Monitoring Landcare in Central Victoria

by

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Summary

The research reported here is part of an on-going monitoring of Landcare on farms in the upper Loddon and Avoca catchments in central Victoria. The catchments contain local, semi-regional and regional groundwater systems which contribute to salting. The Landcare approach has been readily embraced by many landholders in these catchments. This monitoring study is an attempt to gain an understanding of what landholders perceive to be the important components of Landcare within the general ethic of land management.

This study involved reinterviewing people who had already been interviewed in a previous study in the area. By interviewing the same people we had spoken to in 1988, we were able to compare their beliefs and attitudes in 1988 with their subsequent behaviours. Questions were asked about the landholders' beliefs and attitudes, and the land management practices they had undertaken since our previous survey. Beliefs were elicited by qualitative methods, conventional response item measures and by a magnitude estimation pair-comparison method.

Although the majority of farmers considered salinity was a major problem in the region, few believed it was a major problem on their own properties. Landholders generally were consistent in their perceptions of the salinity hazard on their own farm between the two surveys, but were inconsistent in their perceptions of the salinity hazard to the Central Highlands and to their neighbourhood. In aggregate, farmers' perceptions of salinity on their own properties appear to be consistent with the best estimates of the extent of salinity in the catchment areas.

In the period from 1988 to 1991 more farmers planted trees than in the previous five years. More trees had also been planted. The number of trees planted by farmers was unrelated to the size of their farms, but those with larger farms planted a greater proportion of their farms to phalaris-based perennial pastures. Most trees were planted along fencelines for stock shelter. Between 1988 and 1991 fewer farmers sowed pasture than planted trees. However, the area of the two upper catchments sown to phalaris is four times larger than the area revegetated by tree planting.

Membership of the Landcare movement in the upper Loddon and Avoca catchments increased substantially over the period from 1988 to 1991. During the three year period reducing soil salinity became more associated with pasture improvement than with planting trees. Pasture improvement also became considerably more attractive to landholders than planting trees. It is argued that this is an instance of the need for profitable and practical technologies for conserving farmland. Such an approach is more likely to be successful, in both the short and long term, than calls for more favourable attitudes to the land.

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Introduction

In the 1980s Australian farmers were influenced by two factors which few would have predicted in the late 1970s. The first was the growth of environmental consciousness across the nation. In rural Australia this was expressed through the rise of the Landcare movement. The other major influence on farms was the simultaneous collapse of most major rural commodity prices late in the decade. This economic climate also coincided with a dramatic rise in public concern about environmental issues. With the subsequent deterioration of the economy the stability of this increased environmental concern in the community came to be questioned.

The research reported here is part of an on-going monitoring of Landcare on farms, in this case, the upper Loddon and Avoca catchments in Victoria. The Avoca and Loddon Rivers rise in the northern watershed of the Great Dividing Range in Central Victoria. The Avoca is one of those strange Australian Rivers that has no direct link to the sea; it commences in the Pyrenees Range and finishes in the Avoca marshes near Swan Hill. The Loddon flows north into the Murray, but is slowed and diverted along the way by reservoirs. The southern highlands of these catchments are dominated by the granite Pyrenees and old volcanic cones such as Mount Franklin and Smeaton Hill which have provided some of the best agricultural soils of the region. Elsewhere the soils are derived from ordovician sediment. These latter soils are some of south eastern Australia's most delicate land systems, prone to both soil erosion and salting. The catchments contain local, semi-regional and regional groundwater systems which contribute to salting. The mechanisms of salinisation in the area are better understood than elsewhere in south eastern Australia. A recent estimate of the extent of catchment land salinisation was less than one per cent of the land area (Barr and Cary, 1992).

In the Lexton and Avoca areas the Landcare movement was a catalyst in the 'discovery' of salinity as a land degradation problem for the district, and the promotion of revegetation by tree planting and sowing of phalaris-based pasture as a solution. Landholders' awareness of soil salinity in the district grew sometime between 1984 and 1988. In the 1984 Australian Bureau of Statistics farm census 15 per cent of Lexton Shire farmers reported soil salting on their land. By 1988 slightly more than 50 per cent of farmers interviewed indicated they had some salting on their farm (Vanclay and Cary, 1989).

Urban views of rural land degradation are typically characterised by stark and simple images of denuded landscapes. The solution to such problems, correctly or incorrectly perceived, is commonly seen to be widespread programs of tree planting. The use of trees for overcoming land degradation problems is usually seen more problematically by rural landholders. Community-based Landcare has encouraged groups of landholders to become involved in land conservation at the farm level and in broader catchment planning (Chamala and Mortiss, 1990). The Landcare approach has been readily embraced by many landholders (Campbell, 1991). This monitoring study is an attempt to gain an understanding of what landholders perceive to be the important components of Landcare within the general ethic of land management.

The beliefs of landholders concerning the appropriateness and effectiveness of various land management practices for ameliorating land degradation are important determinants of 'on the ground' action. The question arises to what extent various beliefs about aspects of land management influence management behaviour. Simplistic assessments of what are, in fact, complex and interrelated belief systems often produce naive and confounded ideas that changing a single belief, or an attitude to 'the environment', will result in more appropriate environmental behaviour.

Method

This study is part of an on-going monitoring program of central Victorian landholders' environmental beliefs and conservation behaviours. It began with a random sample survey conducted in 1988 in the upper Loddon and Avoca River catchments (Vanclay and Cary, 1989). In the 1988 study 131 of the 329 farmers in the upper Loddon and Avoca catchments were personally interviewed. In the present study those people were reinterviewed. Their beliefs and attitudes in 1988 were then compared with their subsequent behaviours.

The questionnaire schedule was pilot tested by telephone with five farmers from the study area who had not been interviewed in 1988. These respondents were chosen at random. Interviews were conducted in October and December 1991. Many farmers in the area were shearing during October: the break between interview periods was to allow those farmers to participate. Some respondents were unavailable for reinterview on two or more occasions, some had ceased farming in the district and some refused to be reinterviewed. In 100 cases we were able to interview the same person, and in a further 11 cases another member of the same family was interviewed. Of the 131 families interviewed in 1988, 111 were reinterviewed in 1991.

In the 1988 survey data had been obtained for the landholders' attitudes toward and beliefs about environmental problems, land degradation and practices which had been recommended as ameliorating the effects of land degradation on farms in the region. Information was also obtained concerning which practices had been adopted. In this study questions were asked about the landholders' beliefs and attitudes, and detailed questions were asked about land management practices landholders had undertaken since the previous survey. Beliefs were elicited by qualitative methods, conventional response item measures and by a magnitude estimation pair-comparison method.

