3 Natural resource management and Australian farmers

With 60 per cent of the Australian continent under leasehold or freehold tenure for agriculture or grazing (chapter 1) farmers and pastoralists are responsible for much of the land management in Australia. This chapter examines the characteristics of farms and farmers that may influence natural resource management.

Estimates of the number of farm establishments vary according to the definition of farm one uses. In 1996 there were 104,400 farm establishments that earned more than $5000 gross value of production. In the same year 196,000 persons described farming as their main occupation. There were 98,600 farm families. ¹

Australian agriculture is characterised by a large number of small farms and a small number of large farms. In 1996 the median gross farm establishment income was estimated at $96,400 (using 1996 dollars and farms with at least $5000 gross income). The financially smallest 50 per cent of farm establishments (incomes lower than $96,000) produced approximately 10 per cent of total value of agricultural production. The financially largest 10 per cent of farm establishments (incomes greater than $400,000) produced between 40 per cent and 50 per cent of gross value of Australian agricultural output. These larger farms managed over 60 per cent of Australian agricultural land. This is over a third of the total land area of Australia.

For further information see Barr (2001) and Cary et al. (2001).

¹ The definition of a farm is problematic. The Australian Farm Census data set has had an inconsistent structure over the period 1983-1997. Farm businesses (establishments) are included in data aggregation if the value of their production exceeds a minimum Estimated Value of Agricultural Operations. The minimum Estimated Value of Agricultural Operations required for inclusion within the census has varied inconsistently from $2,500 to $22,500 measured in nominal dollars. This report is based upon a data set with an Estimated Value of Agricultural Operations cut-off of $30,000 (measured in 1996 dollar terms). The definition of a farmer is also problematic. The categorisation of a person’s occupation as farmer is based upon a self-description question used in the Australian Population and Housing Census. Respondents are asked their major occupation within the preceding week. The self-description of farmer is open to ambiguity. Any family with at least one member who describes his or her major occupation as farming is defined here as a farm family. For further discussion refer to Barr (2001).
Responses to pressures for change

Development of Australian agriculture in the last two centuries was generally driven by a production-focussed ethos. Natural resource protection was often a reaction to the unanticipated major threats to the productive resource. Australian agricultural development has consequently been described as a continuing unplanned experiment (Barr & Cary 1992). In more recent times the focus of the Australian community has shifted from the historic production-focussed ethos towards a balance of concern for both the protection of natural values such as biodiversity and landscapes and the maintenance of food safety and quality. Agricultural landholders have not been immune from this shift in concerns; landholders in Australia generally now recognise significant land or water degradation problems. In one recent study a quarter of the farms in most of the major farming regions of Australia reported one or more significant land or water degradation problems in 1998-99. There was also a widespread awareness amongst farmers of the importance of environmental impacts beyond the farm boundary (Reeve et al. 2001). The translation of these changes in awareness of environmental impacts and attitudes to changes in land management practice has been mixed. There are some significant success stories where the methods of production have undergone major change with consequent real improvements in natural resource protection. The widespread adoption of minimum tillage and direct drilling in many parts of the cropping zone is a good example. However, other aspects of land management have been relatively unchanged despite clear deleterious impacts on natural resource management. The continued use of cultivated fallow and stubble burning in other parts of the cropping zone is an example of this latter situation (Karunaratne & Barr 2001a; Karunaratne & Barr 2001b).

Recognition of a resource degradation problem is a necessary but rarely a sufficient condition for the adoption of sustainable natural resource management practices. Whether farmers change their land management in response to this recognition depends on many interrelated factors. These factors include:

- the characteristics of the natural resource management practices;
- farmer beliefs about the environment and practices to protect the environment;
- financial capacity of farm businesses to invest in natural resource protection;
management skill and knowledge of land managers;

- support for environmentally friendly behaviour from peers and social networks;

- individual differences between landholders; and

- regulatory and legal pressures.

In this chapter we present a brief discussion of the first six of these factors.

The nature of the natural resource management practices

It is the inherent characteristics of natural resource management (NRM) practices that largely determine the rate of their adoption by producers. Sustainable NRM practices that provide economic and other advantages will generally be adopted more rapidly. In most cases such advantages will depend on commodity prices.

Landholders generally seek to reduce the risk of adopting a new practice. Sustainable NRM practices which are observable, trialable, and less complex are generally more quickly adopted than NRM practices that are unobservable, untrialable, and complex. Table 3.1 lists a number of practices and grades them according to these characteristics. The characteristics of a practice vary in different locations. It is dangerous to assume that a practice with advantages in one location will yield the same advantages elsewhere. Few sustainable practices have universal applicability. Our assessment of these practices should be taken only as a general guide.

