the text of one single interview. A KiwiGreen Hayward participant identified the pest intrusion from the bush as “... having a big impact on the property”, but he

immediately continued to say that the bush "... was also a very attractive feature of the property which is why we like the property". He continued:

I suppose it is quite attractive to get away from the kiwifruit and come down and walk around the bush boundary at the end of the day and there's something different other than kiwifruit and you can look out there and see the native bush and look down towards the mountains or whatever and it is quite attractive.

(iii) *Armillaria* (5 maps, 4 transcripts) (3, 1, 1)

Armillaria is noted on the maps by three Organic Hayward participants, one Hort 16A participant, and one KiwiGreen Hayward participant. An Organic Hayward participant included *Armillaria* on their map but did not talk about it at the time of drawing the map. They may have added the *Armillaria* area to their map at a later point in the interview and talked about it then. Three of the mentions in the transcripts were cursory. An Organic Hayward participant, however, referred to an area of his orchard as "death valley". He had lost, he said, over one hundred plants to *Armillaria* and blames it on the existence, in the past, of willow shelterbelts. They now had *Armillaria* in every block and lost six to ten plants a year to it.

2.4 Conclusion

It is possible, on the basis of the data, to draw some conclusions about the things which characterise an ideal, generic, kiwifruit orchard and which exemplify the differences between the varying production systems. In this section an 'ideal type' of kiwifruit orchard is developed, and, for comparison, characteristic types of KiwiGreen Hayward, Organic Hayward and KiwiGreen Hort 16A orchardists are proposed.

2.4.1 The 'ideal' kiwifruit orchard

The ideal site for a kiwifruit orchard is a relatively level area, at low altitude and with a northerly aspect. It has high fertility, volcanic soils of even depth. The climate has high sunshine hours but also high rainfall fairly evenly distributed throughout the year. The boundaries of the orchard run north – south and east – west, configuring a square or a rectangle. Blocks are arrayed within this and are separated with shelterbelts.

Shelter is provided by belts of varying tree species, other than willow. These shelterbelts allow cold air to drain from the site, but protect it from cold winds, thus creating a micro-climate in which steady and relatively warm temperatures can be maintained on the orchard. At the same time they protect it from blustery winds from all directions, but also avoid wind dumping. Vines are grown on pergola type supports as this provides the best wind resistance. The shelterbelts cause minimum shading and nutrient sapping, and both protect the orchard from neighbours spray drift, and protect neighbours from the spraying activities within the orchard.

The site has a reliable water source; either a river, bore, or access to a communal water scheme. Overhead sprinkler systems are in place, doubling as irrigation in dry periods and frost protection in cold periods. A gully or depression on a neighbouring property is an advantage for frost protection, but not when filled with bush or scrub.

Loading areas and sheds are positioned in the most convenient places, minimising the reduction of productive land or the provision of shelter. The house, where there is one, is placed to ensure the most effective use of the available land. Ideally, it is on land which could be subdivided off, providing a form of insurance against financial strife, as well as a home. It also provides the orchard with heightened security.

Other trees and some other crops may be grown for commercial and personal use, and for aesthetic reasons when the orchard is occupied.

2.4.2 Orchardist characterisation by production system

(i) Organic Hayward

The Organic Hayward growers noted the most features, the most things to manage and the most management responses of all the management systems. As fewer Organic Hayward growers live on their orchards than KiwiGreen Hayward growers, this cannot be explained by habitation. This suggests that the Organic Hayward orchardists are more observant than KiwiGreen Hayward and KiwiGreen Hort 16A growers, and see their operations as more complex. It is possible that they may be more dependent on their ability to identify and manage situations than their compatriots who have a different range of management tools at their disposal.

The organic kiwifruit orchard is seen as a biologically more complex place than those of the other management systems. More mention is made of the biotic context of the orchard by organic growers than by others, and more mentions are made of other crops and trees. The major pests on the organic orchards are characteristic. Passionvine hopper and *Armillaria* are common and serious problems, and both are associated with the proximity of bush and gullies. The natural soil conditions form a context for the orchard and are either a constraint or a benefit. The means at the disposal of the organic orchardist for working with their soil's fertility are limited and compost is of primary importance for managing soil health and fertility. Shelterbelts can be a problem for fertility, sapping nutrients from the soil in their vicinity.

The organic kiwifruit orchardist is significantly more concerned with features to do with water than their compatriots. We understand that organic registration entails mapping water sources and that process appears to have heightened organic orchardists' sensitivity to water and they see it as an important feature of their orchard. Only organic growers noted that the ponds created by drainage as water sources had significant aesthetic value for them. Perhaps the aesthetic value of the streams on these properties was something which attracted these people to the properties in the first place.

For the organic grower, their house on the orchard is important as their home. For example, one orchardist emphasised that the home was a key part of creating an ecologically benign and aesthetically pleasing environment. The aesthetic importance of their ponds, to the growers that have them, and the positive aesthetic impacts of gullies, despite their being a source of pests, suggests a strong affective relationship with the place that is the orchard for the organic growers. This reflects a lifestyle view of organic production: these growers do not seem to be motivated solely by premium prices. This lifestyle focus is also reflected in the problematic relationships the organic growers tend to have with their neighbours. They are different to other orchardists and this results in practical problems, with spray drift for example, and, possibly, some social isolation.

(ii) KiwiGreen Hayward

KiwiGreen Hayward orchardists are more like Organic Hayward orchardists than KiwiGreen Hort 16A orchardists. They note more features, more things to manage, and more management responses than KiwiGreen Hort 16A growers. In all feature categories their frequencies are closer to the Organic Hayward growers than to the KiwiGreen Hort 16A growers (see Table 3). It is possible this is simply because they

are growing the same crop, and so have similar timetables and issues. However, more KiwiGreen Hayward orchardists live on their properties than either Organic Hayward or KiwiGreen Hort 16A, and those respondents living on their orchards noted significantly more features and contextual aspects than those not living on the orchard (see Table 5).

Wind seems to be a significant problem for KiwiGreen Hayward growers. However, it is unclear from the data why this should be so. While shelter and issues which go with shelter such as shading and wind dumping are ubiquitous, KiwiGreen Hayward growers make some distinctive responses to wind using plant husbandry techniques to manipulate the crop size in particularly windy places. However, other problems with shelter are noted by KiwiGreen Hayward growers, including having to make trade-offs between adequate loading space and adequate shelter. Also, shelterbelts can trap cold air exacerbating frost risks, and the lower branches of shelter trees are pruned to allow cold air to drain through.

Armillaria is a problem but the most characteristic pests are definitely somewhat larger! Possums, hares, deer and wild pigs are problems and all are associated with proximate native bush. Presumably the KiwiGreen Hayward growers have more options at their disposal to deal with the insectivorous and microscopic pests than the Organic Hayward growers. In common with the Organic Hayward growers, the bush also has a positive aesthetic value, however.

For the KiwiGreen Hayward growers contoured (hilly) ground is problematic because of the difficulties caused for tractor work and spraying, and for fertiliser run off. Consequently fertiliser is applied in small, frequent dressings on contoured ground. Soil management varies from simple fertiliser application to the preparation of new orchard sites by deep tillage where the topsoil is removed, the subsoil broken up and then the top soil restored. This is usually associated with the application of fertilisers.

KiwiGreen Hayward growers have a utilitarian approach to living on their properties. Houses on the orchard increase the security of the property, discouraging trespassers. Building a house on the property also ensures 100 percent utilisation of the land, reflecting a functional, economic based view. An old packhouse may be converted to a house, further reflecting the optimisation of resources.

KiwiGreen Hayward growers seem to have quite neutral relationships with their neighbours. However, periurban development impacts unfavourably on orchard management. In this context growers see educating new neighbours about orcharding practice, and compatible behaviour, as a solution to these pressures

(iii) KiwiGreen Hort 16A

KiwiGreen Hort 16A respondents note fewer features, contextual aspects and management responses than KiwiGreen Hayward growers, and significantly fewer of all of them than Organic Hayward growers. This paints a picture of a simpler orchard, perhaps more focused on the economic priority of growing the primary crop. In part this apparent simplicity may be because the KiwiGreen Hort 16A orchards are often, more accurately, part of a larger orchard, or of a business which incorporates a number of orchards at different sites. In this way the KiwiGreen Hort 16A orchards are perhaps more strictly business units than are other production systems.

One apparent paradox in the results is that climate is talked about more by KiwiGreen Hort 16A growers than by growers from either of the other production systems, but frost protection talked about less, shelter about the same amount, and

irrigation (which usually doubles as frost protection), not at all. It appears that frost is a less important climatic consideration for the KiwiGreen Hort 16 growers than for the KiwiGreen Hayward growers; this is despite the fact that the Hort 16A vine flowers earlier than the Hayward vine and should, therefore, be more at risk of frosting. That having been said, the only grower to mention using a helicopter for frost protection was a KiwiGreen Hort 16A grower. One explanation could be that climate, through sunlight hours, is linked to dry matter production in kiwifruit fruit which is of increasing importance to the Hort 16A orchardist as their financial returns are going to be related to taste measurements.

A further impact of the delicate nature of the Hort 16A fruit is to be seen in the treatment of wind problems. Where the Hayward growers prune to allow for a loss of fruit to wind, Hort 16A growers are more concerned with protecting the vines, stressing the benefits of pergola supports over t-bar supports in windy places.

The impact of altitude is given more emphasis by the KiwiGreen Hort 16A growers, than the others. At altitude summers are cooler and rainfall is higher. This increases the need for accuracy in the timing of interventions. The higher rainfall to be had at altitude is usually good for the fruit, but heavy rain at the wrong time can cause splitting of the fruit. Varied microclimates within the orchard increase the challenge of growing the fruit.

Soil management is similar for KiwiGreen Hort 16A growers as for KiwiGreen Hayward growers. However, as the Hort 16A vine is so much more prolific than the Hayward vine it can be grown on poorer soil. When it does relatively poorly it is still more profitable than poorly performing Hayward vines.

Fewer Hort 16A growers live on their orchards that do KiwiGreen Hayward or Organic Hayward growers. This further underlines the characterisation of the Hort 16A orchards as being more strictly productionist than either of the Hayward production systems. The existence of a house on a property, on sub-dividable land, is a way of mitigating against economic risk. For those who do live on their orchards their neighbours provide positive social benefits, and in some instances, their shelterbelts are appreciated as an extra bonus.

Chapter 3

Sheep/beef Results

3.1 Sheep/beef farm sketch map analysis

The design of the ARGOS project for the Sheep/beef sector consists of 37 farms, three farms from each management system (organic, integrated and conventional) in each of 11 locations plus four in another location (organic, converting to organic, integrated, conventional). The 12 locations are spread throughout the South Island reaching from Marlborough in the north to Eastern Southland in the south.

As with the kiwifruit sector of the project, interviews were conducted with the farmers over the second half of the year 2004. Part of that interview consisted of the participants drawing a sketch or conceptual map of the things that were important to the management of the farm or impacted on their management. A total of 40 maps representing the 37 sheep/beef farms were analysed. These entailed 14 maps of 12 organic farms; 13 maps of conventional farms; 12 maps of integrated farms; and one map of a farm in the process of conversion to organic production. The reasons for the multiple maps were that on one organic farm, three family members each drew their own map, and one conventional farm entailed two separate blocks which were represented by separate maps. For the purposes of statistical analysis, the converting farm was included in the organic panel.

Unsurprisingly, given the much greater land area of the sheep/beef farms in comparison with the kiwifruit orchards, the sheep/beef maps were usually much more complex and often pictorially more interesting (see Appendix 2). A total of 567 features were identified in the process of content analysis, as opposed to 298 for the kiwifruit orchards. In the analysis of the kiwifruit orchards, idiosyncratic features (defined as occurring on only one map) were few and were eliminated from the analysis. However, in the sheep/beef maps idiosyncratic features were quite numerous, and these were included in the data as a group.

In as far as it was possible, the features of the sheep/beef maps were analysed in the same way as the kiwifruit maps. The features were first grouped into categories as shown in Table 6. From this it is apparent that three new categories have been added compared with the kiwifruit analysis – features to do with stock management, neighbouring buildings and miscellaneous. Stock management is an obvious addition! Neighbouring buildings were neighbourhood features such as churches and halls, typical of rural areas.

Table 6: List of sheep/beef categories and features

Categories	Features¹³
Spatial organisation	Blocks, boundaries, paddocks, fences, tracks, bridges (internal), grazing, organic, conventional and quarantine areas, reserves
Wind	Shelter trees, prevailing and problematic winds
Buildings	Houses, sheds, haybarns, parents' homes, power pylons, huts
Transport	Roads, driveways, airstrips, bridges (external)
Social context	Neighbours, visitors, forestry, dairy, reserve, gorse – neighbours, competitors, lifestyle blocks, customers, advisors, children, ram breeder
Other biota based activities	Crops, gorse hedges, forestry, trees - aesthetic
Landscape morphology	Slope, aspect, terraces, sea and beaches, cliffs, swamps, wetlands, flat land, slips, under-runners, tailings, peat
Climate	Weather
Water	Water sources, rivers, irrigation, lakes, ponds, water tanks, wells, water races, pumps, dams, rivers
Biotic context for management	Soils, bush, DDE levels, manuka/gorse, weeds, hares and rabbits
Stock management	Animals, laneways, sheep, cattle and stock yards, shearing and deer sheds, silage pits
Neighbouring buildings	Private businesses, churches, halls, schools
Miscellaneous	Bikes, seeds, limeworks, horse arena

The features were also grouped into the contextual aspects of the farm, and the management responses, as for the kiwifruit (see Table 7). The contextual aspects of the farm were defined as those features which were a given; the landscape and environmental factors out of the immediate control of the farmer which required, or impinged on, management. The management responses were defined as human actions or creations; things that were done or created in response to the wider environment. By having this grouping we wished to explore whether participants from different management systems noted the same things on their maps and in the transcripts which were outside their immediate control, and whether they had a similar array of responses within their management 'tool kit'.

