Chapter 7
Design and conduct of research

> The main problem is not so much to find the 'best decision', but rather to understand how decisions are actually made, for what reasons, on the basis of which information and with which consequences.
> (Petit 1978, p. 141)

7.1 Introduction

Personal construct theory is based on the premise that people may know why they make particular decisions. Similarly, the factors to include in models of decisions based on the hierarchical decision approach are obtained directly from the decision makers. Therefore, personal interviews were considered necessary to obtain the information for this study, at least in the model-building stage. This requirement placed constraints on the design and coverage of the research. A tradeoff was required between selecting an area for study that might be generalised to an important section of the wool industry, and an area that could be handled within time and resource constraints faced by the researcher.

Outlined in this chapter are the procedures followed in choosing the population to be studied, designing the research, selecting the sample and conducting the interviews.

7.2 Choice of area for study

Previous research conducted using the hierarchical decision model has generally closely defined the location or decision situation (e.g., to a village or to a particular change in an enterprise). Since this study had an objective to predict wool producers' production and marketing decisions, a broader perspective than this was necessary. However, as discussed in 6.8.2, to apply personal construct theory to decisions made by a group of people in the manner prescribed by the hierarchical decision model required some assumptions. These assumptions implied a need to limit the

range of people to which a set of models would apply. Accordingly, a balance was sought between the general application of the models and their ability to predict decisions.

ABARE's division of wool production into three zones (Pastoral, Wheat-Sheep and High Rainfall, see earlier discussion in 2.3) provided a useful starting point for defining the different populations to be considered in this study. In each of these zones the environment restricts the enterprises that can sensibly be undertaken. While there are variations in environments within each zone that favour one enterprise over another, they are more of degree than the major differences that exist between the zones. Consequently, it was felt sheep producers within a zone would face similar decisions and would be more likely to use similar constructs when making these decisions.

Initially it was planned to conduct the research in two of the zones - the High Rainfall and the Pastoral. The High Rainfall Zone was chosen because: it was the zone in which the researcher was located, and therefore research would be cheaper and more convenient; it was an important zone of wool production; and it provided a range of enterprise options for graziers, without the complexity added by cropping choices. The Pastoral Zone was the other one chosen, by default, because it was felt that given the exploratory nature of this research, the Wheat-Sheep Zone would be too complex for the time-frame available for the research. As it turned out, it was not possible to develop models for the Pastoral Zone either because of time constraints.

Target population for the research was initially defined as graziers in the High Rainfall Zone who had a commercial sheep operation, or had country suitable for a commercial sheep operation. For reasons of cost and time it was decided to limit the scope further to the New England area of the High Rainfall Zone. The desired sampling unit was defined as the management team of a grazing unit in the New England area which had country that could be used to run a commercial sheep operation. The property also had to have at least one person who spent most of their time working on the property.

Difficulty was experienced in obtaining a sampling frame meeting these requirements, but eventually a list was obtained of farms that had more than 500 sheep in the Armidale Rural Lands Protection Board area. This list had two main weaknesses: it was expected to contain some properties that did not have someone working on them for most of their time; and the list did not include properties that could run a commercial sheep operation, but for various reasons were not when the list was developed. These weaknesses were not considered sufficient, in the circumstances, to preclude using the list as the sampling frame for the research. Therefore, it was decided to limit the study to the Armidale Rural Lands Protection Board area.

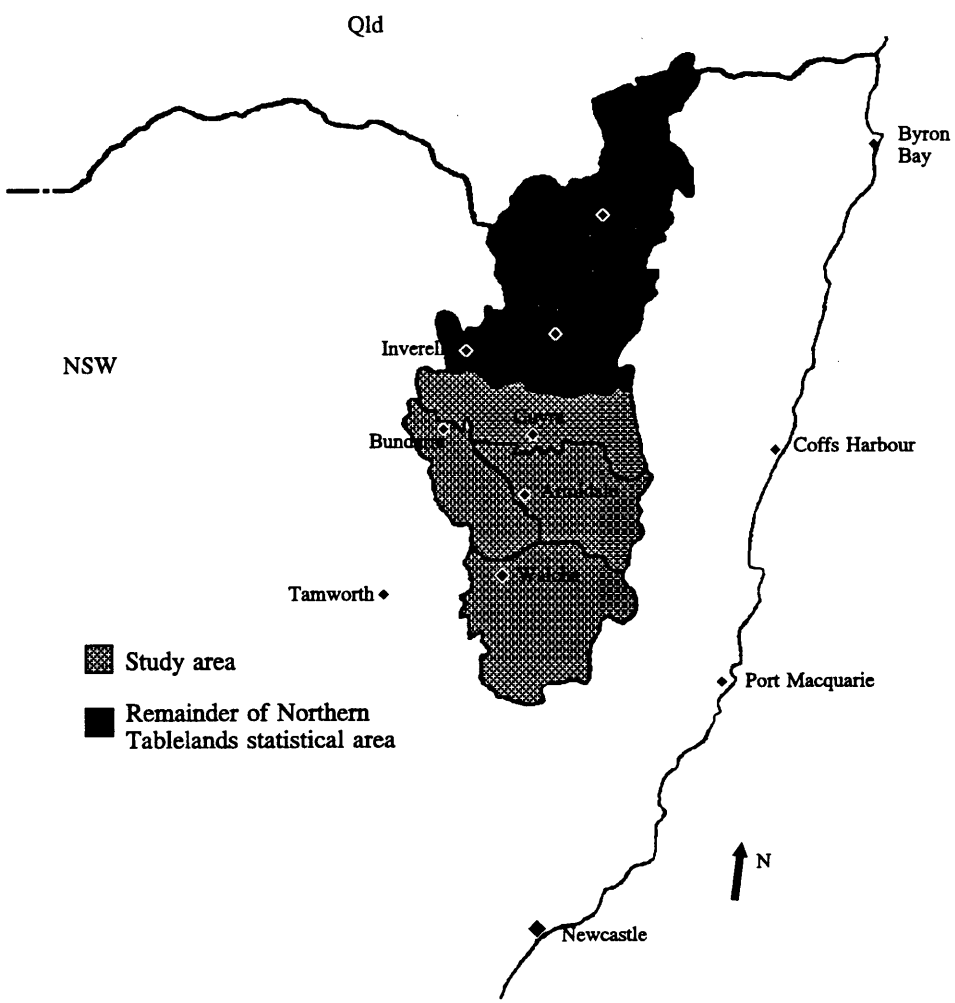
7.3 Characteristics of Armidale Rural Lands Protection Board area

The Armidale Rural Lands Protection Board area is in the southern part of the New England Tableland (see location in Figure 7.1), and includes most of the shires of Dumaresq, Guyra, Uralla and Walcha, plus the city of Armidale. Apart from mountain peaks and gorges, much of the area consists of three main plateaus with average altitudes of around: 700 metres in the Bundarra area; 1000 metres in the Armidale, Uralla, Walcha areas; and 1300 metres in the Guyra area.

7.3.1 Climate

Rainfall in the area generally increases with altitude and towards the east. Median rainfall for the main centres is as follows: Guyra 863 mm, Walcha 809 mm, and Armidale 772 mm (Bureau of Meteorology 1988). Rainfall figures were not available for Bundarra. However, Inverell, which has similar conditions, has a median rainfall of 745 mm. Rain is spread throughout the year, although autumn and early spring receive the lowest rainfall. This can be a problem since dry autumns and springs can create difficulties for graziers because limited growth during these periods can accentuate the normal feed shortage caused by the winter halt to growth. Average minimum temperatures are at or below zero during midwinter. Maximum temperatures during summer average around 23°C at higher altitudes and increasing to 30°C towards Bundarra.

Figure 7.1
Location of study area



7.3.2 Farm size and land use

According to the Australian Bureau of Statistics (1990), in March 1990 there were 1207 agricultural establishments in the shires of Dumaresq, Guyra, Uralla and Walcha, and the city of Armidale (Table 7.1). To qualify, the agricultural establishment had to have an estimated value of agricultural operations of $20 000 or greater. The average size of these establishments was 1040 ha. Of these, 1040 establishments had sheep and averaged 3555 sheep per establishment. The area had a total of 3.7 million sheep and 385 thousand cattle; 71 and 59 percent respectively of the totals for the Northern Tablelands statistical area. All four shires had significant numbers of sheep and cattle.

Table 7.1
Properties and stock numbers in shires encompassing the Armidale Rural Lands Protection Board
March 1990

Shire	Properties		Beef cattle		Sheep	
	Total	Av. area	Total	Farms	Total	Farms
	No.	ha	head	No.	head	No.
Dumaresq	265	1 202	113 454	226	734 349	218
Guyra	362	924	94 331	308	1 048 017	333
Uralla	250	1 001	54 345	201	842 629	224
Walcha	327	1 071	122 705	306	1 066 831	263
Total[a]	1207	1 040	385 257	1 043	3 697 324	1 040

[a] Includes Armidale city area

Source: Derived from Australian Bureau of Statistics (1990), *AgStats: Agricultural Statistics on Microcomputer*, Australian Bureau of Statistics, Canberra.

As shown by Table 7.2, in 1988-89 wool provided the bulk of income for properties in the area, although its long-term importance was exaggerated in that year by the higher than average wool prices. Clearly the major enterprises in the area are wool, lambs and cattle, with crops and other enterprises less important.

Table 7.2
Gross value of agricultural commodities produced in shires encompassing the Armidale Rural Lands Protection Board 1988-89

Shire	Wool	Sheep & lambs	Cattle & calves	Crops	Other
			($'000)		
Dumaresq	21 298	2 234	12 490	958	1 889
Guyra	27 228	4 514	12 487	1 126	507
Uralla	26 215	2 012	7 597	1 155	592
Walcha	31 865	3 740	15 552	84	90
Total[a]	106 606	12 500	48 126	3 323	3 078

[a] Does not include Armidale city.