The magnitude estimation pair-comparison method allowed the construction of belief maps which were used to depict the spatial relationships between systems of beliefs, as well as to depict changes in belief systems over time. A belief map depicts the way people view complex issues. Relationships between the parts may have many dimensions, and a belief map displays as much of this complexity as is possible in two dimensions.

By way of example, if a person is asked to estimate the distances between each of the six state capital cities of Australia 15 inter-city distances are obtained. Standard mathematical methods can then be used to convert these distances into a map which shows the perceived location of each capital city. Individual estimates can be averaged and the same process undertaken for a group of people to produce an average map showing the group's perception of the location of the capital cities.

In the belief map used here, a belief is defined as the perceived distance between the objects -- aspects of landcare -- which comprise the belief. The objects central to landholders' beliefs about the care of rural land were established previously. Respondents were asked to estimate the distances between these various objects. A belief map was produced from the average perceived distances using metric multidimensional scaling (Torgerson, 1958; Woelfel and Fink, 1980). Landholders were asked to estimate how far they saw themselves from various belief objects. This allowed the position of the average landholder to be mapped in relation to the belief objects, providing a measure of landholder attitudes to the belief objects. Objects that are close together are beliefs that are more strongly held.

The responses to the qualitative, unstructured questions on land management issues were recorded and analysed using a quantitative method of analysing textual data such as in-depth interview transcripts, based on word proximities. The method identifies the most important words in a text and determines their patterns of similarity based on their associations in the text. The more closely associated two words are considered by a landholder, the closer they will appear in the text of the interview transcript. Weights are assigned to the linkages between the two words, based on the strength of their association. The resulting table of inter-word associations is similar to a table of inter-word distances. It can then be made into a map showing the respondents' perceptions of the relationships between the words using the same metric multidimensional scaling methods which are used to produce belief maps.

Although the same methods are used to produce both types of maps, the two types of data are quite different. Belief map data are the actual inter-object distances estimated by the respondents. However, the numerical inter-word distances on which the word maps are based are created from less precise information, in the form of word associations.

Results

Farmers' appraisal of salinity

No more than 54 per cent of farmers were concerned about any one type of land degradation (Table 1). Erosion and salinity were perceived to be the biggest problems, cited by 54 and 51 per cent of farmers respectively, although, in response to later prompting, another seven per cent of farmers said they had salt on their farms. However, farmers' concern about the extent of these types of land degradation appears to be low. Farmers thought that erosion and salinity affected less than one per cent of the area of their farms. Even when those farmers who did not recognise salinity or erosion on their properties are excluded, the perception of the area affected remains low (1.5 per cent). Soil acidity was rarely mentioned.

Table 1: Farmers' perception of land degradation on their farms: type and extent (n=111, multiple responses=201)

Type of land degradation	Per cent recognising degradation	% of farm affected (farmers recognising)	% of farm affected (all farms)
erosion	54	1.4	0.6
salinity	51	1.5	0.7
vermin	19	9.4	1.3
weeds	18	10	1.0
declining pastures	6	55	1.5
soil acidity	4	25	0.9
other	12	10	0.9
none	18	0	0.0

Although the majority of farmers considered salinity was a major problem in the region, only five per cent believed it was a major problem on their own properties -- a belief which

did not change between 1988 and 1991 (Table 2). For all but a small minority, salinity was a minor problem on their farm or no problem at all. Landholders generally were consistent in their perceptions of the salinity hazard on their own farms between the two surveys. Almost half (42 per cent) said salinity was not a problem on their own farm on both occasions. In 1991 only 13 per cent considered salt a moderate problem, and five per cent thought it a major problem. Even after considerable publicity, few farmers in the upper Loddon and Avoca catchments considered salt to be of sufficient concern to justify making significant changes to their farm management. This publicity may have had an effect in causing the instability of farmers' perceptions of the salinity hazard to the Central Highlands and to their neighbourhood between surveys.

Table 2: Farmers' perceptions of the seriousness of soil salting (n=111)

Seriousness of problem	Frequency of response (per cent)		
	Central Highlands	Neighbourhood	Own Farm
not a problem	0	14	47
small problem	13	32	36
moderate problem	38	28	13
major problem	49	27	5
total	100	100	100
1991 mean [a]	3.4	2.7	1.7
1988 mean (n=131)	3.2	2.5	1.7

[a] The mean of the rating when scored: 1 not a problem, 2 a small problem, 3 a moderate problem, 4 a major problem. Note that these means were calculated from an ordinal scale.

In aggregate, farmers' perceptions of salinity on their own properties appear to be consistent with the best estimates of the extent of salinity in the catchment area. Although five per cent of farmers considered salinity a major problem on their own property, almost half the respondents considered salinity to be a major problem in the Central Highlands region. Whilst this estimate of regional seriousness increased only slightly in aggregate between 1988 and 1991, these perceptions were, individually, unstable as individuals'

responses were not consistent between surveys (Table 3). This instability is an indication of a phenomenon, observed elsewhere (Cary, 1991; Barr and Cary, 1992), that beliefs related to salinity are frequently 'symbolic'. Such beliefs are easily changed and are not closely linked to behaviour consistent with the belief.

Table 3: Stability of farmers' perceptions of the seriousness of soil salting (n=111)

Seriousness of problem (1991 compared with 1988)	Frequency of response (per cent)		
	Central Highlands	Neighbourhood	Own Farm
better	23	19	12
same	42	44	69
worse	35	37	19
total	100	100	100
stable (unchanged)	42	44	69
unstable (changed)	58	56	31
total	100	100	100

Revegetation Behaviour

Planting trees

Although 90 per cent of farmers had planted trees on their farm in the five years to 1988, very few had planted trees in any significant numbers. The mean number of trees planted was 200, with a median of 100 trees for the five year period: half the landholders had planted less than 100 trees in the previous five years (Vanclay and Cary, 1989). The existing four per cent tree cover on farmland was almost entirely natural forest. Assuming medium density tree plantations on salinity recharge areas planted at a density of 200 trees per hectare, in the five years prior to 1988 trees had been planted on, at most, one hectare

of the average farm. The true area would probably be considerably less than one hectare given that farmers often plant trees at densities greater than 200 trees per hectare.

In the period 1988 to 1991 more farmers planted trees than in the previous five years. More trees had also been planted. Ninety per cent of farmers planted some trees between 1988 and 1991. The mean number of trees planted in that period was 895 (almost 300 per year; see Figure 1). The average is raised by a small minority planting large numbers of trees. These were the same people who were planting large numbers of trees three years before. The median number of trees planted was 100 per year. Using the assumption of 200 trees per hectare, landholders planted 1.5 ha of trees per year, or 0.3 per cent of their farm (Figure 2).