¹³ Note: The order in which these features are presented mirrors that of the kiwifruit.

Table 7: Division of sheep/beef farm features into ‘contextual aspects’ and ‘management responses’

Contextual aspects of the farm	Management responses
Boundaries, prevailing and problematic winds, power pylons, roads, bridges (external), neighbours, visitors, forestry, dairy, reserve, and gorse neighbours, competitors, lifestyle blocks, customers, children, slope, aspect, terraces, sea and beaches, cliffs, swamps, wet lands, flat land, slips, under-runners, tailings, peat, weather, water sources, lakes, dams, rivers, soils, bush, DDE levels, manuka/gorse, weeds, hares and rabbits, animals, neighbouring buildings	Blocks, paddocks, fences, tracks, bridges (internal), grazing, organic, conventional and quarantine areas, reserves, shelter trees, houses, sheds, haybarns, parents’ homes, huts, airstrips, driveways, advisors, ram breeder, crops, gorse hedges, forestry, trees – aesthetic, irrigation, wells, water races, water tanks, ponds, pumps, dams, laneways, sheep, cattle and stock yards, shearing and deer sheds, silage pits

Table 8 presents the frequencies of these features and categories. As before in the kiwifruit results presentation, ‘M + T’ refers to the number of features both on the map and in the transcript. ‘T’ refers to the number of features in the transcript only – that is features not appearing on the map. ‘M+T’ was thought to be a better unit of analysis than ‘M’ only because the maps were being used as a tool to find out what was important to the participant for the management of the farm and so what they mentioned, even if it was not drawn on the map, was an answer to this question. Hence, the ‘T’ only data are likely to indicate what some participants found difficult to represent on a map.

Table 8: Frequency of sheep/beef map features¹⁴

Category	Organic (n=13)		Integrated (n=12)		Conventional (n=12)		Totals	
	M + T	T	M + T	T	M + T	T	M + T	T
Spatial organisation	44	17	36	12	42	21	122	50
Boundaries	11	0	11	0	11	2	33	2
Blocks	8	1	9	3	8	2	25	6
Paddocks	8	6	6	3	9	7	23	16
Fences	7	7	6	5	9	8	22	20
Tracks	3	2	3	0	4	2	10	4
Grazing	2	1	0	0	0	0	2	1
Other	5	0	1	1	1	0	7	1
Wind	11	3	11	4	15	5	37	12
Shelter trees	9	2	7	1	7	1	23	4
Problematic winds	2	1	4	3	5	3	11	7
Prevailing winds	0	0	0	0	3	1	3	1
Buildings	19	3	16	1	20	0	55	4
Houses	10	1	9	0	11	0	30	1
Other buildings	9	2	7	1	9	0	25	3
Transport	12	0	10	0	13	0	35	0
Roads	9	0	9	0	10	0	28	0
Airstrips	2	0	1	0	1	0	4	0
Bridges – external	1	0	0	0	1	0	2	0
Driveways	0	0	0	0	1	0	1	0

¹⁴ Features are ordered within categories by starting with the highest frequency of occurrence, so the order may differ from the similar table for the kiwifruit results.

Table 8 cont. Category	Organic (n=13)		Integrated (n=12)		Conventional (n=12)		Totals	
	M + T	T	M + T	T	M + T	T	M + T	T
Social context	8	6	13	5	9	6	29	17
Neighbours	2	2	6	5	8	6	16	13
Other	6	4	7	0	1	0	13	4
Other biota	11	2	10	7	16	7	37	16
Crops	4	2	5	5	5	4	14	11
Forestry	6	0	3	0	5	1	14	1
Trees – aesthetic	0	0	2	2	4	2	6	4
Gorse hedges	1	0	0	0	2	0	3	0
Landscape morphology	21	6	20	5	13	3	54	14
Slope – terrain	7	1	9	4	7	0	23	5
Wet land	3	1	2	0	3	2	8	3
Aspect	3	2	0	0	1	1	4	3
Other	8	2	9	1	2	0	19	3
Climate	4	3	5	4	2	1	11	8
Weather	4	3	5	4	2	1	11	8
Water	28	15	30	10	26	8	84	33
Rivers	8	1	7	1	6	0	21	2
Irrigation	5	5	6	1	5	1	16	7
Ponds	3	2	4	1	3	0	10	3
Pump	2	0	4	3	3	3	9	6
Water Sources	2	2	3	2	4	2	9	6
Dam	3	2	1	1	3	2	7	5
Well	2	2	2	1	1	0	5	3
Water races	2	1	1	0	1	0	4	1
Other	1	0	2	0	0	0	1	0
Biotic context	8	2	15	9	12	7	34	18
Soils	4	2	7	5	5	4	16	11
Bush	3	0	3	0	3	1	9	1
Manuka / gorse	0	0	2	2	3	2	5	4
Weeds	1	0	2	2	0	0	3	2
Other	0	0	1	0	1	0	1	0
Stock management	21	2	22	5	16	7	59	14
Stock yards	9	0	12	0	7	1	28	0
Shearing shed	6	0	3	0	7	2	16	0
Laneway	3	0	4	2	0	3	7	5
Animals	2	2	3	3	1	1	6	6
Silage pit	1	0	0	0	1	0	2	0
Neighbouring buildings	1	0	0	0	5	2	6	2
Other features	1	0	2	0	1	0	4	0
Contextual aspects	78	23	86	29	83	28	247	80
Management responses	111	36	102	22	108	39	321	97
Total features	189	59	188	51	191	67	568	177

3.2 Sheep/beef statistical analysis

The first interesting point to note about the sheep/beef data is that the distribution of the mean number of features is the reverse of that of the kiwifruit orchards. There the organic kiwifruit orchards as mapped appeared to be more complex places than those of the other production systems (see Table 3). In contrast, on the sheep/beef maps the mean number of features for the organic maps was 14.5, for integrated, 15.7 and for conventional 15.9 (Table 9).

Two-way ANOVAs were carried out on all the categories of grouped features from Tables 6 and 7 to see if there were any significant differences between production

systems. However, the only statistically significant difference between the production systems which could be determined was between integrated and organic with regard to the group of features called the 'Biotic context' (see Table 9). In this instance the mean features per organic map at 0.6 was significantly different ($p=0.04$) from the 1.3 per map for integrated. Organic participants did not feature manuka, gorse or weeds, and only four mentioned soils compared with seven integrated participants

Table 9: Two-way ANOVA results for means of contextual, management response and total features for maps (M) and transcripts (T) across farm types

Category	Organic (n=13)		Integrated (n=12)		Conventional (n=12)		Statistical significance	
	M + T	T	M + T	T	M + T	T	M + T	T
Contextual aspects	6.0	1.8	7.2	2.4	6.9	2.3	n.s.	n.s.
Management responses	8.3	2.8	8.3	1.8	8.9	3.3	n.s.	n.s.
Biotic context	0.6 ^a	0.2	1.3 ^b	4.3	1.0	0.6	'a' significantly different from 'b' ($p=0.04$)	not normally distributed
Total features	14.5	4.5	15.7	4.3	15.9	5.6	n.s.	n.s.

Note: The means presented here may sometimes differ a little from those obtained from Table 8 as the two-way ANOVA corrects these means for differences between locations because there were two organic farms at one of the locations instead of just one. This also accounts for the fact that the 'contextual aspects' and the 'management responses' do not always add up to the 'total features'.

What is particularly interesting in the overall data is that location does account for many significant differences in the numbers of features noted on the maps. The ARGOS design is robust and allows for an assessment of the effect of location on the results. Without this design, differences might have shown up between management systems that could have been confounded with the location. This shows that location is far more significant than the farm management system in explaining the number of features on the maps.

When considering the total numbers of features that participants drew on their map or mentioned in the transcripts while they were drawing their map, location does not have an overall significant effect as a factor in the ANOVA. This means that differences between the locations did not dominate, but within that factor there were many significant differences (at the 5% level) between some of the locations. For example, the lowest numbers of total features occurred on the maps of the farms in the Dunsandel-Leeston area, and this farm was significantly lower than the seven highest locations (see Table 10). Given the nature of the landscape in this area, a flat, Canterbury Plain's landscape, this is unsurprising. The highest number of features occurred on the maps of the farms in the Outram area, a hilly landscape extending over a wide range of altitudes and this location was significantly higher than the five lowest locations.

Table 10: Total features (map + transcript) - management system by location

Location	Total features (map + transcript)				
	Organic	Integrated	Conventional	Converting	Mean
Outram	16	27	20		21.0
Owaka	22	19	17		19.3
Ashburton	21	15	20		18.7
Waimate	14	20	20	17	17.8
Bank's Peninsula	19	19	14		17.3
Marlborough	16	12	23		17.0
Gore	11	13	19		14.3
Oamaru	14	14	12		13.3
Rakaia	11	8	20		13.0
Fairlie	12	24	3		13.0
North Canterbury	9	9	16		11.3
Leeston/Dunsandel	6	8	7		7.0
Mean	14.3	15.7	15.9	17.0	15.3

Note: the overall mean of organic does not quite match that shown above because the converting farm was included in the analysis as an organic farm.

In terms of contextual aspects of the farm requiring management, the locational pattern was slightly different compared to that for the 'total' features (see Table 11). In this case location was a significant factor overall, meaning that differences between the locations dominated this factor in the ANOVA. Again, maps of farms in the Dunsandel-Leeston area scored the lowest, and this location was significantly lower than all other locations, but the maps of Banks Peninsula farms, another hilly, complex landscape, scored the highest, and this was significantly higher than the eight lowest locations.

Table 11: Contextual aspects (map + transcript) - management system by location

Location	Contextual aspects of the farm that need to be managed					
	Organic	Integrated	Conventional	Converting	Mean	% of total
Bank's Peninsula	11	11	8		10.0	58
Marlborough	9	9	10		9.3	55
Outram	4	11	11		8.7	41
Owaka	7	9	10		8.7	45
Gore	7	7	8		7.3	51
Rakaia	7	4	8		6.3	48
Oamaru	5	7	6		6.0	45
Waimate	6	8	6	4	6.0	34
North Canterbury	5	5	6		5.3	47
Fairlie	6	9	2		5.7	44
Ashburton	4	4	6		4.7	25
Leeston/Dunsandel	3	2	2		2.3	33
Mean	6.2	7.2	6.9	4.0	6.7	44

In order to explore possible explanations of this finding a column was added to Table 11 showing the number of contextual aspect features on the map as a percentage of

the total number of features.¹⁵ In this column a value of 50 percent or more indicates a predominance of contextual aspect features over management response features to these facets of a farm, which indicates a dominance of the landscape morphology and biotic context. It is therefore fits that Banks Peninsula (58%) and Marlborough (55%) have the highest percentages, whereas the locations of Leeston/Dunsandel (33%), Ashburton (25%) and Waimate (34%) have the lowest. Leeston/Dunsandel and Ashburton are on the eastern side of the Canterbury Plains, a flat landscape. The Waimate result is more difficult to explain, but is remarkably consistent across the cluster (see Table 11).

In the examination of management responses (Table 12) location did not have a significant overall effect on the number of features noted but once more there were some significant individual differences. Again, the farms in the Dunsandel-Leeston area were the lowest but the Ashburton location was significantly higher than eight other locations. Overall, there is high variability within panels indicating highly individualised responses. The additional percentage column was also added and, of course, just reiterates the observations made in the previous paragraph. In this case results over 50 percent indicate the predominance of management responses to contextual aspects on the maps.

Table 12: Management responses (map + transcript) - management system by location

Location	Responses to contextual features of maps					% of total
	Organic	Integrated	Conventional	Converting	Mean	
Ashburton	17	11	14		14.0	75
Outram	13	16	9		12.7	59
Waimate	8	12	13	13	11.5	66
Owaka	15	10	7		10.7	55
Marlborough	7	2	13		7.3	44
Fairlie	6	15	1		7.3	56
Oamaru	9	7	6		7.3	55
Gore	4	6	11		7.0	49
Bank's Peninsula	8	6	6		6.7	42
Rakaia	4	4	12		6.7	52
North Canterbury	4	4	10		6.0	53
Leeston/Dunsandel	3	6	5		4.7	77
Mean	8.2	8.3	8.9	13	9.1	56

Individual features were cross tabulated with management systems to see if any significant relationships were apparent. As with the kiwifruit data, low numbers mean only tendencies can be mentioned and these cannot have any statistical significance attributed to them. Only organic farmers mention grazing, reserves and customers, and they were the only ones not to mention or mark manuka-gorse or trees (aesthetic). Only conventional farmers mentioned or marked the prevailing wind, churches and schools, and did not mention laneways, cattle yards and flat land. It is hard to imagine what might prompt these differences. Cross tabulations between management systems and the grouped idiosyncratic features failed to show any patterns to the idiosyncrasies.

