The value of native vegetation:

Urban and rural perspectives

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National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation

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Foreword

Few things shape the character of our rural landscapes as much as the way we manage remnant vegetation.

The great diversity of distinctive and often endemic species that comprise our extraordinary flora is still relatively poorly understood by most of the population, whether in cities or 'the bush'. Science is yet to fully comprehend all of the ecological functioning and processes of native vegetation, nor the long-term impacts of the loss of this functionality. The fact that an entirely new species of large tree (the Woollemi pine) was discovered in Greater Sydney only in the 1990s illustrates the imperfect state of knowledge of Australia's native vegetation.

But we do know that the continuing loss, fragmentation and degradation of native vegetation is the single greatest driver of dryland salinity, the single biggest factor in loss of biodiversity, and one of the major contributors to our greenhouse gas bottom line. In some of our older agricultural landscapes, the current generation of scattered old trees dotting the paddocks will be gone in our lifetimes, with major aesthetic and ecological implications.

If we want to arrest and reverse the decline in native vegetation communities in rural landscapes, we need first to understand what motivates those whose everyday decisions and actions influence their ecological functioning. Conventional surveys about attitudes to trees on farms are rarely convincing in their conclusions about what farmers and others really think about native vegetation or how that influences their behaviour.

This monograph by John Cary and Kath Williams is unusual. It is at once scholarly, innovative and practical in its approach to the question of how rural and urban people perceive native vegetation in rural landscapes. It takes as a starting point the popular thesis that human landscape preferences have their roots in the origins of our species in the savannas of Africa, where the importance of being able to see without being seen, and to move and navigate freely, were critical to human survival. Hence the aesthetic attractions for many people of parkland landscapes — large trees scattered across well-managed fields, with room to move and vistas to appreciate.

Yet from an ecological perspective, we need to get people to appreciate landscapes that are scruffier in appearance, with intact understorey layers of shrubs, herbs and grasses. Informing contemporary Australian aesthetic preferences with some ecological literacy is a formidable challenge. This challenge must start with an appreciation of how people perceive and react to the world around them. John Cary and Kath Williams offer some tremendous insights into these perceptions and how they vary across different regions, between rural and urban people, and according to factors such as age, gender and property size.

This research was funded through the Land and Water Resources Research and Development Corporation/Environment Australia National R&D Program on Rehabilitation, Management and Conservation of Remnant Vegetation. The well-written report should be essential reading for policy makers, extension workers, community groups and designers of conservation programs, particularly in south-eastern Australia.

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Executive summary

This report describes a project undertaken to examine human perception of native vegetation. The project employed photo-questionnaire techniques designed for measuring psychological preferences, adapting these for the purpose of identifying attitudes that promote or hinder the protection of native vegetation. Landholders in south-eastern Australia and urban residents of Melbourne were surveyed to identify preferences for vegetation types. A total of 568 rural landholders from three regions (Victoria's Wimmera, the Midlands of Tasmania, and upper south-east South Australia) and 664 residents of Melbourne completed a survey of preferences for photographs of native vegetation. Respondents indicated their preference for 36 black and white photographs of native vegetation, using a five-point rating scale. Follow-up surveys and interviews were used to obtain oral descriptions of scenes from five categories of vegetation.

There was more commonality than difference between urban and rural preferences for different arrays of native vegetation. Respondents tended to prefer more open woodland with a smooth or lightly textured understorey. Urban and rural respondents were found to have relatively low preference for some non-eucalypt vegetation. There was higher preference for eucalypt dominant woodlands than for bull-oak (buloke) (*Allocasuarina luehmannii*) and she-oak (sheoke) (*Allocasuarina verticillata*) vegetation. Rural respondents had a higher preference for she-oak vegetation than did urban respondents.

Landscape preference was found to have a significant relationship with a range of individual characteristics of landholders and urban residents. These include region of residence, education, age and Landcare membership. An important finding is that rural landholders who took more action to protect native vegetation on their own property also expressed higher preference for relatively undisturbed ecosystems. Urban residents with pro-environment attitudes were also more likely to prefer relatively undisturbed vegetation.

In a second study, landholders indicated their relative preference for rural landscapes in which native vegetation had been retained over more traditional agricultural landscapes. The results suggest that landholders value native vegetation in rural landscapes, but value it primarily for utilitarian reasons. This study also indicated relatively low regard for native grasslands. The results of these studies have been used to develop guidelines for promoting native vegetation protection.

These findings, along with analysis of oral descriptions of the vegetation categories, suggest a number of factors that should be considered in the design and implementation of strategies to protect and maintain native vegetation on private properties.

1. *Ecosystem- and species-based interventions:* Woodland dominated by species other than eucalypts appears to be less attractive to both rural and urban respondents. There is a need to promote awareness of the characteristics and ecological significance of less familiar species and ecosystems.
2. *Consider human purpose and landscape values* (for example agricultural production or recreation) in development and implementation of education and incentive programs.
3. *Production landscapes:* For rural landholders, the primary value of rural landscapes is their production value. Economic arguments and incentives are likely to be more effective at changing attitudes among rural landholders than are ecological arguments.

4. *Communicating biodiversity:* Promotional programs should emphasise the value of understorey species and link ecological diversity with the concept of naturalness. In urban communities, the importance of ecological diversity should be linked to provision of wildlife habitat and to national identity.
5. *Creating meaning:* The design of public spaces should provide opportunities to explore nature (particularly through pathways). Interpretative material could provide insight to characteristics and ecological significance of less common species. Direct experience of nature is likely to enhance urban appreciation of the value of native vegetation. This is particularly important for more dense and unusual forms of vegetation.
6. *Younger landholders:* Younger landholders have somewhat lower preference for native vegetation and report lower levels of native vegetation protection behaviour. There is a need for better understanding of the beliefs and motivations of younger landholders concerning native vegetation.
7. *Regional concerns:* While *Allocasuarina* species are present in all study regions, landholders from upper south-east South Australia and the Midlands of Tasmania expressed lower preference for bull-oak and she-oak vegetation than did landholders from the Wimmera. Species-based interventions would be valuable in these areas.

More detailed guidelines for promoting native vegetation protection are presented in the body of the report.

1 Introduction

1.1 Project background

Native vegetation has been cleared from much of the Australian landscape. Remaining areas are often small, isolated and threatened by grazing, fire, soil salinity, weeds, fertiliser, insects and plant diseases. In many areas it is clear that native vegetation will soon disappear from rural landscapes unless management is significantly improved. Better management will result in part from improved understanding of the physical processes of remnant ecosystems. Adoption of better management techniques will not occur, however, without the efforts of Australia's agricultural industry. This includes individual landholders and their families who manage significant areas of our most threatened ecosystems. The cooperation of urban communities is also critical to ensure financial and moral support for those who must directly manage remnant vegetation in rural landscapes.

The Land and Water Resources Research and Development Corporation (LWRRDC) and Environment Australia (EA) have identified a need for better information about protection of remnant native vegetation. Their jointly funded research and development program on the rehabilitation, management and conservation of remnant vegetation is directed towards removing shortcomings in understanding remnant native vegetation and its management. While many of the projects funded investigate biological aspects of remnant management, a significant feature of the program is the attention paid to socio-economic factors that contribute to management of remnant vegetation.

> In addition to developing a broadly-based ecological understanding which can be transferred and applied generally, Environment Australia and LWRRDC also have a particular interest in socio-economic and policy research. There is clear evidence of a large and continuing gap between the knowledge and understanding gained by researchers and its application by private and public managers of remnant vegetation. There are large differences in the way that native vegetation is viewed and managed between government agencies, and between individual landholders. These may reflect actual differences in value or significance of remnant vegetation in different locations, or differences in awareness or in willingness or ability to carry out sustainable management of native vegetation, even when it is recognised as a desirable goal. Whatever the reasons, it is clear that these impediments to ecologically sustainable management of remnant native vegetation must be addressed if current knowledge is to be used effectively in managing our rural landscapes. (Price and Tracy, 1996)

The studies reported in this monograph comprise an investigation of perceptual attributes contributing to maintenance of native vegetation. The focus of the studies is psychological — to explore the understanding Australian people have for native remnant vegetation and their relative preferences (which may have both conscious and subconscious origins) for native vegetation. The project explored landholder and urban perceptions of native vegetation, to help enable the development of better strategies to promote protection and maintenance of native vegetation.

1.2 Project objectives

Many agencies recognise the need for more effective targeting of programs that promote the importance of native vegetation protection. Understanding rural and urban perceptions of native vegetation can assist this process in three ways.

First, people do not respond to all types of native vegetation in the same way. For example, some

trees may be considered valuable for timber while others are not. Some ecosystems may be considered more attractive than others. Some shapes and sizes of remnant vegetation may be more compatible with agricultural enterprise. Native vegetation programs can be targeted to ensure protection of species, ecosystems, and remnants that are not fully appreciated by landholders and urban residents.

Second, not all people respond to native vegetation in the same way. Rural and urban residents may have different preferences for vegetated landscapes, resulting from different expectations and intended uses of these places. Similarly, rural landholders of different ages, education levels or enterprises may assess native vegetation in divergent ways. Where such differences can be identified, it may be possible to design native vegetation programs to target the different preferences of specific audiences.

Finally, human response and behaviour toward native vegetation are shaped by a wide range of internal factors such as values, innate preferences (determined in the process of human evolution) and learned preferences. Values that are innate or deeply held may be difficult to change, while learned preferences and socially determined attitudes are more open to influence. Native vegetation programs will be made most effective by working within the deeply held values espoused by landholders and urban communities, while challenging beliefs and attitudes that may hinder the protection of native vegetation on private land (Gardner and Stern, 1996).

The first study reported in this monograph identified vegetation and landscape preferences that might help or hinder protection of native vegetation on private land.

The second study identified landholder perceptions of the ecological, agricultural and aesthetic value of native vegetation in rural landscapes. This study examined the influence of broadscale landscape characteristics on landholder preference for native vegetation in farm landscapes.

An important objective of the two studies was to provide guidelines for use by conservation and land-management organisations, agricultural consultants, extension officers and community groups in the design and implementation of native vegetation protection programs. The guidelines that are developed may challenge some of the assumptions we make about the way landholders and urban people respond to native vegetation. They are designed to provide a resource for setting regional priorities, and to suggest new ideas for people communicating the importance of native vegetation to landholders and urban people.

1.3 The psychology of landscape preference

Attraction to nature is an important aspect of human experience (Kellert, 1997). Numerous studies have demonstrated preference for environments with natural elements over those that are predominantly built (Kaplan and Kaplan, 1989), and one might therefore predict that humans will prefer those environments that are most natural and rich in a variety of life forms. However, three decades of research about human response to different types of largely natural landscapes (Kaplan and Kaplan, 1989) raises the possibility that the most natural environments may not be the most preferred. Observing apparent preference for modified savanna environments, Gobster (1994; 1995) has speculated that the psychological processes that underpin preference for nature may also promote dispositions less consistent with protection of biological diversity.

Landscape architects have noted that natural ecosystems are often considered less attractive than more manicured environments. Both Nassauer (1995) and Thayer (1989) have suggested that the appearance of natural habitat transgresses cultural norms for neat appearance of landscapes.

Observing the social 'language' of landscape among Americans, Nassauer (1995) suggested that, through regular mowing of grassy areas and pruning of larger plants, landowners communicate their intention to care for their property; neatness equates with good management or stewardship of land. In this social context natural ecosystems may be viewed as messy and untended (Thayer, 1989). Such social expectations signal significant challenges for those wishing to promote the value of biologically diverse ecosystems, such as native vegetation.

Preference for neat landscapes may reflect more ancient and widespread landscape responses than has been recognised by the writers mentioned above. Anthropologist Rhys Jones (Jones, 1985) has observed a preference for neat landscapes among Australia's Indigenous peoples. Australian Aborigines managed their landscape by regular burning for hundreds of centuries before colonisation by Europeans. The practice of regular burning continues in some parts of Australia today, and recent indigenous writers (Stanley, 2000) have suggested that contemporary Indigenous peoples continue to perceive 'good country' to be that which is open and has relatively low understorey growth.

There is considerable evidence that humans prefer landscapes that are relatively open and smooth (Kaplan *et al.* 1989). These seemingly universal preferences are most commonly attributed to inherited predispositions (Cary and Williams, 1998). The preference for park-like landscapes has also been attributed to learned responses. Gobster (1995) has suggested that 18th century fashions in landscape design have led to familiarity with, and preference for, traditional English style 'parkscapes' in nations which were originally British colonies. Whatever the psychological origin, it is clear that preference for open and smooth landscapes may have important implications for human response to biologically diverse environments. The landscapes which we can view and move through with greatest ease are often those which have been most heavily modified through removal of understorey plants.

Functional theories of landscape preference, which are the theoretical underpinning for this research, propose that humans prefer environments that provide for their needs. Some functional theorists emphasise inherited response to landscape, while others highlight learnt environmental preferences. Habitat theory (Orians and Heerwagen, 1992) falls into the former class, emphasising the biological factors that shape landscape preferences. Habitat theory is concerned with evolution of the human brain, including emotional behaviour. It presumes that evolutionary development of the brain occurred while humans lived as hunters and gatherers in the savanna environment of eastern Africa. The members of the species most likely to survive to reproduce were those who chose to settle in landscapes that provided for basic human needs such as shelter, food and water. In the African savanna, widely spaced trees indicate a source of shelter and availability of hunting. Habitat theory proposes that innate attraction to such landscapes would provide an evolutionary advantage for hunters and gatherers; the processes of natural selection have ensured that innate attraction to such landscapes still influences the attitudes of humans today. Other writers have attributed preference for open landscapes to other survival needs of humans, including the need to see potential predators and prey without being seen oneself (Appleton, 1975) and to navigate and move through a landscape with ease (Kaplan, 1991).