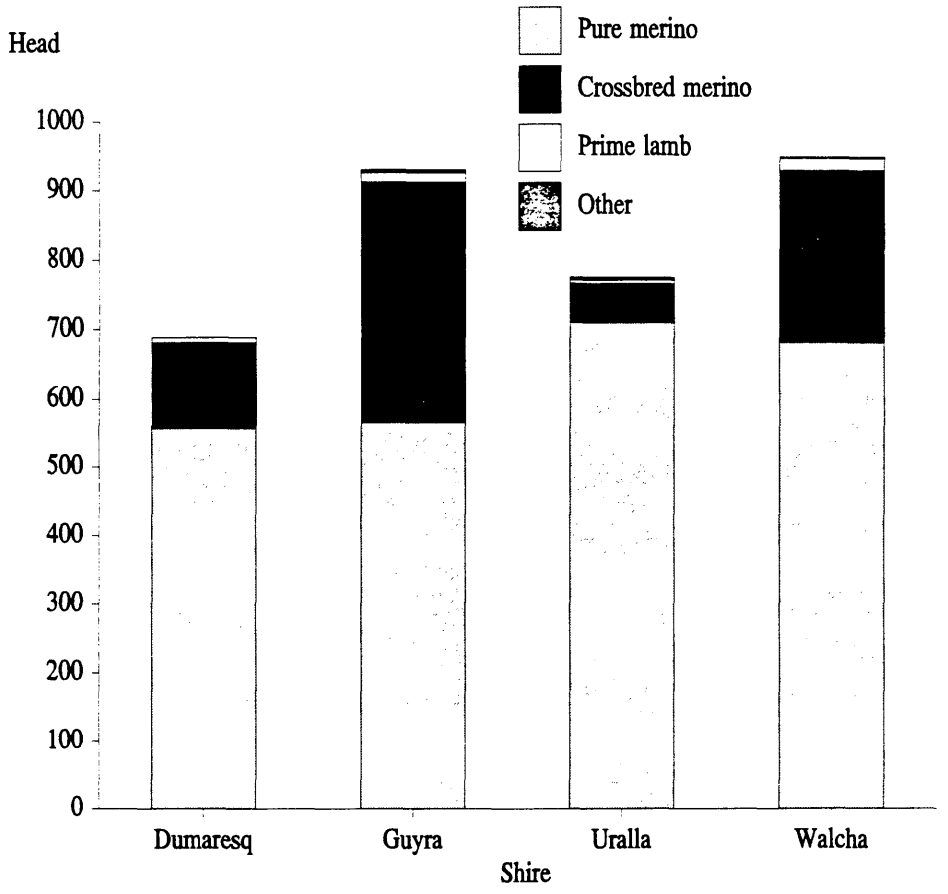
Source: Derived from Australian Bureau of Statistics (1989), *AgStats: Agricultural Statistics on Microcomputer*, Australian Bureau of Statistics, Canberra.

7.3.3 Breeds of sheep

The influence of environmental conditions on the composition of sheep flocks in each shire is illustrated in Figure 7.2. Guyra, with higher rainfall and more consistent pasture growth, had the highest proportion of crossbred merinos, first cross ewes being the main dams used for prime lamb production. This is supported by Table 7.2 which shows Guyra received a higher proportion of the gross value of agricultural commodities produced from sheep and lambs than the other shires. Both Walcha and Dumaresq shires, which have good fattening areas (mainly towards the east), also had significant prime lamb flocks. Uralla on the other hand, with a lower rainfall and

less suitable fattening country, had mainly purebred merinos, which are suitable for wool rather than meat production.

Figure 7.2
Sheep breeds in shires of Armidale Rural Lands Protection Board 1989



Source: Derived from Australian Bureau of Statistics (1989), *AgStats: Agricultural Statistics on Microcomputer*, Australian Bureau of Statistics, Canberra.

7.4 Research design

To test the theoretical approach outlined for this research three important dilemmas had to be resolved:

what approach should be used to derive the models?;

how should the models be tested?;

what decisions should be modelled?

Two other factors were kept in mind when solving these dilemmas:

the decision criteria in the models had to be group-specific and not person-specific and needed to include the general principles underlying the criteria;

introduction of theoretical or interviewer biases as to what criteria ought to be included in the decision models should be avoided.

7.4.1 Method for deriving and testing the models

Below is a summary of the five steps proposed by Gladwin (1977, pp. 85-7) to be used to develop and test a hierarchical decision model:

(1) Observe and elicit the criteria used in decisions made by a small sample of 20-30 decision makers.

(2) Build a flowchart based on the language and categories used by the decision makers.

(3) Test the flowchart for descriptive accuracy against decisions made by a small sample of the decision makers used to build the chart.

(4) Rebuild the flowchart into a general model using the aspects and constraints which underlie the decision rules used by the decision makers.

(5) Test the model using a new representative sample of decision makers.

Gladwin's approach involved making several visits to particular decision makers. It had to be adapted to meet the particular circumstances of this study. Wool producers in the study area live a considerable distance apart which meant that it would be expensive to make a series of visits when developing and testing the initial models.

Since the interviews were likely to be lengthy, to involve collection of information on stock numbers and decisions made in previous years, and to involve personal information, it was felt that an initial introductory meeting was necessary to gain the decision maker's confidence and support for the study. Subsequent experience with a couple of interviews without an initial meeting showed the benefit of this approach. It was initially thought that follow-up interviews might be conducted by telephone and, while this was done in a few limited cases, the complexity of the decision models meant that this approach was generally not appropriate.

Taking these factors into account, it was decided to select two groups from the sample frame. The first group was used to develop and test interview techniques and formats, develop initial models, refine these models and to undertake limited testing of the models. The initial interviews for this group were exploratory and experimental in nature. Subsequent interviews involved a refinement of techniques and testing of the first exploratory models; while the last interviews involved further refinements and testing of interview approaches and decision models. Most members of this group received a short introductory visit and a lengthy visit for the main interview. The second group was generally used to test the models developed with the initial group. They also received a brief introductory visit and a lengthy second visit. Details of sample selection and content of the interviews are discussed in later sections of this chapter.

In summary, the 'tyranny of distance' meant it was not possible to return to the initial group to check and test criteria in the manner used and advocated by Gladwin (1977). Instead, it was decided to test the models on a new group of decision makers, as she suggested, but was not able to undertake in her study.

7.4.2 Selection of samples

A definition of the target population and the weaknesses of the sampling frame obtained for the study were discussed in 7.2. After it was culled for double entries and other errors, the list contained 910 separate units. This compares favourably with the 1040 sheep properties identified in the Australian Bureau of Statistics sample

(Table 7.1), allowing for the different methods for selecting the properties and for the two areas being slightly different.

Since the research design called for the selection of two groups to be interviewed, the dilemma was to decide the size of the groups. It was not proposed to make statistically significant predictions from the results of the survey, so the normal methods for deciding sample size were not appropriate. It was important, however, for the groups to be large enough to cover the expected variation in environments and decisions.

Each model needed to be developed and tested on enough interviews to identify the significant aspects and their order in the decision tree. If too few interviews were conducted, the models would not be accurate enough to make reliable predictions. There was no simple way of knowing a priori what this number should be, or how many interviews would be required to achieve it. The author's experience of the industry intimated considerable variation would be found. A one-day visit to seven properties in the district provided support for this view.

Given the above factors, it was decided to make the groups as large as possible given the constraints of time and travel costs. These established an upper limit of approximately 100 full interviews, implying around 200 visits in total. It was expected some decisions would have been made by only a few of the sample, so it was felt that the test group would need to be about as large as the development group. It was therefore decided to make the two groups of equal size. A sample size of 75 was set for each group (approximately 8 per cent of the total), after making allowances for refusals and for a few noncommercial operations in the frame.

Random number tables were used to select a simple random sample of 150 names from the list of 910. After selecting one of the two groups at random, the initial sample was allocated by turns to a group.

7.5 Choice of decisions to be modelled

Managers of grazing properties make a variety of decisions, ranging from long-term decisions to buy another property, to short-term decisions to give the weaners another drench. All, to a greater or lesser degree, have some influence on the supply of wool. From a strategic perspective, these decisions take place within the framework of a hierarchy of objectives and their associated plans that constrain each decision context (Wright 1993).

For most producers in the New England the overriding strategic decision involves the maintenance of the viability of their grazing property (i.e., to survive). All other decisions are made with this in the background. The resources of land, labour and capital determine the opportunities that exist and act as a further constraint to action. Beneath the overriding strategic objective and plan are a hierarchy of objectives and plans that are successively constrained by their superior plans, objectives and the resources available.

The challenge for this research was to delineate those decisions that were the important determinants of wool supply and to arrange them appropriately within the hierarchy. Initially it was hoped to be able to build a series of decision models that might be aggregated to model supply in the chosen area. This proved a forlorn hope.

7.5.1 A need to integrate levels of decisions

Certain things were obvious before the research began. First, decisions that influence livestock numbers are made at many levels and decisions at one level may have implications for decisions at other levels. For example, a decision to shift from buying western wethers into merino breeding may result in a further decision to produce 1x lambs or even 2x lambs. Similarly, once merino breeding has begun, the opportunity arises to run bred wethers, or to have a breeding operation and sell all the wethers. For a grazier breeding merinos, a whole series of decisions then becomes relevant: what micron of merinos to breed; whether to mate cull ewes to prime lamb rams; what proportion of ewes to wethers to young sheep to run; how

many sheep in total can be run; and so on. The models would need to incorporate these complexities in some way.

Second, and correspondingly, many graziers may have made a decision not to 'chase the market' and to stick with what they have; hence they ignore many price signals. These higher level decisions establish barriers that limit the options they will consider. Changes will only be made at the margin, if at all, unless a serious problem arises which causes or forces them to rethink their strategy.

Third, unlike cropping decisions, many livestock decisions are not made at any particular time and often involve a continuous series of decisions. Many enterprises are interrelated (e.g., sheep and cattle - merino ewes, wethers and 1x lambs). Consequently, not all alternative livestock enterprises or other options are seriously considered. Decisions are often compartmentalised. This implied a series of interrelated decision models rather than a single model.