¹⁵ For example, Marlborough had on average 9.3 contextual aspects out of a total of 17.0. So 9.3 represents 55% of the total features on the map.

Compared with the kiwifruit analysis, there was only one other factor of interest for crosstabulation.¹⁶ Sheep/beef farmers still tend to do most of their on-farm work and with one exception, all of those in the ARGOS project live on their farms. A one-way ANOVA was done to test for any link between the number of features and the number of people interviewed at a single interview. (Only five interviews in the sheep/beef cohort were with only one interviewee, and all of these were male). As with the kiwifruit interviews, and as common logic suggests, where there were two (or more) interviewees, more features were noted. This was not statistically significant, however, for any of the categories in Tables 6 and 7, but management responses, and spatial organisation features did have p values between 0.05 and 0.10.

When considering the features that appeared in the transcripts but were not drawn on the maps there are certain aspects that can probably be accounted for. For instance paddocks and fences are frequently mentioned but not drawn, probably because they are too detailed to fit onto a sketch map. Other features which could fit into this category are neighbours, crops, and some of the water features. Things that are difficult to draw could be wind and soils.

Overall this analysis suggests that for sheep/beef farming systems the impact of location plays a greater part in farm management than a particular production system.

3.3 Sheep/beef qualitative analysis

3.3.1 Spatial organisation

- (i) Boundaries (31 maps, 23 transcripts)¹⁷ (11, 11, 11)¹⁸

Boundaries were the most commonly noted feature for all production types. In fact, in one instance they were practically the only thing noted! (See Figure 4.) However, Figure 4 emphasises that though this map may appear simple, the boundaries were important to this farmer because of the neighbours, because a major road runs through his property and because of the altitude of the upper boundary meaning that snow was more likely to fall there.

Boundaries were described by one integrated farmer as being the limit of what they own and administer. However, boundaries are not simply abstractions. As a conventional farmer noted, their boundary with their neighbour passes through a block of bush and that a 30 metre wide strip of the bush has been cleared, making the boundary a clear, physical feature in this area. Another conventional farmer considered they were very lucky to have road and river boundaries because that meant they have “good, solid, well defined boundaries”. An organic farmer conflated boundaries with boundary fences, noting that all the fences on the farm were in good condition except the boundaries, further underlining that boundaries have a physical reality, in this case being marked by a fence, beyond their legal or cartographic status.

¹⁶ Living on or off the property was not a relevant factor for the sheep/beef farmers compared to the kiwifruit orchardists, as all lived on their farms.

¹⁷ As in the kiwifruit section of this report these numbers refer to the frequency of occurrence of this feature on a map and/or in the interview transcript. (It may be that it appears in both.)

¹⁸ The number of times this feature was drawn on the map and/or mentioned in the transcript for each of the management systems under study – organic, integrated and conventional, in that order.

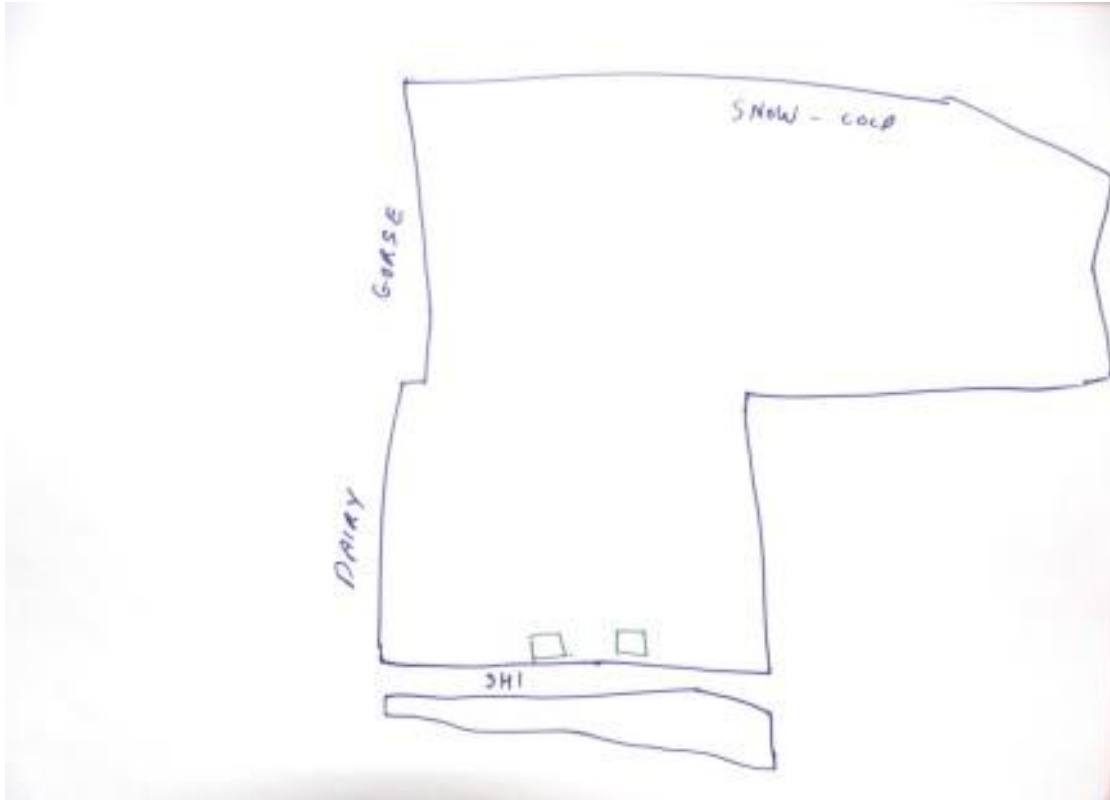


Figure 4: A map with boundaries as the only important features

(ii) Blocks (18 maps, 19 transcripts) (8, 9, 8)

The term 'block' had several distinct meanings within the transcript data. In one instance 'block' was clearly synonymous with an area possibly containing one or more paddocks. One of the organic farming couples referred to their daughter calling "this the home block" and another area "not top block". A second use of the term 'block' was specifically to refer to forestry plantations. They were "blocks of trees", and in this instance had similarities with a paddock in that they were enclosed and a subset of the larger farm.

However, in most instances a 'block' was clearly a substantial spatial unit, and probably a legal entity. For example, an organic farming couple referred to their farm as being in two blocks - the "home block" and the "other block", an integrated farming couple to "Mum and Dad's block" and the "top block", while a conventional farming couple to the "home block" and "out the back". From the map of the latter couple it could be seen that the farm was in two pieces with access between the two being across the neighbour's property. It was more common, however, for these blocks to be separated by a roadway, as was the case for the first two.

A complication, however, is that it seems to be possible to have a farm and a block. One conventional farming couple had a farm, and a hill block, for example. An integrated farmer referred to their whole farm having been a "run block" which was grazed but largely unimproved. This leads me to speculate that a distinction may be that a farm has a home, but a block does not. Complicating this further is the case of an organic farming couple who farmed on a number of sites which were widely dispersed and which they referred to consistently as farms. It may also be the case that for land to be a 'block', as opposed to a farm in its own right, it must be proximate to the other blocks, and perhaps similar in character.

(iii) Paddocks (8 maps, 23 transcripts) (8, 6, 9)

The material relating to paddocks mainly referred to the size or number of paddocks; to the reasons for their size or layout; and to the paddocks' names. Clearly the number of paddocks on a farm is likely to have some relationship with the land area of the farm. However, there is a clear tendency, overall, to reduce paddock size, which, of course, increases paddock numbers. An organic farmer said they had one hundred and five paddocks of six to eight hectares in area. Another organic farming couple had cut down the size of their paddocks and now most of them were between four to eight hectares in area. The reason for smaller paddocks being desirable was characterised by another organic farmer as allowing "controlled starvation". The need for a "good number" of paddocks was explained by another organic farmer as being because they have "three classes of animals", sheep, cattle and deer. A further organic farming woman explained the trend to smaller paddocks as a means of making it "just much easier to control your grass - you can have better quality grass, your sheep are in there and then out again". A conventional farming couple, on the other hand, recounted that their farm consultant thought they had too many paddocks, although they did not explain why.

Paddock shape and dimensions were determined according to a number of criteria. An integrated farmer noted that the positioning of fence lines was determined by the need of stock to be able to gain shelter. For an organic farming couple, who had a farm on hilly land, it meant that their desire to reduce paddock size was something which would have to be done very carefully so as to ensure stock shelter was maintained. This was clearly not a relevant consideration on flat land, where paddocks tended to be laid out in a grid pattern. Another major consideration for paddock layout was irrigation. One integrated farmer had 40 hectares divided into bull paddocks, 100 metres wide by 600 metres long. These figures were the width and run, respectively, of their irrigator. Further, as pointed out by an organic farmer, the necessity of getting water to each paddock puts limitations on the size and shape of them also.

A number of respondents talked at some length about the names given to their paddocks. These names fell into two groupings, those which reflected some sort of attribute of the paddock itself, and those which reflected some social association. Thus one integrated farming couple spoke of a paddock they called the "golf course" because of its smooth surface. An organic couple spoke of paddocks named after people, for example "Kirsty's". Their first farm had all been named when they purchased it with the names written on the map. When they bought more land, they named the paddocks after members of the family who had lent them the money to purchase the farm, their neighbours and so on. One woman mentioned "rocky one, two, three and four" which the man pointed out had probably been one paddock that had been divided into four at some point. Thus, the paddock names had rich associations which had historical, as well as spatial, social and environmental aspects.

Whilst the practice of naming individual paddocks was clearly a demonstration of affective ties with the land, there were practical reasons for doing so also. One organic couple "were a bit rushed" when they named their paddocks soon after purchasing their property, but found it necessary to do so to enable them to discuss their plans for the property: "... where we're going to put stock, what paddocks we're going to work up - all that carry on".

(iv) Fences (2 maps, 22 transcripts) (7, 6, 9)

Clearly fences are features which are closely related to paddocks. As noted above, paddock layout or design was strongly influenced by the optimum placement of fences for ease of construction, and to ensure stock were able to gain optimum natural shelter. An integrated farmer, for example, said the placement of some of their fence lines was determined by the way snow settled on their land. However, fences were related to other features, and served other purposes, also. One organic farming couple spoke of installing deer fencing on their property. They took the opportunity to place the deer fencing four metres inside their boundaries, and to plant trees for shelter in the space left between them. An integrated farmer stressed the need for good fences to establish shelterbelts, while an organic farmer had a double fence line between them and their conventional dairying neighbours, to protect against contamination.

(v) Tracks (6 maps, 7 transcripts) (3, 3, 4)

Tracks provided access through the farm. They differed from 'laneways' (see below) in that tracks pass through paddocks, whereas laneways are fenced off from paddocks. Tracks were reported on farms from the hillier areas: Owaka, Outram, Fairlie, Waimate, and Gore. Laneways were reported on farms from Waimate, Ashburton, Rakaia, and, interestingly, from two of the Outram farms as well. It would seem that topography and the consequent constraints on the layout of paddocks and fence lines, and the movement of stock, determines which is more feasible. Tracks can be quite significant constructions in themselves. One organic farming couple had recently upgraded their farm track for safety reasons and the woman commented "it looks like a state highway [laughs] - cost as much as one."

(vi) Grazing (1 map, 2 transcripts) (2, 0, 0)

The striking thing about the material relating to 'grazing' is how little there was of it, either on the maps or in the transcripts relating to the maps. Clearly for these farmers grazing was ubiquitous. Those mentions which were made suggest that the areas marked 'gazing' on the maps were those which were only grazed (rather than being reserved for grazing), and those which were too steep to be cultivable, and were thus mono-purpose by default.

3.3.2 Wind

(i) Shelter trees (19 maps, 22 transcripts) (9, 7, 7)

Shelterbelts were a common and clearly important feature for many respondents. The material on shelter contained a strong aesthetic element both on a broader scale and in terms of the species used, while, of course, shelter trees were obviously intended to provide protection from wind. Like the kiwifruit there was also talk about the other animals that inhabited them and the problems they caused, and whereas the kiwifruit orchardists talked about the micro-climates created on their orchards, the sheep/beef farmers talked about the broader climatic effects of shelter.

Shelter as protection from the wind had a number of aspects to it. Several respondents mentioned the importance of shelter at lambing time, and for most the problem was cold southerly winds (one organic, two integrated) but for one conventional farmer it was the nor'wester. More general protection for stock from cold southerly and sou'westerly winds was also mentioned by several respondents (two integrated and one conventional). Protection from cold winds was important for

one conventional farmer to protect sheep during pre-lamb shearing, and for another who did winter shearing. An integrated farmer said that the shelter provided some protection for crops as well as for stock. An organic farm was protected from its neighbour's spray drift by their boundary shelter. One organic farming couple were planning on planting more shelterbelts in order to create a quarantine area on their property. For an integrated farming couple shelter was necessary to provide their cattle with shade in the summer.