Other theories highlight learnt responses to the environment, developed as we encounter and accommodate new information about the benefits and costs of landscape characteristics. Appleton's work (1990), based on Gibson's (1968) theory of affordances, also predicts that we prefer environments that provide for our needs. Appleton specifically predicted preference for landscapes affording both prospect and refuge (the capacity to see predators or prey without

being seen), but it is clear from Gibson's work that affordances are learnt during life. Thus, we will learn to prefer environments with characteristics that promote survival in contemporary society: a farmer is likely to be attracted to landscapes with a high production potential. If native vegetation is seen to hinder these production goals, farmers are likely to prefer landscapes with relatively small areas of native vegetation. Response to landscape characteristics will vary with the needs and goals of the individual. In an agricultural context, this may mean that landscape preferences will depend on the intended use of the land; preferences for cropping areas may differ from preferences for landscapes that are primarily managed for grazing.

Humans use a range of criteria to assess landscapes (Purcell *et al.* 1994). It has been established that landholders recognise that native vegetation is valuable for a range of purposes including shelter for stock and crops, aesthetic beauty and protection of ecological systems (Cary, 1993; Gilfedder and Kirkpatrick, 1995), but we have less information about the relative importance of these values. The studies that follow seek to better our understanding of these values and of underlying human preference for native vegetation.

2 Study 1: Landscape preference

2.1 Methods

In this study, photographs of rural landscapes were used in conjunction with surveys and interviews to examine perceptions of native vegetation held by rural landholders and urban people.

Principal components analysis — a technique for identifying patterns in data sets — was used to identify categories of perceptual preference for landscapes representative of native vegetation in south-eastern Australia.

Participants. The study involved urban residents and rural landholders, and data were collected by mailed survey. Residents of metropolitan Melbourne were selected at random from the telephone directory, and correctly completed responses were returned by 664 residents (response rate 44%). Rural respondents were drawn from three regions (Victoria's Wimmera, upper south-east South Australia and the Midlands of Tasmania) selected on the basis of broad similarities in land use and vegetation characteristics. Populations were defined according to municipal boundaries, and all landholders owning property of 5 hectares or more within specified parishes were posted a survey. Correctly completed forms were received from 568 landholders (response rate 38%).

Materials. The photo questionnaire presented 36 black-and-white photographs showing native vegetation characteristics of the three rural study sites.[1] Vegetation included woodland and forest, but excluded open grassland and wetlands present in these areas. Photographic sites were selected in consultation with local botanical experts to represent a range of values related to dominant plant species, spatial configuration (smoothness and openness of vegetation) and degree of human modification of landscape (through grazing or wood collection). Water and built landscape features such as fences and tracks were excluded from the photographs. Photographs showed a relatively small area of bushland; as much as can be captured in a single photograph using a standard 50 mm lens while standing in a small clearing. Photographs were presented in two different sequences to eliminate effects associated with order of presentation.

Landholder and urban residents questionnaire. Respondents rated preference for the photographs using a five-point scale (ranging from "like very much" to "do not like at all") and provided some general demographic information. Surveys of rural landholders also measured reported vegetation protection behaviour. A list of 11 actions was presented (for example "kept stock out a paddock [field] for a time to allow regeneration", "collected seed from local plants for planting", "left dead wood on the ground for wildlife habitat") and landholders were asked to tick actions they had taken to protect the biological diversity of native vegetation on their own property.

Follow-up interviews and surveys were conducted with 131 landholders and 126 urban residents to obtain oral descriptions of representative vegetation types. Respondents were shown one scene from

[1] The validity of using photographic representations to assess perception of actual environments has been established by a number of studies (see for example Shuttleworth, 1980; Stamps, 1990). When individuals view photographs, information visible within the scene is not the only factor that influences their response. Photographs prompt memories of direct experience of similar places, as well as more abstract knowledge of the environment. This knowledge and past experience contributes to the rich responses often obtained through photo questionnaires. A detailed discussion of the validity of using simulated environments in environmental assessment can be found in Craik and Feimer (1992).

each of five vegetation categories and asked to describe liked and disliked aspects of each scene.

2.2 Analysis

Patterns of preference were identified using the statistical procedure Principal Components Analysis with a Varimax rotation (Norussis, 1993). This process determined five categories that accounted for 57% of variance in preferences across all responses. Multivariate analysis of variance (MANOVA) was employed to test relationships between landscape preferences and a range of demographic characteristics. Where multivariate tests indicated a significant relationship, univariate analysis of variance was used to determine the source of group differences.

Oral descriptions of vegetation categories were assessed to identify key concepts (oral descriptors), the frequency with which they were used, and word associations (groups of descriptors that tended to be used together). This process was supported by the software package CATPAC (The Galileo Company, 23A Durham Drive, Amherst, NY, 14228, USA).

2.3 Results

2.3.1 Overall preference for vegetation types

Brief descriptions and mean preferences for the five vegetation types are shown in Table 1. There are considerable similarities between rural and urban responses to vegetation. There was more commonality than difference between urban and rural preference for different arrays of native vegetation. Both rural and urban groups clearly preferred eucalypt vegetation (shown in 'dense', 'grassy' and 'open' categories) to bull-oak *(Allocasuarina luehmannii*) and she-oak (*Allocasuarina verticillata*) scenes.

The overall preference patterns of urban and rural respondents are very similar. While multiple analysis of variance (MANOVA) indicates significant differences between the two groups ($F(1226,5) = 5.181$, $p=.00$), these are very small. Univariate analyses with the appropriate Bonferroni adjustment for multiple tests were conducted to further examine these differences and identified rural–urban differences in preferences for grazed woodland and she-oak woodland. Results indicate that urban respondents have somewhat higher regard for heavily grazed woodland than rural respondents ($F(1230,1) = 8.93$, $p = 0.00$). Analysis of oral data indicates that urban residents consider the grazed woodlands to be pleasant, park-like environments, well suited to walking. In contrast, rural landholders described these scenes as overgrazed and lacking the grass needed to feed cattle and sheep. Urban residents also have slightly lower preference for she-oak vegetation ($F(1230,1) = 5.28$, $p = 0.02$). Oral data suggest that urban residents may be much less familiar with this vegetation type; rural landholders were 7 times more likely to name the vegetation as casuarina or she-oak.

Table 1. Mean preferences for vegetation categories: comparison of urban and rural respondents.

Vegetation category	Rural preference	Urban preference
	Mean	Mean
2. Grassy woodland	3.36^{a}	3.34^{b}
3. Grazed woodland	3.25^{b}	3.38^{b***}
1. Dense woodland	3.30^{ab}	3.26^{a}
4. Bull-oak woodland	2.84^{c}	2.80^{c}
5. She-oak woodland	2.96^{d}	2.84^{c***}

abcd For columns, matching superscript letters indicate no significant difference between values for these vegetation categories.

*** For rows, asterisks indicate rural and urban preferences are significantly different for this vegetation category.

2.3.2 Characteristics of vegetation types

Respondents provided oral descriptions of key scenes from each vegetation category. These provide some insight into landscape characteristics, beliefs and values that shape rural and urban preference for the scenes.

Grassy woodland. Scenes in this category show open eucalypt woodland with a lightly textured understorey, usually grass (see Plate 1). The words most frequently used to describe these scenes are *open, natural* and *native grass*. Urban residents appear to associate the scenes with significant cultural or symbolic values since their next most frequently used concept was *Australian*, with a number of urban respondents (14%) labelling these images as ideal or typical Australian landscapes. In contrast, landholders were more likely to identify utilitarian values of the scenes, using the words *grazing* and *shelter* to describe the major attributes of vegetation in this category. Both rural and urban respondents expressed moderate to high preference for scenes in the grassy woodland category.

Open grazed woodland. Scenes in this category are characterised by openness and a smooth understorey (see Plate 2). Both rural and urban respondents expressed moderately high preference for these scenes. As noted earlier, there is a significant difference between rural and urban preferences for these scenes. This distinction is reflected in associated word use. Both rural and urban respondents appeared conscious that the understorey was cleared or eaten by stock. For rural landholders overall, this characteristic represented an absence of agricultural value. The scenes were described as *heavily grazed* or *overgrazed*, and the absence of grass was frequently noted. In contrast, urban respondents frequently described the scenes with the words *pleasant* and *walk*. The open, smooth landscapes presented a valuable recreation environment.

Dense eucalypt woodland with bushy understorey. Both rural and urban respondents expressed moderately high preference for dense eucalypt woodland (see Plate 3). Mean preference was slightly higher for rural landholders than for urban respondents, but there was no significant difference between their responses. The most common key concepts used by rural landholders to describe scenes in this category were *natural*, *undergrowth*, *fire*, *scrub* and *understorey*. Urban respondents used the terms *natural, vegetation, bush, ground, undergrowth, native* and *interesting*.

Bull-oak woodland. Rural and urban participants indicated low regard for scenes of bull-oak woodland (see Plate 4). For both groups, one of the key concepts was *fire*: many participants considered the dark bark and small, closely growing trees to indicate the vegetation was damaged by, or recovering from, fire. While nearly a third of the rural respondents named the species shown as bull-oak or casuarina, only two urban respondents identified the trees as bull-oak or she-oak. Rural respondents emphasised the *dense*, *thick* growth of the trees and the grass understorey, while urban respondents described the scene with the words *dead, natural, ground (cover)* and *dense*. Further discussion of human response to bull-oak woodlands can be found in Williams and Cary (1998).

She-oak woodland. Both urban and rural respondents expressed relatively low preference for she-oak woodland scenes (see Plate 5). The most frequently commented on elements of the scenes, for both rural and urban respondents, were rocks in the foreground, and dead trees in the background. The dead tree may have been emphasised because the scenes in this category, with only a single exception, showed *Allocasuarina verticillata* woodlands on rocky hilltops in the Midlands of Tasmania. A significant aspect of vegetation throughout the Midlands is the dieback of eucalypt species, particularly manna gum.

Mean preference for she-oak was higher among rural respondents than urban respondents. Rural respondents were far more likely to

identify the canopy species as she-oak or casuarina. They were also more likely to describe the vegetation as *natural* or *healthy*, although these comments also feature in urban descriptions of the scenes. Not surprisingly, rural landholders described the scenes in terms of value for *stock*, particularly *shelter*. Difference in urban and rural response to she-oak vegetation can be partly attributed to different levels of awareness of the species. An equally important consideration is the expected use of the landscape. The rocky terrain may provide a greater hindrance for urban residents (whose principal interaction with the landscape is likely to be recreational, and probably walking) than for rural landholders (who are more likely to consider the value in terms of shelter for sheep).

2.3.3 Relationship between landscape preferences and other variables

Landscape preferences are shaped by a wide range of social, cultural and individual characteristics. This section examines the relationship between landscape preference and a range of demographic and attitudinal characteristics of respondents.

Region

Multivariate analysis of variance reveals significant differences between responses of landholders from the Wimmera, upper south-east South Australia and the Midlands of Tasmania (Wilk's υ (10,1122) =0.88, p = 0.00). Follow-up univariate tests show that landholders from the Wimmera have significantly higher preference for bull-oak (f(1,2) = 10.95, p = 0.00) and she-oak (f (1,2) = 10.68, p = 0.00) vegetation than landholders from other areas (Figure 1). There were no significant regional differences in preference for dense, open and grassy woodland scenes.

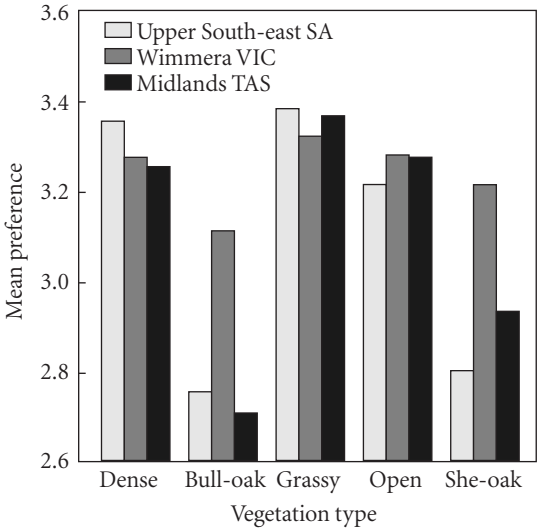

Figure 1. Mean preference for five vegetation types: comparison by region of residence.

Education

Among rural respondents, a significant correlation was found between level of education and preference for native vegetation (Wilk's υ (5,549) = 0.96, p = 0.00). Figure 2 indicates that respondents who had undertaken year 12 or tertiary education tended to have higher preference for scenes in the dense (f(1,1) = 18.17, p = 0.00), bull-oak (f(1,1) = 8.09, p = 0.01) and she-oak (f(1,1,) = 3.93, p = 0.05) categories. Respondents with lower levels of education tended to have relatively higher preference for the open, heavily grazed scenes, and relatively lower preference for grassy woodland scenes (Figure 2), but these findings were not statistically significant.

Among urban respondents, the relationship to education was not as pronounced. Urban respondents with higher qualifications tended to have higher preference for dense and grassy scenes. They also tended to have relatively lower preference for open, grazed scenes. There was no indication of higher preference for bull-oak and she-oak scenes. Multivariate tests indicate that these trends in preference are not sufficient to be considered significantly different (Wilk's υ (10,1312) = 0.97, p = 0.07).

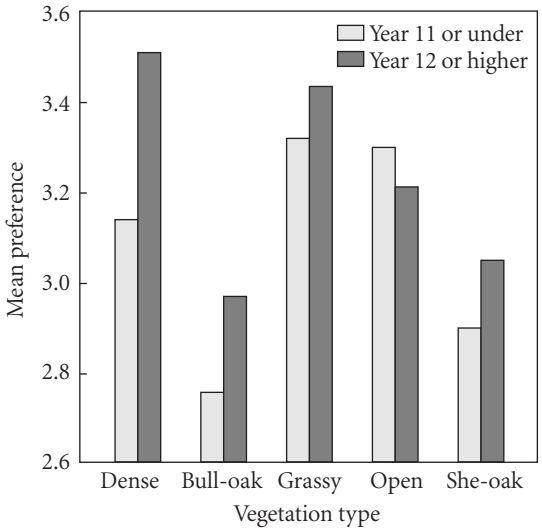

Figure 2. Mean rural preference for five vegetation types: comparison by level of education.