- Clearly not all practices designed to improve natural resource management are unprofitable. However, many are unprofitable, and many that are profitable are both less profitable than alternative practices and often more complex, harder to trial and have benefits which are difficult to observe. For many sustainable practices (such as deep-rooted perennials) the advantage to be gained by adoption of is dependent on the value of the rural commodities produced as a result of using the practice. Low commodity prices for beef and wool over the recent decade have reduced the relative advantage of adopting many sustainable practices in the broadacre industries. Finally, some practices offer advantages that are captured beyond the farm gate.
## 3 Australians agricultural land managers and natural resource management

<table>
<thead>
<tr>
<th>Sustainable practice</th>
<th>Geographic applicability</th>
<th>Relative advantage</th>
<th>Risk avoidance</th>
<th>Simplicity</th>
<th>Compatibility</th>
<th>Trialability</th>
<th>Observability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance of soil cover</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
</tr>
<tr>
<td>Establishing and monitoring ground cover targets (monitoring of pasture and vegetation condition)</td>
<td>Hi (temporal)</td>
<td>Hi</td>
<td>M-Lo (locality)</td>
<td>M</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
</tr>
<tr>
<td>Nutrient balance accounting (soil and plant sampling)</td>
<td>Hi</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi-M</td>
<td>Hi-M</td>
</tr>
<tr>
<td>Soil and plant tissue tests to determine fertiliser needs</td>
<td>Lo</td>
<td>Lo</td>
<td>Lo</td>
<td>Lo</td>
<td>Lo</td>
<td>Lo</td>
<td>Lo</td>
</tr>
<tr>
<td>Regular soil testing</td>
<td>M</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Lo</td>
<td>Lo</td>
</tr>
<tr>
<td>Fertilising of pastures</td>
<td>M</td>
<td>Hi-M (locality)</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi-M</td>
<td>Hi-M</td>
</tr>
<tr>
<td>Agricultural lands treated with gypsum</td>
<td>M</td>
<td>Lo</td>
<td>M-Lo</td>
<td>M</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
</tr>
<tr>
<td>Agricultural lands treated with lime</td>
<td>M</td>
<td>Lo</td>
<td>M-Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi-Lo</td>
</tr>
<tr>
<td>Regularly monitor water tables</td>
<td>M</td>
<td>M (locality)</td>
<td>Hi</td>
<td>Hi</td>
<td>Lo</td>
<td>Hi</td>
<td>M</td>
</tr>
<tr>
<td>Use of deep-rooted perennial pastures</td>
<td>Hi</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M (locality)</td>
<td>M</td>
<td>Lo</td>
</tr>
<tr>
<td>Non-commercial tree and shrub planting</td>
<td>M – Hi</td>
<td>Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
</tr>
<tr>
<td>Commercial tree and shrub planting (farm forestry)</td>
<td>M</td>
<td>Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
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<tr>
<td>Preserve, enhance areas of conservation value</td>
<td>M</td>
<td>Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
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<tr>
<td>Retention of vegetation along drainage lines</td>
<td>M</td>
<td>Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
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<tr>
<td>Protection of land from stock by fencing (exclude stock from degraded areas)</td>
<td>M</td>
<td>Lo</td>
<td>Hi</td>
<td>M</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
</tr>
<tr>
<td>Protection of waterways from stock by fencing</td>
<td>Lo</td>
<td>Lo</td>
<td>Hi</td>
<td>M</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
</tr>
<tr>
<td>Animal pest or weed control to control land degradation</td>
<td>Hi</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M-Hi</td>
<td>M</td>
<td>M</td>
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</table>

(Continued on next page)
### Table 3.1b Characteristics of some agricultural practices with beneficial impacts on natural resources (Continued)

<table>
<thead>
<tr>
<th>Sustainable practice</th>
<th>Geographic applicability</th>
<th>Relative advantage</th>
<th>Risk avoidance</th>
<th>Simplicity</th>
<th>Compatibility</th>
<th>Trialability</th>
<th>Observability</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ideal rating)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
<td>(Hi)</td>
</tr>
<tr>
<td>Pest and disease control in pastures</td>
<td>M</td>
<td>M-Hi (locality)</td>
<td>M</td>
<td>M</td>
<td>M-Hi</td>
<td>M-Lo</td>
<td>M</td>
</tr>
<tr>
<td>Use of integrated pest management (reducing pesticide use)</td>
<td>Lo</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>Lo</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
</tr>
<tr>
<td>Slashing and burning of pastures</td>
<td>Lo</td>
<td>M-Lo</td>
<td>M</td>
<td>Hi</td>
<td>M</td>
<td>Hi-M</td>
<td>Hi</td>
</tr>
</tbody>
</table>

### Cropping farms

<table>
<thead>
<tr>
<th>Description</th>
<th>Geographic applicability</th>
<th>Relative advantage</th>
<th>Risk avoidance</th>
<th>Simplicity</th>
<th>Compatibility</th>
<th>Trialability</th>
<th>Observability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of reduced or zero tillage (minimum tillage)&lt;a&gt;</td>
<td>Hi</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M-Hi</td>
<td>Hi</td>
<td>M</td>
</tr>
<tr>
<td>Stubble or pasture retention in ploughing (direct drilling)&lt;a&gt;</td>
<td>M</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M</td>
<td>Hi-M</td>
<td>M</td>
</tr>
<tr>
<td>Use of crop or pasture legumes in rotations&lt;a&gt;</td>
<td>Hi</td>
<td>M-Hi</td>
<td>M-Hi</td>
<td>M-Hi</td>
<td>M-Hi</td>
<td>M</td>
<td>M-Lo</td>
</tr>
<tr>
<td>Use of contour banks in cropland&lt;a&gt;</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Hi</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Hi</td>
</tr>
<tr>
<td>Strip cropping&lt;a&gt;</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Hi</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Hi</td>
</tr>
<tr>
<td>Adjusting crop sequences in response to seasonal conditions</td>
<td>Hi</td>
<td>M-Hi</td>
<td>M</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>Lo</td>
</tr>
</tbody>
</table>