A wide range of species of trees were used for shelter planting. An organic farmer used "big old pine shelter hedges" that had been planted by his father. Another organic farmer relied on their neighbours' trees for shelter. One integrated farming couple had planted a wide range of species including poplars, eucalyptus, larch and pittosporums. Pines would grow in their environment, but were regarded as too susceptible to snow damage to be desirable. One conventional farmer had toitoti shelterbelts "for the mothers to take their babies in", while another had planted pine, Oregon and eucalyptus.

There are a number of problems associated with shelterbelts. One organic farming couple expressed concern at the removal of shelterbelts in the area to facilitate irrigation. The male partner said that if they got a snow fall like that of 1992 "there'll be thousands and thousands of dead cows out in places like Dunsandel". An integrated farmer noted that the placement of a new shelterbelt meant that sheep behaviour had changed and that this might necessitate a new fence. Another integrated farming couple had problems with hares and rabbits nipping the tops off their newly planted trees. They were planting trees treated with repellent in the hope of overcoming this. A conventional farmer said that they wanted to put in more shelterbelts but that they 'create a lot of work with trimming and forming into fences". Both a conventional farmer and an integrated farmer who ran a mixed cropping and sheep/beef operation, commented that shelterbelts provided nesting sites for birds which was a problem around harvest time, the conventional farmer feeling that trimmed hedges were less hospitable for birds than "bushy type trees".

Shelterbelts and shelter trees were not simply functional aspects of the farm, nor was their management entirely dictated by functional reasons. One conventional farming couple were planting "more ornamental" species, for example red alders, around their home and along their road frontage. The man said he liked "true shelterbelts" on the farm by which he meant neatly trimmed hedges. He had a programme of tidying up the hedges on the farm and getting rid of the "very out of control" trees. His comment above about birds not withstanding, this still demonstrates an aesthetic of neatness, rather than pure pragmatism. Other respondents remarked on their shelterbelts being pretty (organic) and about being excited now their shelter trees looked like poplars rather than sticks in the ground (conventional farming woman).

(ii) Problematic and prevailing wind (4 maps, 13 transcripts) (2, 4, 8)

Data about problematic and prevailing winds have been combined as, while prevailing winds have been reported, little was actually said about them, save that they had an impact on stock placement in winter (conventional farming woman). Opinion was fairly evenly divided over southerly and south westerly winds, and nor'westerly winds as problematic. Unsurprisingly, variations in these opinions seem to be related to the different geographic areas respondents came from. Respondents reporting southerly winds as problematic came from Marlborough, Outram, Owaka, Oamaru, and Waimate. These winds were described as a problem at lambing by one integrated farmer and "A killer here in springtime" by a conventional farmer. Respondents who reported the nor'westers as problematic came from Marlborough,

North Canterbury, Rakaia, Ashburton and Outram. An organic farmer characterised these winds as "... shrivelling up nor'westers". One conventional farmer mentioned that the nor'westers could actually blow lambs away from their mothers.

3.3.3 Buildings

A wide range of buildings existed on the farms. However, aside from noting them, little was said about them. Such buildings included: sheds, workshops, haybarns, grainsheds, haysheds, implement sheds and machinery sheds. In one instance these included a hut, as yet un-built, which was to provide a bush surrounded retreat for "just somewhere you could go to just get out of it for a day or two" (conventional male farmer).

(i) Houses (29 maps, 22 transcripts) (10, 9, 11)

Twenty nine out of 37 respondents clearly noted a house on their map, and a further respondent spoke about it only. Often it was the female partner who made sure the house was drawn on the map. For example, Figure 4 was drawn by the male farmer and when his wife saw the map later she noticed that he had not drawn a house so she added the two houses, one being where her husband's parents lived. A number of maps, in fact, showed more than one house on the property. Three patterns of talk about these houses were evident. The first was the importance, or value, of having the house at the centre of the farm. Where the house was central it was usually associated with other buildings and stock yards, making it part of a working hub. One organic farmer went as far as to declare that "the most important factor is the house on the farm placed in a very strategic place". He carried on by saying that two thirds of the farm was visible from the house, enabling rapid intervention should a problem be evident.

A second strand in the talk about houses related to the expense of the house. One woman (integrated) said of her husband, "He keeps going on about the money, [about] how much the house costs [but it is] a fraction of the irrigation". A conventional farmer said "we are sort of viewing anything we do on the house as a capital investment". Because of the sort of house it was, he felt that the money was as well spent on it as on the farm itself. Another conventional farming couple had a new house and to get it had "stretched ourselves quite majorly". Second houses on properties were sometimes sold off, sometimes rented out, and also used to accommodate staff.

The third strand in the talk about houses related to the house as a home and an aesthetic environment. This was sometimes done to justify the expense of construction. One woman (integrated) said of their house that "children in their own rooms, make for a peaceful life". Another integrated farming woman noted a "lovely green area" around their house. One conventional farming couple were planning to plant natives around their house, along with other plants, to attract birds. For one conventional farming man, building their new house was justified as they wanted a family farm while the family was still there. He noted that business people in town had nice houses separate from their businesses, but farmers "put up with average houses". They decided "that this is our home, it's the base for our business, it's everything for us - so we set to and did it anyway".

- (ii) Parents' home (3 maps, 1 transcript) (1, 1, 1)

One conventional farming couple noted their parents' house on their farm. The parents' proximity meant that the father can continue to do maintenance on the farm and look after the farm so that their family can take holidays.

3.3.4 Transport

- (i) Roads (28 maps, 22 transcripts) (9, 9, 10)

One of the striking features of the farm maps was that 23 of the 37 farms were either bisected by a public road, or existed at more than one site. With this in mind, it is surprising that the respondents did not have more to say about them than they did. A young male organic farmer felt the road bisecting their farm "with all the tourists and stuff - that's a pretty big constraint" but his father thought only "possibly" and his mother, that it depended on how much of a hurry you were in! A conventional farmer also found that increasing tourist traffic on the main road, which bisected their farm, was problematic. For another conventional farmer the road was a problem but more for the bridge discussed above, than for the road itself. An integrated farming couple found being bisected by a road problematic because of the difficulties logging trucks pose when moving stock. Another integrated farming couple had a former public road running through their property which they used as a laneway.

In most instances the roads were part of the broader spatial organisation of the farm and were strongly associated with boundaries and with shelter. In many instances they were the first feature drawn. However, they were more than simply landscape features being described as "really important ... access, transport and all that sort of stuff" by one integrated farming woman. For another conventional farming woman having a significant road boundary was considered to be good because, "Well, we don't have issues with neighbouring stock and things like that. We've got good, solid, well defined boundaries".

- (ii) Airstrip (4 maps, 4 transcripts) (2, 1, 2)

Four farms, all in hilly areas, mentioned having an airstrip. An organic farmer noted that theirs used to be used by the whole community but this could not be done now because of their organic status.

- (iii) Bridge (external) (2 maps, 2 transcripts) (1, 0, 1)

Bridges external to the property were noted in two cases. In one the bridge was simply a local landscape feature. In the other instance the bridge created a traffic hazard when moving stock along the roadway, an activity necessitated by the property being bisected by a major water-race.

- (iv) Driveways (1 map, 0 transcripts) (0, 0, 1)

Almost nothing was said about driveways, probably indicating their "taken-for-granted-ness".

3.3.5 Social context

- (i) Neighbours (3 maps, 16 transcripts) (2, 6, 8)

The major component that reflected the social context was the references to neighbours. Perhaps the most striking thing about the comments made was that

most show neighbours as undesirable and the cause of problems. In part this may be a reflection of a very pragmatic take on the issue stimulated by the mapping process. Respondents were asked to note things that impacted on their management so for many warm social relationships may have existed but were not considered relevant. An integrated farmer went as far as saying they were “very lucky” to have so few neighbours and a conventional farmer also relished only having one farming neighbour. For both of them the advantages were to do with stock management. In the first instance it meant that they had no problem with “stock going through the fences” and, in the latter, the absence of vectors for lice. Other problems caused by neighbours were similarly pragmatic: poor gorse control, possums, loss of shelter from tree felling, and difficulties caused by an easement over the farm to provide water to lifestyle blocks. In addition, one organic farmer had problems with spray drift from their neighbour spraying gorse, and runoff from their neighbour’s dairy operation. One comment in a positive vein regarding neighbours, related to the usefulness of the neighbour’s shelter.

(ii) Others (10 maps, 4 transcripts) (6, 7, 1)

However, it is in regard to the broader social context that the most striking difference between the panels arose. Three of the organic maps included notes which reflected a sense of connectedness with a broader social world in a different way from that demonstrated by any respondents from the other panels. One produced a conceptual map which included reference to school visits, training, volunteers, students and employment. A second noted on their map a number of challenges they faced. One was to “... capitalise on what we have done, by not being miserable, by still being generous”. Another challenge was “... not to burn people out”. The third noted on their map that “... sharing the benefits of the farm with others” was important. All of these statements clearly situated the farm in a broad social context. Further, the first noted that they saw their customers as a key part of the farm system, and, in fact, had a strong practical relationship with them having borrowed the money to build a flour mill from customers to whom they now sell biodynamic flours. The second complained that there was a withholding of information between growers, when they considered there should be more sharing.

In contrast, while two conventional farmers mentioned social networks (one commenting that they were part of a little community, and the second that their focus was eight kilometres away where the shops, doctor, school and so on were located), these social networks had a strong spatial aspect. The networks linked people as a community simply because they were physically close together. The statements of the organic farmers, however, indicated a sense of belonging to a much more dispersed social context, one which might be related by interest, but which was not contained in a particular geographical area. Whilst not characteristic of the organic farmers interviewed as a group, these statements were distinctive and distinguished their originators from those of the other production systems.

3.3.6 Other biota

(i) Crops (3 maps, 14 transcripts) (4, 5, 5)

Some of the ARGOS sheep/beef farms could more accurately be described as cropping or arable farms. As a consequence, the range of crops reported was extremely wide, particularly so for the organic farmers. One organic farmer mentioned growing vegetables and vegetable seed, while another couple grow a range of grains. Another grew organic linseed which the man described as not the “hugest yielder” but it “... crops very well in the dry” and it was “... commanding very

good prices at the moment”. Yet another mentioned growing clover and potatoes.¹⁹ One integrated farmer mentioned kale and lucerne and another grew rape. One of the conventional farmers grew lucerne and made baleage, while another grew a range of grains, grass seed, oil producing crops and vegetables.

Crops were clearly organised and limited by spatial and biophysical factors. An organic farmer would have liked to do more cropping but “the land simply won’t sustain it” whereas another had a “cropping zone” and had looked at finding more land to grow linseed elsewhere. One integrated farmer grew crops on their better soil, and a conventional farmer grew crops mainly on their irrigable land and noted that they did not get the same results on the “dry land”.

The number of crops possible per year and the process of succession and rotation were variable depending on the crop. An organic farmer noted that growing linseed meant “... you’re committed to a full year rotation”, while another made the point that planning was crucial, and pointed out, for example, that you can not grow potatoes after clover. One conventional farming couple did some double cropping, growing winter feed for their bulls on land they had already harvested.

(ii) Forestry (13 maps, 12 transcripts) (6, 3, 5)

The practice of planting forestry blocks was common to all three production systems. It was not evenly spread across the geographical locations, however, there being no forestry reported on the Canterbury plains sites of Leeston/Dunsandel, Rakaia, or Ashburton. At the other extreme, all four farms in the Waimate area reported some forestry. It is likely that there is a relationship between topography, the potential or otherwise for alternative uses, and the venture into forestry.

Two species were mentioned in regard to forestry, *Pinus radiata* and *Pseudotsuga menziesii*. However, the plots were referred to as “pine plantations”, “tree blocks”, “tree plots”, “the retirement fund”, and “our little nest egg”. Clearly these trees were planted with a view to the longer term. Short term uses for these blocks existed and included spring shelter for calving cows, and shelter for pre-lamb shearing.

That these excursions into forestry were, to a degree, speculative was clear from some of the comments made about them. One integrated farmer said that his tree plots were “hopefully” a commercial venture: “We’re gonna retire on those. We’re gonna make a fortune. Otherwise it’s providing firewood”. Another couple (conventional) said they had planted their trees for their children’s education but the male partner described it as a “very speculative forest” and went on to describe it as “just a big shelterbelt”. Another conventional farming couple could not remember how long ago their trees had been planted.

(iii) Trees (aesthetic) (2 maps, 6 transcripts) (0, 2, 4)

Trees planted for pragmatic reasons were clearly appreciated for their aesthetic appeal, but trees were also planted for aesthetic reasons. Interestingly, however, no organic farmers reported either. One conventional farmer had excavated duck ponds for shooting and had planted them with willows and poplars which his female partner described as “really nice now” and “a wee dream”. Another conventional farmer was planting red alders (*Alnus rubra*) and other “more ornamental” species around their living area while yet another wanted to plant native trees to attract birds, but also

¹⁹ A full list is not given here because what organic farmers grow is often commercially sensitive and may also involve other partners in the business.

wanted to plant other ornamental species. Interestingly, the female partner of the latter said this was "... not management, that's just aesthetic".