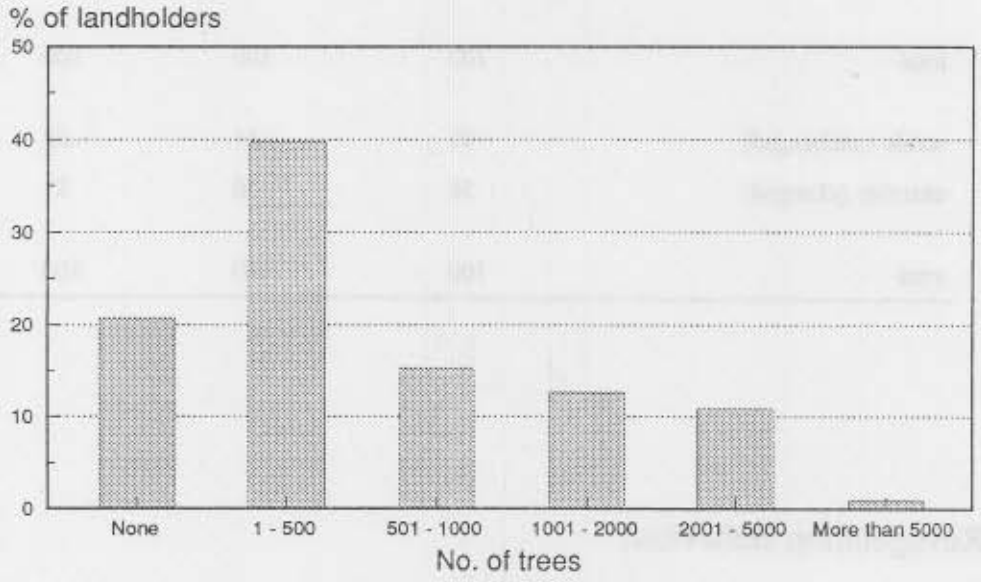

Figure 1: Trees planted between 1988 and 1991

Most trees were planted along fencelines for stock shelter (Table 4). Tree planting was rarely purposely sited with salinity control in mind (Table 5). The mean number of trees planted in rocky groundwater recharge areas over the three year period was 187. Only three per cent of the farmers planted more than 1000 trees in rocky areas. The farmers intended to plant a mean of 285 trees in the following 12 months, about the same rate of planting as they reported for the previous three years.

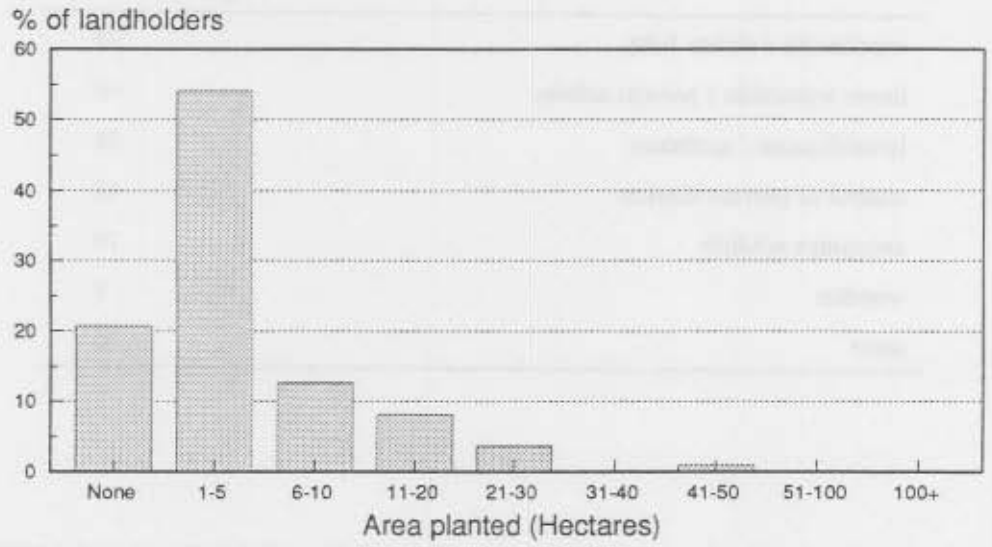

Figure 2: Area of trees planted 1988-91 (assumption of 200 trees per hectare)

Table 4: Location of trees planted (n=88, 141 multiple responses)

Location	Frequency of response (per cent)
along fencelines	56
along drainage lines	33
in recharge areas	21
around the house	14
in waterlogged areas	8
in discharge areas	8
other	22

The respondents believed that trees had several benefits, with most agreeing with the various possible benefits suggested to them (Table 6). Consistent with their expressed reasons for planting trees, almost all agreed trees had benefits for windbreaks and stock

Table 5: Farmers' stated reasons for planting trees (n=89, 186 multiple responses)

Reason	Frequency of response (per cent)
windbreaks / shelter belts	79
lower watertable / prevent salinity	44
beautification / aesthetics	24
control or prevent erosion	18
encourage wildlife	10
woodlot	9
other	26

shelter, while slightly fewer considered trees had salinity and erosion control benefits. While almost all agreed trees enhanced the beauty of their farms, the lowest approval was for the statement that trees increased long term profit. The respondents' degree of agreement with the statements had changed little from 1988.

Sowing deep-rooted perennial pastures

Sowing of phalaris-based perennial pasture has been promoted in these catchments as an alternative method of salinity recharge control. In 1988 about 70 per cent of landholders had some phalaris-based perennial pasture on their farms. The average area of phalaris-based pastures over all farms was 40 hectares. Although many farmers recognised salinity control as an advantage of perennial pasture, salinity control was clearly not the major factor in the decision to sow this pasture. The farmers' ideal area of phalaris on their farms had a mean of 226 hectares, and the farmers intended sowing a mean area of 39 hectares in the following three years.

Sixty seven per cent of respondents said they had experienced problems establishing phalaris, while 62 per cent said they had problems managing phalaris. The respondents found it difficult to be specific about the problems they had experienced establishing

Table 6: Farmers' beliefs about trees

Belief about trees	Mean score 1988 [a]	Mean score 1991	% agree 1988 [b]	% agree 1991
provide a windbreak	1.4	1.3	96	99
control soil erosion	1.7	1.7	88	86
increase long term profit	2.1	2.2	73	70
control soil salting	1.7	1.8	90	89
provide shade and shelter	1.4	1.2	98	100
enhance beauty of farm	1.6	1.4	95	98
increase capital value of farm	1.9	1.8	83	80

[a] Mean of responses when scored: 1 strongly agree, 2 agree, 3 depends, 4 disagree, 5 strongly disagree. Note that these means were calculated from an ordinal scale.
[b] The percentage who either agreed or strongly agreed.

phalaris, but were able to give specific responses about problems managing it (Table 7). Most problems concerned phalaris out-competing other plants and phalaris toxicity. Each of these perceived problems can be remedied with appropriate management, according to extension officers.