### Irrigation farms

<table>
<thead>
<tr>
<th>Description</th>
<th>Geographic applicability</th>
<th>Relative advantage</th>
<th>Risk avoidance</th>
<th>Simplicity</th>
<th>Compatibility</th>
<th>Trialability</th>
<th>Observability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation scheduling&lt;a&gt;</td>
<td>M</td>
<td>M</td>
<td>Hi</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>Lo</td>
</tr>
<tr>
<td>Laser graded layout&lt;a&gt;</td>
<td>Hi</td>
<td>M-Hi</td>
<td>Hi-M</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>M-Hi</td>
</tr>
<tr>
<td>Storage and reuse of drainage water&lt;a&gt;</td>
<td>M</td>
<td>M-Hi</td>
<td>M</td>
<td>M</td>
<td>M-Hi</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Automated irrigation&lt;a&gt;</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Lo</td>
<td>Lo</td>
<td>M-Lo</td>
<td>Lo</td>
<td>Hi</td>
</tr>
</tbody>
</table>

### Rangelands

<table>
<thead>
<tr>
<th>Description</th>
<th>Geographic applicability</th>
<th>Relative advantage</th>
<th>Risk avoidance</th>
<th>Simplicity</th>
<th>Compatibility</th>
<th>Trialability</th>
<th>Observability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control grazing pressure by excluding access to water&lt;a&gt;</td>
<td>M</td>
<td>M</td>
<td>Hi</td>
<td>M-Lo</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Hi</td>
</tr>
<tr>
<td>Control of water flow from bores&lt;a&gt;</td>
<td>Hi</td>
<td>M-Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
<td>Hi</td>
</tr>
</tbody>
</table>
### Table 3.1c Characteristics of some agricultural practices with beneficial impacts on natural resources (Continued)

<table>
<thead>
<tr>
<th>Sustainable practice</th>
<th>Geographic applicability</th>
<th>Relative advantage</th>
<th>Risk avoidance</th>
<th>Simplicity</th>
<th>Compatibility</th>
<th>Trialability</th>
<th>Observability</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ideal rating)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piped water supplies for stock(^a)</td>
<td>Hi</td>
<td>M-Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>M</td>
<td>M-Lo</td>
<td>Hi</td>
</tr>
<tr>
<td>Pastoral land stocked at recommended rates</td>
<td>Hi</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
<td>M</td>
<td>M-Hi</td>
<td></td>
</tr>
<tr>
<td>Degraded pastoral land converted to less damaging use</td>
<td>M</td>
<td>Lo</td>
<td>Hi</td>
<td>M</td>
<td>M</td>
<td>M-Lo</td>
<td>M-Hi</td>
</tr>
<tr>
<td>Pastoral land destocked in low feed conditions</td>
<td>Hi</td>
<td>M-Hi</td>
<td>M-Lo</td>
<td>Hi</td>
<td>M-Lo</td>
<td>Hi</td>
<td>M</td>
</tr>
<tr>
<td>Dairy farms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of effluent disposal systems (collection of effluent; ponds or drainage sump) (^a)</td>
<td>Hi</td>
<td>M-Lo</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td></td>
<td>M-Hi</td>
</tr>
<tr>
<td>Pump dairy shed effluent onto pasture (^a)</td>
<td>M</td>
<td>M-Lo</td>
<td>Hi</td>
<td>Hi</td>
<td>M</td>
<td>Hi</td>
<td>Hi</td>
</tr>
</tbody>
</table>

\(^a\) Some measure of the level of landholder adoption of this practice available from the ABARE Australian Resource Management Supplementary survey. (Comments in brackets refer to locality or temporal constraints on expression of attribute.) Hi = High. M = Medium. Lo = Low.
Box 3.1  **Dryland lucerne: a profitable but complex innovation**

The watertable under the riverine plains of northern Victoria has been rising since the introduction of European agriculture. The long-term solution for rising watertables in this region is to develop a system of farming based on a productive and profitable, deep-rooted perennial crop. The most appropriate commercial plant available at present is lucerne, yet only a minority of farmers grow significant areas of lucerne.

Lucerne is relatively complex to introduce into a pastoral management system, and there are considerable risks in its successful establishment. Sowing lucerne does not guarantee a successful crop of lucerne. The chance of failure is greater than with many other pasture species. One way to minimise the financial risk of establishing lucerne, and to make up for time a paddock may be out of production, is to sow lucerne with a faster-growing crop such as safflower. Farmers may have to learn to grow new crops that are more compatible with lucerne.

Lucerne requires rotational grazing management. Using the four-paddock rotation system, a farm running three flocks would need 12 or 16 paddocks. For farms previously ‘set-stocked’ this implies additional expensive fencing and more dams and reticulation to provide watering points in each paddock. Fencing at this intensity is likely to impede the easy management of cropping activity on mixed farms.

Lucerne pasture is more productive than normal pasture, but there are complex ramifications in the farm system as more sheep will be required to utilise the extra pasture. The increased flock size requires extra capital, more work in sheep handling and an increased workload of rotational grazing. Higher sheep densities in paddocks may mean a greater need for control of intestinal parasites and increased use of veterinary chemicals or greater attention to rotational grazing systems to minimise parasite infestation.