3.3.7 Landscape morphology

While a wide range of morphological features were reported or recorded, most of these were noted in a purely descriptive manner. Thus the proximity to the sea and the presence of terraces, cliffs, slips, under-runners, and mine tailings on the property, could be seen as localised characteristics of the place which, to a great degree at least, are taken for granted landscape features. However, some aspects of landscape morphology were associated with complex responses and these are reported below.

(i) Slope / terrain (19 maps, 21 transcripts) (7, 9, 7)

Farms were commonly divided into flats, downs and hills and these areas clearly had different uses and associations and were valued differently by their owners. Flat land was both more readily cultivated and more readily irrigated, if only because of the ease of moving and siting irrigators. Hilly land was predominantly used for grazing and was generally less desirable, but this depended on its steepness and altitude. Being able to drive a car over the land was noted by one organic and one integrated farmer as an indication of it being quality hill land; "rolling hills" in the first instance and ridges which made up "very easy country" in the second.

Excessive steepness was problematic for a number of reasons. Steep land was not cultivable, and thus it was used for grazing. Steepness also impacted on the ability to develop the land. Development meant maintaining the clearance of scrub as well as ongoing pasture improvement. Access to steep land was problematic, particularly when wet and, in association with high altitude, in snow. An integrated male participant reported that the combination of bad weather and steepness had prevented him from feeding out, and caused problems for lambing two or three times in the past ten years, with snow once preventing access to part of his farm for a full six weeks. For a conventional farming couple the problems associated with higher land prompted them to sell it so they had more to invest in their better, lower ground.

Hills and altitude were not simply management problems, however. One integrated male farmer described the view from the top of the property as "million dollar", "absolutely amazing" and "fantastic". Another organic male farmer said of their property, "I particularly like the contour of the property. Rolling hills", and both he and his wife commented on the "lovely views" they had. Another integrated farming couple had two separate blocks, one of which was hilly. When asked what they liked about this property the woman said, "Everything", with which the man agreed and qualified, "Oh, it's something about the hills - peaceful and quiet". He continued to say that he enjoyed walking in the hills; that it was "just a nice place to be"; and that it offered "solitude and quiet". He characterised the two parts of their operation as, "Here it's intensive, up there it's extensive". Clearly hill country was managed differently to flat land, but the hills can also add to the quality of life of its owners.

Hilly land was regularly contrasted with flat land, or "flats". Most respondents did not explicitly evaluate the presence or otherwise of flat land. For example, one integrated male farmer described his farm as, "It's all the same. It's all flat. It's all easy". Other than this the suggestion that flat land was more desirable than hilly land is a deduction made from the tone of the discussion, rather than explicit statements. It was clear, from both the maps and the transcripts however, that flat land was more easily cultivable and irrigable which made it more versatile in its potential uses.

(ii) Wet land (5 maps, 8 transcripts) (3, 2, 3)

Some discernible, qualitative difference existed between the organic panel and the integrated and conventional panels with regard to wet land. The references in the organic transcripts were cursory, but significant. An organic farmer described how they used the damp hollows for growing their lucerne crop, suggesting an adaptation of farm practice to subtle morphological features. Another organic farmer described a group of ponds as natural and part of a system of springs. They noted these on their map as a “wetland”.

The comments of both the integrated and conventional respondents, in regard to wet land, can be divided into three types. The first was the more descriptive group of statements, referring to particular areas being wet or boggy. This was expanded on to the extent of pointing out the constraints this imposed, in particular in necessitating them as farmers having to avoid putting cattle on this land (two conventional farmers), and having to lamb elsewhere to avoid lambs being born into puddles, if the spring was wet.

The second group of comments expressed highly interventionist approaches to wet land. A conventional farmer had excavated the wet parts of his farm to make duck ponds. When speaking of one of these he said, “It was a big wet area and it was a matter of either draining it or flooding it”. While the duck ponds were intended for duck shooting, when referring to this particular pond both the man and the woman mentioned planting willows and other trees around it when replacing the previous vegetation which was “just rushes”. Another pond on the farm was described by the woman as “a wee dream” and by the man as “quite a wetland really”. The transformation of ‘wet land’, by excavating and the planting of exotic species, into a ‘wetland’ is consistent with a view of ‘man’ having the power to improve on nature. The aesthetic importance of the “improvements” is also of note. One integrated farmer talked disparagingly about the practice of using diggers to drain boggy gullies. This, he considered to be too interventionist. His approach, which he clearly saw as less interventionist, was to dam the gullies and turn the bogs into ponds. This could include fencing them off and planting trees.

The third group of comments related to the value of wetlands, as opposed to wet land. In response to being asked by one integrated farming woman why she was doing the interview, the interviewer said that “we’re looking at sustainable land use basically”. The male of the couple responded to this with, “We do have two wetlands on the farm”, suggesting a conceptual link between ‘sustainability’ and ‘wetlands’. This type of link is underlined further by an anecdote discussed by this couple regarding the application of a proposed District Plan to their property. They noted that they had “quite a wet piece” of land. The woman recounted that they had asked someone from the Regional Council about it and that he had said “... it was of no environmental use”, described it as “a waste of their ground”, and suggested that they drain it. The District Plan, however, required the protection of ‘wetlands’ and this, they claimed, was in direct contradiction to the advice they had already received. Wetlands were of environmental significance, but not of productive use.

(iii) Aspect (1 maps, 6 transcripts) (3, 2, 1)

The complexity of farm landscapes impacts on the assessment of the significance of aspect as a morphological feature. Few farms which are not flat could claim to have “an aspect”; rather areas with varying aspects. “Lying to the sun” was described as being “good and bad” by an organic farmer. It was good in that “it warms up and

grows grass sooner”. However, a northerly aspect made the land more prone to being dry. A conventional farmer said that lying to the east was the most desirable because “it’s away from the weather, the cold southerlies and ... the north drying sun”. They intended to further develop their easterly lying land aiming to double its carrying capacity.

3.3.8 Climate - weather

(3 maps, 10 transcripts) (4, 5, 2)

While weather was noted as an important feature by a small number of respondents, comments made about it related closely to geography. Both the organic and integrated farmers from North Canterbury commented on the cool winters and the propensity for summer drought. The integrated farmer from Banks Peninsula found snow, wind and rain during lambing particularly problematic and it was clear that these problems were related to altitude, and that some topography, in particular gullies and steep slopes could exacerbate the impacts of the weather. The organic respondent from Rakaia reported that they get reliable rain but they do get snow, and one of the organic respondents from Waimate said that drought was a problem.

3.3.9 Water

(i) Rivers (18 maps, 16 transcripts) (8, 7, 6)

Rivers, creeks and streams were commonly mentioned and recorded across all production types. Again, geographical factors seemed to play a much more significant role in the importance of these waterways than the production system. All three properties in Marlborough, Owaka, and Outram mentioned rivers, creeks or streams. In most instances the rivers were not characterised in any way, they were simply landscape features. However, when they were characterised it was either because their flow was highly seasonal; they sometimes flooded; they provided fish and wildlife; they provided water; they ensured longer grazing in proximate areas when the weather was dry; and, in one instance a river provided an aesthetic value and was described as “quite picturesque” (conventional).

(ii) Irrigation (9 maps, 16 transcripts) (5, 6, 5)

The most striking feature of the data on irrigation, was that mentions of it were entirely absent from all of the Southland and Otago farms, but were reasonably evenly distributed across all three production types in Canterbury and Marlborough. This geographic distribution most likely relates to varying combinations of topography, climate and the availability of water, which all impact on the range of production opportunities.

Four organic farmers discussed irrigation. Three of them rely on irrigation to make their cropping venture viable. One of these, whose map was entirely conceptual, commented that irrigation was central, underlining its importance to their operation. They also stressed, however, that they would not use irrigation to grow grass “... unless it’s an absolute emergency”. The fourth organic farmer distinguished himself from all other respondents by describing himself as “... not a big fan of irrigation”. He said there were various ecological reasons for this, but he did not elaborate on them but did say he would use irrigation if it meant the difference between finishing a paddock of green feed and the total failure of the crop. They did report an area of irrigated land on their map, however.

All of the conventional farmers who used irrigation did so to support their cropping activities. One of these farmers stressed its importance in this regard describing irrigation management as crucial. He said, "Irrigation is the key". In contrast to the others, three of the four integrated farmers who reported using irrigation used it to support their livestock production.

Pivots, booms and sprinkler systems were used by all production systems, and there was no mention of border dyke irrigation at all. The design of the irrigation systems, and the spatial layout of the farm to facilitate the use of this equipment, were important processes. An organic farming couple divided their property into ten hectare paddocks to enable irrigation. Removing some trees had been necessary also. One integrated farmer had laid out specialist bull paddocks, the dimensions of which were set to fit the width and run of the irrigator. Another integrated farming couple had undertaken "a major reconstruction of the whole place" to facilitate irrigation and had irrigated the entire farm so as "to produce 100%".

Not all mentions of irrigation were about its use, however. One conventional farm was bisected by a diversion race, nonetheless its owners were unable to access water for irrigation. An integrated farmer commented that not irrigating had the advantage, for them, of enabling them to take the holidays they want.

(iii) Ponds (7 maps, 8 transcripts) (3, 4, 3)

It is interesting to ponder the distinction between 'ponds' and 'dams' (see below). It would seem that both were substantially artificial. However, ponds seemed to have a broader range of functions than dams, including stock water, irrigation and duck shooting. They also seemed to have an aesthetic function, often having trees planted in close proximity.

(iv) Water sources (3 maps, 7 transcripts) (2, 3, 4)

A range of water sources were mentioned. These included water schemes, dams, creeks, rivers, a lake and ground water supplies, both springs and bores.

(v) Pumps (3 maps, 7 transcripts) (2, 4, 3)

A number of respondents commented on the use of pumps to extract water for irrigation. Both diesel and electric pumps were used, taking water from wells, rivers, streams and dams. An integrated farmer talked of burning out a \$35,000 pump when a well ran dry.

(vi) Dams (2 maps, 6 transcripts) (3, 1, 3)

Dams were used as a means of storing water for both irrigation and stock. The sources of water for these dams included springs and water pumped from other sources.

(vii) Wells (2 maps, 4 transcripts) (2, 2, 1)

Wells were used as a source of water for irrigation.

(viii) Water races (3 maps, 4 transcripts) (2, 1, 1)

Water races were a further source of water for irrigation.

3.3.10 Biotic context

- (i) Soils (5 maps, 16 transcripts) (4, 7, 5)

There was clearly a strong sense of agreement across all three panels about the importance of the soil to productivity. This can be summed up in the statement made by an integrated farmer who said, “Everything revolves around the ground - the dirt - what you put in from year to year ...”. Soil types were generally divided into “heavy” clay based soils and “light” silt based soils. Both had benefits and constraints, but, apart from the problems of cattle on heavy soils when the soils were wet, these problems were not detailed clearly. One organic farmer complained that their heavy soils were a constraint on growing carrots, “But we actually learn a lot by growing on difficult land so [when] you can go into some suitable land it seems quite easy”. He went on to say that this learning was transferred to other situations.

Soil was managed in a number of ways. One organic farmer grew manure crops to benefit the soil. An integrated farmer managed soil health by crop rotation, growing maize for cattle feed and replacing the lost nutrients by getting “a lot of cow manure from five star beef”. He also spread compost on two or three paddocks every year (recently at the rate of 25 tonnes per hectare) and used fertilisers. The conventional farmers who mentioned soils had much less to say about its management, save that cattle do “too much pasture damage to the soil” (conventional), and that a “better fertiliser program” on an area will “sweeten it up”.

Two integrated farmers cautioned about chemical use. One of them said, “I’m not organic but I don’t like using nitrogen too much. I won’t put nitrogen on”. He gave a number of reasons for this, implying that it costs too much (“huge amount of inputs”); its impact was too short term; and if the weather was too dry most of it was lost to the system. He tried to breed animals that can thrive on the property as it is. The other farmer expressed concern when he said that it was necessary to “be careful that you don’t put something in that you’re going to contaminate, the next crop or the crops down the road”.

A conventional farming couple had problems in this vein, with high levels of DDE in the soil in some areas of their property. This meant there were areas where they were unable to grow kale for winter feed, and they were unable to graze dairy cattle.

- (ii) Bush (8 maps, 8 transcripts) (3, 3, 3)

The presence of bush on their property was not problematic for any of the farmers. Probably the most negative assessment was from an organic farmer who, when asked if the bush affected the management of the property said, “No, not greatly”. One of the conventional farmers had sold a 300 hectare block of bush to the Department of Conservation, and only regretted that they had sold it too cheaply. An organic farmer simply mentioned some ‘manuka bush’ on a north facing slope.

Those farmers who felt positively about the bush on their land, in the main, demonstrated an aesthetic attachment to it. One organic couple had a QE II covenant on “native forest” on their land and said that they were “quite fortunate” because it was now “part of the tourism thing”. An integrated farming couple both very much liked being able to see their bush, and the man described it as “real rich”. Another conventional farming couple had a 150 acres of bush on their farm which they described as “... really precious to have”. The woman commented on how once the attitude was “... bush is up there to be cleared” but that now they were looking at covenanting it with the QE II Trust.