7.5.2 Where to begin?

In the initial stages of the interview process no attempt was made to find out exactly what decision models should be developed. The guiding principle was that a search should be made to learn from the graziers what decisions had a significant impact on changing the type and numbers of sheep they ran and the amount of wool they sold.

7.6 Conduct of interviews

Initially it was planned to commence interviewing in March 1991. However, the wool industry was in turmoil at that stage and it was decided to wait until the situation had stabilised and there was some idea of the direction in which the industry was heading. The main reasons for the delay were: it was felt woolgrowers might think there was a hidden agenda involved with the survey and this might influence their responses; and the anger that many woolgrowers felt about the industry changes might lead to problems in conducting some interviews. Interviewing eventually began in July 1991. The delay caused difficulties in arranging interviews, because

July to January is the busiest period for grazing properties in the New England area. This is when most of the shearing, lambing and lamb marking takes place.

As discussed in 7.4.1, it was decided to make two visits to each sheep producer. The initial visit aimed to: establish a rapport with the sheep producer; explain the aims and possible benefits of the research; outline exactly what was required of them; obtain their support; and arrange for them to have information on livestock numbers available for the next visit. A time for the visit was arranged by telephone. It provided an opportunity to find out if there was someone who spent most of their time working on the property. This criterion was used because it was simple and could be used over the telephone. It also eliminated the 'hobby farmer', but still allowed for wool producers who might have spent some of their time working away to help overcome problems caused by the downturn in the wool industry. As far as possible several visits were arranged in a particular area on the one day.

7.6.1 Format for first series of interviews

The objective of the first series of interviews was to develop the decision models that could then be formally tested in the second series of interviews. Initially, however, it had not been decided which models would be developed, or which format the interviews should take to obtain the information to develop the models. Initial interviews were, therefore, exploratory in nature. No formal pretest or pilot study was conducted. Over time, improvements were incorporated into the interview guide. All information gathered was used, where relevant, to develop the decision models.

Before the decision models could be developed, the decision criteria used by the wool producers had to be elicited. This was a difficult process because each criterion had to be able to divide a sample of decision makers into two groups: those who met the criterion and decided to go in one direction and those who did not meet the criterion and went in another direction. Decision criteria had to be distinguished from norms or beliefs that did not necessarily predict behaviour. For example, a norm or belief frequently expressed by wool producers was that they did not believe in 'chasing markets'. Despite this, many of them modified their operations in response to changes in price; in effect, they 'chased markets'. When confronted with this they

would be aware of the contradiction, but would have logical reasons for their behaviour. To overcome this problem an approach had to be found which distinguished between beliefs and decision criteria.

Gladwin's approach to this problem (Gladwin 1979a, p. 160) was to identify a sample of decision makers whose behaviour varied only on the criterion of interest and to look for contrasts over decision makers, space and time. She then went back to a decision maker where this contrast existed and attempted to elicit the decision criterion. A further visit was made to another of the sample to test the result. Such an approach was feasible in a village situation, but constraints on the number of visits in this study made it infeasible. Therefore, another method had to be found.

Fortunately, personal construct theory provides a framework that can aid understanding of a wool producer's decisions. In this framework it is acknowledged decision makers will use a variety of construct subsystems (fragmentation corollary) and constructs used in the systems have a hierarchical arrangement (organisation corollary). In consequence, some constructs may not be applied to some decisions, or may be redundant because higher-level constructs come into play.

Personal construct theory also incorporates interview techniques that can help elucidate construct systems. These were discussed in detail in 6.5 and include the repertory grid technique, laddering and pyramiding. Adaptations of all three of these were used in the interviews to help find which criteria were used by graziers to make decisions. Another use was to provide an understanding of the constructs underlying these decision criteria so that the more general rules of the final models could be developed.

A repertory grid analysis can take two hours to complete, obviously too long for this study since it would not leave time to investigate other issues. A shortened approach was developed and used, particularly in the early interviews. Producers were asked to compare a few selected enterprises in groups of three (e.g., fine wool breeding, prime lambs, cattle breeding), and to suggest ways in which two of them were alike and therefore different from the third. To ensure the constructs elicited were not

influenced by other questions or comments, this segment was employed early in the interviews. It helped develop an understanding of the construct systems used by sheep producers when comparing their enterprises and possible alternatives.

Laddering and pyramiding techniques were used throughout the interviews to clarify statements, elaborate construct systems and to distinguish decision criteria from norms and beliefs. A particular example is the one given above of the belief that one shouldn't 'chase markets'. By using questions beginning with 'why' to ladder up and 'how' or 'what' to pyramid down, a more general decision criterion was developed.

An example of the laddering procedure for this example went as follows:

Woolgrower: I don't believe in chasing markets.
Interviewer: And what should woolgrowers do in contrast to chasing markets.
Woolgrower: A long-term strategy is more important.
Interviewer: Why is a long-term strategy important to you?
Woolgrower: Chasing markets only gets you in to trouble, we're in it for the long haul and many people have got seriously burnt by chasing markets so we need to consider what will happen in the long term.

Similarly an example of the pyramiding procedure went as follows:

Interviewer: Obviously there are situations when you do change in response to prices. How does what you do differ from people who chase markets?
Woolgrower: Well - those who chase markets are after the quick buck. Most of them end up chasing their tail. When we make a change it's because we believe there is a long-term benefit from going in that direction and we don't intend to change back overnight.
Interviewer: What types of things do you need to consider when you assess if there is a long-term benefit?
Woolgrower: What I mean is you have to look at whether the return is going to be better, but there's always a chance that things will turn around - then you've got the costs associated with the change, so there's a certain amount of risk involved.

After this type of analysis what was distilled was a decision about whether, in the long run, the change would lead to increased profits given the costs of change and the chance that prices would change back again to favour the existing enterprises.

Particularly in the early interviews, different techniques and formats for questions were tried out. How producers delineated enterprises had to be learned first so that the changes that had taken place could then be defined. An idea of the period in which decisions were made had to be developed, along with an appreciation of the

relationship between enterprises and decisions, in particular the hierarchy of decisions.

The first series of interviews extended from July 1991 to January 1992. They took place in two main groups: 14 between July and August 1991, and a further 29 from October 1991 to January 1992. In the break between the first and second series of interviews a few changes were made to the scope and organisation of the interviews:

a) It was decided to concentrate on merino sheep and not to model decisions about 2x prime lambs and cattle except where they influenced decisions about merinos. Many decisions to begin a 2x lamb enterprise had been made in the 1970s and thus it was difficult to establish, with any accuracy, the criteria used. With 2x lambs, and also cattle, many models were required. They were left out to simplify the problem so the interviews would be a reasonable length and more effort could be put into the merino models.

b) The information collected was used to develop preliminary models for several decisions. Although some criteria had been tried out in the first interviews, the development of these models placed more structure on the interviews and made it easier to test and compare different criteria. When these were incorrect, changes were made and the models were upgraded.

c) Detailed information on livestock numbers was only collected for the last few years and this was simplified to the totals at the 30th of June. Often it had proven difficult to obtain numbers for earlier years and purchases and sales of stock were even more difficult to obtain with any accuracy. Experience showed midwinter stock numbers provided a more stable reflection of stocking rates than other times because purchases and sales of stock generally occur before or after this time. As well, it was the ideal time to obtain mating decisions, because rams are normally put out in the autumn.

Following these changes, the second group of 29 interviews was more focused and concentrated on decisions that influenced production of merino wool. Generalised

questions were asked in the beginning of each section so that the answers were not constrained. The criteria in the models were tried out later in each section of the interviews. Changes and additions were made to the criteria when producers' replies indicated this was necessary.

7.6.2 Development of models for second or 'test' series of interviews

Decisions about livestock enterprises, unlike cropping decisions, were not made at any particular time. Instead, a continuous series of decisions was made. This, plus the complementary and supplementary relationships between the enterprises (e.g., sheep and cattle; merino ewes, wethers and 1x lambs), meant not all alternatives were seriously considered. Livestock decisions are also different to cropping decisions since breeding operations require strategies for the long term and are tied into previous decisions (e.g., micron type, fencing layout, sheds and yards). In this context there was no one time of the year when producers sat and decided what livestock enterprise would be run for the next 12 months. Apart from those (very few) who did this as a planning exercise, it appeared a catalyst was necessary to trigger a decision to change.

In addition, it became obvious in the initial stages of the research that producers unconsciously filtered, or often deliberately ignored, information about the short-term relative profitability of the various enterprises that could be undertaken on their properties. Comments such as:

> '. . . not going to change in the short term - a long term strategy is more important. . . .'
>
> '. . . chasing market trends is like shutting the gate after the horse has bolted.'
>
> '. . . don't follow trends - believe in sticking with what I've always done and I won't get into any bother.'
>
> 'We're here for the long term benefit - not going to go chasing the end of the rainbow.'

reflect the long-term orientation of many producers which mainly arose because of the difficulty of predicting prices and their experience of prices being like a 'pendulum' which swung back in their favour eventually. In such an environment producers tended to maintain their existing mix of enterprises unless something occurred that triggered them to begin to consider a change.

Typically the factors that initially triggered a decision to change did so as part of a stage 1 or pre-attentive type process. Other aspects were also used in this stage either to decide against change, or to eliminate various options and to simplify the subsequent decision. A generalised model of the decision trees developed is presented in Figure 7.3. This splits the decision process into the two stages and shows the general type of factor considered in each of these stages. They are shown as occurring sequentially, with one factor leading on to the next. Reality was considerably more complex than this simplified model. For example, factors that may have been judged pre-attentively by some, may have received more conscious attention from others.

Another complication was that producers' existing combinations of enterprises influenced the factors that were relevant to decisions to begin or change another enterprise. Although particular decisions were generally compartmentalised, they often opened other options for which decisions became necessary. So that this could be modelled, a hierarchical arrangement for the decisions was required. The manner in which decisions relating to the merino enterprises were linked together is illustrated by Figure 7.4 and Figure 7.5. For example, the existence of a merino breeding enterprise was linked to decisions about changing the breeding of the merinos, keeping wethers, mating merino ewes to short-wool and/or long-wool rams, stopping merino breeding and changing the micron of the wool clip.

