nonbroadscale land clearing in southern australia:

economic issues in managing native vegetation on farm land

abare research report 07.2

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january 2007

abare

www.abareconomics.com

innovation in economics

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ISSN 1037-8286
ISBN 1 920925 83 X

Mallawaarachchi, T. and Szakiel, S. 2007, *Nonbroadscale Land Clearing in Southern Australia: Economic Issues in Managing Native Vegetation on Farm Land*, ABARE Research Report 07.2 Prepared for the Natural Resource Management Division, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, January.

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ABARE project 3115

foreword

Australian farmers are under continued competitive pressure to increase their productivity and land use intensity. These changes are often at odds with the wishes of those who are increasingly concerned with the environmental impacts of farming operations on natural vegetation.

Legislation regulating the management of on-farm native vegetation has recently been introduced by all states and territories in Australia. While there are environmental benefits that are derived from these regulations, there can also be significant costs imposed on landholders.

This report, based on a series of case studies and commissioned by the Natural Resource Management Division of the Australian Government Department of Agriculture, Fisheries and Forestry, focuses on nonbroadscale vegetation management issues. It examines how existing regulatory measures affect landholders in southern Australia, and options that could be used to achieve the economic and environmental outcomes sought by Australians.

Phillip Glyde
Executive Director

January 2007

acknowledgments

This work was funded by the Natural Resource Management Division of the Australian Government Department of Agriculture, Fisheries and Forestry. The authors thank Lee Nelson and Jack Archer for facilitating this work, providing feedback and assisting them in the planning phase.

ABARE gratefully acknowledges the voluntary assistance of farmers in providing information about their operations and sharing their experience during farm visits for the case studies presented in this report.

Assistance provided by Jane Bradley of the Murray Catchment Management Authority, Neville Fernando of the Victorian Department of Primary Industries, Tom Mowbray of the South Australian Vegetation Council, and Ben Hyde, the Australian Government Biodiversity Facilitator in the planning of this work is gratefully acknowledged.

The authors also recognise the contributions of ABARE colleagues Dale Ashton, Kasia Mazur and Kevin Burns, the advice of Anna Heaney, Peter Gooday and Stephen Beare during the course of this work, and the constructive comments provided by Tim Goesch and Nico Klijn.

contents

summary

- Vegetation management is an integral aspect of commercial agriculture in Australia. The practice of land clearing for agricultural production has facilitated the development of a viable rural economy organised around agricultural activity.
- Vegetation management on private land has become a public policy issue because on-farm vegetation provides a range of environmental and amenity services that are valued by society. However, the benefits of these services are not usually captured by private landholders. As a result, the level of environmental services supplied privately is likely to be below the socially optimal level. As the values that society places on the environmental benefits derived from on-farm vegetation appear to be increasing, vegetation management on private farm land has become an issue of concern in land management policy in Australia. Currently, every state and territory in Australia has introduced legislative controls over the management and clearing of native vegetation on private land. This report focuses on the issues related to nonbroadscale land clearing – that is, the clearing of small areas of remnant vegetation on-farms.
- A difference in the level of on-farm vegetation that is privately optimal for landholders to maintain and the level that is optimal from a societywide perspective is the rationale for government intervention in managing on-farm vegetation. The main sources of this disparity are the public good nature of some environmental services that are not considered in private decisions. In this context the resource allocation challenge is to identify where and when government intervention could bring about greater social benefits and the nature of interventions that can achieve this goal.
- In this report a set of case studies is used to provide an overview of landholder perspectives on on-farm vegetation management and nonbroadscale land clearing restrictions in southern Australia. The case study farms surveyed for this study were drawn from the Murray Valley in New South Wales, west Gippsland in Victoria, and the Mount Lofty Ranges and the Bordertown regions in South Australia.
- It should be noted that these findings are based on case studies, rather than a representative sample, and may not be representative of the wider farming community in these regions. The study identified profitability, asset value and lifestyle concerns as the primary motives for vegetation management. The case

studies also revealed a number of common themes, despite differences in the location, intensity of land use and the enterprise mix among the farms studied.

- In general, the case studies did not identify nonbroadscale land clearing restrictions as having a significant impact on the operation of the farms, except in relation to land use change in the Bordertown region of South Australia. In that region, scattered trees on development paddocks were an issue of concern when landholders were planning to install large centre pivot irrigation systems. The landholders indicated that the land clearing restrictions were impeding development plans, potentially affecting returns to investment in centre pivot irrigation. However, landholders were generally convinced that an offset program, when properly implemented, could reduce these opportunity costs and deliver net environmental benefits.
- Landholders that were interviewed also generally felt that some level of external control over vegetation clearance was required to avoid clearing that could substantially disrupt the environment. Other insights from the case studies suggest that larger properties have greater flexibility in matching land use to land capability and can more easily target areas for establishing vegetation cost effectively.
- When considering government intervention to manage the private provision of native vegetation, the diverse range of land uses and land capability across Australia are important issues that have an impact on the opportunity costs farmers face. The case studies in this report demonstrate that there are properties across southern Australia that are able to provide environmental services with relatively low opportunity costs. This indicates that there may be benefits from vegetation management policies that allow some flexibility in the way in which environmental targets are met.

1

introduction

Over the past decade, retention, management and rehabilitation of native vegetation and biodiversity on private land have become issues of policy debate. In particular, the role that native vegetation plays in sustaining resource productivity and the protection of endangered ecosystems have been a focus of this debate. However, heavy reliance on regulating the clearance of native vegetation on private rural land may impose substantial costs on landholders (Productivity Commission 2004; Davidson et al. 2006). While native vegetation – and vegetation more generally – provides a range of public benefits, the benefits that could result from small amounts of clearing remnant vegetation – that is 'nonbroadscale' land clearing – are not well understood.

Currently, every Australian state and territory has some legislative control over management of native vegetation and broadscale land clearing. Previous ABARE work has focused on the issue of broadscale land clearing (Davidson et al. 2006). In this report a set of case studies is used to provide an overview of landholder perspectives on on-farm vegetation management and nonbroadscale land clearing restrictions in southern Australia. Focusing on the intensive land use zone of New South Wales, Victoria and South Australia, this report investigates the economic and environmental characteristics of the issues and regulations surrounding nonbroadscale clearing. Also examined in this report are:

- the opportunity costs of land clearing restrictions on sustainable agriculture
- key regulatory measures contributing to these costs
- whether there are opportunities for socially efficient nonbroadscale land clearing to occur and
- the options available to manage cost–benefit tradeoffs.