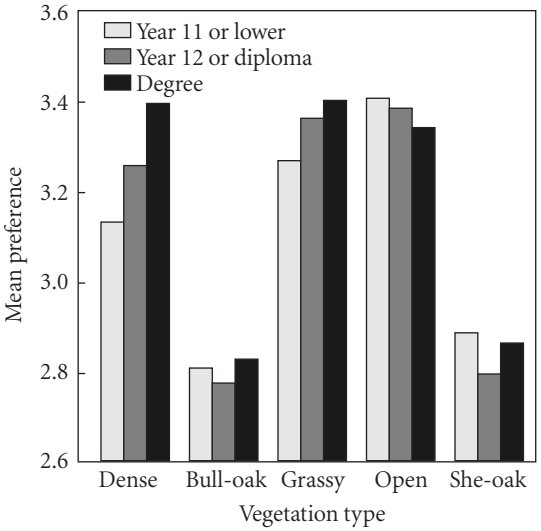

Figure 3. Mean urban preference for five vegetation types: comparison by level of education.

Age

Preference for native vegetation is related to age among rural landholders (Wilk's υ (15,1546) = 0.96, p = 0.04). Respondents in the youngest age group (39 years or under) tended to have lower preference for all categories of vegetation. For bull-oak, grassy, open and she-oak categories, mean preference of the youngest cohort was lower than for all other age groups. While this trend is pronounced (Figure 4), significant differences were found only in relation to she-oak scenes (f (1,3) = 4.95, p = 0.00).

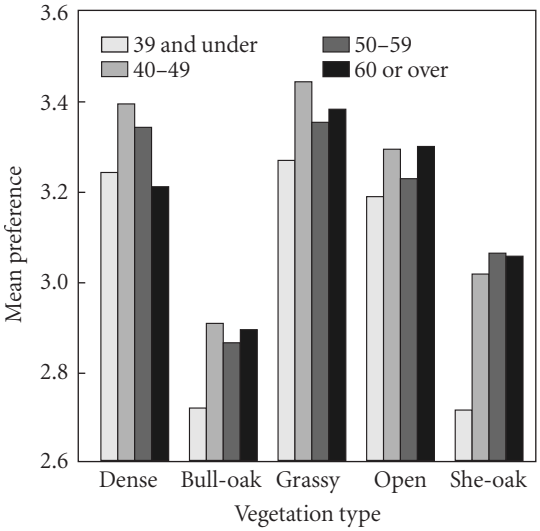

Figure 4. Mean rural preference for five vegetation types: comparison by age.

The relationship between age and urban preference for native vegetation is more difficult to discern. Multivariate analysis of variance indicated significant differences (Wilk's υ (10, 1312) = 0.97, p = 0.07). Follow-up tests identified two sources of variation. Urban respondents in the 30–39 age group tended to have much lower preference for bull-oak (f(1,4)=2.65, p=.03) and she-oak (f(1,4) = 3.53, p = 0.01) scenes than did respondents in the 60+ age group. Other age groups did not differ significantly. There is a tendency for older respondents to express relatively higher preference for she-oak and bull-oak scenes (see Figure 5).

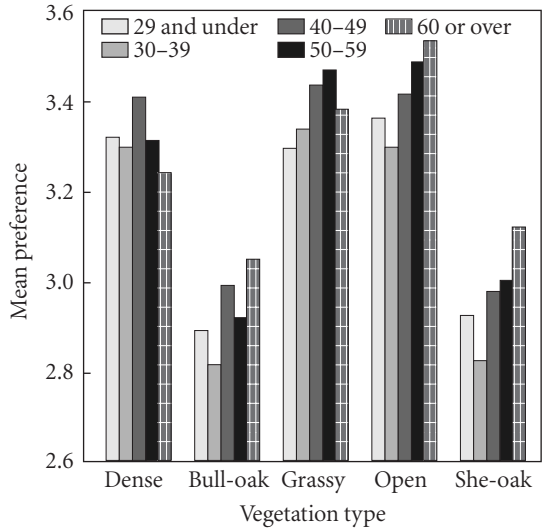

Figure 5. Mean urban preference for five vegetation types: comparison by age.

Gender

Gender was found not to be significant in preference for native vegetation. This was true for both rural (Wilk's υ (5,543) = 0.98, p = 0.07) and urban (Wilk's υ (5,651) = 0.99, p = 0.61) respondents. Non-significant trends suggest women may have relatively higher preference for dense vegetation. Men may have relatively higher preference for bull-oak and she-oak scenes.

Landcare

Membership of Landcare groups (among rural respondents only) was related to preference for native vegetation (Wilk's υ (5,549) = 0.94, p = 0.00). Univariate tests indicate Landcare members tended to express considerably higher preference for bull-oak (f(1,1) = 18.41, p = 0.00) and she-oak (f(1,1) = 17.29, p = 0.00) than did respondents who were not members of Landcare (Figure 6). There was no significant difference in preference for dense, open and grassy categories. This suggests the Landcare movement is more successful in raising awareness of specific species than in raising awareness for the more general characteristics of biological diversity.

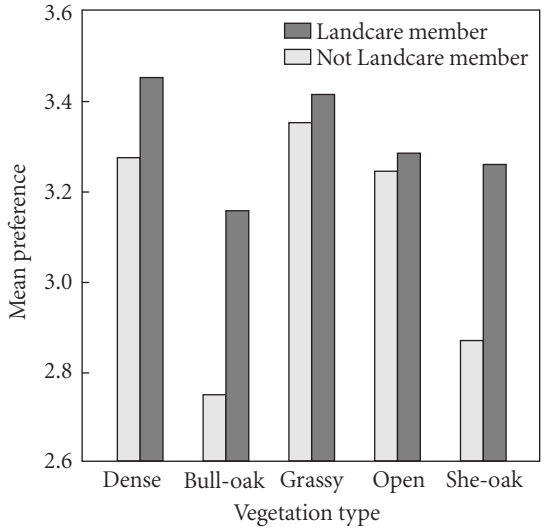

Figure 6. Mean rural preference for five vegetation types: comparison by Landcare membership.

Property size

Property size had no significant effect on landscape preferences (Wilk's υ (15,1532.512) = 0.964, p = 0.15).

Native vegetation protection behaviour

Landholders were asked to indicate steps they had taken to protect native vegetation on their property. These steps included reducing stocking rates, deciding not to clear an area, fencing off vegetation to control stock, and leaving dead wood on the ground for wildlife habitat. Landholders were assigned to one of two groups on the basis of the number of activities undertaken to protect native vegetation. Landholders with high remnant native vegetation (RNV) protection behaviour reported undertaking four or more activities to protect native vegetation, while landholders with low RNV protection behaviour reported undertaking three or fewer activities to protect native vegetation. This method of comparison is very simple, but nevertheless reveals some important patterns in landscape preference.

There is a significant relationship between preference for native vegetation and self-reported action to protect these areas (Wilk's υ (5,544) = 0.93, p = 0.00). Rural landholders with high RNV protection behaviour express higher preference for most vegetation categories (Figure 7). Importantly, this relationship holds for four of the five vegetation categories: dense, bull-oak, grassy and she-oak. Preference for the highly modified open grazed vegetation is not related to behaviour.

The general structure of scenes in the grassy and open vegetation categories is very similar. Scenes in both categories generally show widely spaced, mature trees. Figure 7 shows that landholders who are acting to protect their native vegetation discriminate between these two categories; they express much lower preference for heavily grazed scenes. Landholders making little effort to protect vegetation on their own properties express equal preference for scenes in these two categories. This

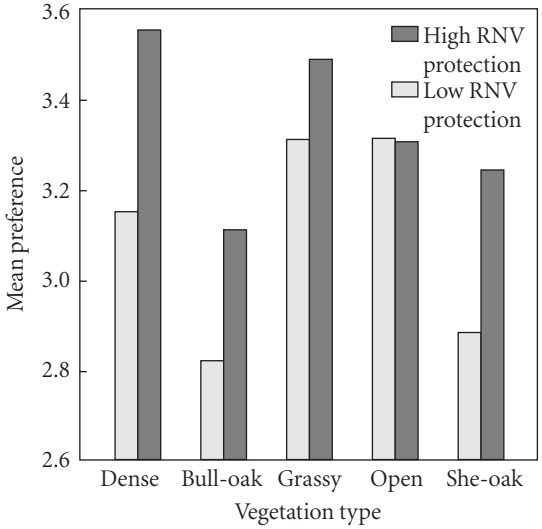

Figure 7. Mean rural preference for five vegetation types: comparison by level of remnant native vegetation (RNV) protection behaviour.

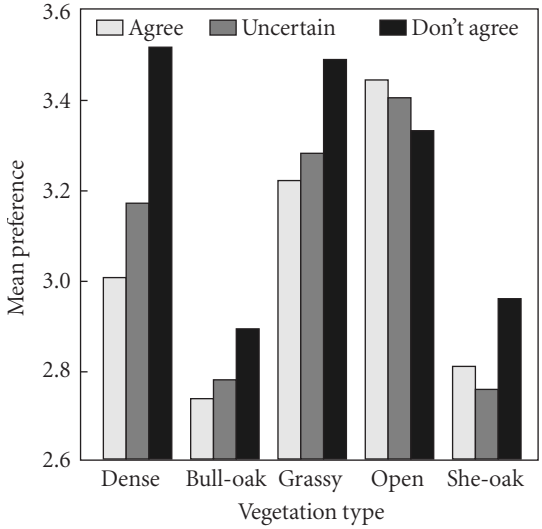

Figure 8. Mean urban preference for five vegetation types: comparison by attitude to the right of humans to modify the natural environment.

suggests that attention to understorey species may be a key perceptual attribute that influences maintenance of native vegetation on private land.

General attitudes toward the environment

Urban respondents provided some indication of their general attitudes toward the environment through their response to the item "Humans have the right to modify the natural environment to suit their needs". Responses were given on a five-point scale ranging from *strongly agree* to *strongly disagree*. These were subsequently recoded to create three categories of response (agree, neither agree nor disagree, disagree).

There is a strong relationship between general environmental attitude and preference for some vegetation types (Wilk's υ (15,1811.329) = 0.917, p = 0.00). Figure 8 shows that people who support human rights to modify natural environments have lower preference for the four (relatively) undisturbed vegetation types (dense, grassy, she-oak and bull-oak), and relatively higher preference for open, heavily grazed scenes. Significant differences were found in preferences for dense (f(1,3) = 13.65, p = 0.00), grassy (f(1,3) = 5.44, p = 0.00), and she-oak categories (f(1,3) = 3.68, p = 0.01).

2.3.4 Oral descriptions of vegetation types

Several issues are raised by the landscape preferences described above. First, the general low regard for bull-oak and she-oak vegetation has important implications for the protection of ecosystems. It appears that some species, including eucalypts, are more attractive to Australia's urban and rural populations. It is likely to be relatively difficult to raise concern for protection of ecosystems such as bull-oak and she-oak woodlands.

The results also indicate that some sectors of both rural and urban populations have lower preference for dense vegetation with a textured understorey. This is important for two reasons. First, the scenes included in the dense category are characterised by high levels of plant diversity. Dislike for these scenes implies low regard for biologically diverse landscapes. Second, rural respondents who did not like these scenes also tended to report low levels of action to protect native vegetation on their own properties, while urban respondents who did not like the scenes tended to have low levels of general environmental concern.

Finally, urban respondents tended to express higher regard for open, heavily grazed scenes. This preference for less ecologically intact landscapes emphasises the need for effective communication to urban populations of the importance of biological diversity.

The following sections identify beliefs, values and knowledge that may contribute to preference for bull-oak, dense and open vegetation. Each analysis compares the verbal descriptions of respondents with higher and lower preference for scenes in the category of concern. Respondents with higher preference were defined as those whose overall preference for scenes in the category fell into the top 40% of responses (urban n = 54; rural n = 45). Respondents with lower preference were defined as those whose overall preference for scenes in the category fell into the bottom 40% of responses (urban n = 54; rural n = 45).

Rural perception of bull-oak woodlands

The most important difference between rural landholders with higher preference for bull-oak scenes, and landholders with lower preference for the scenes, appears to be their awareness of bull-oak as a species. Landholders expressing higher preference for bull-oak vegetation used the terms *bull-oak*, *bull-oaks* and *casuarinas* more often (see Table 2). They were also more likely to describe the scenes as *familiar*.

Landholders with higher preference for the scenes appeared to have a greater appreciation of the agricultural value of bull-oak. Both groups considered the vegetation to provide *shelter*, but landholders with low preference for the scenes saw little value for feed. Landholders with higher preference were more likely to describe the *grassy* understorey. Landholders with lower preference for the scenes used the term *grazing* more often. With the exception of one respondent, all uses of the term grazing indicated the vegetation had no value for feed.

Landholders with higher preference for the scene appeared to have greater recognition of the ecological value of bull-oak. A number described the scenes as *natural* and *young* bull-oak, possibly regenerating after a fire.

Both groups of landholders appeared to assess the recreational value of the bull-oak scenes but came to very different conclusions. Landholders with low preference for the vegetation considered the bull-oak scenes too *thick* to *walk* through. Landholders with higher preference for the scenes saw potential for exploring the vegetation and looking for wildflowers.

An important aesthetic component of landholder descriptions is their response to the density of the scenes. Some saw density as a virtue in providing shelter and wildlife habitat, others saw it as barrier to both human and stock use of the vegetation. It would be useful at a later date to examine landholder descriptions of less dense forms of bull-oak. A number of landholders (23) also responded strongly to the foliage and habit of bull-oak which was labelled *scraggly, unhealthy, straggly, spindly, scruffy* and considered to provide no shade. One respondent referred to the "dark satanic shapes" of the trees. Bull-oak foliage is difficult to capture in a photograph and this may have contributed to this perception. It appears that the distinctive canopy of bull-oak is consciously or subconsciously associated with trees in poor health.

Rural and urban perception of dense vegetation

A comparison between the key descriptors used by landholders who expressed higher or lower preference for the scenes revealed some interesting patterns. Most strikingly, those with higher preference were more likely to describe the scenes as *natural*, *untouched* or *undisturbed* (Table 3). These landholders sometimes used the terms natural and variety in association, which indicates that landholders with higher preference for the scenes may have better understanding of the importance of biological diversity.

Table 2. Key words used to describe bull-oak woodland scenes: comparison of rural landholders with high and low preference by number of cases using concept.