After the completion of the first series of interviews, the information collected was used to improve and expand the preliminary decision models and to create other models that filled the gaps, where possible. Using the guidelines discussed above, the models to be tested in the second series of interviews were developed. A list of models is given in Table 7.3. The decision trees for these models are presented and discussed in Appendix 3.

Some models in Table 7.3 (shown with a *) were only at a preliminary stage of development. Not many in the initial series of interviews had made these decisions so only some aspects likely to influence decisions for a group of wool producers could be elicited. No attempt was made to seek out extra interviews for these as it

Figure 7.3
General model of decision process

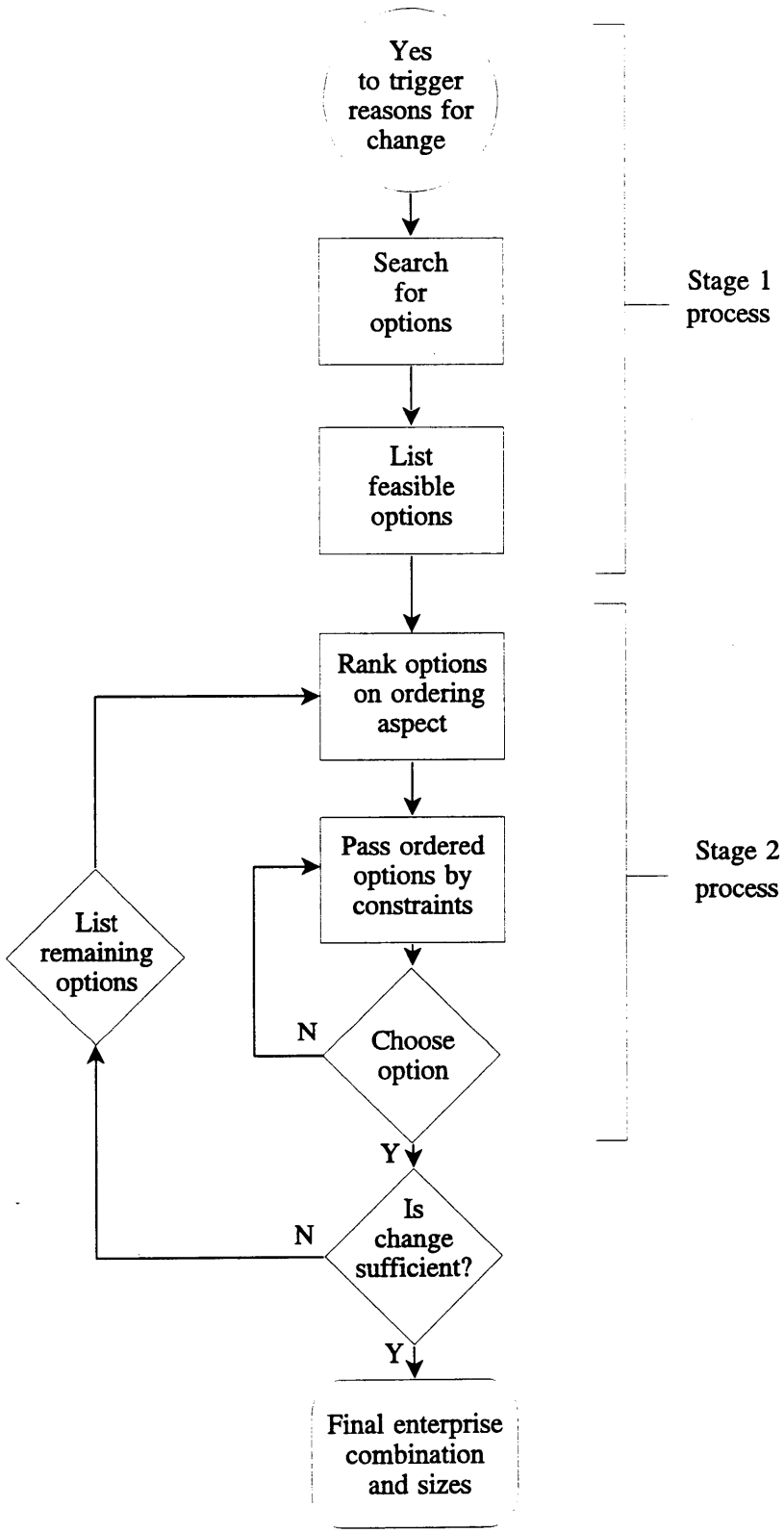


Figure 7.4
Guideline for decisions related to breeding merinos

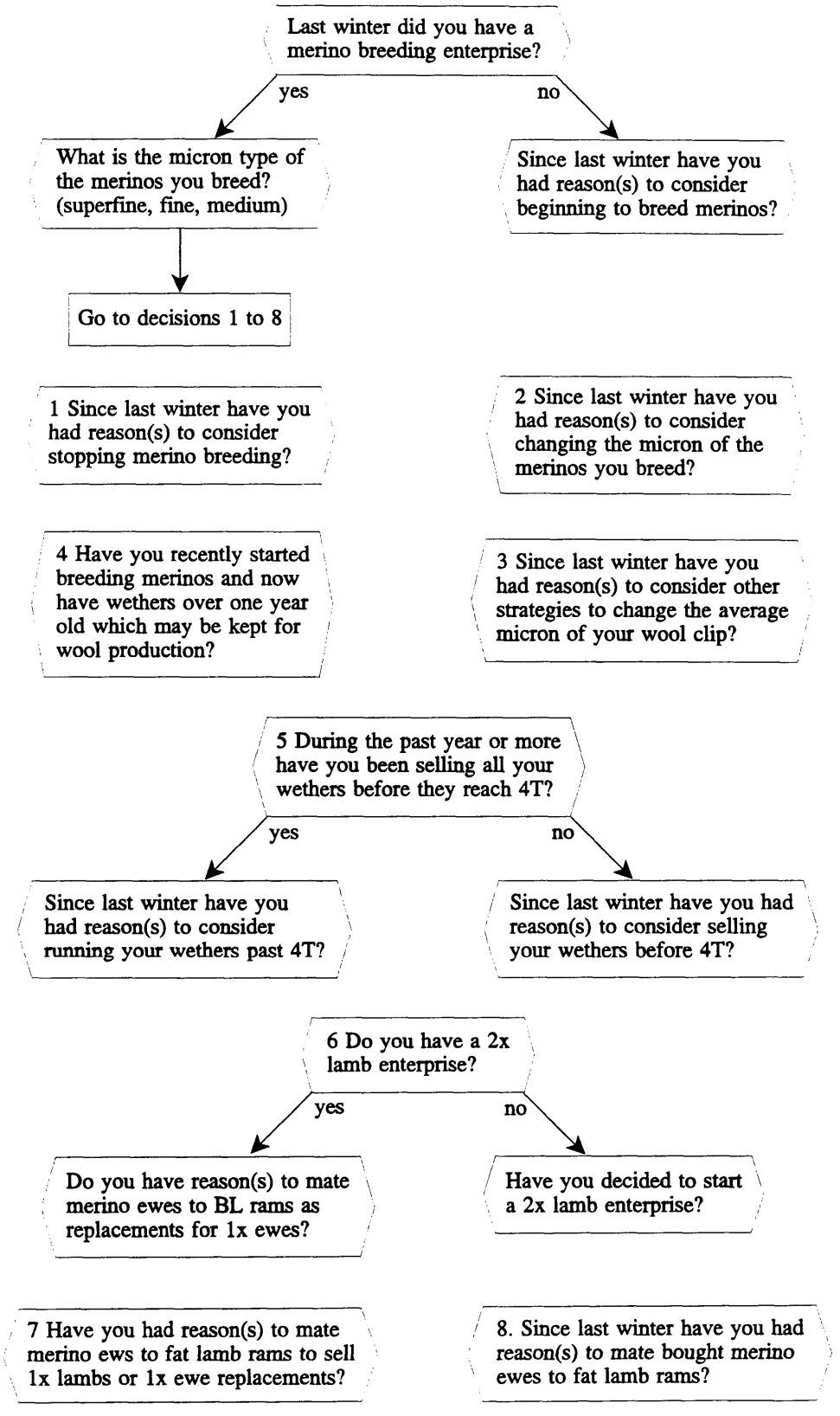


Figure 7.5
Guidelines for decisions related to bought merino ewes and wethers

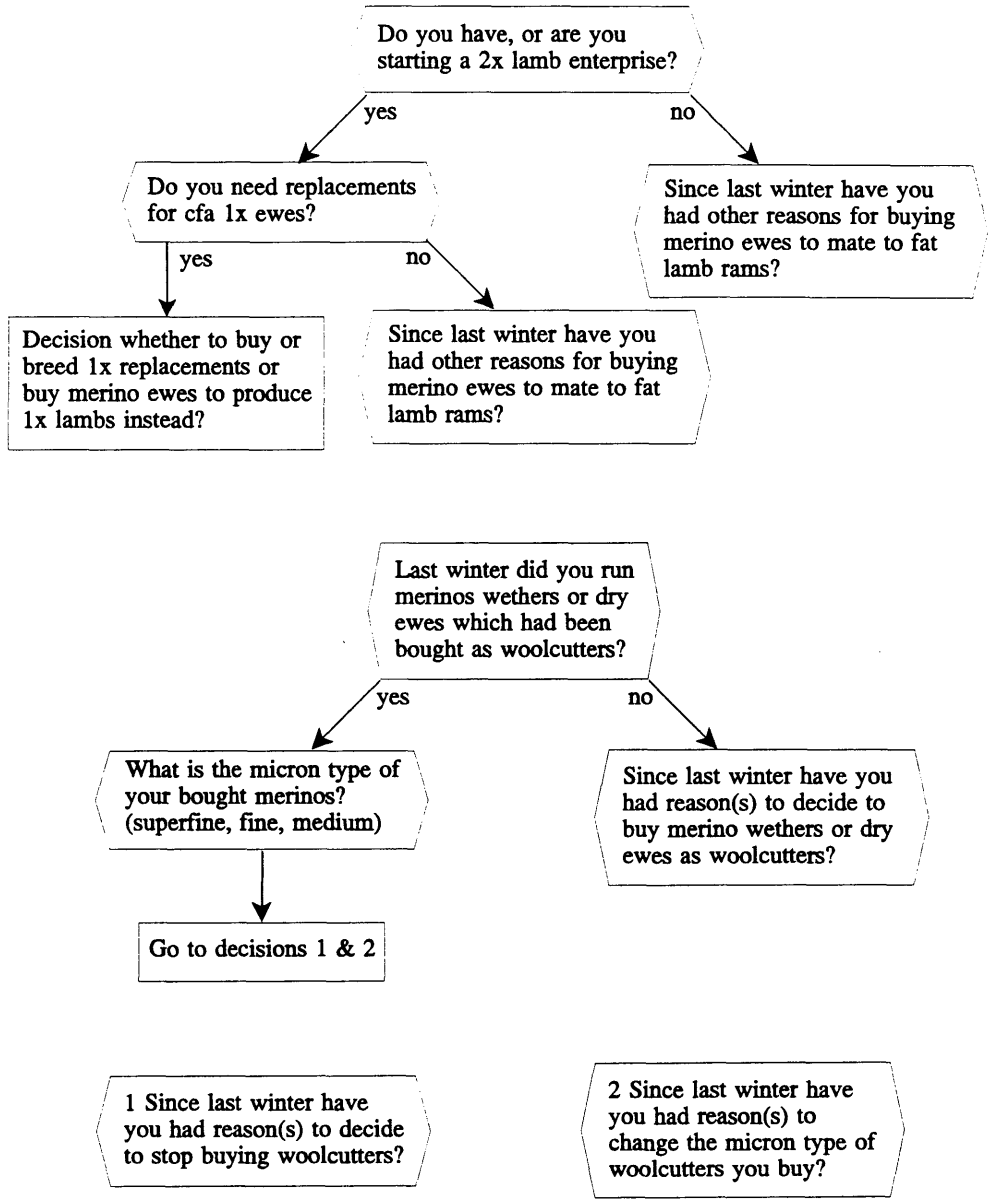


Table 7.3
List of production and marketing decisions modelled

Begin merino breeding
*Stop merino breeding
Change micron of merino breeding flock
Keep young seconds to reduce micron of wool clip
Run own wethers after merino breeding begun
Begin to keep own wethers past 4T
*Stop running own wethers
Mate ewes from merino breeding flock to prime lamb rams to sell 1x lambs
*Raise own 1x ewes by mating ewes from merino-breeding flock
*Buy merino ewes and breed 1x ewes
*Mate bought merinos to produce 1x lambs
Begin to buy merino woolcutters
Micron type of woolcutters to buy
Buy another micron type of woolcutter
Stop buying a micron type of woolcutter
Delay sale of wool
Whether to sell main lines by auction or private sale

was felt resources should be allocated to decisions based on their relative frequency of occurrence. While the models were not expected to be very accurate, they were included so that improvements could be made once further information was available from the final series of interviews.

From the first series of interviews, it was apparent many people had trouble remembering why they had made changes before about 1980. This was the period just before the last widespread drought that seemed a focal point in peoples' memories. Major decisions, such as beginning or ending merino breeding, could usually be remembered clearly this far back. Other decisions of a more cyclical nature, which did not involve such a large change, and in which unconscious type processing was used (e.g., such as mating cast-for-age merino ewes to prime lamb rams, or timing of

wool sales), could only be remembered reliably for the previous three or four seasons. It was decided, accordingly, to restrict questions on major changes in enterprises to after 1980 and for minor decisions from the winter of 1989 to 1992.

To test the models for situations where decision makers may have considered a change but rejected it, even when this occurred unconsciously, a tactic was needed which prompted the interviewees to discuss these occasions. The approach chosen was to get them to read a list of reasons for change derived from the initial series of interviews. For each of the financial years from 1989 to 1992 they were asked if one or more of the situations, or another more important situation, had arisen which had made them consider, initially at least, making a particular change. It was emphasised that it was important to know if they were aware of that situation having arisen, even if they had rejected making the particular change we were discussing at the time. It was stressed that any awareness of the situation was important, no matter how brief, and that their reasons for making a change (or not making a change) because of the situation, would be discussed later.

This approach appeared reasonably successful, although not all unconscious processing was detected. Some would obviously have been forgotten, but on a couple of occasions it became apparent from subsequent questions that producers had considered a change, or were aware of a situation listed, but had promptly rejected change. This rejection generally occurred because a change in enterprises conflicted with a long-term strategy and therefore was not seriously contemplated. Sometimes the strategic orientation appeared to act as a filter when they were asked if the situations had occurred.

An attempt was also made to develop models that could predict changes in livestock numbers. The factors involved in decisions to increase or decrease stock numbers proved to be too situation-specific and the models too complex and difficult to generalise.

Decisions seemed dependent upon the existing enterprise mix and the particular combination of resource restrictions. For example, a person with a self-replacing

merino flock, who had a high equity, might be 'understocked' in good seasons for strategic reasons and might have a long-term strategy of sticking with the existing mix of enterprises. Stock numbers would change very little. On the other hand, another person in a similar situation might have a small prime lamb enterprise as well, and have decided to go out of them after a period of declining returns. Merino ewe and/or wether numbers might then be increased to replace the prime lamb dams and lambs. A third person might use merino wethers as a safety valve for dry seasons and therefore would maintain ewe numbers, but decrease wether numbers when the seasons turned. For these reasons it was decided to elicit only the most important factors influencing a change in livestock numbers rather than try to develop decision models.