2

native vegetation – economic issues

Vegetation management is an integral aspect of commercial agriculture in Australia. The practice of land clearing for agricultural production in Australia has enabled the development of a viable rural economy organised around agricultural activity. While agriculture provides direct economic benefits and often contributes to landscape amenity, governments are increasingly responding to changing societal expectations by encouraging conservation on privately managed lands. This has involved the use of policy instruments including information provision, suasion, financial incentives and regulation. All of these approaches involve costs either to landholders because they affect on production decisions, or to taxpayers through increased public expenditure.

Development of public policy to improve the net social benefits of land management will require an understanding of the tradeoffs between production and environmental objectives.

benefits of on-farm vegetation

Vegetation on private property contributes to a range of market and nonmarket goods and services that accrue to the landholders and society, either directly or indirectly. The market benefits include increased production whereas the non-market benefits include environmental amenity services. The benefits of improved productivity accrue mainly on-farm, although they can accrue to other landholders For example, private decisions on vegetation management could affect the vegetation density in a catchment, which can have an impact on water flows, biodiversity and downstream salinity. Changes in salinity and water flows could affect the production and the profitability of downstream farmers. Similarly, vegetation may also increase the aesthetic value of the landscape and may influence property values (appendix A). The environmental benefits associated with native vegetation are largely a public good that accrues to the wider community, including landholders.

issues in the provision of native vegetation on private land

Many aspects of a well maintained and healthy production landscape have the characteristics of nonexclusive and nonrival goods. Goods are called nonexclusive when it is impossible to exclude people who do not bear the costs of providing them (for instance, nonpaying passers by) from consuming them. In particular, nonexclusivity could lead to free rider problems – discouraging private investment – where people can consume a nonexclusive good that was paid for by others. Nonrival goods provide joint or repeated consumption benefits. Nonrival goods can still provide private benefits, as is the case for golf clubs. Essentially a vegetated landscape offers collective benefits permitting concurrent private and public benefits. Because of their nonexclusive benefit characteristics, these forms of goods tend to be underprovided in a free market.

Unlike farm products, such as beef or milk, which are sold in the marketplace, most environmental goods arising from farm land do not have a market price and land owners are not able to recover payment for their efforts that result in public good environmental benefits. The lack of a market price also means that supply of these goods, in the absence of policy intervention, is not responsive to changes in demand.

Farmers will generally conserve native vegetation on their property to the extent that it delivers private benefits – for example, in the form of shelter for livestock and windbreaks – but have little incentive to conserve vegetation beyond that level. Once native vegetation exceeds some threshold level, it may start to compete with agricultural production. Government involvement in the management of native vegetation may be justified where the increased provision of native vegetation conservation benefits outweigh the costs. In such cases, the purpose of government intervention should be to ensure that the net benefits (public and private) of both agricultural and conservation land use are increased (Davidson et al. 2006). Because land clearing provides opportunities for landholders to increase agricultural output, policies that are designed to enhance environmental protection beyond the level achieved under normal agricultural practice will impose costs on landholders and taxpayers.

Clearing of native vegetation in rural Australia has been identified as a cause of dryland salinity, weed invasion, soil erosion, soil structural decline and a key factor in the loss of native plant and animal species (ABS 2006). Many environmental consequences of land management are broadly viewed as externalities that have occurred when landholders pursued commercial operations within existing

property rights, either granted or implied in their traditional use of the land. Often the flow-on public costs of such actions have not become apparent for some time. When managing these impacts, it is important to note that a large proportion of land clearing impacts may occur onsite, rather than external to a farm. Where these onsite impacts are predominantly affecting future onsite production, they should be more properly classed as sustainability issues involving private costs. However, where on-farm effects also lead to impacts on biodiversity and productivity offsite, then externality, public good and sustainability issues are confronted concurrently (Rolfe and Mallawaarachchi 2003). Consequently, conservation and restoration of on-farm native vegetation have received public support as a means to combating dryland salinity, declining water quality, soil erosion, and loss of biodiversity.

Differences in the level of information that is available to landholders, resource managers and society more generally will also create differences in the private and socially optimal level of environmental service provision. Information issues include the appropriate actions to be undertaken and the expertise and knowledge to make these changes. Private provision of environmental services from landholders with limited information and expertise to adapt their practices is likely to lie below the socially optimal level of provision. It is important to note, however, that the future capital value of the land is an important consideration for most landholders; therefore, any actions that they take today are likely to include consideration of future impacts. Likewise, environmental experts and government officials who may not have all the relevant information to make decisions are also likely to contribute to these disparities between private and socially optimal levels of environmental service provision.

3

landholder perspectives

The purpose of the case studies summarised in this chapter is to draw on case study evidence to explore the hypothesis that there are significant costs to sustainable and profitable agriculture in some regions of southern Australia resulting from legislation restricting vegetation clearance on private land. In particular, the case studies examined the incidence of opportunity costs, as perceived by landholders, resulting from restrictions on the clearing of remnant vegetation to improve land management, adopt new technology or change land use. When conducting the case studies, interview questions were directed to general vegetation management issues; however, most of the farmers that were interviewed directed their responses toward the management of native vegetation. This response was expected as much of the public debate on vegetation has focused on native vegetation issues.

As noted in chapter 2, the level of environmental benefits achievable in a given landscape will be determined by the nature and the composition of agricultural activities and other associated land uses in that landscape. With this in mind the case studies were designed to illustrate the broader sustainability and vegetation management issues from the perspective of farmers, and in particular to:

- identify the measures likely to encourage improved land use from a social perspective.

It should be noted that these case studies were identified based on suggestions made by local contacts including government officials, natural resource managers and other informal means. They do not represent a sample of farmers chosen randomly so the insights gained cannot be viewed as a true representation of the full cross section of farmers. The case studies are examples of profitable farm businesses that pursue sustainable farming practices. ABARE farm survey data are also used to complement the case study analysis where possible.

The case studies were undertaken by two ABARE researchers through personal visits to each of the farming properties. The interviews were guided by a semi-structured survey schedule incorporating ten to twelve questions. The interviews ranged in length from one and a half to two hours.