One means of maximising the benefit of lucerne is to abandon lambing in autumn in favour of spring lambing. This may mean a need to further re-arrange the farm timetable. To maximise the benefits of prime lamb production, the farmer will often need to develop new marketing skills and develop relationships with export abattoirs.

These changes have to be worked in with the continuing cropping enterprise. There are good reasons to maintain a lucerne paddock for its full eight-year life after successful establishment. Consequently, the farmer may have to crop paddocks elsewhere on the farm for a longer period before putting them back into pasture. This will require improved cropping skills.

Lucerne will also introduce greater risk into cropping systems. The environmental advantage of lucerne is its ability to remove water from the soil profile to reduce recharge of the watertable. Traditional long fallow crop systems reduced risk by conserving soil moisture before a crop phase. Entering a crop phase after drying the soil moisture may increase crop production risk if the following season’s rainfall is below average.

Ransom et al 1993, Oxley 1997
Beliefs about the environment

There was a dramatic rise in farmer concern for the environment in the late 1980s. During the 1990s there has been much less change in attitudes. The University of New England has recently repeated a monitor survey of farmer attitudes (Reeve, Frost, Musgrave, & Stayner 2001). The survey found:

- decreasing concern overall about the seriousness of land degradation, but with decreases in concern in Queensland, New South Wales and Tasmania being partly offset by increases in Victoria, South Australia and Western Australia;
- increasing concern overall about chemical residues in agricultural produce and about the environmental and health effects of agricultural chemicals, but with those who are regular users of chemicals, such as cereal or fodder crop producers being less concerned and showing relatively little change over the period;
- increasing awareness that farm practices have impacts beyond the farm boundary, and increasingly favourable views nationally towards consideration of the wider public interest in farm decision-making, although the trend was the reverse in Queensland;
- increasingly favourable, but slightly more polarised, views about conservation, while there is less support for conservation organisations and their activities;
- increasing acceptance that there will have to be major transformation of agricultural landscapes if farming is to be sustainable, with just over 46 per cent of respondents agreeing with the proposition that: If Australian agriculture is going to have a long term future, there will have to be a lot of cleared country put back to bush and forestry plantations; and
- strong support for the view that farmers should be compensated for loss of income or autonomy of decision-making due to measures taken in the public interest. However, there is also substantial, but not majority, support for the view that compensation should be a matter of degree — that is, when the loss of income is relatively small no compensation should be expected.
These findings demonstrate the existence of a positive but pragmatic attitude towards environmental issues on the part of Australian farmers. Attitudes to resource degradation do set the bounds of achievable social change. Recognition of a resource degradation problem is usually a necessary condition but, rarely, a sufficient condition for the adoption of sustainable practices. Other factors such as financial risk, management skill intervene and other characteristics influence farmers’ capacity to change.

It follows that one must be careful of the expectations of how an investment in attitude change might modify the behaviour of land managers. The expectation that changing attitudes of land managers will directly lead to changed behaviour is simplistic in many situations. This is most evident in beliefs about the value of promoting a ‘stewardship ethic’ as a means of changing management practices. Stewardship involves the belief that one has a responsibility or obligation to maintain the land for future generations. Policies to change behaviour via changing the stewardship ethic are likely to achieve relatively little in the absence of other enabling conditions. In situations involving common property resources or externalities there will be a conflict between individual self-interest and the expectation that farmers will undertake activity for the common or future good for little, or negative, financial return (Cary & Webb 2001).

There is a significant body of research that demonstrates that links between environmental beliefs and environmental behaviour are tenuous. This is not just the case in the field of land degradation. Environmental attitudes are far more weakly linked to measures of adoption of farm conservation practices than beliefs about the profitability and risk associated with those practices (Cary 1994; Gorddard 1993; Vanclay 1988; Wilkinson & Cary 1994).

A stewardship ethic cannot be relied upon alone as a sufficient condition to facilitate change in farming practices. Policies designed to promote a stewardship ethic may often indirectly, rather than directly, influence the adoption of improved resource management practices. Community awareness programs create effective impacts through a two-stage process where awareness generates a favorable climate for the use of other policy instruments that, more directly, influence behaviour change. Recent examples of this use of a public stewardship ethic are the implementation of a cap on the extraction of water from the Murray-Darling system and tree clearing controls in some states.

For further information see Reeves, Frost, Musgrave and Stayner (2001).
Financial capacity

Over the past decade the farm sector in Australia has generated a net value of farm production of between $3 billion and $7 billion dollars (ABARE 2000). For farming families this surplus must fund farm family living expenses, farm investment, superannuation and natural resource protection.