7.6.3 Format for second or 'test' series of interviews

For the second series of interviews, it was decided to follow the same approach of an introductory interview and a second full interview. Again potential interviewees were contacted initially by telephone to arrange an introductory visit. At this time it was learned if they met the work criteria and if they were willing to be involved. The aim of the introductory visit was to establish rapport, explain the objectives of the study and gain support. If this was achieved, the information that would be required at the main interview was explained, along with a four-page form left for them to complete beforehand. It contained an introductory letter, asked them to mark on a list which enterprises were undertaken on the property, and to enter livestock numbers at the end of June for the years 1989 to 1992. Usually the latter could be obtained relatively accurately and reasons for changes in the numbers could be remembered.

The main objective of the second series of interviews was to test the decision models. To this end the interviews began with questions designed to find out what enterprises were currently on the property and what changes had occurred between 1980 and the present (or when the interviewee first took over management of the property if this occurred later than 1980). The answers to these questions were entered on a sheet that was the reference used to decide which of the models were appropriate to that interview and therefore which questions should be asked. Since the initial models

had been developed from information collected before the end of 1991, their application to the first half of 1992 provided a limited test of their ability to extrapolate into uncharted territory.

Structure was provided for the interviews by deciding which models were appropriate in each case and by asking the appropriate questions related to them. Since some models and questions in the models were irrelevant to most of the interviewees, it was not possible to use an interview schedule that covered all the possibilities in a formal sense. Instead, an interview guide was used which helped keep track of the models from which questions should be asked and the answers given to the particular questions. The interview guide was based on the questions in Figure 7.4 and Figure 7.5.

Also flexibility was needed to allow further exploration of events when the need arose; for example, when deciding what situations had initially caused a decision maker to consider making a particular change. The laddering and pyramiding techniques were used often in these situations. Since most of the questions asked in the interviews came from the decision trees, discussion of this is left to Appendix 3 where they are presented and discussed in detail.

A pilot survey of three properties was conducted in April 1992, two of which had been in the list for the first series of interviews but had not been interviewed then because a suitable time could not be organised. Following a few minor alterations, interviewing commenced in May and continued through to July 1992, by which time 49 interviews had been conducted.

7.7 Concluding remarks

This chapter contains an outline of the design of the research and the conduct of the interviews. The next chapter provides an overview of the characteristics of the properties included in the study and the changes that took place on them.

Chapter 8
Study area characteristics and changes 1980-92

> If scientific reasoning were limited to the logical processes of arithmetic, we should not get very far in our understanding of the physical world. One might as well attempt to grasp the game of poker entirely by the use of the mathematics of probability.
> (Vannevar Bush)

8.1 Outline of chapter

In the previous chapter a brief introduction was provided of the study area (the Armidale Rural Lands Protection Board) its location, climate and land use. This chapter uses results from the surveys conducted in 1991 and 1992 and data from the Australian Bureau of Statistics to illustrate the changes that took place in the livestock enterprises of the area between 1980 and 1992. Discussion of the reasons for these changes is left to the next chapter when the decision models are discussed.

8.2 Survey response rate

For the initial series of interviews 75 names were selected from the sample frame. Of these, 43 (57 per cent) were interviewed. A further two were interviewed as part of the pilot for the second series of interviews. Eighteen (24 per cent) were considered part-time operators and therefore were not interviewed, while a further 10 (13 percent) either refused or a suitable time could not be organised for a visit. Of the remaining two, one could not be contacted and the other was not interviewed because the property had been bought recently.

Of the seventy-five selected for the 'test' series, 49 (65 per cent) were interviewed, 12 (16 per cent) were considered part-time, and 14 (18 percent) either refused or a suitable time could not be organised for a visit. Most of the refusals from this series

came from the Guyra area, which may mean underestimates for livestock numbers and models dealing with prime lambs and changes from 1x ewes into merinos.