Summaries of the interviews for each case study are presented below. Each summary is preceded by a short overview of the case study region.

case studies 1 and 2: broadacre agriculture – New South Wales Murray

regional overview

The New South Wales Murray bioregion is characterised by an extensive area of foothills and isolated ranges, with a warm to hot and dry climate on the lower, inland slopes of the Great Dividing Range. The landscape features steep to undulating terrain that has moderate to high rainfall (up to 1200 mm in the east), gently undulating hills, and low relief floodplain country that has low rainfall (around 400 mm a year). The region has been extensively cleared of natural eucalypt woodlands, open forests and grasslands for cropping and grazing with introduced pastures. The remnant terrestrial and aquatic vegetation includes characteristic scattered trees on private property, roadsides, traveling stock reserves and along creek banks, providing habitats for a range of birds, plants, mammals and amphibians (MCMA 2006; NSW National Parkes and Wildlife Service 2001).

Major land uses are dryland broadacre cropping and grazing, comprising cereals, legumes and oilseeds, irrigated cropping, irrigated pastures and irrigated horticulture. In 2004-05, 62 per cent of the estimated 3070 farm businesses in the Murray catchment reported native vegetation on their property, while around 80 per cent reported weeds as their most significant natural resource management issue (ABS 2006).

ABARE survey data indicate that farm size varies across the catchment, ranging from smaller mixed livestock–crops producers in the east (around 800 hectares), specialist crop producers in the central part of the catchment (around 1500 hectares), and large sheep–beef producers in the west (around 5400 hectares). Average land values in 2004-05 ranged from around $620 a hectare for sheep–beef producers to $2300 a hectare for mixed livestock–crops producers. The farmgate value of agricultural production in the catchment was around $1 billion in 2004-05. Farm incomes (cash receipts less cash costs) for mixed livestock–crops producers averaged around $34 000 in 2004-05, compared with an average around $77 000 for specialist sheep–beef producers.

case study 1: broadacre agriculture – New South Wales Murray

property background

The property, owned and managed by a sixth generation farmer, currently supports 5000 merino sheep on 730 hectares. When farming began in the 1830s, the country was under 'open timber'. Development has involved extensive clearing and establishment of permanent pasture since the 1950–60s. The farm is currently sown to perennial pastures, with 30 per cent natural grass and 70 per cent improved pastures.

The property requires minimal inputs as the land has been managed and improved to the point of 'sustainability' within a philosophy of 'sensible farming is conservative farming'. Chemical fertilisers have not been used on the property for many years. The owner claims that the low input costs make his operation very profitable, despite a lower gross income than farms of comparable size in the region.

property management issues, including vegetation

The property has been managed well in the past and is considered to be operating at the long term profit maximising stocking rate. The farmer believes that further expansion would require increases in input costs greater than what might be recoverable through a possible increase in long run returns.

The property has a few scattered paddock trees and a stand of pine trees that are managed predominantly for amenity value. The owner believes that the paddock trees on the property provide some productive benefits such as shade and shelter for livestock; however, he does not intend to plant any more or remove any existing trees.

In recent times, a large number of ornamental trees have been planted along the driveway, largely to improve the capital value of the property. Vegetation on the property has not been established at the expense of agricultural production, highlighting the possibilities to increase vegetation cover, production and capital value concurrently by appropriately assigning vegetation to land areas not suitable for agricultural production.

Despite the low level of tree cover, the property has nearly 30 per cent native vegetation, comprised mainly of natural pastures. A conservative stocking rate and

rotational grazing has kept the native and improved pasture in very good condition, providing shelter and food for the stock and good ground cover to prevent soil erosion.

views on vegetation management approaches

As a grazier, the owner agrees with the need for vegetation management policies and programs. But he was concerned about the current approach to tree planting, fearing that planting too many trees in too high a density and along fence lines could create bushfire hazards and impacts on fences. He advocates planting trees in the middle of paddocks, in clumps.

sources of inefficiencies and threats to farm viability

The landholder identified the following as sources of inefficiency that undermine long term sustainable and profitable agriculture in the broadacre sector.

- A focus on short term financial returns where the focus should be on gaining the knowledge to manage the land in the longer term.
- Overstocking and the resulting land degradation could risk longer term agricultural productivity and threaten farm viability, because increases in input costs could outstrip gains from higher stocking.
- Indiscriminate land management, whereas the need is to manage different areas based on land and crop characteristics. For example, natural pastures are good in the summer – they should be used in the warmer weather, and others should be spelled. Similarly, some properties that are cropping are possibly not large enough to be viable – sometimes it is cheaper to buy grain than it is to grow it on-farm.
- Declining farm returns and increased farm costs.
- Access to trained labor – particularly shearing labor.
- Shire rates and other charges.
- Misplaced emphasis on drought support prolonging unviable farms.

case study 2 broadacre agriculture – New South Wales Murray

property background

The owner is a fifth generation farmer, sharing the management of two adjoining properties with his brother. His family has owned and managed the land since the 1890s. He operates 1240 hectares, with around 700 hectares cropped, 80 hectares under tree vegetation and the remainder grazed. Most of the grazing land is under improved pastures. Approximately 2500–3000 ewes are joined every year on the property.

The current cropping system includes a four year rotation, with minimum till and direct drilling techniques. The owner considers that these practices allow for both cost savings and a longer cropping phase and lead to improved soil structure. In recent times he has sown new areas into perennial pastures, and may move into full stubble retention practices in the future.

The property is fairly highly leveraged, with approximately $1 million owing on a $5–6 million property, in contrast to a neighbor who owes $100 000 on his property. The owner feels that this level of leveraging makes a big difference to his attitude to management.

property management issues including vegetation

Farm management has a clear environmental focus, with a range of environmental benefits produced on the property, including vegetation established with government grants. Areas not suitable for agricultural production have also been set aside for agroforesty. All of these actions have been undertaken to maximise environmental benefits and minimise environmental costs, with a minimal or no impact on production.

Over the past fifteen years, the owner has been involved with Landcare and recently with the Murray Catchment Management Authority. These associations, and programs such as the 'Trees on farms' program that was run in the late 1980s, have made him more environmentally aware and helped him adopt more sustainable management practices such as direct drilling techniques, and the use of lime and organic matter as soil conditioners. Since the 1980s the property has progressively moved to a higher proportion of cropping.