Table 7: Problems managing phalaris (n=79, 103 multiple responses)

Problem	Frequency of response (per cent)
none	38
outcompetes other plants	34
toxic to stock	25
weed in crops	17
other	16
total	100

Between 1988 and 1991 fewer farmers sowed pasture than planted trees. Fifty per cent had sowed some phalaris-based perennial pasture. However, they sowed a mean of 7.3 ha per year (or 1.4 per cent of the area of the farm; see Figure 3). The area of the two upper catchments sown to phalaris is four times larger than the area revegetated by tree planting. Between 1988 and 1991 much more of the catchment was planted with deep-rooted perennial pasture than with trees (Figure 4).

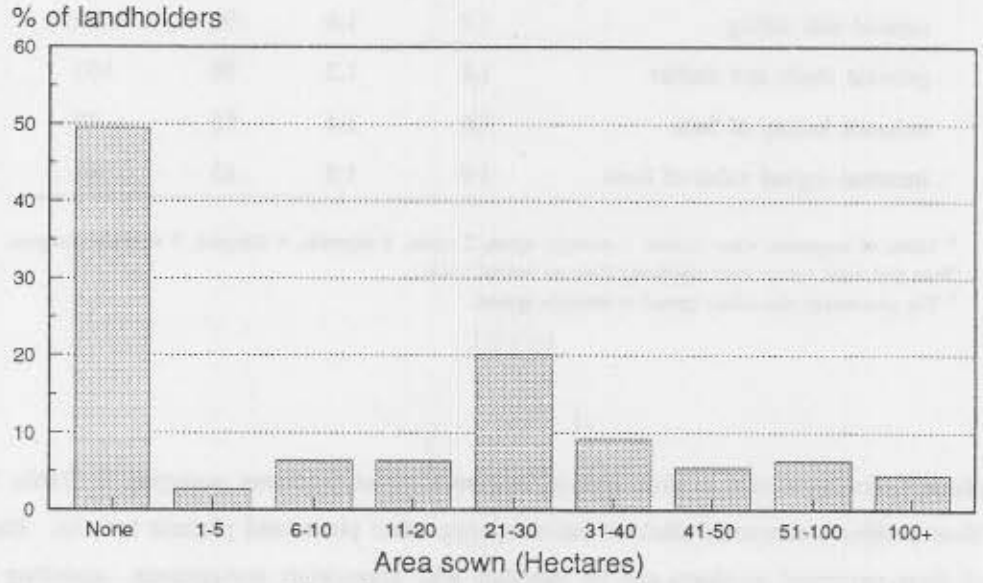

Figure 3: Area of pasture sown 1988-91

Farm Size and Revegetation Behaviour

There was no relationship between farm size and the number of trees planted in the upper Loddon and Avoca catchments, but a significant inverse relationship between the proportion of farm planted to trees and farm size (Table 8). As farmers tend to plant a symbolic number of trees, those with smaller farms planted a greater proportion of their farms to trees. For a factor analysis of this phenomenon, see Barr, Wilkinson and Cary (1992). The size of farm was an important influence on phalaris perennial pasture adoption. Landholders with large and medium-sized properties sowed the same proportion of their farm to deep-rooted phalaris pasture; those with small properties sowed a significantly smaller proportion.

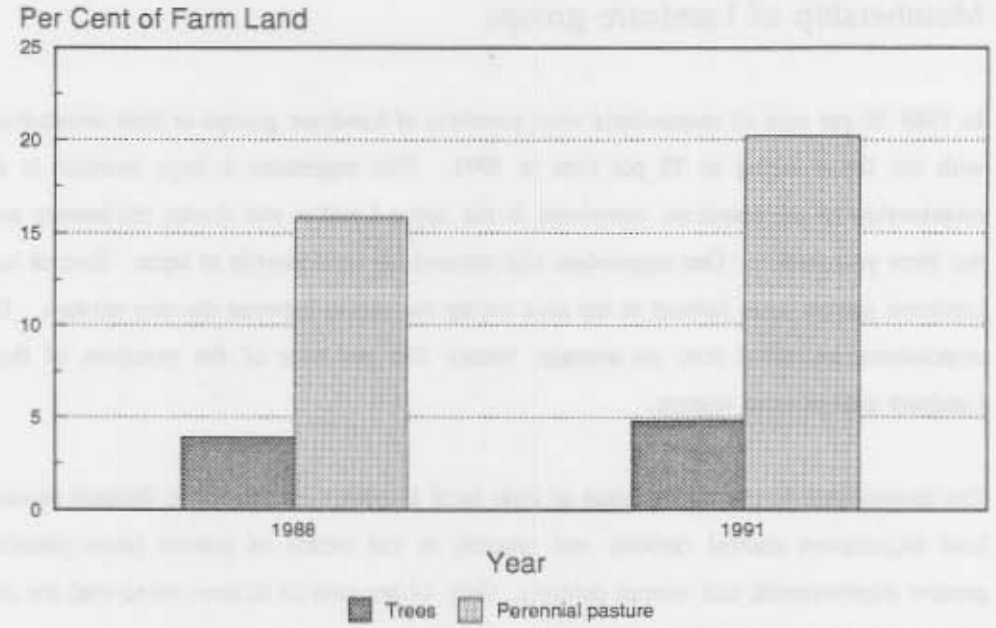

Figure 4: Changes in vegetation cover on farmland, 1988-91

Table 8: Farm size, tree planting and pasture sowing behaviour of landholders

	Small farms (Lower quartile)	Medium Farms (Middle quartiles)	Large farms (Upper quartile)	Significance of difference (F test)
Number of farms	28	56	27	
Mean size of farms (ha.)	165	438	923	
Number of trees planted per year*	183	373	262	.22
Annual percentage of farm planted to trees*	1.1	.43	.14	.04
Annual area sown to phalaris (ha.)*	.86	7.4	13.6	.0005
Annual percentage of farm sown to phalaris*	.4	1.6	1.4	.016

* Years 1988 to 1991.

Membership of Landcare groups

In 1988 38 per cent of respondents were members of Landcare groups or their antecedents, with the figure rising to 72 per cent in 1991. This represents a large increase in the membership of the Landcare movement in the upper Loddon and Avoca catchments over the three year period. One respondent had allowed his membership to lapse. Several new Landcare groups were formed in the area during the period between the two surveys. The respondents estimated that, on average, twenty five per cent of the members of these Landcare groups were women.