Concept	Higher preference	Lower preference
Bull-oak/bull-oaks/ casuarinas	18	9
Natural	7	2
Young	6	0
Grass/grasses	14	3
Familiar	4	0
Grazed	5	2
Walk	3	4
Grazing (no value)	0	5
Thick/dense	16	22

Respondents with higher preference were also more likely to use concepts associated with productive use of the land: eg. *grazed* and *stock*. Analysis of the context of concept use indicates that, in the vast majority of instances, these landholders characterised the vegetation by an absence of stock impact, and by lack of value for stock. It is somewhat surprising that these landholders were also more likely to describe the scene as a *fire* hazard. It is of considerable interest that these landholders consider the native vegetation to contribute little to farm production, yet indicate a higher level of preference for the scenes. The explanation for this may lie in the belief that the sandy soil associated with this dense vegetation was of little agricultural value, and that native vegetation covering was an appropriate use of this land. A small number of landholders in this group described the soil as sandy or poor.

Landholders with lower preference for the scenes were more likely to describe the value of the vegetation for animals and bird life. This group of landholders used the words *appeal* and *attractive* more frequently. The context of word use indicates that half of the respondents using these terms believe the scenes have aesthetic value, while the remaining landholders consider the scenes to have little aesthetic value.

While both groups of landholders appear conscious of the ecological value of the vegetation, some landholders appear to place greater intrinsic importance on this characteristic. The frequency of word use does not suggest that landholders with higher preference for the scenes have a better understanding of the ecology of the vegetation. The groups are roughly equivalent in their use of plant names.

Table 3. Key words used to describe dense eucalypt woodland scenes: comparison of rural land holders with high and low preference by number of cases using concept.

Concept	Higher preference	Lower preference
Natural	12	4
Diversity/variety	9	4
Untouched/undisturbed	8	0
Fire	9	3
(Not) Grazed	5	0
Sandy	5	1
Stock	6	1
Animals/birds/wildlife	8	17
Habitat	0	4
Appeal/attractive	0	8

Among urban respondents, the most striking difference between descriptions of respondents with high and low preference for dense eucalypt woodland is the frequency of use of the concept *natural* (Table 4). Those with higher preference for scenes in this category are more likely to consider dense, eucalypt-dominated vegetation to be *natural* and *undisturbed* by human activity. These respondents are also more likely to consider the vegetation to be *interesting* (to arouse curiosity; to engage attention).

In addition, respondents with higher preference were somewhat more likely to describe the value of the vegetation to non-human species. Respondents with higher preference were more likely to refer to the scene as an *environment* or *habitat* (six cases) while no respondents with lower preference used these or similar concepts to describe the scenes.

Table 4. Key words used to describe dense eucalypt woodland scenes: comparison of urban respondents with high and low preference by number of cases using concept.

Concept	Higher preference	Lower preference
Natural	16	5
Undisturbed/untouched	10	1
Wildlife/habitat	6	0
Interesting	10	4

The groups also differed in concepts used in association. For example, among respondents with higher preference for the scenes, the concept dense was associated with a cluster of words including the term *untouched*. In contrast, among respondents with lower preference for the scenes, the concept dense was associated with the words *difficult*, *cluttered*, *place* and *walk*. The associations suggest that respondents who preferred these scenes interpreted the density of the undergrowth as a sign of absence of human activity in the landscape (and apparently considered this to be a positive attribute). Respondents with lower preference were more likely to associate density of vegetation with lack of potential for human use of the landscape, particularly for recreational activity such as walking.

Respondents with higher preference for the scenes associated the concept natural with a number of concepts: *scrubby, vegetation, undergrowth, trees, ground* and *interesting*. The scrubby (stunted; inferior — Shorter Oxford Dictionary) trees are considered to be interesting and natural. This is significant in the light of work by Lamb and Purcell (1990) that indicates that tall trees are generally considered more natural than shorter trees. In contrast, among respondents with lower preference for the scenes, the concept *natural* is associated with fewer words: *native*, *good* and *type*. As well as placing greater value on *natural* vegetation (indicated both by word frequency and overall preference for these 'natural' scenes), respondents with higher preference for dense, eucalypt-dominated vegetation may hold beliefs about naturalness which can be distinguished from beliefs held by the wider population.

Both groups of respondents noted the wide variety of plants in the scene, particularly understorey species. For respondents with higher preference, the concept of *variety* was associated with a number of words, including *Australian* and *attractive*. For respondents with lower preference, the concept *variety* was associated with a cluster that included the word *fire*. Diversity of understorey species is considered by some to have both aesthetic and symbolic value. Other respondents may perceive variety of understorey species to present a fire hazard.

Urban perception of open grazed vegetation

Urban respondents with higher preference for heavily grazed scenes were compared with urban respondents who did not like those landscapes (Table 5). Respondents who liked the scenes, described them using the concepts *good*, *pleasant*, *walk* and *ground*. The scenes were perceived as *open park*-like places. The *mature* trees and open understorey provided *shade, beauty* and a pleasant place for recreation. Respondents in this category appeared to focus on the recreational and aesthetic aspects of the environment. Urban respondents with low preference for the scenes characterised them with the words *ground, cleared, tree* and *undergrowth*. They were more likely to consider the scenes to show farms which had been cleared, *grazed* and otherwise *maintained*, rather than as a

Table 5. Key words used to describe heavily grazed woodland scenes: comparison of urban respondents with high and low preference by number of cases using concept.

Concept	Higher preference	Lower preference
Recreation		
Pleasant	8	1
Walk	9	1
Park	5	1
Ecological		
Cleared/clear	5	12
Ground	6	15
Cover	1	7
Undergrowth	3	9
Dead	2	5

park. These respondents were more concerned about the ecological value of the landscapes. They were more likely to comment on the absence of *undergrowth* or *ground cover*, and to suggest that the trees were not *healthy* or were *dead*.

2.4 Discussion

2.4.1 Implications for native vegetation protection

The study shows that there are overall similarities between rural and urban preference for native vegetation and that some vegetation types are preferred over others.

The project also identifies several group differences in landscape preferences and shows how these might be linked to a range of individual and social characteristics. Importantly, the study shows that landscape preferences are related in meaningful ways to behaviour, general attitude and ecosystem knowledge.

Analysis of verbal descriptions of vegetation by respondents with higher or lower preference for bull-oak, open and dense vegetation points to some factors that should be considered in the design and implementation of programs to encourage native vegetation protection.

Preference for open woodland

There is a tendency, particularly among urban respondents, to prefer open woodland with a smooth or lightly textured understorey. This finding is consistent with evolutionary and functional theories of landscape preference, which assert that humans will prefer environments that support survival. Evolutionary theories suggest that the human brain, including the processes controlling emotion, has evolved for adaptive, survival-enhancing purposes (Orians and Heerwagen, 1992). Emotional response to landscape has evolved in such a way as to ensure selection of safe and nurturing environments to explore and settle. Much of the development of the brain occurred while humans lived as hunters and gatherers.

The consequence of natural selection is that there is an instinctive preference for landscapes that sustain life, because such landscapes have endowed their residents with an evolutionary advantage. Landscapes will foster survival if they provide prospect to see any potential predators or prey while also providing refuge in times of danger. Open savanna or woodland is generally considered to provide these characteristics.

Among urban respondents open woodland was preferable to dense vegetation, especially when the understorey was highly modified through heavy grazing. This finding lends support to suggestions (Gobster, 1995; Naussuer, 1995) that innate and learnt landscape preferences may act as a barrier to protection of native vegetation. It is important to note that evolutionary factors are considered to generate a weak tendency to prefer open landscapes (Kellert, 1997), and this tendency can be overcome by cultural factors such as education or association of particular landscapes with financial gain. It is therefore encouraging, but not surprising, that, overall, rural respondents express slightly higher preference for dense, biologically diverse vegetation over heavily grazed vegetation.

Preference for bull-oak and she-oak

The study shows overall low regard for vegetation in which the dominant species are from the Casuarinaceae family. For the bull-oak category, there can be no doubt that the low preferences can partly be explained by the density of many of these scenes. Similarly, low preference for she-oak scenes may in part be attributed to the rocky terrain. These characteristics reduce the habitat value of these environments from the evolutionary perspective outlined above. In more contemporary terms, the value of the landscapes for recreation or agriculture is also limited by the density of vegetation or rockiness of the soil.

Low preference for bull-oak and she-oak is likely to be influenced by additional factors, since even smooth, open bull-oak woodlands were rated as less preferred landscapes by both urban and rural respondents. It is not clear whether bull-oak and she-oak are intrinsically less appealing vegetation, or whether low regard for the ecosystems can be attributed to lack of familiarity with the species. People who are less familiar with bull-oak and she-oak generally express lower regard for these scenes. This was demonstrated by rural landholders use of the terms bull-oaks and casuarinas. Bull-oak and she-oak vegetation may also be innately less attractive. Evolutionary theories predict preference for species and tree forms that are characteristic of high quality savanna (Sommer and Summit, 1995). The leafless foliage of bull-oak and she-oak appear to be associated with trees in poor health or extreme climates. These characteristics may contribute to low preference for this vegetation.

These findings indicate a need for ecosystem- or species-based interventions, in addition to more general programs to promote the value of native vegetation. Both rural and urban populations need to be alerted to the characteristics and values of less well-known species such as bull-oak.

Human purpose and landscape preference

Landscape preferences vary with social and personal characteristics of respondents. In particular, preference patterns of urban respondents differ from those of rural respondents. This finding could be attributed to specific demographic differences between the rural and urban samples. For example, urban people tended to be younger than rural respondents, to have a higher level of education, and included a higher proportion of women. A more complex analysis of the data might be able to identify the relative influence of these elements. However, the most likely source of variation in urban and rural responses is divergent purposes and expectations rural and urban residents associate with native vegetation. This is made very clear in the key concepts used to describe scenes. Rural respondents used a wide range of agricultural and ecological concepts to describe liked and disliked aspects of the vegetation. Urban respondents were more likely to describe vegetation with regard to potential for recreational uses such as walking.

Intentions and purposes of the target group must be a primary consideration in development and implementation of native vegetation promotion and education programs.

Production landscapes

Human purpose for the landscape has particularly important implications for communicating with rural landholders. Rural descriptions of dense, eucalypt-dominated woodland suggest that landholders are generally aware of the ecological values of these landscapes. Landholders with low preference are likely to recognise the habitat values of this vegetation for wildlife, and they also are aware of many plant species shown in the photographs. However, awareness of the ecological value of dense vegetation has relatively little influence on their overall assessment of the landscape. For these landholders, further persuasion for remnant vegetation protection on the basis of wildlife protection is likely to have little impact. For many landholders, economic arguments or incentive programs will have far greater impact.

One distinction in the belief systems of landholders with higher and lower preference for dense vegetation is the link between vegetation type and soil quality. Landholders who valued dense vegetation scenes appeared to place more emphasis on the lack of productive value of the sandy, poor soil. For these landholders, native vegetation cover is likely to be viewed as an appropriate land use. Other landholders may believe that all agricultural land is potentially productive, and that large areas of native vegetation have little purpose in production landscapes. This view was exemplified for the researchers by several South Australian

landholders that spoke with excitement about the development of claying techniques to make previously unusable sandy hills productive. One farmer suggested that if he could have established his farm with present-day knowledge and technology, he would clear all his sandy hill tops, clay these and use these areas for crop production (he proposed leaving a larger proportion of the lower land uncleared, since he found the native vegetation growing on the richer soil to be more aesthetically appealing). The belief in equal, direct productive value of all rural land is likely to be a major obstacle to native vegetation protection.

Understanding biodiversity

Attention to understorey species and appreciation of the value of variety of species in ecosystems are important elements in explaining preference for biologically diverse vegetation. Respondents with higher preference for dense vegetation were more likely to point out the diversity of understorey plants. Urban respondents with lower preference for open, grazed woodland were more likely to describe and dislike the absence of understorey species. An important related finding is that landholders taking little action to protect native vegetation on their properties appeared to make little distinction in preference for woodland in which the understorey was largely intact and woodland with highly modified understorey.

These findings suggest that the design of programs to promote native vegetation protection should place greater emphasis on identification and explanation of the function of understorey species. Many programs have traditionally emphasised the importance of trees. The role of grasses, shrubs and herbs in wildlife habitat and protection of soil and water resources requires greater attention.

The use of the term 'natural' is relevant to this discussion. This term is used frequently and almost always with positive connotations in the evaluation of a scene. Research by MacNaghten *et al.* (1992) has shown that the term 'natural' can be understood in many different ways, and that human perception of naturalness can be influenced through oral and other subtle messages. Naturalness is a key descriptor of dense eucalypt scenes. For landholders with higher preference for this vegetation, the concept of naturalness was linked to the notion of variety and also to the idea of scrubby trees. Educational material could be developed to create a stronger association between biodiversity and naturalness across a wider section of the population.

Education is likely to play a role in developing understanding of biodiversity, but type of education may also be important. Among rural landholders, there is a significant correlation between general education level and preference for biologically diverse scenes (dense woodland), but this was not true for urban respondents. Urban populations are likely to have very diverse educational backgrounds while a higher proportion of rural respondents with education beyond year 12 is likely to have undertaken courses in agriculture or resource management.

Wildlife habitat

Individual animal species, threatened or endangered, have long been used by the conservation movement to arouse public concern for ecosystem protection. The results presented here indicate that this message is likely to be effective with urban communities. Urban respondents with lower preference for dense vegetation pay less attention to the value of the landscape for native wildlife. Strategic prompts reminding urban residents of the importance of wildlife habitat may draw attention away from the concern for the value of the environment to humans.

This strategy is less likely to be effective with rural landholders. Landholders with low preference for dense eucalypt vegetation readily recognised the habitat value of this vegetation. Belief in the wildlife value of dense vegetation was, however, not

Plate 1. Grassy woodland.

Plate 2. Open grazed woodland.

Plate 3. Dense eucalypt woodland with bushy understorey.

Plate 4. Bull-oak woodland.

Plate 5. She-oak woodland.

Plate 6. Native grassland.

Plate 7. Landscape with no remnant vegetation.

Plate 8. Landscape with a small area of remnant vegetation.

Plate 9. Landscape with a large, unfenced area of remnant vegetation.