8.3 Size of operational properties surveyed

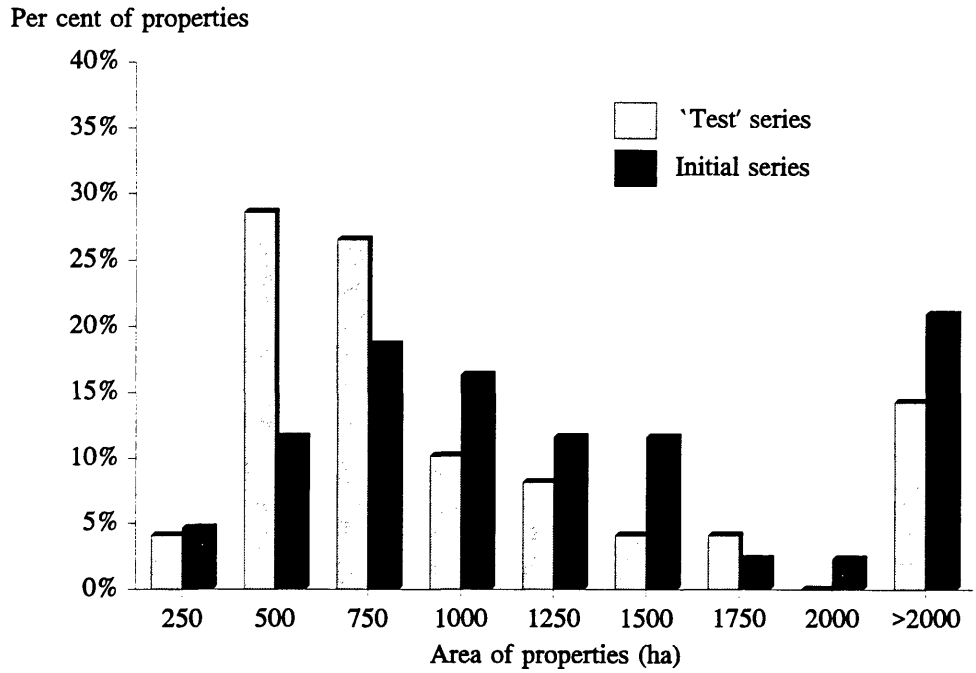
For the purposes of this study it was decided to define an operational property to be a property, or properties, which had the same management team, and for which the decisions were integrated. If more than one property was involved, integration of decisions was taken to mean that decisions on one property about numbers and types of livestock to be run were influenced, or had an influence on, the numbers and types of livestock run on other properties under the same management team. The reason for this approach was to simplify the decision models so they did not have to account for changes that might take place because of changes on another property under the same management team.

Operational properties visited in the initial series of surveys had an average area of 1429 ha while those in the second series averaged 1017 ha (Appendix Table A2.1). The average for the 'test' series is similar to the average of 1040 ha for the Australian Bureau of Statistics survey given in Table 7.1, but the average for the first series is considerably larger. Distributions of property sizes for the two surveys (Figure 8.1) show the initial series had a greater percentage of large properties. The largest property in this survey was also twice the size of the largest in the 'test' series. Most properties in the latter series were between 250 and 750 ha.

8.4 Livestock numbers

Livestock numbers were collected for the initial series of interviews, however, because several formats and collection periods were tried, no consistent data is available. For the 'test' survey group a standard format was used and an effort was made to collect livestock numbers for the years 1989-92. Four replies from the total of 49 were not usable for all four years, so the details reported over this period are for the 45 properties with usable replies. In 1990 all the properties surveyed in the

Figure 8.1
Distribution of areas managed for each interview series

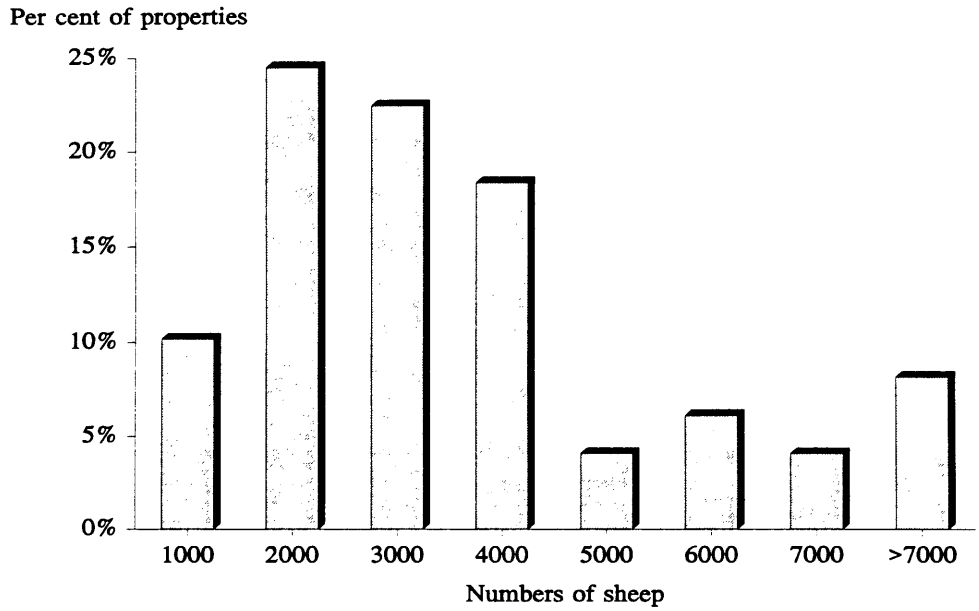


'test' series had sheep, with the total for the group being 161 272. This is an average of 3584 sheep per property, which is comparable to the average of 3555 obtained by the Australian Bureau of Statistics in the same year (see Table 7.1).

The distribution of sheep numbers on the properties in the 'test' series was highly skewed, with over three-quarters having less than 4000 sheep and over a third less than 2000 (Figure 8.2). Cattle numbers were even more highly skewed with nearly 40 per cent having between 1 and 100 cattle (Appendix Figure A2.1).

Although livestock numbers were collected from producers in the 'test' group for 1989-92, decisions to change enterprises were assessed back to 1980. Statistics on livestock numbers for the study area were first published by the Australian Bureau of Statistics in 1982. To help provide an understanding of the changes that have taken place in the period 1980-92, in the next sections, the Australian Bureau of Statistics census figures are used in combination with the survey results. Despite their different sampling unit and data collection methods, the comparable results obtained

Figure 8.2
Distribution of sheep numbers for 'test' series
n=49[a]



[a] Percentages are calculated on all 49 properties in the sample, but the property with no sheep is not included in the graph.

for property size and sheep numbers suggest they may be used side by side with some confidence.

Sheep numbers in the area increased continually from 1982 to 1990 (Figure 8.3, ignoring the statistical aberration in 1987), and were over one-third higher by 1990. (in line with, but proportionately greater than the national increase; see Figure 2.5). Unfortunately the Bureau of Statistics stopped publishing shire data after 1990 and the information was only available at considerable cost. Wool production increased even more dramatically during the same period (Figure 8.4), with an increase in numbers of sheep shorn and wool cut per head. The increase was not at the expense of cattle, since their numbers also increased by a similar proportion to sheep numbers, coinciding with steady price increases and rebuilding of the herd after the drought in the early 1980s. Following the considerably lower wool prices and the poorer seasonal conditions in 1991-92, the survey figures show a peak in 1990

followed by a decrease in both sheep and cattle numbers. Sheep numbers still appear considerably higher than they were ten years earlier in 1982.

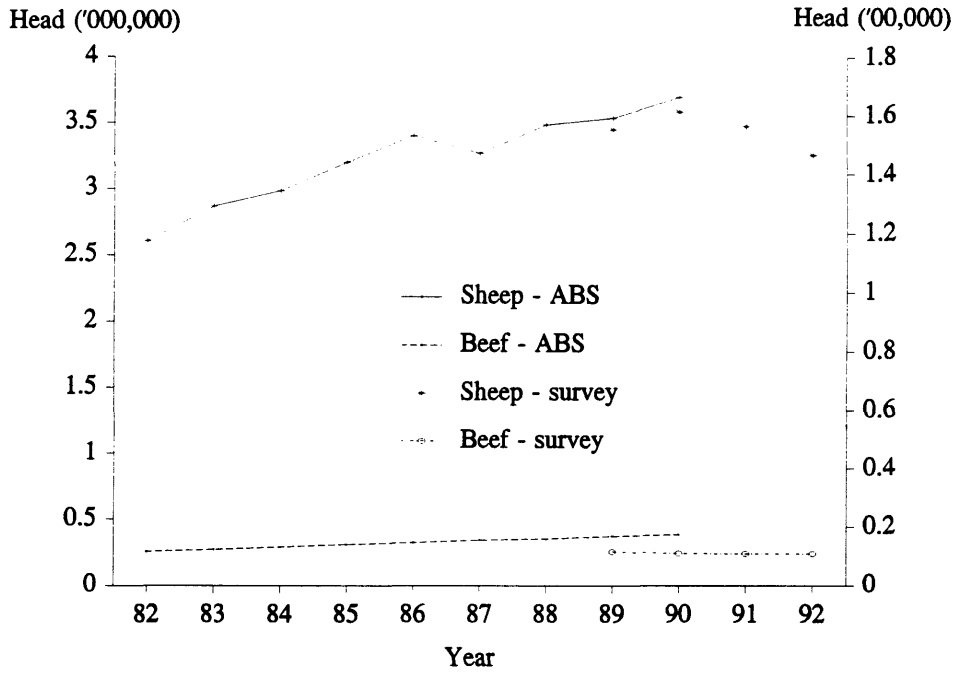
8.5 Changes in gender composition of sheep flock

A clearer picture of how the increases in stock numbers during the 1980s were achieved is given by the change in gender composition of the flock shown in Figure 8.5. In the period 1982 to 1990, breeding ewe numbers appear to have increased. Even allowing for the statistical change between 1986 and 1987, the increase was less than 10 per cent (Appendix Table A2.5). Figures on the numbers of ewes mated (Appendix Table A2.6) are even less dramatic, with most of the increase between 1982 and 1990 appearing to coincide with the end of the drought in 1983. Lamb numbers increased also, but much of this increase was due to improved lambing percentages, probably due to the series of good seasons (see both Appendix Table A2.5 and Table A2.6).