The respondents perceived the aims of their local Landcare groups to be directed towards land degradation control (salinity and erosion) or the means of control (trees planting, pasture improvement, and vermin control). Only 10 per cent of farmers mentioned the aim of increasing awareness of land degradation (Table 9).

Table 9: Farmers' perceptions of the aims of their Landcare group (n=77, 247 multiple responses)

Landcare groups aims	Frequency of response (per cent)
to plant trees	65
to control erosion	56
to control salinity	53
to establish more deep rooted pasture	44
to care for and improve the productivity of land	26
to control vermin	20
to share information	10
to increase awareness of land degradation	10
other *	34
don't know	4

* No category was mentioned by more than 10 per cent of respondents.

Farmers' reasons for joining Landcare were somewhat different from their perceptions of the aims of their Landcare groups (Table 10). Although more than half the farmers perceived Landcare to be about reducing land degradation (Table 9), only 25 per cent of farmers mentioned that they joined Landcare because they were seeking help to tackle land degradation problems. Most mentioned the benefits of working with others in a local group. Some suggested peer pressure was the reason. In addition 21 per cent of respondents were candid enough to say that they joined Landcare to gain easier access to government grants.

Table 10: Reasons for farmers joining Landcare (n=77, 131 multiple responses)

Reason	Frequency of response (per cent)
benefit of working in a local group	53
seeking help to tackle land degradation	25
to cooperate to achieve more than individuals	23
make it easier to get government grants	21
felt peer pressure, or "I was in their area"	18
had an interest in land conservation	17
other	13

Forty per cent of the farmers had received a grant or a loan for land conservation works in the previous three years (Table 11). Those farmers who suggested that they had joined their Landcare group to make it easier to obtain government grants were not just being cynical. Only two non-members of Landcare groups had received grants or loans for conservation works in the previous three years. Whether Landcare membership is seen by farmers as a *de facto* prerequisite for receiving a grant, or whether Landcare membership sensitises farmers to apply for grants is not clear. Certainly Landcare members were more likely to have received some government support that non-Landcare members.

Membership of a Landcare group and the time of joining the group were strongly related to the number of trees the respondents had planted and the area of phalaris-based perennial pasture they had sown (Table 12). Those who had joined Landcare by 1988 planted more

Table 11: Farmers' receipt of grants or loans for land conservation works (n=111)

	Frequency of response (per cent)	
Member of Landcare group	not received a grant	received a grant
no	26	2
yes	34	38
total	60	40

trees in the eight year period from 1983 to 1991 than those who joined between 1988 and 1991. Those who had not joined Landcare by 1991 planted even fewer trees.

The greatest increase in tree plantings between 1988 and 1991 was reported by Landcare members of longer standing, suggesting a possible lag effect between joining the Landcare movement and planting increased numbers of trees. However, this increase was not matched by those who joined between 1988 and 1991. This group reported intending to increase their tree plantings by a smaller amount than those who were not members of Landcare. Landcare members of longer standing still intended to plant more trees in 1992 than those who had joined between 1988 and 1991. For those who joined Landcare between 1988 and 1991, their joining Landcare has not been associated with an intention to substantially increase tree plantings.

The relationship between Landcare membership and phalaris-based perennial pasture sowing was similar to the pattern for tree planting. Those farmers who had joined Landcare prior to 1988 had sown more pasture than those who did not join until after 1988, who in turn had sown more than those who had never joined. In the case of pasture, the lag effect is clearer. Those who joined Landcare between 1988 and 1991 intended to sow more phalaris pasture in the following three years (1992 to 1994) than did those who had joined by 1988.

This phenomenon can be interpreted in several ways. The Landcare movement has shifted its emphasis from planting trees toward improving pastures, and the newer Landcare members could be responding to this change. Another possible interpretation is that the

Table 12: Landcare membership and revegetation behaviour of farmers

Tree planting and pasture sowing behaviour	Never in Landcare (n=30)	Joined Landcare between 1988 and 1991 (n=39)	Joined Landcare before 1988 (n=41)
Median area of farm (hectares)	462	469	480
Median number of trees planted (5 years to 1988)	45	100	200
Median number of trees planted (3 years to 1991)	50	150	1100
Median number of trees planted on rocky areas (3 years to 1991)	0	0	127
Median number of trees intended to plant in 1992	100	100	500
Median area under phalaris in 1988 (hectares)	8	14	28
Median area sown to phalaris, 3 years to 1991 (hectares)	0	8	16
Median area of phalaris intended to sow, 3 years from 1992 (hectares)	0	20	12

two groups had different orientations to conservation and farming. The farmers who were members of Landcare groups at the time of the 1988 survey were likely to be those farmers holding conservation attitudes sympathetic to the ideals of the landcare movement. They became involved early in the life of the landcare movement. It is possible that those who joined Landcare groups later may have joined for different reasons. However, there is little evidence to suggest those who joined Landcare groups more recently did so for different motives from those who had joined before 1988. The stated reasons for joining Landcare and perceptions of the aims of the local Landcare group were not substantively different between the two groups.

Beliefs about Landcare and land management

To gain an insight into rural communities' images of the Landcare movement respondents were asked to explain what Landcare meant to them. Farmers associated Landcare most strongly with the control of land degradation (Table 13). Landcare was commonly associated with 'looking after the land' and was very frequently linked with tree planting. Tree planting, in association with Landcare activity, has increased significantly in the catchment; however the numbers of trees planted have not been of a magnitude which would substantially lower local watertables.

Table 13: Farmers' perceptions of the term 'landcare'
(n=105, 283 multiple responses)

Perception	Frequency of response (Per cent)
Control of physical degradation problems	51
Tree planting	44
Looking after the land (unspecified)	41
Pasture improvement	25
People working together and exchanging ideas	23
Awareness and education of people	17
Government handouts, bureaucracy, questionable government motives	16
Improving productivity	12
Other*	27

* No response in this category constituted more than 10 per cent of responses.

When asked to expand on what they believed good land management involved, farmers most commonly mentioned 'good cultural practices' or 'awareness of land capability' (Table 14). Recommended management techniques, such as pasture improvement, minimum tillage, and fertiliser application were mentioned far more frequently than conservation works.

Table 14: Meaning of 'good land management' to farmers (n=105, 260 multiple responses)

Response	Frequency of response (Per cent)
Good cultural practices	83
Awareness of land capability	50
Conservation works (incl. tree planting and erosion control)	37
Vermin control	19
Other*	50

* Includes farm planning, financial planning, making informed decisions. No response in this category constituted more than 15 per cent of responses.