The manager feels that his entry to farming at a younger age, that also coincided with an increased emphasis on sustainable farming made him more receptive to change. Although he is happy now that he made those choices, he is becoming aware as he gets older that he is less inclined to make dramatic changes to his management plans.

managing vegetation on the property

In 2001, 40 hectares were developed into an agroforestry block using land on steep and rocky terrain unsuitable for agriculture, therefore minimising the opportunity costs of gaining environmental benefits. Even though the owner is exploring the possibility of a timber milling operation, he considers that any profit earned would be a bonus. The primary motives for establishing the trees were environmental and amenity values. The owner views the agroforestry block as an environmentally responsible project that is low cost and provides a service to the community.

In recent times, the private and public benefits of on-farm vegetation have become a more topical issue to the manager because he is concerned that farmers have a role to assist in making the best use of public expenditure allocated to address environmental issues.

Recent tree planting and maintenance activities have been along the fence lines of the property as shared activities with neighbors. Despite these investments, the manager is worried that on a broader scale, there is not enough replanting of trees. In the next five years he would like to increase the number of trees planted. On one of the jointly managed adjoining properties, new trees have been planted in clumps in the grazing paddocks. These paddocks are now unlikely to be turned into cropping paddocks. If any trees were to be planted in the future then the less agriculturally productive areas would be investigated.

Land clearing legislation has not had any direct effect on management and the manager makes a concerted effort not to reduce the number of trees on the property. Any trees that are lost are unintentional and even dead trees are kept for habitat purposes as long as they are not interfering with operational activities.

amenity value of the vegetation

One of the main objectives of vegetation management on the property is for visual amenity and the 'feel good' benefits of seeing the trees thriving in rocky outcrops. The additional production benefits of allowing sheep to graze between the trees for food and shelter are also considered but as a secondary benefit. Although the

manager has heard of productivity improvements associated with paddock trees, he is not certain of the magnitude of such benefits.

paddock trees

Established paddock trees are not considered to be a large operational hurdle. Whenever additional trees are planted, or more plantings are investigated, the landholders will first look at planting along the fence lines. The owner concedes that there may be some increased costs associated with paddock trees, for example, on weed control and destroying vermin habitat. Although in the scheme of things he believes that these costs are manageable, because the benefits far outweigh the costs.

If new paddock trees were to be planted and established, then the provision of production benefits may be greater if they were established in clumps rather than single trees. When considering the location of new paddock trees, the manager would think twice about planting trees in the middle of paddocks. He considers that it is easier and more economical to rely on existing fences as this reduces the opportunity cost of gaining environmental benefits.

key changes, future outlook and plans for the property

One of the key changes in farm management in the owner's time managing the property is the increased effort and expense required to maintain books, particularly in view of cash flow management and meeting legislative obligations.

There are no major changes planned for the future management of the property. Significant capital invested in the cropping component of the business makes it undesirable to move out of cropping. In particular, the dry conditions in the past have improved the drainage across the majority of the property, making it more suitable for cropping. If seasonal conditions return to wet winters then the management plan will have to be adapted for areas that will no longer be suitable for cropping.

case study 3: broadacre agriculture – eastern Mount Lofty Ranges, Murray Darling Basin, South Australia

regional overview

The Murray Darling Basin catchment in South Australia consists of a number of regions, including the Upper Murray, eastern Mount Lofty Ranges, Murray Plains, and Murray Mallee. The eastern slopes of the Mount Lofty Ranges drain into the Murray River or Lake Alexandrina (RMCWMB 2003).

Much of the Murray River catchment is semiarid mallee forest interspersing land where the mallee forest has been cleared. The region's wetlands provide habitats, breeding sites, and drought refuges for a diversity of birds and other biota. The Coorong and lower lakes are a major wetland network threatened by salinity and shore erosion (RMCWMB 2003).

The Murray Darling Basin catchment in South Australia supports a diverse range of agricultural industries. The Riverland is a major horticultural region producing wine grapes, citrus, stone fruit, almonds, vegetables, apples and olives. The South Olary Plains is a pastoral region with very little rainfall. Stock grazing is the dominant land use and weed incursions are a major natural resource management issue. Wine grapes, lucerne, dairy and vegetables are the major agricultural land uses in the eastern Mount Lofty Ranges and Murray Plains regions. The Murray Mallee region is dominated by dryland farming and grazing (RMCWMB 2003).

In 2004-05, the Murray Darling Basin catchment contained 4104 agricultural establishments (ABS 2006). Around 53 per cent of these establishments reported some native vegetation on their property, while nearly 70 per cent reported weeds as the most significant natural resource management problem.

property background

The property is a family farm managed by two brothers who are fifth generation farmers. The primary enterprises of the 7000 hectare operation are sheep, mainly for wool, then for prime lambs and first cross lambs. There are also some cattle on the property and some cereal cropping – oats, barley, triticale and wheat. Prior to settlement, the area was predominantly grassy woodlands. Extensive clearing occurred on the property in the 1960s.

The land is fairly diverse, ranging from 500 mm annual rainfall in the area of improved pastures, moving into lower rainfall in the Murray plains area where the

land is fertilised. The Murray plains area of the property was previously an area of relatively low productivity compared with the rest of the property; however, with changes in management practices to a rotational grazing system and increased spelling of the land, the owner has increased cropping yields as well as biodiversity.

property management issues including vegetation

Increased vegetation planting has been undertaken for various reasons, including increased private amenity value from increased tree cover, productivity gains from the shelter provided to stock, a concern for addressing the external costs of salinity on downstream entities that can be addressed at limited costs through recharge planting. The owner recognises that there are projects that can be undertaken that are able to provide environmental benefits and improved amenity values with limited production losses and occasional productivity gains.

The owner first became involved in the environmental side of farm management when he joined the local Soil Conservation Board. In the beginning he was involved as an observer, and was not aware of any environmental issues that were affecting his property. However, after a field trip to observe salinity and erosion problems that were occurring on another property, the owner recognised that similar issues, such as salt scalding, were also affecting his property on a smaller but appreciable scale.

Recent activities include fencing off creeks from stock to protect banks from erosion and to reduce silting in a downstream dam. These activities delivered significant environmental benefits to the owner, and have been achieved with limited opportunity costs as the creek was not previously used as a primary watering point for stock.

vegetation management

Paddock trees are not a major issue for the cropping enterprise on the property. Tree clearing in the 1960s left the cropping paddocks free from vegetation. In the grazing areas of the property some remnant vegetation is being fenced off from full time stock access to protect the vegetation and improve environmental value. However, some grazing still occurs on these areas to manage the weeds.