Most of the increase in stock numbers was due to an increase in wethers, which more than doubled between 1982 and 1990 from around half a million to over a million. Part of the increase was, of course, a function of restocking after the drought, as wethers are often off-loaded or run harder by many wool producers to lighten stocking rates and to allow room for breeding stock.

The manner of the decline in sheep numbers after their peak in 1990 is illustrated in Figure 8.6. Initially, matings of merino ewes remained relatively stable, but as the dry conditions continued through 1992, around twice as many 2T or older ewes were left dry (Appendix Table A2.3). Often, but not always, these were 2T ewes that had not grown out, or which would not be expected to lamb well under the poorer feed conditions. Matings of 1x ewes also decreased as producers either decreased the number they mated or went out of them altogether. This was especially apparent in 1992 with the percentages of properties in the 'test' series who mated 1x ewes to prime lamb rams falling from 40 per cent in 1990 to 38 per cent in 1991, and to 27 per cent in 1992. Again, however, the main contributor to the fall in sheep numbers was a decline in the numbers of merino wethers which fell by 15 per cent between

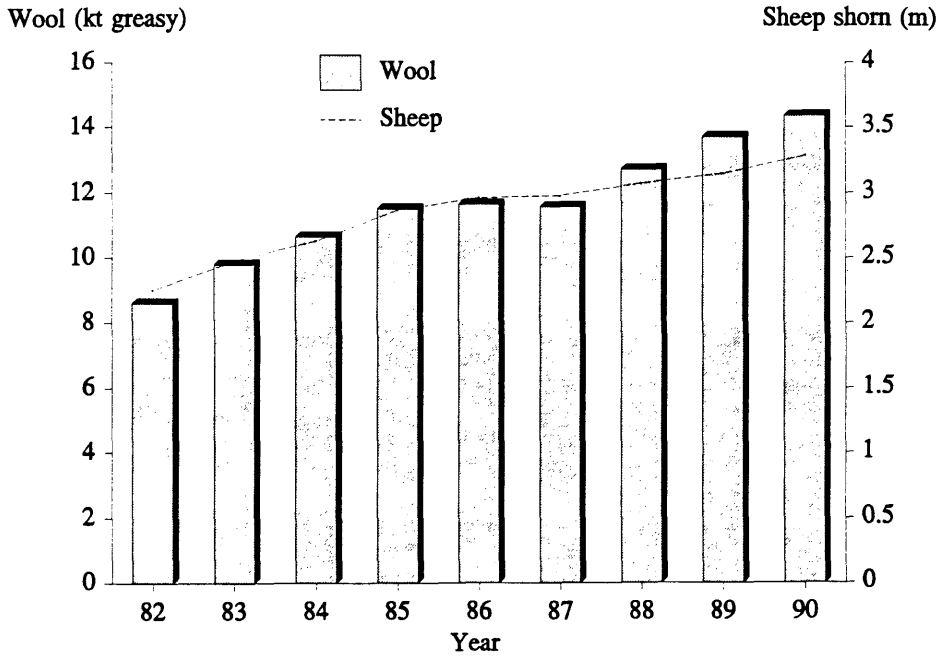
Figure 8.3
Sheep and beef cattle numbers in study area[a]



[a] This graph combines the Australian Bureau of Statistics data for the shires in the Armidale Rural Lands Protection Board area and the livestock numbers for the 'test' series. The ABS figures were adjusted for the change in definition of establishment between 1986 and 1987 using the ABS conversion for NSW. The adjustment appears to have been insufficient for sheep numbers because there is no other obvious reason for the drop in sheep numbers between 1986 and 1987.

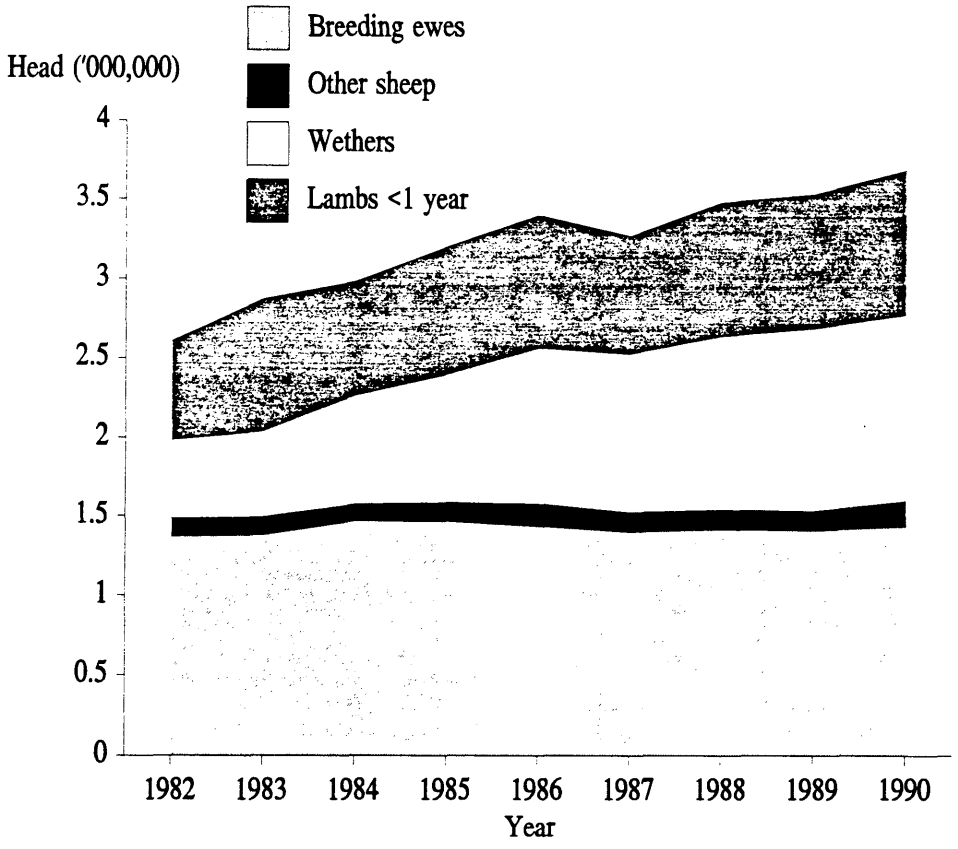
Source: Derived from Australian Bureau of Statistics, *Livestock and Livestock Products - New South Wales*, Cat. No. 7221.1, AGPS, Canberra.

Figure 8.4
Wool production in study area



Source: Derived from Australian Bureau of Statistics, *Livestock and Livestock Products - New South Wales*, Cat. No. 7221.1, AGPS, Canberra.

Figure 8.5
Gender composition of sheep flocks in study area[a]

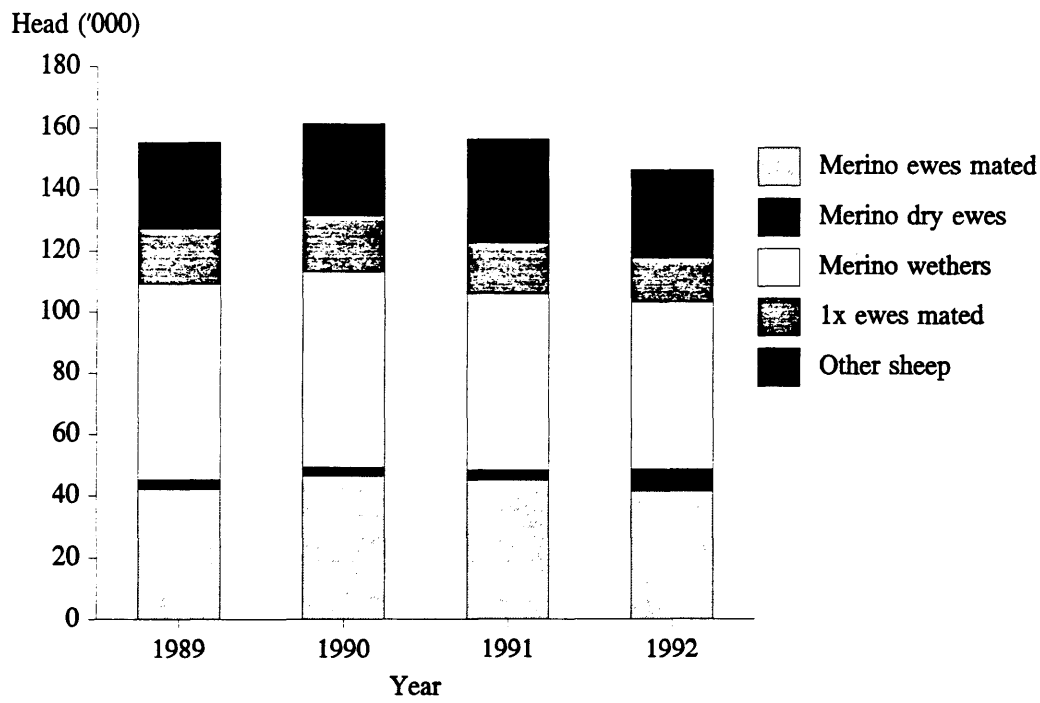


[a] The ABS figures were adjusted for the change in definition of establishment between 1986 and 1987 using the ABS conversion for NSW. The adjustment appears to have been insufficient for sheep numbers because there is no other obvious reason for the drop in sheep numbers between 1986 and 1987.

Source: Derived from Australian Bureau of Statistics, *Livestock and Livestock Products - New South Wales*, Cat. No. 7221.1, AGPS, Canberra.

1990 and 1992, primarily due to a decline in the numbers of bought wethers (Appendix Table A2.7).

Figure 8.6
Gender composition of 'test' series flocks



8.6 Changes in breed composition of the sheep flock

An account was given in 7.3.3 of the breeds of sheep that made up the flocks of each shire in the study area. For the whole survey area, Australian Bureau of Statistics figures suggest that in 1989 approximately three-quarters of the flock were pure merinos and one-quarter crossbred merinos (Australian Bureau of Statistics 1989). No livestock numbers were obtained from the interviews to show the change in the proportions of these breeds between 1980 and 1989. However, numbers are available from the interviews that illustrate changes that occurred between 1989 and 1992. As well, details are available on the numbers of properties that started or stopped merino breeding or 2x prime lamb production in the period 1980-92.