An integrated farming couple were ambivalent about the bush on their property, but more because of the interest of the District Council in it than any concern about its management implications for their farm. They described it as “a lot of native bush” which “they want us to fence off”. ‘They’ were, apparently, the District Council. The idea of fencing it off was not problematic; they described themselves as “quite keen” on the idea. What was problematic was the role of the District Council who they complained “were going to flog about 200 acres of our ground for conservation”.

(iii) Scrub (reported as ‘manuka / gorse’) (1 map, 5 transcripts) (0, 2, 3)

Interestingly, none of the organic farmers either recorded scrub on their maps, or mentioned it. The one organic farmer who did mention manuka, mentioned it as ‘manuka bush’ and consequently it has been coded and examined as ‘bush’. The two conventional respondents who mentioned manuka, mentioned it in association with gorse, and consequently these references have been coded as scrub. This distinction is very interesting. The perception of manuka (usually in fact kanuka, *Kunzea ericoides* and not manuka, *Leptospermum scoparium*) amongst farmers as a pest plant, a weed, or ‘scrub’ has been discussed elsewhere (Read, 2005). That this perception was, here, not seen amongst the organic farmers, and only seen amongst the conventional may have significance. This was further suggested by the comments of one conventional farmer who related, regretfully, that “What we should have done was take Mr Muldoon’s money ...” to plant trees in the gullies where they had scrub cut in the 1970s and early 1980s. He continued,

Now the manuka’s growing back again. Manuka is not an endangered species in New Zealand. I can’t see any reason to protect it because it must have 50 year life cycle. Stuff that was cut and bare is now 15 to 20 feet high (conventional).

Apart from the mentions of manuka, the integrated and conventional respondents portray scrub in a similar manner to one another – as a problem. One integrated farming woman said,

The other thing that rules my life a bit is the jolly gorse that we get coming up out of the lake. We pride ourselves almost on being gorse free. But our neighbour and the lake isn’t.

Another integrated farmer had recently cleared a block of broom. He said,

We got a machine in and it mulched it all down and we got a guy to plough it and we’ve grown the last three years kale out there to feed the bulls - amazing crops.

A conventional farmer talked about having “pushed out of the way” tree stumps, gorse and broom. He envied people who could “buy an ugly block and have got the finances - they can just put a bulldozer through the whole thing and start again”. The block they had bought “wasn’t really the tidy farm we wanted”, and they still have the goal of a tidy farm.

A conventional farmer talked about “redeveloping” the areas of scrub re-growth now that they had cleared in the past. Another conventional farmer complained that they had “quite a problem” with the re-growth of gorse on their downs. They were “knocking it into shape” presently by slashing it, fertilising the ground and sowing seed. That these respondents were again clearing ground that they had already cleared in the past is very interesting. It was clear from both interviews that the original development of scrub land occurred prior to 1984, in the days of agricultural subsidies, and that “when things got a bit tough” (conventional) in the later 1980s and

1990s the gorse and scrub was allowed to re-establish. This shows a very clear link between government policy and its expression in the physical landscape.

(iv) Weeds (1 maps, 3 transcripts) (1, 2, 0)

Mentions of weeds (other than those categorised as ‘scrub’) were not extensive, and were clearly site related. An organic farmer noted an area of Chilean Needle Grass on their property which was described as a “class A noxious weed”. The female partner talked about having the goal of getting rid of it but the man retorted that “That’s like a 40 year plan”. An integrated farmer mentioned having thistles but not how extensive or problematic they were. Another integrated farmer talked about buying a block of land with nodding thistles (*Cardus nutans*) on it, but then finding there was burdock (*Arctium minus*) as well. He described burdock as “a terrible thing” and “an absolute shocker”.

3.3.11 Stock management

(i) Animals (0 maps, 6 transcripts) (2, 3, 1)

Despite the fact that the farmers interviewed all managed some animals from the range of sheep, cattle and deer, most of the discussion relating to the maps had to do with sheep. Even so, sheep were only mentioned directly on one map and no-one actually drew a sheep on a map. (Other mentions on maps included things like “sheep genetics”, and “wool”.) Sheep were definitely characterised as objects by the conventional and integrated farmers who spoke of them. Speaking for those who were mainly arable farmers, one conventional farmer said, “We use sheep as tools”. They bought in lambs to fatten but “the sheep have to work in with the crop”. An integrated farmer said they were moving away from sheep farming to arable and were also buying in lambs for fattening. As the male farmer said, “A ewe will produce one and a half lambs and a fleece of wool. One fleece of wool doesn’t even pay for its maintenance”. He went on to say, “There’s just not enough money in it, to have a heap of sheep”.

One integrated couple were more focused on livestock farming. For them, gaining a 150 percent lambing rate was a positive thing and they were changing the breed of ewe they used in order to achieve this. The male noted that the new breed “may only last four years” as opposed to the lower lambing breed currently used, “which may last six or seven years”. These farmers also kept deer, much to their accountant’s disgust.

(ii) Laneways (5 maps, 9 transcripts) (3, 4, 0)

Laneways were tracks or roadways internal to a farm, onto which paddocks, yards, and other facilities open, as opposed to a track which passes through paddocks. Laneways on a farm, whilst being an aspect of spatial organisation, were primarily a means of livestock management. One organic farming couple had a central laneway that ran the length of their farm. The man said of it:

“...the advantage of this place is you can shear sheep or whatever - work the sheep in the yard and we just open the gates and send them out to the paddock. It’s very easy to run right, in that respect.”

One conventional farmer who does cropping as well as running sheep finds the laneway useful when harvesting crops as well as for managing the sheep. An organic farmer pointed out that the laneway makes access easier for the workers also as they do not have to be opening lots of gates.

(iii) Stock yards (28 maps, 6 transcripts) (9, 12, 7)

Three sorts of stock yards were reported or drawn: sheep yards, cattle yards and stock yards. Six respondents reported having both sheep and cattle yards. Two respondents reported both sheep yards and stock yards. From this it can be deduced that for these farmers stock yards could be either cattle yards or yards which can be used for cattle and, most probably, deer. Little was said about them. Some farms had more than one set of each type of yards. One integrated farming couple had several blocks of land, each of which had its own sheep yards. The man complained that this required too much maintenance.

(iv) Shearing sheds (14 maps, 10 transcripts) (6, 3, 7)

Shearing sheds (or woolsheds), along with the house, the stock yards, and shed, are clearly key features on sheep/beef farms, and of central importance. This is underlined, in an ironic manner, by a conventional farmer who, having said he has no aspirations to be a sheep farmer, wants to pull down his shearing shed because it is in the middle of their yard space and interferes with his cropping work.

3.4 Conclusion

While it is possible, as with the Kiwifruit data, to draw conclusions about the ideal sheep/beef farm, there is little data on which to base characterisations of the different production systems. Consequently, an ideal type of generic sheep/beef farm is proposed, and then some observations about the particular differences between production systems which have been noted are made.

3.4.1 The 'ideal' sheep/beef farm

The ideal site for a sheep/beef farm encompasses flat to gently rolling land with some higher, but still rolling, hills. There are no steep hillsides or gullies, but the topography is sufficient to afford views of the surrounding landscape. One or more boundaries are physical in nature - either a river or a roadway or both, providing a definite border - and the fewer neighbours there are the better. The higher lands have an easterly aspect and there is little or no wet land. There may be a patch of native forest, which contributes to the aesthetic appeal of the property, but patches of manuka are undesirable and are likely to be cleared. It is preferable that the management of any bush is left to the landowner and not enforced, or restricted, by regulation.

The property will be laid out in paddocks of six to eight hectares in area. The fence-lines will be placed so as to enable stock to make the most of any natural shelter which might be afforded by the topography. The paddocks all have names to make it possible to discuss plans, and to give staff instructions. These names either relate to physical characteristics of the paddock, or to social connections. Shelterbelts have been planted along some of the fence lines in order to provide stock with shelter from cold southerly and hot nor'westerly winds. Shelterbelts around paddocks which are cropped will be trimmed to minimise bird nesting and to create neat, tidy, hedges.

The main house, woolshed, sheep and cattle yards, and implement sheds are all located near the centre of the property. The house is separated from the utility areas by trees planted for their aesthetic appeal as well as their usefulness as shelter. A second, older house exists on the property also, and is used to house staff. Connecting the utility area with the flat paddocks is a laneway which extends into a farm track when it reaches the hillier ground. The laneway is not only a key livestock

management tool, but also allows for the movement of machinery and irrigators around the area of the farm which is cropped.

A forestry block has been planted in an awkward corner of the property and it is hoped that the income from the timber will provide for retirement. In the meantime the shelter it provides is welcome for stock and their young, in the Spring. Some crops are grown on the flatter land on the better soils. These include green feed for stock. The soils are managed by careful crop rotation, grazing providing animal manure, and fertilisers. The crops are irrigated as a matter of course. Irrigation is a major expense and investment.

3.4.2 Variations between sheep/beef production systems

While it has been stressed that statistically no significant differences exist between the organic, integrated and conventional production systems, some small differences are suggested by the qualitative analysis. These are not adequate to base an 'ideal type' of farmer related to each management system upon, however.

With regard to soil management conventional farmers mentioned only stock management and fertiliser application as soil management strategies. Within the organic panel manure crops were mentioned, and within the integrated panel, animal manure (gained from a feedlot which fed cattle maize) and compost were used, along with conventional fertilisers. This suggests quite a difference in approach with the integrated and organic panels using more similar methods than those used by the conventional farmers. This requires further investigation by the ARGOS biophysical team to ascertain if there are significant differences in soil quality between the production systems.

The second area in which some apparent difference between the production systems can be found is in the social context within which they see themselves. It appears that some organic farmers see themselves connected to a much broader social context rather than to their immediate neighbours, than do any of the others. Further, some noted links to schools, training volunteers, employment and customers, and wanted to share their benefits with others. This underlines a point, suggested elsewhere (Fairweather 1999), that is that there are committed organic farmers and pragmatic organic farmers. The committed organic farmers see themselves and their practices as part of a wider, even international, movement. They are, to a notable degree, motivated by principles that connect these farmers to people well beyond their geographical region. The pragmatic organic farmers are, on the other hand, more similar to the conventional farmer. They are driven by profit, and organic management is, perhaps, more about what is not done (spraying, using artificial fertilisers and chemical drenches) than what is done.

This distinction about social context is paralleled by the level of ecological concern expressed by organic farmers. On the topic of wetlands some organic farmers adapted their management to the land in contrast to integrated and conventional farmers who were more likely to intervene by draining or flooding. Similarly, none of the organic farmers reported manuka as scrub while only integrated and conventional farmers saw it this way. On the topic of irrigation, only one respondent, an organic farmer, actually raised the fact that there are potential ecological consequences of irrigation. One other organic farmer mentioned that irrigation is not used on their property to grow grass. These two respondents stand out in stark contrast to all the other respondents who talked about their irrigation practice from all three production systems. For all of these other farmers the use of irrigation, where there is water that can be accessed, is a given.

Chapter 4

Comparison between Kiwifruit Orchards and Sheep/beef Farms

4.1 Introduction

This short chapter provides a comparison between the two sectors.

4.2 Comparisons between the kiwifruit orchards and the sheep/beef farms

Comparisons between the kiwifruit orchard material and the sheep/beef material must be interpreted carefully because the production systems do not neatly match across sectors. The organic management systems are similar in each sector. Both the KiwiGreen Hayward and the KiwiGreen Hort 16A producers use integrated pest management systems and in this sense are thus both, more or less, equivalent to the integrated sheep/beef system. No direct equivalent to the conventional sheep/beef production system is available and therefore cannot be examined. Therefore, in the following comparison between the overall sector means, the integrated management system is over represented in the kiwifruit and the conventional is not represented at all.

A statistical comparison of the mean number of features per map was made between the categories of the map features for the kiwifruit and the sheep/beef data.²⁰ A one-way ANOVA showed, as might be expected, that the two sectors were significantly different in many regards (see Table 13). However, there were areas where they did not differ significantly, and where the sector means were the reverse of what might be expected. That is, they did not fit the pattern of sheep/beef having more features than kiwifruit. It should be noted that this will partly be due to the fact that there were no categories equivalent in the kiwifruit to those of 'stock management', 'neighbouring buildings' and 'miscellaneous' used in the sheep/beef analysis.

²⁰ There is debate within statistics about how to compare such results as these. To compare means a source of variation is required and the design of the ARGOS programme would seem to be ideal because it is used across all sectors, and so sector means should be able to be compared using the organic, integrated and conventional sector means as the source of variation. However, as mentioned above, there is no equivalent conventional kiwifruit panel. The kiwifruit results were showing up significant differences between management systems (Chapter 2) but few differences between the blocking factor of location, whereas the sheep/beef results were demonstrating the opposite – few differences between systems but big differences between locations (Chapter 3). Hence if the panel means were used as the source of variation (the usual method in macro-studies) the kiwifruit would contribute more to the overall variation measuring the significance of the differences between the two sectors, and if the location means were used the sheep/beef would contribute more. Using the location means could be regarded therefore, as a more stringent test and the variation against which the means are tested is likely to be larger. Hence, it was decided to try both and see what they produced. As Table 10 demonstrates, similar results were received regardless of the source of the variation against which the means were tested, indicating that the results can be supported with some confidence.