The main costs involved in improving native vegetation on the property are for fencing. If trees are planted too close to fence lines then future repairs and maintenance will be required. Potential for vermin and rabbits in the area is also an additional cost placed on the owners that requires careful management. Finally,

increased weed coverage that would previously have been managed by grazing stock is a concern for the owners.

managing NRM outcomes

The landholder regards government initiatives as important but notes that conflicts may arise when there are a myriad of programs running at the same time with no distinct drivers to get all of the landholders working in the same direction. The owner feels that programs such as Environmental Management Systems will be very important in the future and should be encouraged. He also feels that it is important to get industry bodies involved in the move to managing environmental issues.

The landholder considers that when government programs are initiated, at the national and state levels, it needs to be recognised that there are already farm level plans in operation and that the activities at farm, regional and national levels need greater coordination and alignment to be effective at meeting the desired objectives.

The landholder noted that monitoring government funded programs could improve accountability, recognising that achieving goals at the least cost or obtaining the greatest benefit from expenditure is important. If farmers receive public money to provide environmental benefits, they need to be able to demonstrate that environmental goals are being achieved.

other environmental involvement

The owners are also involved in the Bush Bids program that is run by the Commonwealths Department of Environment and Heritage. The program has the support of the owners as it provides flexible use of the land – the program is providing incentives and financing to clear weeds and improve environmental values that previously would not have been achieved. Although the owner admits that he does not prioritise the land areas to be used for environmental purposes as much as he should, some consideration is given to salinity problems by not heavily grazing areas that are prone to salt scalding. Salinity is not a serious issue at present.

The environmental management approach used stems from the landholder's observation that farmers need to be aware of their productivity but also need to recognise that they are living in an environment that must be protected to be able to maintain a sustainable farming enterprise.

case study 4: urban fringe – Mount Lofty Ranges, South Australia

regional overview

The Mount Lofty Ranges region of South Australia extends from Cape Jervis in the south to Stockwell in the north, and is bounded to the east by the Mount Lofty Ranges. The region encompasses metropolitan Adelaide, the Fleurieu Peninsula, the Adelaide and Northern Adelaide Plains, Southern Vales, the Barossa Valley, and the western Mount Lofty Ranges. The region is highly urbanised, but also has areas of high biodiversity in isolated pockets of remnant vegetation (INRMG 2003).

Soil types across the region are highly variable, ranging from highly fertile and productive soils to steep rocky areas. Many soils in the region are naturally acidic, while acidity has increased as a consequence of agricultural use. Soil erosion is also a major problem, with widespread stream and gully erosion (INRMG 2003).

Many vegetation types and landscapes in the region have been cleared for agriculture and urban settlement. Native vegetation accounts for only 8 per cent of the land area in the region, with nearly half located on private land and the remainder on public reserves and national park (INRMG 2003).

Land use in the region is diverse and includes commercial rural properties and small noncommercial rural holdings. The better soils in the region are typically used for horticulture and dairy where supplementary water is available, while other major agricultural industries include cropping, and sheep and cattle grazing (INRMG 2003).

In 2004-05, the Mount Lofty Ranges region contained 2313 agricultural establishments (ABS 2006). Around 44 per cent of these establishments reported native vegetation on their property, while nearly three-quarters reported weeds as the most significant natural resource management problem.

The farmgate value of agricultural production in the region was around $240 million in 2004-05. The largest land use is broadacre grazing, while much of the production value comes from specialised high value produce such as wine grapes, apples, cherries, strawberries, cut flowers, nursery products and dairy.

property background

The owners have been on the property for at least the past 25 years. The property covers approximately 60 hectares, with sheep and cattle grazing and agroforestry being the main enterprises. As the property is located in the Adelaide freshwater catchment area, the management focus of the property has generally been directed toward maintaining or improving water quality.

property management issues including vegetation

The owners stated that the property was badly rundown when the owners acquired it, and since that time they have worked to maximise the sustainable return to the land, reinvesting any returns into the property to improve environmental outcomes and farm productivity. They have a source of off-farm income that allows them to manage the property in this manner.

Since the owners purchased the property, they have faced a number of environmental issues such as increasing salinity. Careful investment has paid dividends in terms of improved productivity and environmental benefits. While any financial returns on the property have been reinvested in farm infrastructure, salinity and erosion control and pasture improvement in the past, the property can be considered a model for development at the urban fringe, where complementary production and environmental benefits have been achieved through conscious management in an environment facing high salinity risks. In particular they believe that they have demonstrated how farmers can help communities achieve multiple benefits by taking the regional context into account when planning property developments.

environmental management on the property

The owners pride themselves on working toward best environmental practices on the property, while also making the property financially viable in the long run. Management arrangements include regular destocking of the property in the drier months of December and January to reduce the risk of erosion.

A rotational grazing program has also been initiated on the property, restricting grazing to two hectare blocks to protect the soil and the grasslands from degradation.

Other activities directed toward environmental management on the property include, fencing and protecting paddock trees from stock and revegetating previously cleared land areas and isolating saline patches. In 1999 the owners planted

six hectares of agroforestry on the property. On-farm monitoring of salinity through piezometer readings have indicated a declining trend in subsoil salinity that could be attributed to targeted revegetation of the recharge areas.

The owners consider that an on-ground support officer providing advice and guidance on environmental management is an important factor in ensuring that farmers are providing efficient levels of environmental protection. In this case they have benefited from the Upper Torrens Land Management Project (box 1 in chapter 5) that they are keenly involved in. When they began environmental management plans 25 years ago, the owners started out with a 'scattered' approach to the issues on the property, including establishing double fence lines and providing wind breaks but it was not until they met the field officer in the area that they began to focus their operations on key issues in a systematic manner.

case study 5: horticulture – west Gippsland, Victoria

regional overview

The west Gippsland region, which incorporates a number of regional centres around Warragul, is home to a number of terrestrial and aquatic species and ecosystems, some of which are classified as rare or threatened. In the north and west, high rainfall (up to 1600 mm) and deep soils support native forest vegetation. The plains in the east receive much lower rainfall (600–1000 mm), with native vegetation consisting of woodland, grassy woodland, heathland, riparian complexes, and wetlands in low lying areas.