Between 1980 and 1992 one major change to occur was a shift out of 2x prime lamb production and a shift into merino breeding. For properties where the manager interviewed had been in control throughout this period, the number of properties producing 2x lambs declined by 43 per cent from 32 in 1980 to 18 in 1991-2 (Table 8.1). Simultaneously the number of properties breeding merinos increased by nearly one-third from 48 to 63. While most of the properties that stopped producing prime lambs did so towards the end of the period, a significant number also stopped between 1980 and 1983. On the other hand, most of those who began merino breeding did so between 1986 and 1992. This, of course, only measures those who stopped or started an enterprise. Many others, who were in both prime lambs and wool sheep, cut back their 1x ewe flocks and increased their wool flocks without stopping or starting a new enterprise.

While there was a shift from prime lamb production into merino breeding there was a change towards the production of finer merinos. For the purposes of this study, merino flocks were divided into the categories of superfine, fine and medium based on the average micron for wool of adult sheep in the flock (i.e., older than 1½ years). The average micron was taken over all adult sheep on a property provided the sheep came from a similar genetic line. Flocks of sheep on the one property, from different lines, were allocated to different categories if the averages for the

Table 8.1
Number of properties from interview series breeding merinos and producing 2x prime lamb
n=78[a]

	Period				
	80	80-83	84-86	87-89	90-92[b]
Merino breeding					
Number breeding					
superfine	17	17	17	18	19
fine	22	22	25	33	36
medium	9	10	9	8	8
Total	48	49	51	59	63
Number who began[c]					
superfine	-	0	1	1	2
fine	-	1	5	9	5
medium	-	1	0	0	0
Total	-	2	6	10	7
Number who stopped[c]					
superfine	-	0	1	0	1
fine	-	1	2	1	2
medium	-	0	1	1	0
Total	-	1	4	2	3
Prime lamb production - 2x					
Number producing	32	28	26	21	18
Number who began	-	3	0	2	3
Number who stopped	-	7	2	7	6

[a] Includes properties from the initial and 'test' series where the manager interviewed had been involved with management of the property from 1980 onwards. A property may be counted more than once in the table if it has two merino flocks of different breeds.

[b] May be an underestimate for this period since most of the interviews for the initial series were completed by the end of 1991.

[c] Includes changes from one breed of merino to another when this occurred. If this change occurred through breeding it is an estimate of the time when the average for the adult flock changed from one category to another.

flocks placed them in different categories. The following guidelines were used to define the categories:

Superfine: Average micron is 18.5 or less;

Fine: Average micron is 18.6 to 20; and

Medium: Average micron is greater than 20.

An idea of the shift towards finer merinos can also be obtained from Table 8.1. The shift is not as dramatic as that from prime lambs into merino breeding, with the main indication being the slight decline in number of medium wool flocks while the numbers of both fine and superfine flocks increased. Again these figures do not account for the gradual fining of clips that occurred within each of the merino categories, particularly towards the end of the 1980s.

A clearer picture is available for the period 1989 to 1992 of the shifts in livestock numbers between the different merino categories and prime lamb production (see Figure 8.7). Figures for the 'test' series (Appendix Table A2.2) show the following changes during that time:

Superfine merino numbers increased by 21 per cent from 36 825 to 44 487.

Fine merino numbers decreased by 6 per cent from 74 085 to 69 636.

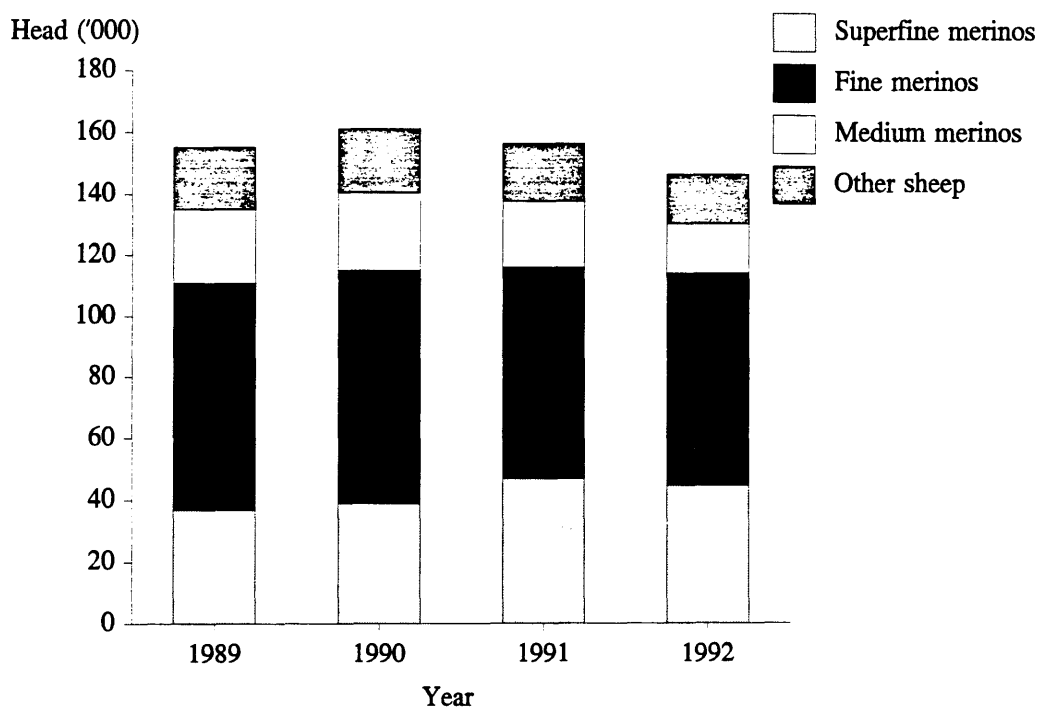
Medium merino numbers decreased by 32 per cent from 24 099 to 16 313.

Non-merino sheep numbers, which mainly includes 1x ewes, decreased by 20 per cent from 20 212 to 16 117.

Perhaps just as telling as the changing numbers of livestock, which fluctuate in the short term under the effect of seasonal conditions, is the decline during the same period in the percentages of properties with medium merinos and non-merino sheep. These declined from 29 to 20 per cent and 44 to 40 per cent, respectively.

Numbers of ewes mated (or intended to be mated) to different breeds of rams also reflect the changed emphasis of sheep producers in the area for the late 1980s to early 1990s. Particularly towards the end of the 1980s (see Table 8.2 and also Appendix Table A2.4), matings to merino rams increased at the expense of production of 1x ewe replacements (matings to longwool rams) and production of 2x prime

Figure 8.7
Breed composition of 'test' series flocks



lambs (matings to shortwool rams). Occasionally 1x lambs were produced instead of 2x lambs to take advantage of the higher wool return from the merino dams.

Table 8.2
Intended matings of ewes in study area by breed of ram

Ram breed	1988	1989	1990
Merino	659 190	723 820	801 298
Shortwool	480 825	460 439	414 995
Longwool	163 120	120 230	117 902
Other	16 252	11 250	33 651
Total	1 319 387	1 315 739	1 367 846

Source: Australian Bureau of Statistics (various issues 1988-90), *Agstats: Agricultural Statistics on Microcomputer*, Australian Bureau of Statistics, Canberra.

The shift into superfine merinos is reflected in the increase in the number of merino ewes mated to superfine rams, while the number mated to medium rams declined (Table 8.3). The decline in medium merino breeding, however, was only slight. Most of the decline in medium merino numbers between 1989 and 1992 was due to a halving in numbers of bought medium wethers between 1989 and 1992 (Appendix Table A2.7). These sheep were generally bought from the west of NSW.

In 1991-92 these trends were altered by two important changes, a collapse of the wool price (particularly in the finer end of the market) and continuing dry conditions. The latter immediately affected the numbers of ewes mated, while the effect of the former had only just begun as producers had yet to assess the long-term implications of the alterations to the wool market.

8.7 Summary of changes in study area (1980-92)

Most of the properties included in this study were relatively small, with less than 750 ha, 3000 sheep and 100 cattle. However, on average they seem representative of the commercial sheep properties in the area. Sheep numbers increased about one-third

Table 8.3
Matings of merino ewes to merino rams in 'test' series flocks
n=45

Merino ewe type	1989	1990	1991	1992
Superfine				
No. ewes mated	14 245	14 842	17 529	15 930
No. properties	11	11	11	11
% of properties	24%	24%	24%	24%
Fine				
No. ewes mated	19 778	21 651	18 010	19 367
No. properties	16	18	18	18
% of properties	36%	40%	40%	40%
Medium				
No. ewes mated	3 260	3 194	3 293	2 854
No. properties	3	3	4	3
% of properties	7%	7%	9%	7%
Total matings	37 283	39 687	38 832	38 151

between 1982 and 1990 but declined after then. Although ewe numbers increased until 1990 most of the increase was due to a doubling of wether numbers. It appears from the changes that have occurred in the size and composition of the sheep flocks throughout the 1980s and early 1990s, that sheep producers maintained flexibility when adapting to changes in wool prices and seasonal conditions by making major changes in their wether numbers and maintaining or gradually changing their breeding flocks.

Two other important changes took place between 1980 and 1992. The first was a shift from prime lamb production into merino breeding that took place throughout the period. For the producers interviewed in the study, the number raising 2x prime lambs decreased about 40 per cent, while the number breeding merinos increased by nearly one-third. The second change was a shift by wool producers towards the production of finer merinos, mainly towards the end of the 1980s. For the 'test' series, from 1989 to 1992, superfine merino numbers increased by 21 per cent, fine

merino numbers remained relatively stable, and medium merino numbers decreased by 32 per cent.

The next chapter contains a discussion of the decisions that resulted in the changes outlined in this chapter. An understanding of wool producers decision processes and the important aspects they use is given by hierarchical decision models of the decisions.