Table 13 shows that spatial organisation, transport, climate/weather and water sources were categories with significantly different mean number of features per map. Of these, spatial organisation and water sources were the two categories which had higher frequency on the sheep/beef maps. In both cases, these categories had more types of features on the sheep/beef farms: spatial organisation had seven for sheep/beef compared with two for kiwifruit, and water sources had nine for sheep/beef farms and six for kiwifruit. It was in these two categories that the complexity of the sheep/beef farms was manifest, not surprisingly, since these farms are on larger areas of land on which more forms or instances of these features could be found. Slope was by far the most frequently noted morphological characteristic by both sectors. However, the problems it caused farmers were mostly to do with the difficulties of cultivating sloping ground, and the snow in winter and spring. For the kiwifruit growers slopes caused a much wider range of difficulties, which seemed, from the material, to be fairly idiosyncratic. Also, gullies were problematic for both sectors, but much more commonly so for kiwifruit orchardists who attribute them with being the source of a number of problems.

Table 13: ANOVA comparisons between the kiwifruit and sheep/beef mean number of features per map

Category	Mean number of features/map		Significance	
	Kiwifruit	Sheep & Beef	Using Location as source of variation	Using Panel as source of variation
Spatial organisation	1.8	3.3	p=0.00 **	p=0.00 **
Wind	1.2	1.0	p=0.30 n.s.	p=0.30 n.s.
Buildings	1.5	1.5	p=0.98 n.s.	p=0.91 n.s.
Transport	1.5	1.0	p=0.01 *	p=0.00 **
Social	0.6	0.8	p=0.35 n.s.	p=0.07 n.s.
Other biota	0.8	1.0	p=0.32 n.s.	p=0.40 n.s.
Landscape morphology	0.9	1.5	p=0.20 n.s.	p=0.06 n.s.
Climate/Weather	0.9	0.3	p=0.00 **	p=0.00 **
Water Sources	1.1	2.3	p=0.01 **	p=0.03 *
Biotic context	0.6	1.0	p=0.04 *	p=0.18 n.s.
Contextual aspects	4.7	6.7	p=0.02 *	p=0.02 *
Management responses	6.3	8.6	p=0.02 *	p=0.03 *
Total	11.3	15.4	p=0.01 **	p=0.02 *

Of interest now are the categories where the data shows that the kiwifruit orchards had higher mean number of features and were therefore more complex than the sheep/beef farms. Two categories, 'transport' and 'weather' were ones in which the kiwifruit means were greater than the sheep/beef means. For 'transport', an examination of the data shows that this occurs through a variation of emphasis rather than complexity. The transport category for the kiwifruit data is made up of roads, driveways and loading areas. For the sheep/beef data in the transport category there is no loading area feature, but there are the features of airstrips and bridges. Thus the sheep/beef maps have additional types of features noted in the transport category but still a lower frequency overall. The biggest variation between the sectors occurs in the numbers noting driveways, there being 23 noted by kiwifruit orchardists, and only one by sheep/beef farmers. There is nothing in the data which hints at an explanation of this. It is possible that it is simply a matter of scale, the space within a kiwifruit orchard being taken up by the driveway being significantly greater than that on a farm.

'Weather' was the other category in which kiwifruit orchardists appeared to have significantly more issues than sheep/beef farmers. 'Weather' (not including wind) arose in more different ways in the kiwifruit material than in the sheep/beef material, encompassing frost areas, frost protection, altitude (because it impacts on weather) and climate. The sheep/beef farmers made more generic references which were all coded as 'weather'. Even collapsing the kiwifruit categories so as to count the number of orchardists mentioning 'weather' features (frost areas, climate and altitude) results in 21 orchardists mentioning some aspect of weather, as opposed to 11 sheep/beef farmers.²¹ Recourse to the qualitative data supports the notion that weather is a more important variable for kiwifruit orchardists than sheep/beef farmers. They mention frost, rainfall, sunshine hours, warmth and the impact of altitude on these, as important issues. The sheep/beef farmers, on the other hand, identify drought and snow as significantly problematic, and these are highly localised problems and due to the greater extremes of climate experienced in the South Island farming country compared with the kiwifruit growing locations.

Six categories showed no significant statistical variation between the two sectors. These were 'wind', 'buildings', 'social', 'other biota', 'landscape morphology', and 'biotic context' (although in this instance this was only the case when location was used as the source of variation).

When considering why this should be so for 'wind', we noted that kiwifruit orchardists referred to 'prevailing wind' and 'wind damage' a total of 17 times. Sheep/beef farmers referred to 'prevailing wind' and 'problematic wind', roughly comparable categorisations, 14 times. A closer examination of the figures shows that only three sheep/beef farmers noted prevailing winds, whereas 11 kiwifruit orchardists noted them. 'Wind damage' was noted by six kiwifruit orchardists compared with 11 farmers who noted 'problematic winds'. Twenty-six kiwifruit orchardists mention shelter compared with the 23 sheep/beef farmers. Attention to the qualitative data suggests that wind is an equivalent problem in both sectors because of its impact on their 'babies'; specifically growing the fruit of kiwifruit and producing new lambs.

The lack of significant variation in the number of buildings might seem easily explained. While the productive processes of the two sectors are clearly different they are still family businesses which require a home, garages, sheds and so on to function. However, for the kiwifruit orchards, the 52 buildings reported were of only three types, 25 being houses, 25 being sheds, and two being packhouses. For the sheep/beef farms, 55 buildings were reported, and of these 33 were houses (three of these were parents' homes), 14 were sheds, six were hay barns, and two miscellaneous. Thus the greater complexity of the sheep/beef farms is maintained in the range of buildings noted. Further, 16 shearing sheds and one deer shed were included as aspects of stock management in the sheep/beef analysis, rather than in the building category. Had they been included in the 'buildings' category the results would have been significantly different.

The social context data did not show any significant differences either. Neighbours were the only ones included in this category for the kiwifruit analyses, but sheep/beef farmers mentioned not only neighbours as a generic identification, but also sometimes, specific kinds of neighbours identified by their land use – dairy, forestry, reserve or lifestyle. Then they also mentioned visitors to the farm, such as advisors

²¹ Whenever raw counts of features are quoted in this chapter it has to be remembered that there are 35 kiwifruit orchard and 37 sheep/beef farms being compared. The sheep/beef farms therefore, have a slight advantage!

or customers. All of these features were only mentioned once or twice. The qualitative data also suggests that the sectors were quite similar in this regard. Practical issues with neighbours were commonly raised by both kiwifruit orchardists and sheep/beef farmers, indicating that in both sectors neighbours are problematic. Problems common to both sectors include spray drift, for organic producers; and pests, albeit very different ones. Only kiwifruit orchardists raised peri-urban development as problematic. Both the kiwifruit orchardists and the sheep/beef farmers, in the main, characterised their community as located geographically, often around a local school, church or township. However, as noted above, some of the organic sheep/beef farmers clearly saw themselves as part of a larger social network because they were 'committed organic producers' as opposed to 'pragmatic organic producers'. This same division is evident amongst the orchardists.

When the 'other biota' results are investigated, even though there appears to be quite a difference in total between the two sectors (27 counts in kiwifruit and 37 in sheep/beef) when averaged over the 35 kiwifruit and the 37 sheep/beef farms, this difference becomes less apparent (0.8 compared with 1.0). The main difference between the results is that the sheep/beef maps include 14 forestry plantations, with the other categories differing only by one, two or three.

The similarity between the mean number of landscape morphology features on sheep/beef farms and those on kiwifruit orchards is perhaps unexpected given the huge difference in size and scale between a kiwifruit orchard and a sheep/beef farm. Perhaps for sheep/beef farmers, the sketch map process of reducing the scale of the farm to fit the size of paper meant that more detail was sacrificed compared to kiwifruit orchardists.

Perhaps it is not so surprising that there was little difference between the kiwifruit and sheep/beef material with regard to the 'biotic context' category. For the kiwifruit material this category included soils, bush and *Armillaria*. For the sheep/beef material this category included soil, bush, DDE, scrub, weeds and hares and rabbits. While, again, the range of features noted by the sheep/beef farmers was broader than that noted by the kiwifruit orchardists, the detail is, again, most interesting. Whilst logic might suggest that soils would be more important to horticulturalists than to agriculturalists as the former are intensive producers on small sites and the latter extensive producers on large sites, eight kiwifruit orchardists mentioned soils as a feature impacting on their management as compared with 16 farmers. Perhaps this reflects more homogeneity on the small orchards which are sited to benefit from high quality soils anyway. This interpretation is supported when it is observed that of the eight orchardists who featured soils, only one drew this on their map. That is, seven of these mentions of soil appeared in the transcript only. In contrast, of the 16 farmers mentioning soils, five drew soil on their maps, indicating that they had probably drawn areas of different soil types on their farms. As it was, both groups obviously found it difficult to draw soils on a map.

Finally, the 'total' number of features on the maps, and the contextual aspects and management responses groupings, all showed a significantly higher number of average features per map for the sheep/beef sector. The 'total' features is greater for the sheep/beef sector because these maps included three categories (stock management, neighbouring buildings and miscellaneous) containing features not present on the kiwifruit maps, along with many more features in the spatial and water categories. (The categories not present on kiwifruit maps averaged 1.9 per map.) In the group of contextual aspects, the sheep/beef maps contained many more rivers, a feature which did not appear on the kiwifruit maps (streams and creeks being more apparent), and a greater number of features in 'landscape morphology',

demonstrating the larger scale and different regional location of the sheep/beef farms from the kiwifruit orchards. Similarly to the 'total' features, the 'management responses' grouping, sheep/beef maps had many more spatial features than the kiwifruit maps, and included the stock management category with an average of 1.7 features per map. These results demonstrate that the sheep/beef participants while having to draw a map with a greater reduction in scale compared to the kiwifruit participants, still managed to draw more features on their maps.

Attention to the qualitative data clarifies some of the differences shown by the statistical analysis. In terms of the 'spatial' category, boundaries are fundamentally spatial delineations for the kiwifruit orchards, whereas they often have a very physical dimension for the sheep/beef farms. Blocks are quite different entities between the sectors, being productive sub-units of the kiwifruit orchard, but large, probably legal, entities with in the larger farm business.

4.3 Conclusion

This short chapter shows interesting differences across the sectors. These differences are discussed in more detail in the concluding chapter.

Chapter 5 Conclusion

5.1 Introduction

The objectives of this research were to (1) analyse sketch maps completed by ARGOS kiwifruit orchardists and sheep/beef farmers to find what was important to their management of their orchard or farm, and to compare production systems and sectors, (2) provide documentation of the sketch maps because part of their value rests with future assessments of them, and (3) assess sketch mapping as a research method. The focus of the analysis was on counting and interpreting the features on the maps, and comparing production systems. The first two objectives have been achieved and the third will be addressed in this chapter which provides a summary of all the findings and develops a short discussion of these results, including an assessment of the sketch mapping method.

5.2 Summary of results

So what were orchardists and farmers in ARGOS telling us about what was important to their management, via the medium of their maps? For kiwifruit orchardists, the biophysical aspects of their region and landscape in which they operated were very important – slope, lie of their land, water sources and streams, climate (including frosts and wind), altitude, soils and bush. Next there was the way in which their property was separated from others – their boundaries – and the impact on orchard management of the neighbours on those boundaries. In terms of infrastructure, buildings and transport features, particularly driveways, predominated in importance. The importance of the organisation of the orchard was seen in the layout of the blocks and shelter belts. Then there were the inclusion of the orchardists' responses to mitigate risks: the risks posed by climate were managed by the placement and type of shelter, water for irrigation and frost protection, and financial risk was able to be spread by growing other crops.

For sheep/beef farmers, again biophysical aspects of the region in which they lived were very important to their management – terrain and the way the land lay and other morphological features of the landscape, soil, climate extremes (drought and snow), wind and water sources. Their boundaries were also very important to their management and these were marked by public roads and rivers, and the neighbours. The way in which land next door was used and public buildings on those boundaries were also important. The importance of the manner by which the land was organised into blocks and fenced paddocks, served by tracks and lanes, and had an infrastructure of farm buildings, houses and stock yards, was apparent on the maps. Risks from weather were mitigated by shelter belts and water for storage and irrigation, and financial risk was spread by growing crops and having small commercial forestry blocks.

Differences between the management systems appeared when the maps were analysed. Analysis of kiwifruit map features showed that orchardists using Organic Hayward management drew more map features, ahead of KiwiGreen Hayward than KiwiGreen Hort 16A. KiwiGreen Hayward orchardists were more likely to mention the importance of wind to their management, Organic Hayward orchardists were more likely to mention biotic context and water, and KiwiGreen Hort 16A orchardists

were less likely to mention buildings, water and frost management. Those living on the orchard reported a higher mean number of features.

Kiwifruit transcript data show that the Organic Hayward ideal type orchardist was observant, saw the operation as complex, had a concern with water, saw their house as a home and as part of their lifestyle, had an affective relationship with their orchard, and had much to say about neighbours - in some cases this relationship was problematic.