The contribution of off-farm income to total farm family income has been steadily increasing for many of Australia’s farm families over the past 20 years. This strategy has helped to maintain standards of living on many Australian farms. Chart 3.1 compares the distribution of farm family incomes and Australian family incomes as reported to the 1996 Population and Housing Census. Approximately 3.5 per cent of farm families reported no net family income compared with less than one per cent of Australian families. Farm families are under-represented in the income category between $6,000 and $15,000 and over-represented in the income category between $25,000 and $35,000. What is striking is the degree of similarity between the distributions. ²

Chart 3.1 Australian farm family income distributions and Australian family income distribution in 1996


² The reader must be careful not to assume that farm family income is similar to rural family income. In 1996 farm families comprised greater than 20 per cent of all families in only 3 SLAs (Conargo, Kent and Kulin). This apparently low figure may in part result from the definitional ambiguity of farming in census data. It is also a timely reminder of the common tendency to confuse “rural” and “farm” in popular debate (Gleeson 2000).
The observation of similar income distributions between farm families and Australian families should not be interpreted as arguing that low incomes for some farm families is not an issue worthy of policy attention. Rather, low incomes exist within and without agriculture and are equally worthy of attention. From the perspective of natural resource management policy, the distributions imply we should expect no more or no less of Australian farm families in their financial contributions to the environment than we expect of Australian families in general.

Low incomes resulting from farm industry structural change, or because of extended low commodity prices or extended drought conditions, will frequently be geographically concentrated in specific localities, with potentially adverse effects on resource management. This makes it difficult to draw conclusions about the financial capacity of Australian farms based upon regional data from any one year. Chart 3.2 maps median farm family income averaged over the last three Population and Housing Censuses after adjusting for inflation. This map indicates areas with consistent low farm family incomes, suggesting the existence of underlying structural problems in regions such as the Murchison-Gascoyne in West Australia, the Eyre Peninsula in South Australia and parts of the semi-arid rangelands of New South Wales.

Low farm incomes and high debt are likely to discourage adoption of sustainable practices that require capital investment but do not have immediate financial returns, or that increase the risk exposure of a farm business. Confidence in stability of future incomes is associated with a greater capacity likelihood to invest in natural resource management (see Table 3.2).
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Table 3.2 Factors which are associated with the adoption of sustainable management practices (derived from an analysis of the ABARE 1998-99 Resource Management Survey)

<table>
<thead>
<tr>
<th>Farm family, farm property and farm business characteristics</th>
<th>Pastoral zone</th>
<th>Wheat-sheep and high rainfall zones</th>
<th>Dairy farms</th>
<th>Irrigation farms</th>
<th>All farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>controlled flow bores</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>controlling grazing pressure by excluding access to water</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>monitoring of pasture and vegetation condition</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>deep rooted perennial pasture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>soil/plant tissue tests to determine fertiliser needs¹</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>tree and shrub establishment</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>regularly monitor water tables</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>collection of dairy effluent</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pump dairy effluent onto pasture</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>laser graded layout</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>use irrigation scheduling tools</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>collecting dairy effluent</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pumping dairy effluent onto pasture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>monitoring of pasture and vegetation condition</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>preserving/enhance areas of conservation value</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>exclude stock from degraded areas</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>percentage conservation tillage</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Age                                                                 +         -         -   
Environmental concern attitude                                    -          +         +   
Technical concern attitude                                         +          -         -   
Financial concern attitude                                         -          +         -   
Financial outlook attitude                                         -          -         +   
Landcare membership (1998-99)                                     +          +         -   
Length of landcare membership                                     +          +         -   
Recent training                                                    +          +         -   
Farm cash income                                                   +          +         -   
Closing equity ratio                                               -          -         +   
Profit at full equity                                              +          -         -   
Farm plan                                                          -          +         +   
Farm size                                                          -          +         +   
Land use intensity                                                 +          +         -   
PMP participation in last 3 years                                  +          +         +   

¹ broadacre farms only  
² including dairy farms  

For further details see Cary et al. 2001a
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Chart 3.2 Median farm family income averaged from 1986–91 and 96 censuses using 1996 dollars by Statistical Local Area

Source: Derived from data supplied by the Australian Bureau of Statistics

For further information see Cary et al. (2001) chapter 4.
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Management skill

The low rates of observability and trialability of many sustainable management practices will continue to impede their adoption. Work commissioned by the Audit found that landholders who considered they did not have the technical knowledge to adequately address land and water degradation on their properties were less likely to adopt resource management practices (Cary et al. 2001).

There is a wide range of abilities and knowledge among farmers. There is also a wide range of formal education and knowledge about sustainable farm practices. According to the 1996 Population and Housing Census, 50 per cent of farm owner-managers had completed 1–4 years of secondary school and 23 per cent had completed 5-6 years. There are significant regional differences in the formal education level of farmers (see chart 3.3). Educational levels are related to age, with younger farmers generally having higher educational attainments than older ones.
It is reasonable to assume that more complex sustainable management practices will be more easily grasped and integrated into farming systems in the future as the formal education level of farmers rises. Where adoption needs to be increased for the benefit of the wider community, the wider community may need to invest in extension support to facilitate learning and skill development.
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Participation in training courses related to management and skills is an important contributor to an individual’s capacity to adopt sustainable practices as well as an indicator of their interest in better resource management. More frequent landholder involvement in training courses is associated with adoption of new management practices (Kilpatrick 2000). Improved investment in farmer training, and the development of more advanced learning strategies for farmers, is likely to enhance adoption of sustainable management practices. Decisions about the level or extent of support for such learning activities by government should be based on the extent of public good activity involved in such support.

Farmers do not all learn about sustainable practices in the same manner. Styles of farmer learning vary from reliance upon a few key informants to styles that are based on extensive networks of sources and informants. No one delivery system will be appropriate for all farmers (Kilpatrick & Johns 1999). Dissemination of local knowledge will remain a key feature of any successful training program. The adoption of sustainable management practices often entails greater complexity in integrating the practice into existing farming systems and less certain outcomes. Learning how to master this complexity and accommodate the technical and financial uncertainty will often require locally adapted knowledge and the need for local networks or local professional sources of knowledge support.