Soils across the region are moderately well structured; however, soil erosion is common in steep slopes. Many vegetation types and landscapes in the region have been cleared for agriculture. Much of the private land has been cleared and only 14 per cent of native vegetation occurs on private land. The balance is usually found as small isolated patches on public land along roadsides, rail reserves and streams (WGCMA 2006).

The west Gippsland region contained 3929 agricultural establishments in 2004-05 (ABS 2006). Around half of these establishments reported native vegetation on their property, while over two-thirds reported weeds as the most significant natural resource management problem.

The farmgate value of agricultural production in the catchment was around $800 million in 2004-05. Dairy accounted for over half the value of agricultural produc-

tion and beef cattle another quarter. Wool, lamb, potatoes and carrots make up most of the remainder.

property background

The property is owned and managed by a second generation farmer. In 1946, the owner's father bought the property and started to progressively purchase adjoining properties in the area. Currently, the operation involves 130 hectares of potatoes and 1000 breeding sheep, producing at least 1000 prime lambs. The 255 hectare operation is also vertically integrated through wholesale produce trade and an interstate transport business.

The original landscape of the area was mountain ash forests. As the land was settled, there has been heavy clearing of native trees and a resultant loss of fauna.

Recently, significant changes have occurred in the region, particularly an increase in the average size of farming operations. Increasing costs of production, and falling or static returns, have led to farm amalgamation to achieve economies of scale and to improve efficiency of production. The trend has meant that the client base for the wholesale business has reduced while the tonnage of potatoes processed has increased. There has also been a dramatic move toward increased mechanisation in the area. This has allowed the larger properties to increase their productivity and reduce dependence on labor, as labor supplies are also thought to be dwindling.

property management issues including vegetation

The owners place a high value on the property's visual amenity, and are prepared to put effort and money into maintaining trees along fence lines and generally healthy vegetation. Vegetation management plans are in place on the property, which also involve replacing introduced pine trees that are used to mark paddock boundaries with native species indigenous to the region.

Previously, when the owners were allowed to sink dams on the property, every dam had native trees planted around the edges to protect the dam walls from erosion. Today, along the creek beds, the existing pussy willow trees are being removed and replaced with native species.

The motives behind increased plantings of native trees are a mixture of improved land management and increased amenity value for the owner. The owner claims

that once the native trees have become established, they require little maintenance and provide significant soil and stock protection as well as amenity values. Maintaining the sustainability of the property is also a main focus of the owner's management practices. He has sought advice from agronomists and conducted soil tests on the property to match management practices and fertiliser applications to suit soil conditions.

Two main external issues that are having an impact on the operation are increased fuel prices and restrictions on sinking new dams. Increased fuel prices are having a flow-on effect to the transport business as well as placing pressure on labor and machinery costs.

Regulations restricting new dams on the property to increase water storage are also limiting the ability of the owners to increase irrigation and productivity. The owners feel that in a high rainfall area, new dams should not be restricted in the same way as they are in low rainfall areas of the Murray Darling Basin.

case study 6: mixed enterprise – west Gippsland, Victoria

property background

The current owners are relatively new to the farming industry, operating a seed potato growing business over the past fifteen years on what was a dairy/sheep property. The potato growing business, originally started on only one hectare, gradually increased as they purchased additional land and amalgamated a family farm to expand the operation to 285 hectares. The current enterprise includes 50 hectares of seed potatoes and an average of 500 milking cows. The seed potatoes are produced for the export and domestic markets.

The owners are committed to self improvement and regularly attends training courses in agricultural development, executive training and business management. He feels that as he was not brought up in a farming environment, being a builder by training, he did not have any preconceived ideas on how things should be managed. This perspective has encouraged him to investigate alternative management options and he has developed his willingness to try new approaches. He has also been involved in focus groups, steering committees and open farm projects as a way of learning and to share his experience with the industry.

property management issues including vegetation

A program of tree planting over several years has been completed on the property with government assistance that subsidised the cost of trees and fencing in exchange for the owners providing the labor and the land as well as managing weeds onsite into the future. Participation in this work was motivated out of a personal interest in vegetation management and the prospects for increased capital appreciation through increased vegetation and improved habitat on the property.

In addition to the government sponsored investment in vegetation, the owners have also revegetated marginally productive land without assistance. These trees were generally not planted for economic production benefits but as part of forward planning and succession management, potentially increasing the value of the property if it were to be subdivided in the future. The trees may be providing extra shelter to stock that may or may not have productive benefits – the owners feel that this is almost impossible to ascertain.

vegetation management

While the owners are currently increasing the native vegetation cover on the property, they are concerned that in the future they might face restrictions on what they will be allowed to clear. Possible future management changes may include a change in irrigation practices that are required to keep the property viable. The operator is concerned that native vegetation clearing restrictions could prevent these management changes in the future. These concerns are starting to influence the location and type of vegetation that is being planted.

The owners have also become aware of farmers who have applied to clear vegetation for centre pivot irrigation and the lengthy delays of the process in the Northern Victorian region. He is particularly concerned with the delays in processing clearing applications that create opportunity costs in delayed income, possibly by a whole season, adding to the costs associated with the application process (see case studies 7 and 8).

plans for the next five years

The owners have plans to possibly diversify the business into farm stay accommodation. The increased value of the land as an accommodation business has also been considered when the owners have been deciding the level and location of new vegetation plantings.

Additional plans include a diversification into other crops such as blueberries or hazelnuts, depending on their viability. Expanding the land base is also an important option for the owners as they believe that in ten to twelve years there will be three generations of families trying to draw a living from the property. To maintain a sustainable and viable business to meet extended family needs, it is likely that the operation will have to increase in size and diversity.

changes in the area and current pressures on the business

The owners perceive that over the past ten years, the declining terms of trade for farming have meant that it is no longer possible to remain competitive as a small operation. The owners believe that farms need to increase in size to safeguard viability. With smaller margins it is easier to make mistakes that have a large impact from which it is harder to recover. They believe that maintaining a sufficient margin to cope with uncertainties such as drought and price movement is important.

In response to these pressures, the owners have increased the size of their operation by purchasing additional land as well as moving toward increased land use intensity to increase yields where appropriate. However, the owners recognise that in some circumstances there is a decreasing return to intensity and are working to reduce the input costs of the business.