Plate 10. Landscape with a large, fenced area of remnant vegetation.

sufficient to generate high regard for biologically diverse scenes. Landholder perception of other values, including agricultural production, appears more important in determining landscape preferences.

Pest plants and animals

Concern for pest plants and animals did not feature in descriptions of any vegetation category. Key pest concepts were used relatively infrequently. For example, the concept *weed/s* was used 15 times across all cases and all vegetation types. The concept *rabbit/s* was used 17 times. The concept *fox/es* was used only once. These numbers are quite low compared with use of similarly concrete concepts that are not visible in the photographs, but might be associated with native vegetation through past experience. Consider the frequency with which landholders described the presence of *bird/s* (70 times across all cases and vegetation types), *stock* (64 times) and *animals* (34 times). These results suggest the association between native vegetation and pest plants and animals is relatively weak.

It is important to assess these results in the context of studies which overtly measure concern for pest plants and animals. Hamilton *et al.* (2000) directly queried landholders on their level of concern about pests in native vegetation. Their findings suggest landholders consider pest plants and animals to be a problem. The majority of landholders agreed they felt "some" or "considerable" concern about pest animals (73%) and weeds (54%) in box–ironbark remnant vegetation.

Confusing places

There is evidence that humans are attracted to environments that offer information and way-finding cues, and avoid environments which appear be confusing or difficult to understand (Kaplan, 1991). In addition, biologically complex or significant environments may be perceived as boring where individuals have limited knowledge of the species and associations of native vegetation. This is supported by findings concerning preference for open woodland; by the description of dense vegetation as cluttered and difficult for walking, and by the relative dislike for less familiar vegetation such as bull-oak and she-oak. Perceived coherence and complexity of an environment is likely to change with increased understanding of an ecosystem.

Simple information about plant species and soil associations will help both urban and rural residents become more comfortable with visually complex and biologically diverse environments. Opportunities to explore nature will also help individuals to develop more sophisticated understanding of natural ecosystems. Biologically rich but readily accessible nature (using pathways and interpretive material) may be a significant component of promoting biodiversity protection, particularly to the urban population. Local interpretation sites could provide a simple but effective means of conveying information about the characteristics of unusual species and ecosystems. These could be developed in readily accessible areas such as roadside stops, public parks and gardens. Even urban sidewalk 'nature strips' may provide an opportunity to raise awareness of less familiar native plant species.

Symbolic landscapes

Landscapes can have symbolic value. This does not feature in rural descriptions of vegetation, but urban respondents often attributed their appreciation of vegetation to its Australian character. Open, grassy woodland scenes appear to provide a quintessentially Australian scene, but urban respondents with higher preference for dense vegetation are also likely to associate diverse understoreys with Australian landscapes. Urban populations may respond to messages which associate biodiversity with national identity.

Regional differences and informal education programs

The findings indicate that Wimmera landholders have greater appreciation of bull-oak and she-oak

ecosystems. The Wimmera has a large number of Farm Tree groups, and long established Landcare groups and extension officers. Greater awareness of bull-oak can probably be attributed to these initiatives. A recent conference in Warracknabeal promoted bull-oak management and attracted over 100 participants from the Wimmera and beyond (Williams and Cary 1998). Agencies in South Australia and Tasmania may learn from these activities.

Future prospects

The vegetation preferences of young rural landholders raise some important concerns for the future, particularly in the light of the association between landscape preference and maintenance of native vegetation. It would be valuable to undertake closer analysis of the environmental beliefs of this group.

The significance of these results is reinforced by findings concerning the relationship between native vegetation protection behaviour and age. Figure 9 indicates that, on average, landholders aged 39 and under report taking fewer actions to protect native vegetation on their property. A one-way analysis of variance indicated this difference was significant ($f(1,3) = 2.96$, $p = 0.03$).

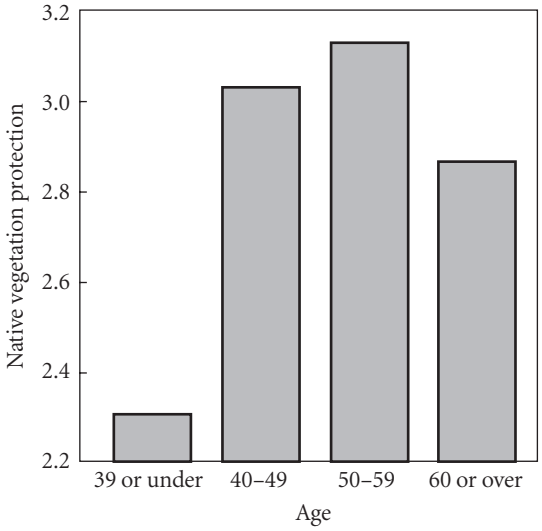

Figure 9. Mean number of actions taken to protect native vegetation on own property: comparison of landholders by age.

2.5 Areas for further research

The findings point to several priorities for further research:

2.5.1 Identify values, beliefs and knowledge systems of young landholders

The findings indicate that younger landholders (under 40 years) place relatively less value on all forms of vegetation than do landholders in older age groups. This is especially important because people in this age group were also less likely to report taking action to protect native vegetation on their own properties. There is a tendency to assume that younger landholders will have more positive attitudes toward ecosystem management. This study indicates that younger landholders may in fact have less positive attitudes. The capacity and interest young landholders have to maintain native vegetation on their properties may be constrained by financial instability. Pressing cash needs associated with establishing an agricultural enterprise and raising children may contribute to young landholders placing greater importance on agricultural production than their elders. In contrast, more established landholders may have greater financial opportunity to incorporate more diverse goals in their property management. There is need for better understanding of the beliefs, motivations and behaviour of younger landholders.

2.5.2 Identify low preference ecosystems

The study indicates that some vegetation types, particularly she-oak and bull-oak woodlands, are generally regarded to be less appealing. It may be more difficult to promote protection of ecosystems dominated by species other than eucalypts. The vegetation types used in the present study were determined by those found in the participating regions. It would be valuable to identify less preferred vegetation types in other regions, to assist with development of effective intervention programs.

2.5.3 Test effectiveness of messages promoting biodiversity protection

The project highlights a number of messages that may be valuable in communicating the importance of biodiversity and ecosystem protection to rural and urban communities. Further research is required to test the effectiveness of these messages in changing attitudes and behaviour.

2.5.4 Examine farm management beliefs

The study indicates that beliefs about farm productivity may illuminate landholder attitude toward native vegetation. Specific knowledge and beliefs about vegetation type, soil association, and relative productivity may be key elements of changing landholder attitudes to, and management of, native vegetation. Further research is required to explore and test this hypothesis.

2.6 Conclusion

The study found that some vegetation types are preferred over others. Eucalypt-dominated vegetation is rated higher than bull-oak and she-oak. Open woodland is preferred over more dense vegetation, especially among the urban community. These findings have a bearing on the protection of biological diversity. First, they indicate the necessity of species- and ecosystem-based interventions. Second, the findings indicate the need for native vegetation programs to highlight the characteristics and value of biologically diverse environments, especially the importance of understorey species.

The study also found that rural and urban respondents express divergent values and preferences for native vegetation in the rural landscape. Rural landholders assess native vegetation primarily for its production value. Urban residents appear to place greater emphasis on the value of nature for passive and active recreational enjoyment. Native vegetation programs are likely to be most effective if they are designed for specific audiences with these value orientations in mind.

While there is evidence that environmental values change over time, this change is likely to be slow (Gardner and Stern, 1996). With widespread cultural shifts occurring in Australian society, it is possible that an increasing number of landholders and urban residents will value native vegetation on private land for its ecological significance. In the intervening period, native vegetation programs are likely to be most effective if they are designed to emphasise the agricultural value of native vegetation for landholders, and the recreational opportunities which native vegetation provides for the urban community. Programs should focus on changing those beliefs and attitudes which are most amenable to change. This project has identified a number of beliefs and attitudes which are likely to hinder protection and maintenance of native vegetation on private land. Examples include: low awareness of bull-oak woodland; belief that the dark bark and leafless foliage of bull-oak indicate a tree in poor health; belief that remnant native vegetation has little or no agricultural value. The study has also identified a range of principles to enhance positive associations with native vegetation. For example, in working with urban communities, native vegetation programs should emphasise the naturalness, Australian character and wildlife value of ecosystems with species rich understorey.

The results of this research enable the design of native vegetation programs which will be ecologically sound and maintain the support of 'grass roots' land managers and the urban community. The findings are being used to develop guidelines for promoting native vegetation protection to urban and rural communities.

3 Study 2: Broadscale rural landscape values

In Study 2 five major questions are considered:

- What broad landscape characteristics contribute to landholder preference for native vegetation in rural landscapes? Specific landscape characteristics examined in this project are: presence and size of remnant vegetation, presence of fencing and associated land use (crop or pasture).
- What are the perceived ecological, agriculture and aesthetic values of native vegetation in rural landscapes?
- How important are perceived agricultural, ecological and aesthetic values in predicting landholders' preference for various landscape arrays on their own properties?
- What are the perceived ecological, agricultural and aesthetic values of open native grassland?
- How important are perceived agricultural, ecological and aesthetic values in predicting landholders' preference for native grassland on their own properties?

3.1 Methods

In Study 2, computer-modified photographic images were used to elicit landholder perceptions of rural environments. The validity of using photographic representations to assess perception of actual environments has been established through several studies (see eg. Shuttleworth, 1980; Stamps, 1990), but this type of research is more commonly done using a large number of naturalistic photographs. The use of computer-generated or edited images has been reported in a number of recent studies (eg. Schroeder and Orland, 1994; Swaffield and Fairweather, 1996; Thorn *et al.*, 1997). Computer-edited images allow the researcher greater control over the range of environmental stimuli presented to respondents. This is especially useful for testing people's response to potential planning or landscape design options. A single environment can be systematically varied to characterise the visual impact of future management regimes. The validity of using computer-edited images in environmental assessment has yet to be established, but several studies have concluded the approach yields valuable results.

Patterns of preference were identified in this study, as in Study 1, using the statistical procedure Principal Components Analysis (PCA) with a Varimax rotation (Norussis, 1993). This approach is a variant of the Category Identification Method (CIM) described by Kaplan and Kaplan (1989). The approach requires respondents to make simple preference judgments about a large number of photographs. Respondents indicate how much they 'like' each scene, and the preference ratings of a large number of respondents are analysed to identify groups of photographs which respondents tend to react to in a similar manner. Attributes or categories that respondents use to assess photographic images can be identified. Valued and disliked characteristics are readily identifiable, and the way that different groups of people respond to the categories of photographic stimuli can be compared.

Participants. The participants were a subset of the rural-based participants in Study 1. The participants were located in each of the same localities as in Study 1 – the Victorian Wimmera, upper south-east (USE) of South Australia and the Midlands of Tasmania. Participants in Study 1 were asked to indicate whether they would be willing to participate in a follow-up interview; 310 landholders of 614 respondents in Study 1 were willing to be interviewed. Interviewees (n = 131)

were selected from among those who responded in the affirmative. Selections were stratified to ensure adequate representation of each region, and of men and women. The selection was also stratified to ensure the interviewees reflected the range of levels of native vegetation protection behaviour (see section 3.2.1) present in the original sample.

Photographic material. The photographs were full colour and approximately 21 cm x 21 cm. Each landscape was based on a single landform. Three aspects were systematically varied: amount of remnant vegetation, presence of fencing, and associated land use. Eleven photographs and two orders of photograph presentation were used.

One scene (Plate 6) showed native grassland. While there was an opportunity to use only a single grassland scene in this study it is important to recognise that the visual appearance of native grassland changes significantly across seasons. The chosen scene showed native grass with clear seed heads; many landholders could readily identify this as kangaroo grass. The grassland image showed a large area of long grass with no visible forbs.

The characteristics of the eleven rural landscapes were as follows:

1. large remnant, crop, fenced
2. large remnant, crop, not fenced
3. large remnant, pasture, fenced
4. large remnant, pasture, not fenced
5. small remnant, crop, fenced
6. small remnant, crop, not fenced
7. small remnant, pasture, fenced
8. small remnant, pasture, not fenced
9. no remnant, crop
10. no remnant, pasture
11. no remnant bushland, native grass

Procedure. Landholders were interviewed in their homes. Participants rated the 11 visually edited photographs on four 5-point scales, responding to the following questions:

1. How much would you like this paddock on your property? (*Overall preference*)
2. How valuable is this paddock for protecting native plants and wildlife? (*Perceived ecological value*)
3. How valuable is this paddock for farming? (*Perceived agricultural value*)
4. How attractive is this paddock? (*Perceived aesthetic value*)

Two orders of question presentation were used. Following questions 2 and 3, respondents were asked to describe how they decided which paddock was better for farming or protection of native plants and animals. They were also asked to describe liked and disliked aspects of the grassland scene. Responses were recorded verbatim.

Finally, participants answered the following question "Given your current knowledge and expertise, if you could start over again with this property, what percentage would you leave as native vegetation?" This question was adapted from Jenkins (1996).

3.2 Results and discussion

3.2.1 Remnant woodland — landscape types

The initial data matrix presented a complex set of information about the perceived values of woodland vegetation in rural landscapes. Landholders made four evaluations of each of the ten images.[2] It was necessary to reduce the complexity of this data set by identifying the landscape factors which contributed most to landholder evaluations. PCA was used to identify landscape arrays that landholders tended to assess in similar ways.

The overall preferences of 126 landholders for the ten paddock scenes were entered into PCA (see

[2] Responses to the native grassland scene were analysed separately. This analysis is reported later in sections 3.2.6 and 3.2.7.

Appendix 1 for mean preference values). The procedure identified four components or categories that accounted for 79% of variance in preference scores. The loadings of the ten scenes on the rotated (Varimax method) components are shown in Table 6.

The results of PCA suggest that variance in preference for ten scenes (evaluations of the native grass scene were excluded from this analysis) can be adequately accounted for by examining preferences for four categories of landscape:

1. landscapes with no remnant vegetation (Plate 7);
2. landscapes with a small area of remnant vegetation (Plate 8);
3. landscapes with a large unfenced area of remnant vegetation (Plate 9); and
4. landscapes with a large fenced area of remnant vegetation (Plate 10).