For further information see Cary et al. (2001) chapter 4.

Landcare involvement

Community landcare is based upon landholder groups promoting self-reliance, developing social capital and social norms that encourage the adoption of sustainable farming practices. This participatory approach has become the dominant means for implementing policies to improve natural resource management in Australia (Curtis & De Lacy 1996).
Approximately 37 per cent of broadacre and dairy farms had a property representative who was a member of a community landcare group in 1998-99. Ten per cent of all farmers are actively involved in Landcare (Reeve et al. 2001). There are distinct geographic variations in landcare membership (see chart 3.4). ABARE surveys show the highest level of membership is in the wheat-sheep and pastoral zones (Mues, Chapman, & Van Hilst 1998). This variation is a reflection of the history of landcare in different regions and differing membership structures in different states.
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Community landcare has contributed to human and social capital building by increasing awareness, extending skills and knowledge and developing networks that are conducive to the acceptance of sustainable farming practices. However, the causal relationship between landcare membership and both changing of attitudes and the actual adoption of improved sustainable farming practices is not particularly strong.

Chart 3.4 Membership of Landcare in 1998-99

Source: Based upon ABARE survey data.
An audit of farmer environmental attitudes found that the change in environmental attitudes between 1991 and 2000 is about the same among landcare group members and those who are not members (Reeve et al. 2001). However, the findings show more favourable environmental attitudes among those who report they are actively involved in a landcare group. It is unclear to what degree membership of landcare groups changes attitudes or landcare attracts active members with already strongly held attitudes.

Analysis of data from ABARE surveys shows a limited relationship between adoption of sustainable management practices and either landcare membership or length of time as a member of landcare. Landcare membership is most strongly related to the adoption of practices such as tree planting which place only limited demands upon financial capacity and management skill (see table 3.2). Change has been constrained by other major factors: limited capital, the common incidence of low farm incomes, and a lack of feasible technical solutions to degradation issues that can be easily and profitably implemented on farms (Cary & Webb 2001). Excessive expectations of the capacity of the landcare movement runs the risk of reducing the current effectiveness of the movement through member burnout (Byron, Curtis, & Lockwood 2000).

For further information see Cary et al. (2001) Chapter 6.

**Individual demographic and psychological differences**

Individual capacity to change is not uni-dimensional. One individual’s capacity to change differs according to the changes being considered, the stage in a person’s life and, often, many other factors. Research commissioned by the Audit has found that it is difficult to predict that landholders are more likely or less likely to change land management practices (Fenton, MacGregor, & Cary 1999; Taylor B. et al. 2000). The more important landholder characteristics which are, or might be, useful indicators of capacity to change to sustainable management practices are:

- participation in training
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- level of farm income
- optimism about future farm income
- farms with a documented farm plan
- proportion of farms carrying out landcare related work
- membership of landcare
- age.

The relationship between these factors and adoption behaviour was investigated using sample data provided from the annual ABARE farm survey. This survey covers a sample of broadacre grazing, cropping and dairy farms across Australia.

Landholders’ expectations of their future financial situation were one of the better predictors of the adoption of sustainable management practices. In fact, financial outlook was more often associated with practice adoption than were objectively measured indicators of financial position. Similar associations between financial perceptions and business behaviour can be observed in the wider economy. This highlights the importance of perceived reality in adoption behaviour. Adoption of major changes to a farm business is not just an intellectual task, but often an emotional and social task as well (Barr & Cary 2000). Farmers who feel secure in their financial future are more likely to invest resources in adopting new resource management practices. Feeling financially secure is an outcome not just of current financial circumstances, but of future expectations and psychological disposition.

There is a long tradition of research that shows how individual personality traits and psychological resources have a significant influence on determining response to risk. Recent research in Queensland suggests farmers are more likely to have a personality style adapted to perseverance, autonomy, solitude and a capacity to cope with adversity (Shrapnel & Davie 2000). Of 14 general personality styles expected in the wider community, farmers were found to generally fall into a limited suite of five styles. These
five styles have in common a tendency to discomfort in group situations. Whilst this work is formative, it provides an indication of why membership of landcare groups is unlikely to cover the whole of the farm population.

Like most other occupations in Australia, the average age of Australian farmers has been increasing (Barr 2001). Age is an important social characteristic because it is an indicator of the structure of the agricultural workforce that is changing in Australia, and changing differentially in different localities. There is mixed evidence concerning the impact of age on adoption of sustainable practices; any relationship between age and the adoption of sustainable practices is unlikely to be linear, and may be confounded by other factors. In localities with an increasingly aged farmer population and low rates of inter-generational transfer, adoption of changed management practices that require increased capital and labour commitment is likely to be lower. This scenario will become more common in the Australian farming landscape over the next decade.

For further information see Cary et al. (2001) chapter 6, and Gordon et al. (2001).