Only 13 per cent of farmers considered that everyone who was undertaking Landcare measures was making it pay (Table 15). Of the respondents 42 per cent were able to refer to specific examples; however, these farmers appeared to be perceived as 'atypical'. Given the long term nature of Landcare activities, a surprisingly small number of farmers (21 per cent) considered it was too early to tell whether Landcare would pay.

Table 15: Farmers' beliefs about profitability of Landcare activities (n=99)

Response	Frequency of response (per cent)
specific examples given of farmers making Landcare pay	43
too early to tell, such a long term thing	21
everyone undertaking Landcare activities is making them pay	13
nobody is making Landcare pay	10
other	2
don't know	11
total	100

Only about one third of the respondents believed they had changed their farm management practices as a result of their membership of the Landcare movement (Table 16). However, a third of respondents also said that Landcare had increased their awareness of land degradation and its implications for their farms. However, a substantial number of the respondents considered the Landcare movement had had little or no impact on their farm management.

Table 16: Perceived impact of Landcare on farm management
(n=100, 132 multiple responses)

Perceived impact	Frequency of response (per cent)
made me change some management practices	36
made me think, more aware	34
none	22
very little	20
none, been practising landcare for years	17
other	3

Of those who responded, 30 per cent said that it was too early yet to make a judgement about the effect of the Landcare movement on their district (Table 17). About one third of the farmers felt that the Landcare movement was responsible for considerable changes in the appearance of their district, either generally, or, at least in specific areas. For example, respondents often mentioned that a lot of work was being carried out in the Lexton area. The visible effects of this work generally consisted of more tree planting, or salinity and erosion control works.

Almost all respondents said a shortage of money was the factor most limiting to their undertaking of land conservation works (Table 18). A quarter said lack of time was a factor. Few suggested that farmers' attitudes or their lack of knowledge were factors.

Table 17: Farmers' perceptions of the impact of Landcare on the land (n=101, 211 multiple responses)

Impact	Frequency of response (per cent)
more tree planting	39
more erosion and salinity works	33
greater awareness, knowledge of land degradation	32
not much, its too early yet	20
a lot in specific areas	25
a lot (unspecified initially)	18
more planting of deep-rooted pastures	17
other	12
none	3
don't know	2

Table 18: Farmers' perceptions of the key constraints to land conservation (n=102, 184 multiple responses)

Constraint	Frequency of response (per cent)
lack of money	95
lack of time	26
attitudes	21
knowledge	10
season / climate / weather	6
other	21
don't know	2
none	1

Unconditional government grants and tax deductions for land conservation works were the most favoured suggestions for methods by which the government could encourage land conservation (Table 19). Increased extension and education were mentioned regularly. Few farmers suggested conditional grants, however those who did tended to believe strongly in them.

Table 19: Farmers' beliefs about how government could encourage land conservation (n=106, 219 multiple responses)

Response	Frequency of response (per cent)
unconditional grants & unspecified assistance	52
tax deductions	32
more extension	26
more education	15
conditional grants	12
more money "on the ground"	11
other	10
don't know	35

Multidimensional Belief Systems

Analysis of quantitative data

Belief systems are like biological or social systems; they are comprised of interdependent components that are linked to, and influence, each other. Each belief influences other beliefs, so it is difficult to discover the influence of each belief separately. Inter-relationships between beliefs were established by pair-wise magnitude estimation of the association between a set of eight belief objects related to Landcare. A relevant subset of these distances for beliefs about planting trees, pasture improvement (with deep-rooted species) and reducing soil salinity is presented in Table 20.

Table 20: Changing belief distances related to landcare[a]

Belief	Planting Trees			Pasture Improvement			Reducing Soil Salinity		
	1988	1991		1988	1991		1988	1991	
Pasture improvement	40.9	35.0							
Reducing soil salinity	25.0	22.1		37.5	20.4	***			
Having a good farm	30.0	19.0	***	14.8	6.8	**	20.9	14.2	*
Long-run profitability	31.0	22.7	*	21.1	12.0	**	27.4	18.8	*
Short-run profitability	62.7	54.1		37.1	37.0		59.1	50.0	
You	34.1	26.3	*	19.5	13.6	*	28.0	20.3	
Landcare[b]		17.9			15.0			14.2	

[a] Smaller distances indicate more strongly held beliefs.
[b] Landcare belief measured in 1991 only.
Difference between years significant: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; T test (one tailed).

During the period from 1988 to 1991 reducing soil salinity became more associated with pasture improvement than with planting trees. Pasture improvement also was considerably more attractive to landholders than planting trees. (The average landholder -- represented by 'You' -- was associated much more closely with pasture improvement than with planting trees.) Landcare was slightly, but statistically not significantly, more closely associated with pasture improvement than with planting trees.

Metric multidimensional scaling of the complete pair-comparison matrix of belief distances allowed the expression of the inter-relationships between the beliefs to be expressed in a coordinate set of two dimensions (Figure 5) which explains 84 per cent and 93 per cent, respectively, of the variance of the 1988 and 1991 belief sets.

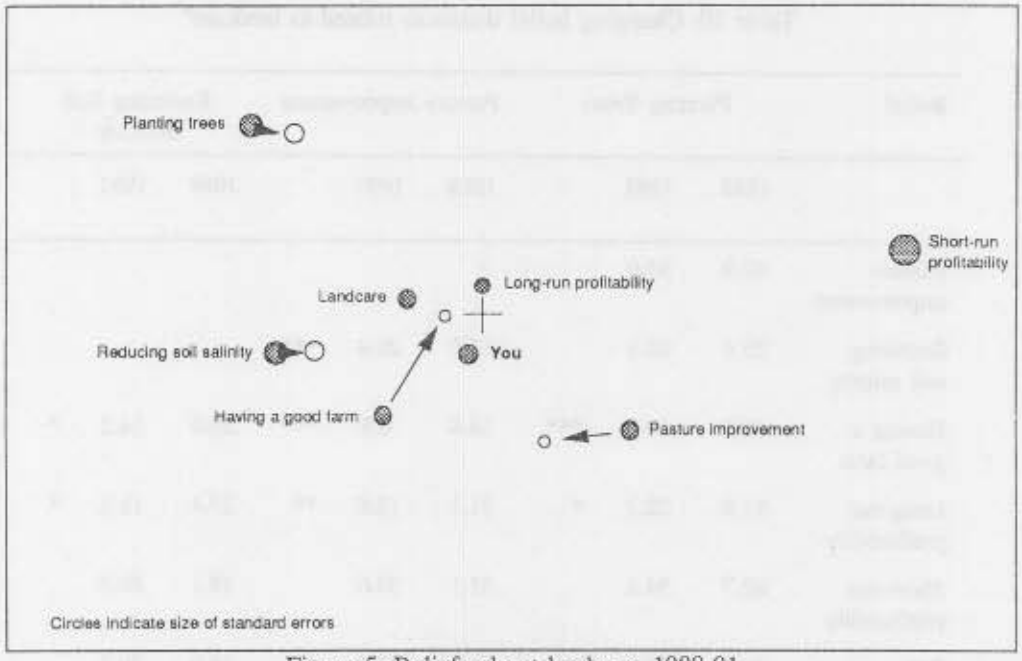

Figure 5: Beliefs about landcare, 1988-91
(Beliefs with arrows changed significantly between 1988-91;
unhatched circles represent new location of 1991 beliefs.)