The most important landscape array variable appeared to be size or presence of remnant vegetation. Three different values of remnant size were represented in the four categories. Presence of fencing was also important, since preference for scenes with large areas of remnant vegetation varied according to whether the vegetation was fenced or not.

Some predetermined landscape array variables do not feature in these categories, and their absence is important to note. First, the categories do not distinguish between different associated land uses. While landholders generally preferred paddocks with crop to paddocks with pasture,[3] this characteristic makes little contribution to explaining overall variance in preference. It remains possible that land use might be a more important variable given a larger range of landscapes. In this study, all areas of native

[3] Mean overall preference for crop images is 3.272 (standard error 0.060). Mean overall preference for pasture images is 3.122 (standard error 0.056). While the difference is very small, it is statistically significant ($f(1,129) = 9.78$, $p = 0.002$).

Table 6. Loadings of ten scenes on four components accounting for 79% of variance in preference for rural landscape images.

Image characteristics			Component			
Size RNV*	**Fencing**	**Land use**	**1**	**2**	**3**	**4**
Small	Yes	Pasture	0.815	–0.128	0.232	0.236
Small	Yes	Crop	0.771	–0.283	0.156	0.329
Small	No	Pasture	0.689	0.498	0.178	–0.148
Small	No	Crop	0.747	0.415	0.218	–0.137
Large	No	Crop	–0.007	0.866	0.008	0.185
Large	No	Pasture	0.103	0.795	0.157	0.323
None	N/A	Crop	0.203	0.103	0.919	0.008
None	N/A	Pasture	0.243	0.148	0.899	0.004
Large	Yes	Pasture	–0.001	0.152	0.003	0.832
Large	Yes	Crop	0.193	0.205	0.007	0.747

* Remnant native vegetation

vegetation were located in a compact clump in one corner of the paddock. Different arrays (such as remnants central to the paddock) may lead to more distinct evaluations with regard to crop and pasture.

Second, interpretation of the four derived categories suggests that presence of fencing had an important influence on overall preference only where there was a large area of remnant vegetation. Presence of fencing had little influence on preference where the area of remnant vegetation was small.

These patterns in landholder preference have implications for effective targeting of native vegetation programs. First, the study provides little evidence that native vegetation programs should distinguish between landholders and properties on the basis of farm enterprise. Second, the results suggest landholders may need more information about the value of fencing small remnants. Well-managed small remnants may contain rare species and, in many landscapes, small, scattered remnants may represent the only reminder of past ecosystems. Landholders may not fully appreciate the significance of fencing-off small areas of native bush.

3.2.2 Remnant woodland — perceived value of landscape types

Landholders' evaluations of the four landscape categories are summarised in Table 7. Mean perceived ecological, agricultural, and aesthetic values, as well as landholders' preferences for their own properties, are presented.

Four analyses of variance (ANOVA) with a repeated measure design were conducted to test whether landholders considered the four landscape types to have different values. For overall preference, perceived agricultural value and perceived ecological value, landholder evaluation of the four categories followed a similar pattern. Scenes with large, fenced areas of RNV were valued over those with large areas of unfenced RNV. Scenes with small areas of RNV were considered somewhat less valuable than both of these landscape arrays, while scenes with no RNV were the least valued of all. Perceived aesthetic value of the landscape types varied in one small way: scenes with large areas of fenced and unfenced vegetation were considered to be of equal aesthetic value.

For the landscape arrays presented in this study, relatively large areas of RNV are considered beneficial to rural properties for agricultural, ecological and aesthetic purposes. This finding should be interpreted with some caution. It is important to note that the area of remnant vegetation was still relatively small in these landscapes. In scenes with comparatively large areas of native vegetation, the majority of the landscape is still available for crop or improved pasture. While the preference patterns provide a clear indication that landholders value native

Table 7. Overall preference, perceived agricultural, ecological and aesthetic values of four landscape array categories.

	No RNV*	Small area RNV	Large unfenced area RNV	Large fenced area RNV	
Overall preference for own property	2.015 ^{a}	2.958 ^{b}	3.823 ^{c}	4.231 ^{d}	Wilk's $\upsilon(3,128) = 0.202, p = 0.000$
Agricultural value	3.233 ^{a}	3.685 ^{b}	4.034 ^{c}	4.290 ^{d}	Wilk's $\upsilon(3,128) = 0.551, p = 0.000$
Ecological value	1.336 ^{a}	2.405 ^{b}	3.542 ^{c}	4.088 ^{d}	Wilk's $\upsilon(3,128) = 0.096, p = 0.000$
Aesthetic value	2.142 ^{a}	3.006 ^{b}	4.200 ^{c}	4.265 ^{c}	Wilk's $\upsilon(3,128) = 0.176, p = 0.000$

* Remnant native vegetation
^{a,b,c,d} For each row, non-matching superscript annotation indicates means are significantly different.

vegetation in rural landscapes, further research is required to identify landscape arrays that landholders consider to depict optimal relationships between area with vegetation and area available for crop or pasture.

This problem is partially addressed by landholders' estimates of the ideal percentage of native vegetation to be retained on their own properties. During the interview, landholders were asked to imagine their own property before European settlement, and to suggest the amount of vegetation which should be retained, taking into account current-day knowledge and expertise. Many landholders found it difficult to answer this question, but estimates were obtained from 128 interviewees. Responses ranged from retaining no native vegetation (4 landholders) to retaining 100% of native cover (1 landholder). The most common response was to retain 10% of cover. One quarter of landholders elected to retain less than 10% of native vegetation, a further 25% would retain between 10 and 14 percent. Fifty percent of landholders would retain greater than 14% of vegetation and one quarter would retain greater than 25% of the cover. These results appear similar to those reported by Jenkins (1996).

3.2.3 Remnant woodland — predicting landscape preferences

A question of considerable significance for native vegetation programs is the relative importance of perceived agricultural, ecological and aesthetic values in predicting landholder preference for landscape arrays. This was explored through both correlational and regression procedures.

Perceived agricultural, aesthetic, and ecological values of rural landscapes all had a positive correlation with landholder preference. This relationship existed for each of the four landscape types, as can be seen from the correlation tables presented in Appendix 2. For landscapes with remnant vegetation, overall preference was most closely associated with perceived agricultural value. There were also several significant inter-correlations between perceived agricultural, aesthetic and ecological values of the landscape types. The moderately strong correlation between perceived agricultural and aesthetic value for all four landscape arrays presented a risk that regression analysis would be confounded. Perceived aesthetic value was therefore excluded from these analyses. Similarly, the distributions of all evaluations of landscapes with no remnant vegetation were characterised by severe positive skew that could not be reversed by applying common transformation procedures. No regression was conducted for this landscape category.

The moderately strong relationship (explaining between 27 and 35% of covariance for landscapes with remnant vegetation) between perceived aesthetic and agricultural values of the landscape arrays is consistent with functional theories of landscape aesthetics (Appleton, 1990; Gibson, 1968). These theories predict that humans are attracted to environments that will provide the things they need to live and work in that environment. Hence, landholders will tend to have a positive aesthetic response to landscapes that are also considered agriculturally productive.

Landholder preference was predicted for three landscape types separately. The adjusted R^2 and beta weights for each multiple regression are summarised in Table 8. For all landscapes with remnant vegetation, perceived agricultural value was a significant contributor to overall landscape preference. The relationship between ecological value and overall preference varied with landscape type. For landscapes with large areas of fenced remnant vegetation, perceived ecological value was a significant contributor to overall landscape preference. For these landscapes, overall preference increased with both perceived agricultural and ecological value of the landscape, although perceived agricultural value made a stronger contribution.

For landscapes with small or large unfenced areas of remnant vegetation, perceived ecological value of the landscape was not a significant contributor to overall landscape preference as a main effect. There was, however, a significant interaction between perceived agricultural and ecological value of the landscape. This means that the importance of perceived agricultural value in predicting landholder preference varies depending on whether the landscape is considered to have high or low ecological value. This relationship is depicted in Figures 10 and 11. While overall preference for landscapes with small or large unfenced areas of remnant vegetation increases with the perception of agricultural value in the landscape, this effect is enhanced when the landscape is also considered to have high ecological value.

While each regression presents a unique picture of the relationship between ecological and agricultural value of landscapes and landholder preference, one clear message can be distilled from the results. Landholder preference for landscape arrays with varying amounts of remnant vegetation is most closely related to the perceived agricultural value of the scene. While ecological value is also important, it contributes most when agricultural value of the landscape is considered to be high.

These findings have important implications. The primary criterion which landholders use to assess rural landscape is its value for agricultural production. Landholders clearly value native vegetation in rural landscapes, but they value it mainly for utilitarian reasons. Programs promoting the importance of native vegetation should place greatest emphasis on the economic and agricultural benefits these ecosystems provide. Messages about the ecological value of native vegetation are also important when landholders are able to identify the benefits of native vegetation for agricultural practice.

3.2.4 Landscape preferences and landscape management

The results reported above provide significant clues to understanding and promoting landholder concern for native vegetation on private land, but the practical significance of these results depends largely on the assumption that landholder preferences for rural landscape have an impact on their management of native vegetation.

This assumption was tested by comparing the landscape preferences of landholders who reported taking high or low levels of action to protect native vegetation on their own land. Native vegetation protection behaviour was measured using a simple checklist. Landholders were asked to indicate

Table 8. Summary of regression analyses: predicting landholder preference from perceived ecological and agricultural value of the landscape.

Landscape type	Adjusted R^2	Variables with significant contribution	Beta weight
Small area of remnant native vegetation (RNV)	0.335***	Interaction between perceived ecological and agricultural value	0.361***
		Perceived agricultural value	0.286**
Large area of unfenced RNV	0.459***	Perceived agricultural value	0.394***
		Interaction between perceived ecological and agricultural value	0.327**
Large area of fenced RNV	0.368***	Perceived agricultural value	0.469***
		Perceived ecological value	0.253**

***$p < 0.0001$, **$p < 0.001$

actions they had taken to protect native vegetation on their property. These actions included reducing stocking rates, deciding not to clear an area, fencing off vegetation to control stock, and leaving dead wood on the ground for wildlife habitat. To compare landscape preferences, landholders were assigned to one of two groups on the basis of the number of activities undertaken to protect native vegetation. Landholders with high RNV protection behaviour reported undertaking four or more activities to protect native vegetation, while landholders with low RNV protection behaviour reported undertaking three or fewer activities to protect native vegetation. The mean landscape preferences of these two groups are shown in Table 9.

Multivariate analysis of variance (MANOVA) indicated significant differences in landscape preferences of landholders with high and low levels of native vegetation protection behaviour (Wilk's υ (4,120) = 0.905, p = 0.016). Subsequent one-way analyses of variance suggest that group differences occurred in responses to two landscape arrays. Landholders taking fewer actions to protect native vegetation expressed significantly higher preference for rural landscapes with no remnant vegetation, and for unfenced areas of remnant vegetation. There is need for some caution in interpreting these results. Landholders taking more action to protect native vegetation reported somewhat lower preference for landscapes with small areas of native vegetation, and for landscapes with large areas of fenced native vegetation, but this difference is not significant.

While these results provide some evidence that landscape preferences are related to landscape management, they also provide an additional clue for native vegetation programs. Landholders taking more action to protect native vegetation on their properties have a stronger preference for fenced remnants over unfenced remnants. In contrast, landholders least likely to take action to protect native vegetation appeared to exercise less discrimination between fenced and unfenced remnants. This finding confirms the need for native vegetation programs to emphasise the management and ecological benefits of fencing remnant vegetation.

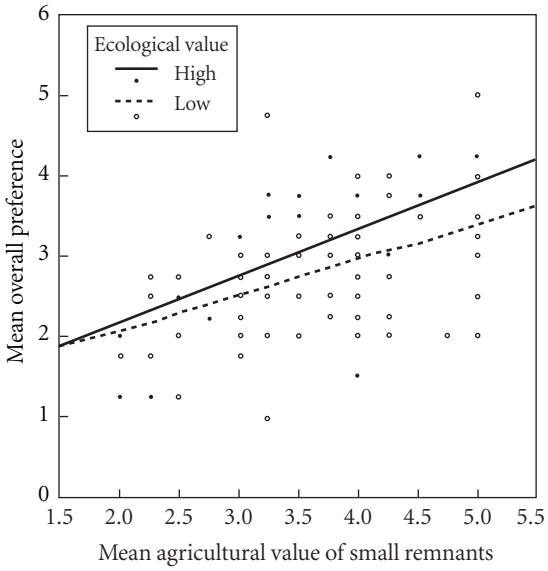

Figure 10. Preference for landscapes with small areas of remnant vegetation: relationship between perceived agricultural and ecological value.

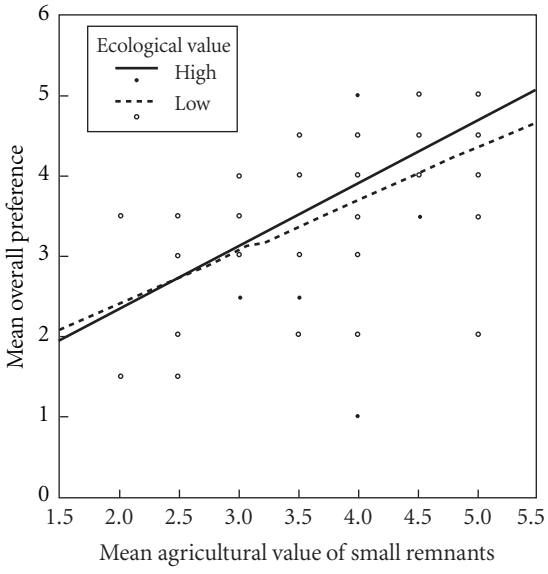

Figure 11. Preference for landscapes with large areas of unfenced remnant vegetation: relationship between perceived agricultural and ecological value.

3.2.5 Variation in landscape preferences

A series of multivariate analyses of variance (MANOVA) provided little evidence of variation in preferences for broadscale landscapes according to demographic characteristics of landholders. These results are summarised in Appendix 3. In Study 1 — for smaller scale vegetation scenes — there were significant variations in landscape preference associated with age, region, and education. In Study 2, photographic stimuli were varied on a very limited number of characteristics, and differences between images tended to be quite coarse. This, rather less subtle approach, was likely to elicit more standardised responses, perhaps because the socially desirable evaluation would be apparent to many interviewees.