Planned increased use of technology includes global positioning systems navigation that increases fuel efficiency and provides opportunities for precision farming. This increased use of technology is a trend that the owners have observed across the region and the industry. Farmers are recognising that with falling prices, increased productivity and reduced input costs are the main avenues for increased returns and profitability.

Additional pressures perceived by the owners include increased fuel costs and flow-on effects to increased energy costs, freight costs and other inputs. They believe that increasing land values in the area have changed their management philosophy to manage the property to cover costs and a modest profit rather than high rates of return. This would mean that long term profits will come from asset growth. They are changing their investment strategies accordingly and feel that the value of land in the area is too high for a profitable farming investment and the owner is therefore keen to maintain the amenity value.

case study 7: land use change – Bordertown region, south east South Australia

regional characteristics

The south east region of South Australia is bounded by the Victorian border to the east and adjoins the Murray Darling Basin to the north and west. The region has a low relief landscape that contains few surface water streams or rivers. Water for industry, irrigation, stock and domestic use is sourced primarily from the ground-water system (SENRCC 2003).

Soil types and landscapes in the region can be classified into three broad areas. From the east of the Naracoorte range to Tintinara has an elevated landscape with light soils overlying buried clays and sands that support primarily dryland cropping and grazing enterprises. The Mount Gambier region has much higher rainfall and features more intensive livestock grazing and horticulture on deep, fertile soils. The coastal plains are composed of sandy calcareous soils of low fertility (SENRCC 2003).

Flora and fauna species in the region are highly diverse, with native vegetation covering around 13 per cent of the region. A number of native vegetation types now consist largely of remnants along roadsides or as scattered woodland and forest trees on private land (around three-quarters of the remnant native vegetation in the south east region is on private land). Typical plant communities include red gum woodland, string bark forests, and grassy woodlands (SENRCC 2003).

The agricultural industry is predominantly composed of large scale sheep properties, cereal cropping, beef cattle, dairy, wine grapes and horticulture production (SENRCC 2003).

In 2004-05, the south east region of South Australia contained 2828 agricultural establishments (ABS 2006). Around 60 per cent of these establishments reported some native vegetation on their property, while nearly three-quarters reported weeds as the most significant natural resource management problem.

property background

The owners purchased the property in 1990, and have since expanded the operation by purchasing additional land. Currently the farm business covers 1030 hectares and is valued in excess of $3 million. The main enterprises are prime

lambs, white clover, dryland cropping and wool production. The collapse of the wool market in 1991 directed the owners toward white clover production.

Prior to the introduction of irrigation technology, the land was not suitable for cropping and was predominantly under grazing. Irrigation technology, falling rainfall reliability, increased value of water licences and opportunities for commercial seed production provided incentives for land use change and the adoption of conservative management practices such as direct drilling techniques.

Extensive centre pivot or boom irrigators are replacing flood irrigation technology previously used in the area. Flood irrigation methods were considered inefficient, with an uneven distribution of water for the crops and excessive water application in general. Pivot irrigation systems have provided opportunities for efficient water use, rotational practices to meet sanitary requirements for commercial seed production and a greater certainty in the farming business. Currently there are three pivot irrigation systems in operation on the property that allows optimal use of the existing water licence.

property management issues including vegetation

The owners have undertaken approved clearing of a small number of scattered River Red Gum trees on the property to install pivot irrigation systems. The farmer believes the development resulted in a net environmental improvement as areas were set aside, as part of the approval process, to compensate for the small number of tress removed. He was concerned that although it is not possible to save trees that interfere with the optimal location of the centre pivot, with an investment of around $150 000 to irrigate 32 hectares, the environmental benefits associated with using pivot irrigation systems compared to flood irrigation is often overlooked. On full development the property will have 100 hectares under pivot irrigation, but all pivots will not be used at the same time.

During investigations for the optimal location of centre pivots, the primary concern has been to match the soil type that provides the greatest net returns on the investment and to use water efficiently. As clay and sandy soils intersperse the region, location of pivots on clay areas is critical to ensure the right conditions for white clover. Tree clearing issues bring a further layer of complexity in the choice of location to create tradeoffs between financial, environmental and agronomic issues. The owners have been conscious of the need to minimise tree removal to preserve both environmental values and reduce the set up costs of the operation. The ability to use offsets in seeking development approval was considered a significant benefit in this regard.

The areas set aside for conservation by the landholder in this development far exceed the statutory requirement under the Draft Guidelines for a Native Vegetation Significant Environment Benefit Policy adopted by the Native Vegetation Council, South Australia. Restoration will involve fencing to remove stock, selective use of herbicides for broadleaf weed control, natural seasonal flooding to promote regeneration of red gums and encouragement of existing patches of native grasses.

In addition to the offsets, the owners also have revegetated areas of the property through direct seeding of the 'Frances mix', containing seeds of local bush varieties, to create biodiversity corridors and established wetland areas on their property.

native vegetation clearance and opportunity costs

On this property, native vegetation became an issue of concern only with the installation of centre pivot technology. The first centre pivot that was installed did not require the clearing of any trees; the owners located the area that posed the lowest setup costs for the greatest return. The second pivot required the clearing of four red gum trees with the owners providing an offset area of stringy bark trees to be protected. The third application was initially refused but was eventually approved following negotiation.

For landholders, pivot irrigation systems provide increased water use efficiency and reduced water and environmental costs compared with flood irrigation. Additionally, when a set of centre pivot irrigators is established on a property, there are a number of awkward areas between the circular irrigation areas that are unsuitable for agricultural purposes apart from intermittent grazing. The landholder believes that these areas provide potential to achieve low cost environmental benefits. Planting these areas to trees could also generate production benefits in terms of shelter and wind breaks.

The third application for vegetation clearing on the property was initially refused. Throughout the process, the owners felt that there was little flexibility in the assessment process and in particular they felt frustrated and intimidated by some individuals who acted as if they were not conversant with farming operations. The cost of the application of around $5000 – 10 000, which includes the preparation of a vegetation plan, fencing, planting of tube stock, spraying and ongoing costs of the offset area, was not the key issue of dissatisfaction.