In this model of beliefs about landcare planting trees was most associated, but not closely associated, with reducing soil salinity and landcare. Landcare was most closely associated with long-run profitability and having a good farm. Both long-run and short-run profitability were more associated with pasture improvement than with tree planting. In contrast to the perception presented in Table 13, in this more 'disguised' systematic approach to eliciting landcare beliefs landcare was more closely associated with pasture improvement than with planting trees. Between 1988 and 1991 pasture improvement became more associated with reducing soil salinity, having a good farm and long-run profitability. Planting trees became more associated with having a good farm.

Analysis of qualitative data

Belief systems can also be identified through analysis of interview transcripts. This can be less restrictive than using conventional belief map analysis because respondents are free to use their own perception of the relationship between objects by speaking freely about the topic, rather than by assigning numbers to a relationship. The respondents' understanding of the meaning of the term 'landcare' was analysed in this way (Figure 6). The figure displays 78 per cent of the real variance present in the belief system.

The words *landcare* and *group* were closely associated, as were *farm* and *management*. These four words were close to each other, indicating that Landcare groups and farm management were connected ideas. *People*, *planting* and *trees* were loosely linked, and were some distance from *landcare*, indicating that, although people planting trees is a commonly thought set of words in the context of landcare, it is not necessarily closely linked with landcare. Farm management was considerably more closely linked with landcare than was planting trees. Various forms of degradation were also mentioned frequently. These words clustered loosely near the word *landcare*. For clarity, they are represented by the single word *degradation*.

The respondents' understanding of the nature of good land management was also investigated using this method (Figure 7). The figure displays 71 per cent of the real variance in this case. *Good*, *farm*, *land* and *management* were all closely associated, indicating that the respondents thought of good land management in terms of good farm management. Although the current emphasis in extension is for good land management, this is not always the same thing as good farm management. To the respondents, good

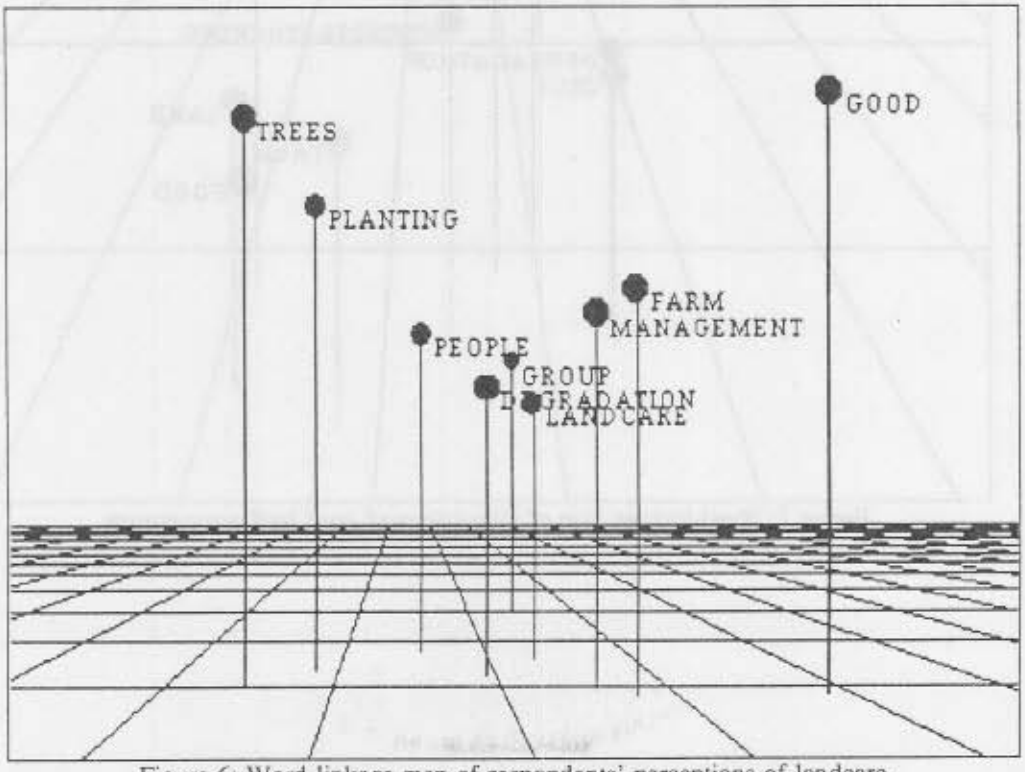

Figure 6: Word-linkage map of respondents' perceptions of landcare

farm management was as important as good land management. In this sense, good land management can be seen as only a part of good farm management.

Various terms relating to good livestock management were loosely grouped, such as fertilising pastures, ensuring an appropriate stocking rate, and pastures. Further away from these, and furthest from the good farm and land management cluster, was a tight group of words connected with the control and improvement of soil problems such as erosion. The components of this cluster could not be separated, indicating a possible weakness in the method. The word *crop* was also included in this cluster, indicating that the respondents associated soil problems more closely with cropping than with grazing. In a predominantly grazing area with only a small part of the land suitable for cropping, this is not surprising. The word *tree* was also a considerable distance from the good farm and land management cluster.