The changing social landscape of agricultural Australia

In Chapter 1 we noted the gradual long-term movement of labour out of agriculture and the declining proportional contribution of agriculture to total economic growth. This decline brings with it significant changes in the social structure of rural areas. During necessarily gradual implementation of catchment management plans, rural communities are likely to change in response to these global economic trends. These structural changes may influence the capacity to implement catchment plans or adopt changed farming practices. The implementation of catchment plans and natural resource management strategies in the future will need to take into account these changes in rural communities.
Declining number of farms

The social and economic structure of Australian agriculture has changed significantly over the past two decades. There was an 18 per cent decline in farm establishment numbers between 1986 and 1996. There was a 16 per cent decline in the number of farm families and a 21 per cent decline in the number of farmers over the same decade. Establishment decline was greatest amongst the middle sized farms, with gross farm incomes between $50,000 and $200,000 (see chart 3.5). The rate of decline in farm numbers appears to be inversely related to remoteness (see chart 3.6).

The net rate of decline in farm numbers masks a much higher rate of farm exit and entry to farming. Between 1986 and 1996 the number of Australian farmers declined at an annual rate of 2.2 per cent. In this same period the annual rate of

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4 Measures of entry and exit to farming were calculated using migration and occupational data drawn from the ABS Population and Housing Census. For further details see Barr (2001).
Chart 3.5  
**Change in number of farm establishments by Estimated Value of Agricultural Operations grouping as a per cent of all farm establishments 1986-96 (using constant 1996 dollars)**

Source ABS Australian Agricultural Census data. See Barr (2001) for further details.

Chart 3.6  
**Average annual per cent change in the number of farm establishments 1986-96 by Statistical Local Area**

Source: ABS Australian Agricultural Census
exit from farming was 5.7 per cent and the rate of entry was 3.5 per cent. The number of farmers exiting agriculture was greatest during periods of higher commodity prices. Higher land values provided a greater incentive to sell farms while higher commodity prices gave neighbouring farms greater financial resources to buy. During low commodity price periods these incentives were greatly reduced. Entry to farming was less influenced by commodity prices. Entry was more likely to occur in more attractive locations or in irrigation areas. Entry to farming was far less likely in traditional broadacre cropping regions. This in part reflects the lower perceived amenity and the higher capital requirements for entry.

Fewer younger people entering agriculture

Throughout this period there was an underlying trend of a loss of younger persons from agriculture (see chart 3.7). The low recruitment of younger persons to agriculture may be a reflection of major adjustment decisions being delayed to the inter-generational transfer period. Given the need for agriculture to maintain international competitiveness through farm consolidation, the declining entry of younger persons to agriculture is not necessarily bad news, particularly as most entries to farming have historically been through the purchase of small farms.

Chart 3.7 Number of persons with farming as their main occupation by age group 1986 and 1996

Data source: ABS Australian Population and Housing Census
Increased dependence on off-farm income

During the last two decades there was a significant increase in the dependence of many farm families on off-farm income, particularly those operating smaller farms (chart 3.8). This may in part explain why, despite periods of low commodity prices and adverse seasonal conditions, average farm family incomes in Australia were remarkably similar to family incomes of the country as a whole (chart 3.1). During 1986 to 1996 there were some areas of significant numbers of low income farm families. These were not necessarily areas with smallest farms, but were more often those with small to medium sized farms with lesser access to off-farm employment.

The increasing reliance of farm families upon the income of a spouse working off the farm should be viewed within the context of two major demographic trends across the developed world. One is the shift towards the two income family as the middle class norm that has taken place over the past generation within Australian society. The other is the trend towards part-time farming in other developed countries. In both North America and Europe farm households are more dependent upon off-farm employment than Australian farm households. In the United States the USDA estimates that 90 per cent of farm family income is derived from off-farm sources (Economic Research Service 1996; Korb 1999) (This estimate is not strictly comparable with Australian data as the USDA definition of a farm includes smaller farms than are included in definitions used by the Australian Bureau of Statistics or Australian Bureau of Agricultural and Resource Economics). In Canada, farm families have become increasingly dependent upon off-farm earnings of farm women (Olfert, Taylor, & Stabler 1998).
Ageing of the farm population

The average age of Australian farmers rose by three years between 1986 and 1996. Farmer age is generally higher along the Great Dividing Range and in coastal areas (see chart 3.9). Increasing farmer age in part reflects broader trends in the Australian workforce with the progression of the baby-boomer generation toward retirement. It is also an outcome of both a lower recruitment of younger persons to agriculture, a greater movement towards off-farm income dependence amongst younger farm-based families and a deferral of decisions to exit farming in the face of low commodity prices and limited demand for farm land. The farmer attitude survey in 2000 shows that inter-generational continuity of ownership is declining (Reeve et al. 2001). While 61 per cent of respondents indicated that their farm had been owned by parents or parents-in-law in the past, only 29 per cent believed that their farm would be run by their children in the future. These findings all point to a period of rapid structural change in agriculture in the coming decade or so.

Chart 3.8 Off farm income earned on Australian broadacre and Australian dairy farms 1980 to 1998 expressed in constant 1996 dollar terms

Data source: Australian Bureau of Agricultural and Resource Economics Farm Surveys.
Continuing decline in the size of Australia’s farm population

Demographic modelling of future structural change in Australian agriculture has produced two scenarios. In one scenario we have modeled a 30 per cent decline in farmer numbers to 2020 and a further increase in median farmer age, peaking in 2011. This scenario is based upon the behaviour of farmers during the period 1991–96 which was generally characterised by poor prices for broadacre farm commodities. An alternative, faster adjustment scenario is based upon behaviour during the period 1986–91 in which commodity prices were generally higher. In this faster adjustment scenario, our model suggests a 55 per cent decline in farmer numbers with little increase in current median age (Chart 3.10).
Diverging landscape trajectories

These projections present a picture of a rapidly changing agricultural community. Other factors which were not able to be modeled suggest the rate of change may be even greater than in these scenarios. Some of these additional factors include the following.