An exception is the finding that landholders from the Wimmera of Victoria had significantly higher preference for landscapes with no remnant vegetation than landholders from upper south-east South Australia. In addition, Wimmera landholders expressed significantly lower preference for landscapes with large areas of fenced vegetation than did landholders from Midlands of Tasmania. The Wimmera has the most extensive cropping areas of the three regions surveyed. Higher preference for landscapes with no vegetation may reflect greater familiarity with significant areas of cleared land but, more likely, reflects the utility of cleared land for cropping.

3.2.6 Perceived value of native grassland

The perceived values of grassland were compared with landholder assessments of landscapes with no remnant vegetation, small areas of remnant vegetation and large areas of remnant vegetation. Mean preferences and perceived values are shown in Table 10.

Landholders expressed low preference for having native grassland on their own property, but considered native grassland to be preferable to landscapes with no remnant vegetation. Native grassland was also perceived to have relatively low agricultural and aesthetic value. Landholders consider the aesthetic value of grassland to be significantly lower than landscapes with large areas of trees, and significantly greater than landscapes with only crop or pasture land cover. This finding is consistent with theories predicting low preference for native grassland on the basis of habitat requirements (Orians and Heerwagen, 1992) or perceived naturalness (Lamb and Purcell, 1990). It is less consistent with the work of Nassauer (1995) suggesting higher preference for neat and tended environments. The crop and pasture scenes provided strong signs of being tidy, managed environments, yet landholders expressed higher preference for the 'messy' grassland environment.

Native grassland was perceived to have moderate ecological value. It is important that the ecological value of grassland is considered to be significantly lower than that of landscapes with large areas of trees. Images with 'large' areas of tree RNV showed landscapes in which the remnant vegetation covered a relatively small area (around one sixth of the visible land). In contrast, native grassland

Table 9. Comparison of landholders with high and low levels of behaviour to protect native vegetation on their own property: mean preference for four landscape types.

Landscape type	Mean overall preference for landscape type		F test
	Low RNV protection behaviour	High RNV protection behaviour	
No remnant native vegetation (RNV)	2.289	1.794	$F(1,123) = 8.061$, $p = 0.005$
Small area of RNV	2.996	2.938	$F(1,123) = 0.163$, $p = 0.688$
Large unfenced area of RNV	4.026	3.647	$F(1,123) = 5.730$, $p = 0.018$
Large fenced area of RNV	4.307	4.176	$F(1,123) = 0.959$, $p = 0.329$

* Remnant native vegetation

scenes showed a very large area of remnant, albeit treeless, vegetation. Current thinking in landscape ecology about management of remnant vegetation (Dramstad *et al.* 1996) suggests that larger remnants are less open to invasion from exotic weeds and from clearing. Larger areas of remnant vegetation (including treeless plains) are highly valuable from an ecological perspective. Landholder response to the grassland scene suggests they had little appreciation of the ecological value of treeless ecosystems, and little appreciation of the relationship between remnant size and viability.

3.2.7 Predicting preference for native grassland

The degree of association between perceived ecological, agricultural, aesthetic value and overall preference for grassland is shown in Table 11. All three values have a significant positive relationship with overall preference for grasslands. There are also significant inter-correlations between agricultural, ecological and aesthetic values. The strongest of these is the relationship between agricultural and aesthetic value. While moderately strong, it is doubtful whether this relationship is sufficient to confound the prediction of landscape preference from the three perceived values.

A step-wise multiple regression was conducted to examine the relative importance of perceived ecological, agricultural and aesthetic values for explaining variation in overall preference for grasslands. The resulting model (Table 12) indicates that perceived aesthetic value is the most important component.[4] When landholders were asked to describe liked and disliked aspects of the grassland, the concept used most frequently was trees. The low aesthetic appeal of native grassland was attributed mainly to the absence of trees. Many landholders also mentioned the need to graze the long grass. These findings suggest the need for simple management and educational strategies to enhance the appeal of native grasslands. These include: judicious planting of trees; mowing grassland edges to create a neat, managed appearance; and providing simple interpretation material about the value of treeless grasslands, and the aesthetic beauty of flowering grassland species.

The interaction between perceived agricultural and ecological values of grassland and landholder preference is illustrated in Figure 12. Overall, increasing perception of agricultural value in grassland is associated with increasing overall preference for this landscape. This effect is

[4] To test for any possible distortion of the regression resulting from inter-correlations between independent variables, two additional regression analyses were conducted. In the first analysis, perceived agricultural value was omitted. Step-wise regression (adjusted $R^2 = 0.400$) identified aesthetic value as the major contributor to overall preference (standardised beta = 0.569). In addition, perceived ecological value was a significant predictor, but made relatively little contribution to accounting for overall preference (standardised beta = 0.176). In the second analysis, aesthetic value was omitted from the regression. In this analysis (adjusted $R^2 = 0.205$) the only significant predictor of overall preference was the interaction between ecological and agricultural value (standardised beta = 0.459). These results suggest that the regression analysis reported in the main text is likely to be reliable.

Table 10. Overall preference, perceived agricultural, ecological and aesthetic values of four landscape categories.

	No RNV*	Small area trees RNV	Large area trees RNV	Native grassland	
Preference for own property	2.015 [a]	2.958 [b]	4.027 [c]	2.585 [d]	Wilk's ʊ (3,127)=0.202, p=0.000
Agricultural value	3.242 [a]	3.688 [b]	4.167 [c]	2.792 [d]	Wilk's ʊ (3,127)=0.381, p=0.000
Ecological value	1.336 [a]	2.405 [b]	3.815 [c]	3.130 [d]	Wilk's ʊ (3,128)=0.087, p=0.000
Aesthetic value	2.142 [a]	3.006 [b]	4.233 [c]	2.938 [b]	Wilk's ʊ (3,127)=0.177, p=0.000

* Remnant native vegetation
[a,b,c,d] For each row, non-matching superscript annotation indicates means are significantly different.

Table 11. Correlations between four measures of perceived value of grassland (ecological, agricultural, aesthetic and preference for own property). N=131.

Ecological	Preference for own property	Agricultural value	value
Agricultural value	0.450**		
Ecological value	0.323**	0.231**	
Aesthetic value	0.617**	0.490**	0.275**

** $p < 0.01$ (2-tailed)

Table 12. Predicting preference for grassland on own property from perceived aesthetic, agricultural and ecological value.

Predictor	Standardised coefficient Beta
Aesthetic value	0.512***
Agricultural value	0.054
Ecological value	0.042
Interactions	
Aesthetic × agricultural	0.129
Ecological × agricultural	0.231**
Ecological × agricultural × aesthetic	0.131
Summary statistics:	$R = 0.650^{***}$ $R^2 = 0.423$

**$p < 0.01$, *** $p < 0.001$

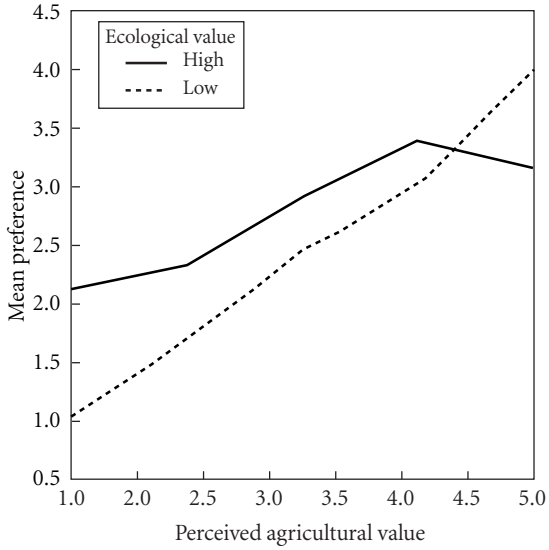

Figure 12. Relationship between perceived ecological and agricultural value of grassland and landholder preference for grassland on their own property.

enhanced if the ecological value of the landscape is considered to be low. Landholders who consider the grassland to have high ecological value tend to express greater preference for grasslands overall; but landholders with highest preference for grasslands were those who considered it to have high agricultural value, but relatively low ecological value.

These findings have important implications for development of grassland protection programs. The findings provide clear evidence that landholders' responses to open grassland are quite different from their response to native woodland or forest. The absence of trees presents a significant barrier to landholder preference for these scenes. For treed vegetation it appears that the ecological and agricultural values are largely compatible. Highest preference for landscapes with small or large areas of woodland is found among landholders who consider it to have both ecological and agricultural significance. For grassland, however, a belief in ecological value may actually detract from landholder preference if the grassland is considered to have high agricultural value. This means that extreme care should be taken in combining messages about the agricultural and ecological value of grasslands. Conservation agencies may achieve most by emphasising the agricultural value of grasslands, but this may do little to ensure landholders appreciate (and appropriately manage) grassland for its ecological significance.

3.2.8 Regional differences in grassland preferences

There is little evidence that preference for grassland varies with demographic characteristics of landholders such as age, education or gender. There is, however, evidence for regional differences in perceptions of grassland. The mean values for the regions are shown in Table 13. Landholders from the Midlands of Tasmania tended to assess the ecological, agricultural and aesthetic value of grasslands more favourably. They were also some-

what more likely to prefer to have native grassland on their own property. This is not surprising in an area which has developed a reputation for its fine wool production associated with native grasslands (see Gilfedder and Kirkpatrick, 1995).

The only significant regional difference in perception of grasslands is in perceived ecological value. Landholders from the Midlands and the Wimmera rated the ecological value of grassland more favourably than landholders from upper south-east South Australia. It is important to note, however, that perception of higher ecological value did not result in significantly higher preference for grasslands. This pattern confirms again the difficulty of communicating the value of native grasslands for supporting both agriculture and native plants and animals.

3.3 Further research

3.3.1 Remnant woodland

Study 2 poses many questions requiring further attention. One important question is the amount of vegetation considered desirable in rural landscapes. This question can be answered in different ways, depending on the landscape unit under consideration: the paddock, the farm, the region or catchment. When assessing landscapes at the level of paddocks, landholders were found to prefer relatively large areas of native vegetation to small bush remnants. Further research is required to identify landholder response to landscapes with a greater proportion of native vegetation relative to land available for crop or pasture. When considering their whole property, 50% of landholders indicated that 14% or less should be left as native vegetation. Research using alternative methods is required to understand landholder preferences for retention of vegetation at a farm and catchment level.

Another area for further research concerns desirable arrangements of native vegetation across the landscape. This study examined responses to essentially one arrangement of native vegetation. Remnants were shown in compact clumps in one corner of the visible paddock. Other layouts may be evaluated more or less favourably by landholders. These may include remnants located centrally within an existing paddock, and elongated remnants following fence or stream lines. Further research is required to determine the influence of remnant shape and location on landholder perception of native vegetation in rural landscapes.

3.3.2 Grassland

There is a strong need for extension of this study to examine landholder perception of a wider expression of native grasslands as they appear in various seasons and in response to different management regimes. The findings must be clarified and confirmed through further research before they are generalised to a wider array of native grasslands.

The findings in Study 2 suggest that regard for grasslands may be enhanced through specific management and educational strategies. There is a need to test the efficacy of these approaches.

Table 13. Comparison of perception of native grassland scenes by region.

	Region of Respondents			
	Upper south-east of South Australia	Wimmera, Victoria	Midlands, Tasmania	
Mean preference for own property	2.268 [a]	2.643 [a]	2.907 [a]	$F(2,123) = 2.925$, $p = 0.057$
Mean agricultural value	2.756 [a]	2.595 [a]	2.953 [a]	$F(2,123) = 1.189$, $p = 0.308$
Mean ecological value	2.488 [a]	3.262 [b]	3.651 [b]	$F(2,123) = 12.330$, $p = 0.000$
Mean aesthetic value	2.829 [a]	2.786 [a]	3.209 [a]	$F(2,123) = 1.869$, $p = 0.159$

[a,b,c,d] For each row, non-matching superscript annotation indicates means are significantly different.

Finally, there is a need for better understanding of urban perception of native grassland. Many significant grasslands are found in the suburbs and periurban areas of Melbourne and Canberra, as well as in provincial towns and cities. Urban perception can have a major influence on the management of these remnants, yet there is no known research concerning urban responses to native grasslands.

3.4 Conclusion

3.4.1 Woodland in rural landscapes

Overall, landholders valued remnant woodland in rural landscapes but valued remnant vegetation primarily for utilitarian purposes. This finding has implications for the design of education and communication strategies for protecting native vegetation. Educational approaches will achieve most by emphasising the value of remnant vegetation for stock feed and shelter, soil and water protection and other tangible agricultural benefits. Since many landholders appreciate the value of native vegetation on their property, educational strategies should also emphasise the particular actions required to minimise threat to remnants from drought, grazing and insect attack. Management may include limited grazing regimes, fencing to exclude stock, and leaving dead wood for wildlife habitat. Messages about the ecological value of remnant woodland are likely to further enhance appreciation of native vegetation, but should be introduced once landholders have accepted the agricultural value of remnant vegetation.

The study suggests that landholders placed relatively little value on fencing small areas of remnant vegetation. Across a landscape, small remnants may contribute a great deal to biodiversity and wildlife protection (Williams, 2000). Native vegetation programs may need to highlight these values for landholders and emphasise the importance of careful management of all remnants regardless of size.

The finding that landholders primarily assessed remnant woodland for its agricultural value may influence the development of incentive-based strategies to protect native vegetation. It appears that some types of remnant vegetation are perceived to be more valuable to agricultural production than others. In Study 2, small remnants (and native grassland) were found to be less valued. In Study 1, open grassy woodland was particularly valued for stock feed and shelter. It is likely that some remnants will be considered less valuable for agriculture because of the locality of the remnant in relation to creeks, fence lines and crop, or because of remnant shape or tree species. Incentive-based strategies should take into account the agricultural benefits of native vegetation and target those remnants which have little agricultural value for the landholder, but provide significant ecological benefits for the wider community.