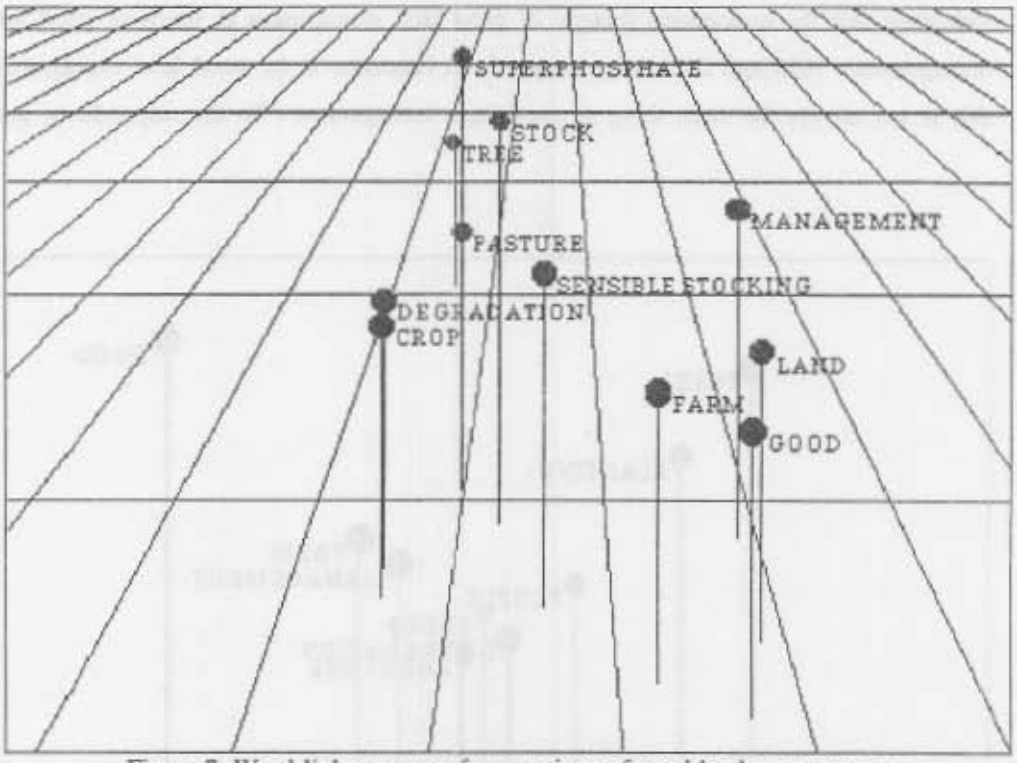

Figure 7: Word-linkage map of perceptions of good land management

Conclusion

In the upper Loddon and Avoca catchments the number of farmers who were members of Landcare groups increased markedly between 1988 and 1991. The number of trees planted by district farmers annually during the period was five times greater than in the previous five year period. The area sown to phalaris-based perennial pastures in the district also increased substantially. By these simple measures the Landcare movement in the upper Loddon and Avoca catchments has been a success. However, much of the increased revegetation activity was undertaken by a small number of farmers, who have become enthusiastic planters of trees and have undertaken other activities aimed at reducing soil degradation where it exists on their land. Most farmers, however, express a concern about such matters which is not matched by action. Many who say they plant trees to control salinity plant small numbers of trees and rarely plant them purposely in high recharge areas.

Campaigns to improve land management are not new phenomena. Neither is their high risk of failure. For most people there is a discrepancy between attitudes to the environment and behaviour related to the environment. This should be kept in mind when seeking to change attitudes to bring about better land management practices. Expressing a positive attitude to controlling salinity, for example, usually does not take account of the costs that might have to be borne to bring about its control.

One basic reason for farmers' lack of activity in relation to tree planting and pasture sowing for salinity control is their perception of the hazard posed by salinity. Landholders across the Central Highlands have been convinced there is a significant salinity problem in the region, but far fewer think there is a problem on their own farm. This may be a reasonable assessment of their situation. Claims for subsidiary environmental benefits arising from their farm management decisions may well be a reflection of humans being good at finding reasons for what they do and not very good at doing what they find reasons for.

Although there is widespread interest in tree planting, we suspect most owners of large and medium sized properties do not believe extensive tree planting to be in their own economic interest. Trees are predominantly seen as paddock dividers and fence line adornments, rather than having a major role in the middle of the paddock. A much more concerted

effort would be required to encourage tree planting on a widespread basis. Such an approach would require the whole community to contribute a very large subsidy to landholders who participate. The question has to be asked whether investment in extensive tree planting is in the wider community's interest.

It is difficult to ask farmers to bear these costs when in south east Australia there is as yet no direct evidence of successful reclamation of dryland salting achieved by tree planting on recharge areas. We know at a general and conceptual level the geologically defined areas of preferential groundwater intake. For given catchments, we do not know with sufficient precision the specific localities where trees should be planted to reduce groundwater intake causing specific areas of salting. We are unsure about the length of the time lag from when trees are replanted to when watertables are lowered sufficiently to control salinity. This ignorance would not be a problem if there was no cost involved. However, there are significant costs in gaining information, planting trees and in production lost from the land on which trees are planted.

When a commercial farmer faces the uncertainties of trees and salinity control, it is easy to see why he or she may decide against such an investment. There are similar technical doubts about the use of improved pasture to reduce recharge of watertables in some situations. Despite these doubts there are other obvious salient benefits from improving pasture. Improved pasture reduces runoff which reduces soil erosion. Improved pasture also promises more tangible economic benefits in the long term.

In 1988 it was clear that beliefs about the long term profitability of trees and pasture were the strongest influences on planting and sowing behaviour. In 1991 the evidence suggests we need to temper this conclusion a little. Promotion of tree planting as a means of salinity control is likely to be most successful with owners of smaller farms. These farmers form a separate market segment. Other writers have suggested that where there are small areas of high recharge land there may be some benefits from subdivision to create smaller holdings of farmers who will probably plant a greater proportion of their land with trees (Hogan, Martin and Stevenson 1991, p. 75). Such a solution may pose more questions than answers.

The evidence still supports the contention that improving pasture as a salinity control strategy is more acceptable to large scale commercial farmers than tree planting. These are

the farmers who control the majority of the farmland in the upper Loddon and Avoca catchments. Promotion of trees and phalaris is best achieved by promoting the benefits which are most salient to the client - long term profit, capital value and beauty, and in the case of pasture, demonstrating practical solutions to the management problems which deter half the landholders from sowing phalaris. We have already noted that salient or 'substantive' beliefs are harder to influence than peripheral or 'symbolic' environmental beliefs. When we talk of promotion we mean activities such as locally relevant trials jointly managed by landholders and advisers, rather than the glossy pamphlet approach.

There is a need to disentangle the symbolism of trees from the practicality of tree planting. In the upper Loddon and Avoca catchments simplistic solutions involving broad scale reforestation are unlikely to be economically feasible. The salinity control reward for the promotion of pasture improvement may be far greater than the reward from tree planting. This is certainly the message being promoted by many active members of the Lexton Landcare group, despite the obvious success of the group in promoting tree planting.

Profitable and practical conservation farming techniques and management strategies are necessary for widespread or universal adoption to occur. Where profitable and practical conservation farming techniques are not available the best assistance is research directed at producing and promoting practical and profitable solutions, rather than a reliance upon calls for better farming and changed attitudes. Extension programs directed to promoting awareness of future loss due to soil degradation are likely to have relatively little direct influence on farm management behaviour and investment. There will be much greater pay-off in developing and promoting conservation farming methods which also offer quickly realised production and economic advantages to landholders.

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