The KiwiGreen Hayward ideal type orchardist was similar to the organic type but was concerned about wind and large animal pests, had a utilitarian approach, and a matter-of-fact relationship with neighbours.

The KiwiGreen Hort 16A type orchardist had a simpler orchard, economic priorities, productionist orientation, and was concerned with climate and altitude.

Analysis of sheep/beef map features show that these maps had many features not present on the kiwifruit maps. There were no significant differences in the mean number of features for each management system. However, there were significant differences in the mean number of features for some locations. Sheep/beef farms on flat land or plains (e.g., Dunsandel/Leeston and Ashburton) had fewer map features than farms on hilly land (e.g., Outram area, Banks Peninsula or Marlborough).

Sheep/beef transcript data suggested that conventional farmers thought about soil management in terms of stock management and fertiliser applications while integrated and organic farmers considered manure crops and animal manure. Organic farmers exhibited a connection to a broad social context and emphasised ecological concerns.

Comparisons between sectors showed that sheep/beef maps had more features than kiwifruit maps but, out of the ten categories common to both sectors, only spatial organisation and water sources had a higher frequency on sheep/beef farms, reflecting the larger scale of farms. Kiwifruit orchards had more transport features (largely because most maps included a driveway) and more weather features (indicating that weather is more important to orchardists). The other categories had similar means.

5.3 Discussion

The sketch maps provided insight to one way that orchardists and farmers see and draw their properties. With varying levels of detail they put a wide variety of features on their maps, reflecting their regional location, the property boundaries, infrastructure and management of risks.

The results show that only for the kiwifruit sector were there any differences in the character of the map for the different production systems. For kiwifruit there was good evidence from both the quantitative and the qualitative data that organic orchardists had a distinctive relationship to their orchard. This relationship meant that their maps had significantly more features and this makes them more similar to the sheep/beef farmers who, as a group, had more features per map than the orchardists. Further, like the farmers, the organic orchardists had a significantly higher number of features that were classified under the water category. These results suggest that there may be some overall similarities between organic kiwifruit and sheep/beef farmers. Perhaps the particular character of the kiwifruit sector as a sector dominated by older or retired people seeking a rural and productive lifestyle

close to urban amenities is manifest more strongly in KiwiGreen Hayward and KiwiGreen Hort 16A orchardists.

Sheep/beef farmers were similar across management systems but not location. The locational effects on the number of features on sheep/beef farms reflected topographical diversity so that farms on flat land tended to have fewer contextual aspect features (e.g., Leeston/Dunsandel and Ashburton). The distribution of farms from varied topography to flat land did not necessarily reflect a gradient in farm size, except the largest farms, which were in the Outram area, averaged the greatest total number of features. (The smallest farms in the Rakaia area bordering on the foothills of the Southern Alps did not have the least number of map features.)

From an indigenous productivity perspective, the maps showed little references to native flora or fauna. There were only seven orchard maps and nine sheep/beef maps with bush shown as a feature. Since kiwifruit orchards and sheep/beef farms are reasonably intense land uses it is not surprising there were few references to bush on the maps. Perhaps bush was present but was not considered important and therefore was not represented on the maps. Research conducted by the ARGOS Environment Team will document this. The types of features that were present on the maps reflected practical and production related considerations.

The finding that Integrated sheep/beef farmers had more biotic context features than organic farmers, appears to be anomalous. One possible explanation is that their involvement in a supplier scheme and audit process may have heightened their awareness and sensitivity to these aspects of their farm (soils, manuka and gorse) at some time prior to the interview. Perhaps a similar process for organic audit did not occur or occurred a long time before the interview. If this is the case, then it could suggest that audit processes stimulate farm level knowledge, at least in the short-term.

5.4 Assessment of sketch mapping

The drawing of the maps presented us with a distinctive focus on management practices when compared to the rest of the interview. Further, without having to actually tour a kiwifruit orchard or a sheep/beef farm we were able to become familiar with the typical spatial organisation and geographical picture of orchards or farms, and take in at a glance what was important to those being interviewed. Without these maps we would be less aware of how important boundaries are as a delineation of management responsibility, and how the response to the physical and climatic features of a region is such an important part of orchard and farm practice. However, other management practices such as pruning, spraying and soil management (and the fruit) on orchards, and soil fertilising and actual stock management (and the stock themselves) were mostly invisible on the maps, as were financial and productivity considerations, the dominant issues in the interviews (see Hunt et al., 2005: Chapter 8).

An important observation of sketch mapping is that it reflected ability to draw and the difficulty of representing the orchard or farm in two dimensions and placing it in its context. Often apparently simple maps were drawn when it was considered too difficult to reflect their complexity. This interchange, taken from one of the interviews, illustrates this difficulty:

Female 1: (laughing) I can't draw all the gullies in the hills and the steep bits (laughing). No, it's kind of hard to compare that to a flat piece of paper.

Interviewer: Yes, it is, isn't it, I'd say, mm. How high is it up on the top there?

Male 1: Ahh, pause, 1200 feet, 300 metres. Pause. From the top, on one corner, you can see Stewart Island.

Interviewer: Really! Ooh. I suppose it's quite good that there is the hill between [you and there].

Male 1: Yeah, that's right. Well that's why it's reasonably exposed. There's nothing between the top of the hill and bloody Antarctica.

Variation in the ability to draw meant that the number of features drawn on the maps was very different over the range of participants. In some cases the maps were basic with little labelling, in others there was a great attention to detail.

Sketch mapping the way we used it meant that participants could choose what way they would draw their map. There was no consistent style: some took a conceptual approach and represented ideas that underlay the person's approach to their land, and some were literal. Consequently, we could not get an equivalently comprehensive set of data for each subject in order to achieve our second research objective, to compare management systems. The fundamental problem here is that map drawing ability is a confounding effect. We compensated for this problem, partially, by resorting to the transcripts to get more information, but it is debatable whether adding the transcript data to the map data gave a 'complete' map which cancelled out the effect of map drawing ability. This observation of sketch mapping suggests that the method has some limitations.

A second observation of sketch mapping is that the data suggest that sheep/beef farmers omitted features more than orchardist because they made a larger reduction to the scale of their representation of their farm. This seems entirely plausible since farmers have large areas and were asked to draw a map on the same size of paper as the orchardists. Notwithstanding this situation they still put more features on their maps. This second observation indicates that care is needed when making comparisons across sectors where scale is an issue. On the other hand, despite scale issues, the farmers did draw maps which were useful in showing the important factors in their management.

A striking feature of the literature on rapid rural appraisal²², of which the sketch mapping used in this project is a research technique, is how often it is designed to assess the accuracy of its results (Beradi, 1998; Christiaensen et al, 2001; Kuruvilla & Joeseeph, 1999; Herlihy, 2003; Murray & Graham, 1995; Temu & Due, 2000) or the efficacy of them (Pido, 1995; Rifkin, 1996). Rapid rural appraisal has been particularly contrasted with various types of survey techniques ranging from door-to-door surveys, random postal surveys, the analysis of existing statistics and so on. However, the underlying purpose of the broader method is to 'enable local people to share, enhance and analyse their knowledge of life and conditions' (Temu & Due, 2000: 46) and to "gain insight into a community's own perspective of its needs" (Murray & Graham, 1995; unpaginated) Its use in this project reflects this purpose as it was intended as a means of allowing the interviewees to establish issues of importance to them within the framework of a reasonably tightly structured interview.

The mapping process was undertaken early in the interview, immediately following a number of questions relating to the actual work involved in running the orchard or farm. Participants were asked to draw a map of their property illustrating the things which were important to their management of the orchard or farm, and their vision for themselves and their property. The interviewer continued an unstructured interaction

²² Referred to here are the body of related techniques which are known in the literature by a wide range of similar names. See Chapter 1 for a list of these names.

with the participants during the mapping process, and returned to the other topics in the interview once the map was complete. The map data and the transcript data are not contradictory. This is not to say that in some instances the maps and the transcripts relating to them were not lacking in detail. In this sense then, the maps seem to have been successful as a tool for focusing the interviewee's mind on the management of their property, and this ensured that further information could be elicited during the rest of the interview. This technique is a way of allowing respondents both a visual and a verbal means of articulating their responses to a question, a two dimensional representation, a drawing, being a very different way of responding to a question than a verbal answer. This interplay appeared to enrich the data collected in the interview, though it is clearly not possible to ascertain whether the same information, and quality of information, would have been obtained without the map drawing exercise. It is our assessment that it would not.

That having been said, the analysis of the maps was problematic. It would be fair to say that little thought had been put into how the maps might be analysed when the intention to include the map drawing exercise in the interview was made as it was seen as simply a means of introduction to the questions following in the interview – those on finding indicators of economic, environmental and social sustainability and wellbeing. The literature was of little assistance in suggesting ways to analyse maps. Those which had used mapping as part of the suite of rapid rural appraisal techniques had mainly used them to quantify specific features within the communities being studied (e.g., Christiaensen et al., 2001; Kuruvilla & Joseph, 1999; Temu & Due, 2000). They usually involved single maps made by groups of key informants intended to indicate the location of specific things, for example the homes of people with disabilities. Both the intent of the map drawing exercise in this project and its execution can thus be distinguished from previous examples.

The methods used to analyse the maps were developed from the work of Rose (2001). They consisted, fundamentally, of the simple tallying of the features included on them, teamed with an analysis of the interview content. It was not feasible to undertake any sort of spatial analysis of the maps, simply because the skill of the map maker, and their willingness to participate in the exercise, appeared to impact significantly on the quality of the finished product. As the content of the associated interview transcript was almost always necessary to make sense of the maps it could be argued that the map itself was redundant: what was important was the respondent's statements about what was important to the management of their property. However, it is entirely moot as to whether simple questions would have elicited such rich information.

While transcript data was essential to make sense of the maps, there remains a question of whether our focus on counting the features meant that some overall qualities of the maps have been overlooked. There may be interesting differences in the overall character of the maps for the different management systems or sectors. Future applications of the sketch mapping method should consider making an overall appraisal of each map.

In conclusion, a key aspect of the mapping process within these interviews is that it gave the participants freedom to express their own priorities and to state clearly what the most important things impacting on the management of their properties were, for them. In this regard it fulfilled the aims of the broader method of rapid rural appraisal. In terms of gaining an understanding of other people's worlds from their perspectives, this means it was a success. However, it is conceded that other, unstructured interview techniques may be just as productive, although probably not as effective at representing the mappable dimensions of orcharding or farming.

References

- Berardi, Gigi. 1998. Application of participatory rural appraisal in Alaska. In *Human Organization*, Vol 57, No 4, pp 438 – 446.
- Christiaensen, Luc; Hoddinott, John; & Bergeron, Gilles. 2001. Comparing village characteristics derived from rapid appraisals and household surveys: a tale from Northern Mali. In *The Journal of Development Studies*; Vol 37, No 3, pp 1 – 20.
- Coser, Lewis A. 1977. *Masters of sociological thought: ideas in historical and social context*. New York: Harcourt Brace Jovanovich.
- Fairweather, J.R., (1999) "Understanding How Farmers Choose Between Organic and Conventional Production: Results from New Zealand and Policy Implications". *Agriculture and Human Values* 16(1):51-63.
- Gerhardt, U. 2004. 'Ideal type', in Lewis-Beck, Bryman and Liao, (eds.), *The Sage Encyclopedia of Social Science Research Methods*, Sage, Thousand Oaks.
- Herlihy, Peter H. 2003. Participator research mapping of indigenous lands in Darien, Panama. In *Human Organisation*; Vol, 62 Iss 4, p 315.
- Hunt, Lesley; Rosin, Chris; McLeod, Carmen, Read, Marion; Fairweather, John & Campbell, Hugh. 2005. Understanding approaches to kiwifruit production in New Zealand: report on first qualitative interviews of ARGOS kiwifruit participants. ARGOS Research Report Number 05/01. Agriculture Research Group on Sustainability, C/- The Agribusiness Group, PO Box 4354, Christchurch, N.Z.
- Johnstone, Peter D. 1994. *How to plan an experiment*. AgResearch, Invermay Agricultural Centre, Private Bag 50034, Mosgiel, New Zealand.
- Kuruvilla, Shyama, & Joseph, Abraham. 1999. Identifying disability: comparing house-to-house survey and rapid rural appraisal. In *Health Policy and Planning*; Vol 14, No 2; pp182-190.
- Murray, Scott A; Graham, Lesley J D. 1995. Practice based health needs assessment: use of four methods in a small neighbourhood. In *British Medical Journal*, Vol 310, Iss 6992, p1443.
- Read, Marion. 2005. The 'construction' of landscape: a case study of the Otago Peninsula, Aotearoa / New Zealand. Unpublished PhD Thesis: Lincoln University.
- Rose, Gillian. 2001. *Visual methodologies*. Sage Publications: London.
- Temu, Andrew E & Due, Jean M. 2000. Participatory appraisal approaches versus sample survey data collection: a case of smallholder farmers well-being ranking in Njombe District, Tanzania. In *Journal of African Economies*; Vol. 9, No 1, pp. 44 – 62.