3.4.2 Open grassland in rural landscapes

The findings in this study confirm agency observations of low levels of regard for native grassland. In addition, the study indicates that landholders had little understanding of the ecological significance of treeless environments. The results suggest three keys for more effective design of grassland protection programs.

First, it is critical to first overcome landholders' negative aesthetic response to treeless environments. This can be achieved through both management and educational strategies. Mowing edges and limited tree planting may enhance the aesthetic appeal of grasslands. Education regarding the naturalness of treeless grasslands and the aesthetic beauty of grassland species will also be valuable.

Second, the results indicate that there may be some level of incompatibility between the perception of both agricultural and ecological value in grasslands. The highest levels of grassland preference were predicted where the grassland was considered to have high ecological value but

relatively low agricultural value. Incentive-based strategies should take into account the ecological benefits of native vegetation and target those remnants that have little agricultural value for the landholder, but provide significant ecological benefits for the wider community. A strategy sometimes observed within agricultural and environmental extension is to initially emphasise the agricultural value of native vegetation systems to landholders, and then gradually introduce information concerning the ecological value of remnants on farms. While this approach is likely to be successful with woodland, care should be taken with extending it to native grassland.

Finally, the general low regard for grassland ecosystems indicates that strong financial incentives, including outright grants or subsidised covenants, may be necessary to protect open grasslands, at least in the near future. This is particularly important in the light of landholder perception that grasslands have little agricultural value.

4 Guidelines for promoting native vegetation protection

These guidelines have been developed to assist individuals and agencies seeking to promote native vegetation conservation to urban and rural communities. The guidelines outline a number of strategies and priorities for more effective targeting of messages about the values of native vegetation.

It is hoped that the guidelines will challenge some of the assumptions we make about the way landholders and urban people think and feel about native vegetation. These guidelines provide a resource for setting regional priorities and suggest new ideas for people communicating the importance of native vegetation to landholders and urban people.

4.1 Identify human purposes for native vegetation

The environment is valued and assessed in different ways by demographically distinct sectors of the Australian population. Educational and other forms of intervention to promote maintenance and rehabilitation of remnant native vegetation must identify and respond to the intentions and expectations of the target audience.

Rural landholders

- A primary criterion for assessing rural landscapes, including remnant native vegetation, is perceived value of the landscape for agricultural production.
- The ecological value of landscape is also important for many landholders. Perceived ecological value in an agriculturally valuable rural landscape generally enhances landholder preferences.

Urban community

- Urban residents are more likely to describe the 'naturalistic' values of native vegetation: many urban people assess remnant native vegetation according to the perceived value for exploration, and passive and active recreation activities.
- Symbolic value of landscape may also be important. Perception of a landscape as typically Australian enhances urban preference.
- Perceived ecological value of landscape is important for many urban residents.

4.2 Counter low recognition and appreciation of biodiversity

Some efforts have been made to broaden the historical emphasis which native vegetation programs have placed on tree/canopy species. There is a need for more widespread emphasis on the characteristics and function of understorey and mid-storey plants. This should include a full range of grassy, shrubby and more cryptic species such as fungi and lichen.

Rural landholders

- Neat (and species-poor) properties may be associated with good stewardship. Educational programs should create an association between biological diversity and 'well managed' properties.
- In some situations, particularly larger remnants, it may be possible to provide for 'managed edges' (eg. limited clearing of understorey around remnant perimeter) (Nassauer, 1995). This would allow the conventional view of good stewardship to be maintained in rural

landscapes while preserving biological diversity within remnants.

- Vegetation has often been retained on poorer soil. Education programs should highlight the benefits of limiting farm development to areas with better soil (Crosthwaite and Malcolm, 1998).

Urban community

- Education on the characteristics and benefits of biologically diverse landscapes should be considered a high priority for urban communities.
- Education should clarify the characteristics and costs of species-poor landscapes, exemplified by heavily grazed remnant native vegetation.
- Emphasise the recreation value of biologically rich landscapes (exploring, photography, observing native flora and fauna).
- Enhance the association between diverse understorey and archetypal Australian landscape.

4.3 Use species and ecosystem based interventions

There is need for education programs which specifically target less familiar and less preferred ecosystems and species. Bull-oak woodland and open grasslands provide two examples of such ecosystems.

4.3.1 Native grassland

There is clear evidence that landholder response to native grasslands is quite unlike their response to native vegetation with significant tree canopy. Grassland protection programs will require specific approaches.

Treeless grasslands are perceived by many landholders to be bare and lacking protection for stock and wildlife.

Rural landholders

- Care should be taken in mixing messages about the ecological and agricultural value of grasslands. Preliminary research suggests that messages about the ecological value of grassland make a positive contribution only when grassland is considered to have little agricultural value. Further research is required.
- Programs should promote characteristics and naturalness of treeless grasslands and counter the perception of 'barrenness' by highlighting the rich variety of forbs and grasses present in many grasslands.
- Highlight the interrelationships between grassland flora and fauna.
- Tree plantings will enhance perception of agricultural, aesthetic and ecological value, but should be carefully designed to ensure ecosystem integrity.

Urban community

- There has been little or no empirical study of urban perceptions of native grassland. Further research is required.
- Theories of landscape preference suggest a number of approaches may enhance the recognition and appreciation of grasslands by urban people. Mowed paths or edges, and attractive fences and shelters, provide "signs of care" (Nassaurer, 1995). These will assist the urban public to view grassland as valued open space rather than untended vacant land.
- Educational material should promote the naturalness of treeless grassland, the beauty of grassland plants, and interdependencies of grassland flora and fauna.
- Enhance the association between diverse understorey and an archetypal Australian landscape.

4.3.2 Bull-oak and she-oak woodland

In general, rural landholders and urban residents expressed low regard for she-oak (*Allocasuarina verticillata*) and bull-oak (*Allocasuarina luehmannii*) woodland. Low preference was associated with low recognition of the species, and poor awareness of the characteristics of bull-oak and she-oak trees. The leafless foliage and dark bark were sometimes interpreted as signs of trees in poor health or damaged by fire. Landholders from the Midlands of Tasmania and from of the upper south east of South Australia expressed significantly lower regard for bull-oak and she-oak vegetation than landholders from the Victorian Wimmera.

Rural landholders and urban community

- Promote awareness of species names and characteristics.
- Create association between leafless foliage and plant hardiness.
- Highlight characteristic dark bark and indicate that tree is not necessarily fire damaged.
- Strategies to promote bull-oak and she-oak protection should be given a high priority in relevant areas of south-east South Australia and the Midlands of Tasmania.

4.4 Promote remnant vegetation as wildlife habitat

A perceived association between biologically diverse landscape and wildlife habitat appears important for urban communities.

Rural landholders

- Promotion of remnant vegetation as wildlife habitat is likely to be somewhat less successful with landholders, particularly where they place strong emphasis on the value of the landscape for agricultural production.

Urban community

- Education programs should highlight interdependencies of flora and fauna, especially the importance of understorey plants for wildlife protection.

4.5 Use designed landscapes to promote understanding of native vegetation

Designed landscapes can help create understanding of less familiar and less preferred environments, including vegetation with a dense scrubby understorey, open grasslands, and non-eucalypt trees such as bull-oak. The term 'designed landscapes' refers to a range of potential modifications. Landscapes may be entirely contrived environments, such as gardens. A garden might be designed to use a range of grassland species in a more familiar context. Creation of paths and development of interpretative material can also support direct experience of less familiar environments, and help create meaning in an otherwise confusing place.

Rural landholders and urban community

- Provide access to urban nature.
- Create paths to encourage visitors to explore areas of vegetation.
- Public gardens can provide a familiar framework in which to encounter unusual and less preferred plants and landscapes. Public open spaces can provide a 'transitional' environment for unfamiliar ecosystems such as grasslands. This will be particularly useful where the designed landscape is close to the natural ecosystem and incorporates local species.
- Use interpretive signs and leaflets to enhance visitor appreciation of the characteristics and ecological and agricultural function of less familiar plants and animals. A simple approach may be the provision of corporate sponsored information signs at roadside stops.

- The above approaches are likely to be particularly valuable for urban communities that may have had relatively little direct experience of nature, but will also assist rural communities to develop understanding of vegetation complexity.

4.6 Focus on agricultural value

The rural landholders surveyed for this study assessed rural landscape, including native vegetation, primarily for its agricultural value. This has important implications for the design of interventions to promote RNV protection.

Rural landholders

- Educational and awareness programs should highlight value of remnant native vegetation for stock and shelter. It will be necessary to provide both financial and anecdotal evidence of this benefit.
- Vegetation has often been retained on poorer soil. Education programs should highlight the benefits of limiting farm development to areas with better soil (Crosthwaite and Malcolm, 1998). Programs should also seek retention of some areas of native vegetation on more productive soils.
- Management agreements which allow access for stock are likely to be more acceptable than more restrictive measures. Incentives are likely to be necessary where complete exclusion of production activity is required, and where the production costs are likely to be appreciable. Binning and Young (1997) discuss these issues in detail.
- In general, perceived ecological value in the rural landscape makes a positive contribution to landholder preference where the landscape is considered to have high agricultural value. Messages of ecological significance of treed vegetation will enhance landholder attitudes.
- Landholders perceive little agricultural or ecological value in native grasslands. Preliminary research suggests that messages concerning agricultural and ecological significance of grassland may not be compatible, and that landholders prefer grassland that is perceived to have considerable agricultural value but little ecological value. Further research is required to identify messages that are most effective in enhancing landholder regard for grassland while protecting the natural values of these ecosystems.

4.7 Focus on needs and attitudes of young landholders

Anecdotal evidence suggests some agencies and individuals anticipate that land degradation issues associated with agricultural production will decrease as younger, often more educated and environmentally aware farmers, take over farm management from older generations. In this project, no evidence was found that younger landholders view native vegetation in a more favourable light; nor were these landholders more active in protecting remnant native vegetation. It is likely that young landholders are in fact more vulnerable to financial instability and have more pressing cash needs, and so must place greater importance on agricultural production in rural landscapes. There is need for education and other forms of intervention to target younger landholders.

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Appendixes

Appendix 1. Overall preference for ten landscape arrays.

Image characteristics			Mean	Standard deviation
Size of remnant native vegetation area	Fencing	Land use		
Small	Yes	Pasture	3.05	1.01
Small	Yes	Crop	3.30	1.02
Small	No	Pasture	2.63	0.96
Small	No	Crop	2.89	1.03
Large	No	Crop	3.89	0.99
Large	No	Pasture	3.78	1.02
None	N/A	Crop	2.08	1.14
None	N/A	Pasture	1.98	0.99
Large	Yes	Pasture	4.22	0.93
Large	Yes	Crop	4.25	0.88

Appendix 2. Correlations between perceived values of native vegetation in rural landscapes.

Table A1. Correlation between four measures of perceived value of rural landscapes with no remnant vegetation (ecological, agricultural, aesthetic and preference for own property). N = 131.

	Preference for own property	Agricultural value	Ecological value
Agricultural value	0.433**		
Ecological value	0.421**	0.164	
Aesthetic value	0.485**	0.438**	0.241**

** $p < 0.01$ (2-tailed)

Note: These correlations may be elevated by severe positive skewed relationships which were not reduced through log-based transformations.

Table A2. Correlation between four measures of perceived value of rural landscape with small areas of native vegetation (ecological, agricultural, aesthetic and preference for own property). N = 131.

	Preference for own property	Agricultural value	Ecological value
Agricultural value	0.519**		
Ecological value	0.386**	0.243**	
Aesthetic value	0.514**	0.592**	0.484**

** $p < 0.01$ (2-tailed)

Table A3. Correlation between four measures of perceived value of rural landscapes with large areas of unfenced native vegetation (ecological, agricultural, aesthetic and preference for own property). N = 131.

	Preference for own property	Agricultural value	Ecological value
Agricultural value	0.643**		
Ecological value	0.436**	0.380**	
Aesthetic value	0.557**	0.538**	0.453**

** $p<0.01$ (2-tailed)

Table A4. Correlation between four measures of perceived value of rural landscapes with large areas of fenced native vegetation (ecological, agricultural, aesthetic and preference for own property). N = 131.

	Preference for own property	Agricultural value	Ecological value
Agricultural value	0.569**		
Ecological value	0.440**	0.395**	
Aesthetic value	0.509**	0.512**	0.491**

** $p < 0.01$ (2-tailed)

Appendix 3. Summary of findings about the relationship between landscape preference and demographic characteristics of landholders.

Characteristic	Value (no. of cases)	Mean preference				MANOVA summary
		No RNV*	Small area RNV	Large area unfenced RNV	Large area fenced RNV	
Region of residence	Upper south-east of South Australia (41)	1.74**	2.79	3.96	4.28	F(8,238) = 2.66 p = 0.008**
	Wimmera (41)	2.26**	3.12	3.62	3.98†	
	Midlands (43)	1.96	2.90	3.80	4.38†	
Cropping enterprise	Yes (94)	2.07	2.99	3.76	4.17	F(4,119) = 1.25, p = 0.29
	No (30)	1.73	2.77	3.90	4.22	
Age of landholder	Under 39 (17)	2.18	2.94	3.97	4.50	F (12, 312.49) = 1.00, p = 0.45
	40–49 (40)	2.00	2.86	3.67	4.19	
	50–59 (34)	1.84	2.89	3.60	3.97	
	60+ (34)	2.03	3.07	4.04	4.35	
Education level of landholder	Year 11 or under (51)	2.09	2.98	3.76	4.16	F(4,116) = 0.67, p = 0.61
	Year 12 or higher (70)	1.90	2.90	3.81	4.29	
Landcare membership	No (84)	1.89	2.91	3.80	4.23	F(8,236) = 0.53, p = 0.83
	Yes (39)	2.20	3.01	3.82	4.20	
Sex of landholder	Male (75)	2.17	3.06	3.83	4.31	F(4,116) = 2.11, p = 0.08
	Female (46)	1.71	2.74	3.72	4.12	

* Remnant native vegetation.
** Wimmera landholders found to have significantly higher preference for landscapes with no RNV than landholders from upper south-east SA.
† Wimmera landholders found to have significantly lower preference for landscapes with large areas of fenced vegetation than landholders from Midlands of Tasmania.