- Accelerating urbanisation of the Australian population, leading to increasing amenity competition for land use in less remote locations.
- Increased urbanisation of the life aspirations of rural youth, leading to increased rates of youth migration to urban areas (Gabriel 2000).
- A decline in the cultural relevance of farming as a lifestyle identity, potentially slowing the rate of entry to farming (Bryant 1999).
- Changing female expectations of marriage and career, complicating the establishment of farm family businesses in more remote locations (Barr 1999; Weston 1999).
Ageing and retirement of the ‘baby boomer’ population segment, reducing market labour supply and providing increasingly attractive alternative employment opportunities for rural youth beyond farming (Access Economics 2001).

In the next decade some contemporary agricultural landscapes will remain clearly agricultural in their character and others will continue to move towards amenity landscapes where land values are not determined by agricultural productivity. In these amenity landscapes the path of existing farm businesses to seek increased competitiveness through land purchase will be blocked by high land values.

In planning for catchments, planners need to be aware that some landscapes are on a trajectory out of traditional agriculture. Catchment management will be less likely to mean sustainable agriculture in these areas than sustainable landscape management. Structural changes in the social landscape may offer opportunities for landscape change that are complementary to current trends of structural change. Catchment planners need to be aware of the continuing social and economic changes in the structure of their catchments.

**Monitoring changing social landscapes**

Some changes to national data collections would greatly increase our capacity to monitor future structural change within farm communities. Desirable changes include:

- broadening the scope of the Australian Agricultural Census to encompass a regular suite of questions on environmental and social issues;
- developing methods to provide tables based upon linkage between data from the Australian Agricultural Census and the Population and Housing Census to provide greater confidence in Population Census data based upon self-definition of the farmer; and
- developing sample longitudinal data sets for the Australian Agricultural Census to provide an enhanced capacity to understand the dynamics of structural change within Australian agriculture.

For further information see Barr (2001).

**Key points**

- Approximately ten per cent of farm establishments produce forty to fifty per cent of gross agricultural income and manage sixty per cent of agricultural and
Australians agricultural land managers and natural resource management

Pastoral land. Encouraging changes in the management practices on this small number of large farms is likely to provide the greatest impact in land management for natural resource protection.

- Australian farmers generally have a positive but pragmatic attitude towards environmental issues. There are significant regional variations in attitude. There has been little change in the level of farmers’ environmental concern over the past decade.

- Environmental attitudes generally show a limited relationship with changed management practices. Recognition of a resource degradation problem is usually a necessary condition but rarely a sufficient condition for the adoption of sustainable practices. Other factors such as financial risk and management skills mediate farmers’ capacity to change.

- It is the inherent characteristics of natural resource management (NRM) practices which largely determine the rate of their adoption by producers. Sustainable NRM practices that provide economic and other advantages, have lower risk and are simpler to manage will generally be adopted more rapidly. Few natural resource management practices have all these characteristics.

- Low farm incomes and high debt are likely to discourage adoption of sustainable practices. Confidence in the stability of future farm incomes is likely to be associated with a greater capacity and willingness to invest in natural resource management.

- Landholders who consider they do not have the technical knowledge and skills to adequately address land and water degradation on their properties are less likely to adopt resource management practices. More frequent landholder participation in training courses is commonly associated with adoption of resource management practices. Investment in skills acquisition should remain a key tool in promoting improved natural resource management.

- Farmers do not all learn about sustainable practices in the same manner. Styles of farmer learning vary from reliance upon a few key informants to the use of a wide range of personal and impersonal sources. No one delivery system will be appropriate for all farmers. Dissemination of local knowledge will remain a key feature of any successful training program.

- Approximately 37 per cent of broadacre and dairy farms had a property representative who was a member of a community landcare group in 1998-99, with the highest level of membership reported in the wheat-sheep and pastoral zones. Ten per cent of farmers are actively involved in Landcare. Landcare membership is most strongly related to the adoption of practices such as tree planting that place only limited demands upon financial capacity and management skill.
Rural Australia is in the midst of a period of significant structural change. The number of large farm businesses is increasing while the number of middle sized farms has been decreasing; the recruitment of young people to agriculture has decreased; many farms families are becoming increasingly dependent on off-farm income; and the median age of the farm population has been rising. The rate of change is likely to accelerate in response to pressures such as:

- accelerating urbanisation;
- changing life aspirations of rural youth;
- a decline in the cultural relevance of farming as a lifestyle identity;
- changing female expectations of marriage and work relationships within the farm business; and
- the impact of the looming retirement of the ‘baby boomer’ population segment on the Australian labour market.

These changes will lead to some regions remaining clearly agricultural in their character and others moving towards amenity landscapes where agricultural productivity does not determine land values. These changes will shift the values local communities place upon their landscapes and resources. Protecting natural assets for cultural or economic reasons may override the needs of agricultural industries.
References