The owners raised concerns over the effects of putting farmers offside during this process implemented to maintain native vegetation on farming properties. If

farmers do not feel that they will be treated fairly during the process then there is no incentive for them to manage and promote vegetation for environmental benefits in the future. It was thought that frustration might discourage farmers from protecting vegetation from stock and entice removing young trees before they are established as an insurance against future costs. Therefore they feel it is important to recognise the commitment that they have to protecting native habitat as they themselves place a significant value on the rural environment.

The landholder noted that 'not enough credit is given to farmers for the money and time they put into protecting native vegetation and restoring areas of native vegetation'. 'The Native Vegetation Council is still very inflexible on applications to clear vegetation', the landholder concluded.

case study 8: Bordertown region

property background

The owners purchased the initial property in the 1990s and have since bought adjoining and additional properties to form the current operation of around 450 hectares involving cattle, sheep and irrigated white clover.

Before the owners purchased the property, it had been run as a cattle stud and was considered to be heavily overcapitalised. Despite the overcapitalisation, the previous owners of the property were environmentally conscious and had planted many trees. This high level of vegetation and the degraded condition of the land had devalued the property. This devaluation represented the costs required to improve returns as well as the changing social values restricting the ability of farmers to clear land.

The current owners place a high value on the visual amenity of trees on the property and this is what attracted them to purchasing the land. As well as amenity value, there is also a significant value placed on knowing that the property is being managed in an environmentally sustainable manner.

property management issues including vegetation

Since purchasing the property, the current owners are planning to improve the environmental and production values of the property. These include setting aside areas for natural uses and developing more productive areas under centre pivot irrigation to increase commercial benefits.

The owners also place significant value on improving environmental benefits above those produced jointly with agricultural production. They maintain existing vegetation in nonproductive areas and have been involved with the Department of Environment and Heritage in a revegetation program. Under this program, 120 hectares have been set aside for a vegetation corridor – the department provided half of the funding for the program and the owners have volunteered to meet the other half of the costs.

The owners claimed that they also employ consultants and agronomists to provide advice on the management of the land and the crops; however, the final decision on whether to follow the advice usually comes down to their preference for a balance between production and environmental returns from the property.

native vegetation clearance and opportunity costs

The owners currently have three centre pivot irrigation systems operating on the property and an application for a fourth is under consideration to irrigate a total of about 133 hectares. Each pivot will be used on a four year on, four year off rotational basis to reduce soil degradation, salinity and disease risks. The first two installations did not cause problems as the chosen areas were of low environmental risk, either containing no scattered trees or some dead trees. The third application has required some environmental offsets.

The application for the final centre pivot was initially rejected on the basis that some of the trees earmarked for clearance represented a high environmental risk as they provide habitat for south east red tail black cockatoo, a rare and endangered species. As the feeding habitat for this species in South Australia is highly fragmented all Buloke trees (*Allocasuarina luehmannii*) within this region are considered important habitat for this bird species. A revised application involving a reduced irrigation area and smaller number of trees is being considered by the South Australian Native Vegetation Council.

The owners are concerned that the time it takes for approval is essentially time lost for farming, which amounts to lost income opportunities. The owners feel that government agencies appear to take a long time to return answers, thus creating opportunity costs. Even a delay of three weeks after a lengthy application process could result in a missed cropping season, from having to wait for the next season – as timing is critical. The owners think that timing issues are not well considered under the current program.

The owners also questioned the capacity of the assessment panel to judge the complex issues involved, in particular the context of farming and the conscious efforts being taken by landholders to provide net environmental benefits. The owners believed that the trees earmarked for clearance are in the final stages of their life span, providing limited environmental values and that the offsets offered are an efficient way to more than compensate the losses.

If the applications were denied, the owners indicated that they would not contribute the proposed offsets as they feel that there are sufficient wind breaks, shelter belts and other vegetation currently on the property to provide private production, environmental and amenity benefits. The offsets are offered purely as a compromise to increase agricultural production while recognising the environmental issues that the public is concerned with.

changes in the farming sector

The owners entered the farming industry when they purchased the property in the 1990s and one of the main issues worrying them is the difficulty that farmers have in addressing the declining terms of trade that they face. As a price taking industry, the only avenue that farmers have for increased returns in the industry is increasing productivity. The introduction of new technology is one of the main avenues through which farmers will achieve this increased productivity. An additional change that has been noticed is the declining population in rural communities.

4

general insights

Although there were differences in the location, intensity of land use and the enterprise mix among the farms examined, a number of common themes emerged from the case studies. There were also some issues that were not common but were critical for the success of farm operations.

opportunity costs of land clearing restrictions

In general, the case studies did not highlight land clearing restrictions as a significant concern in the operation of the farm businesses, except in relation to land use change involving intensive irrigation developments in the Bordertown region case study in South Australia.

In the case studies, concerns were raised about the approval process and the frustration resulting from delays and inconsistencies.

- Landholders believed that controls on vegetation clearance are necessary to avoid inappropriate clearing that could disrupt the environment and cause community concerns.
- Although vegetation management involves costs to farm businesses, these costs were not regarded by the case study participants as significant in the context of overall business costs, and were unlikely to pose a threat to the viability of farm businesses. It was noted that marginal businesses would be vulnerable to any cost increase, irrespective of the source.
- Scattered trees were an issue of concern in the Bordertown region case study where they often conflicted with landholders' preferred location for installing centre pivot irrigation systems. Although farmers could often proceed with developments by offering appropriate offsets, they were concerned about the delays and apparent inconsistent treatment of applications in the approval process. The approval process was considered to be inflexible.
    - Operators of the case study farms did not consider the application costs of around $5000 to $10 000 to be prohibitive in view of the overall investment of around $150 000, and the potential high returns over the long term. The key driver of these investments was the potential to increase returns by growing a high value crop such as white clover for commercial seed production.

- Concerns were raised about vegetated areas becoming sources of pests, disease and fire hazards if left unattended. The importance of careful management was highlighted as a tool to avoid such risks. Crash grazing with sheep was a popular practice to keep weeds under control in fenced off areas containing native vegetation.
- In most cases landholders believed that the benefits of appropriately managed nonbroadscale native vegetation were likely to outweigh the costs, particularly in the long run. The benefits of native vegetation identified in the case studies were largely consistent with scientific studies (appendix A).

native vegetation and farm production

Many case study farmers claimed that improving productivity is a 'must' to remain viable in the face of declining terms of trade. Increasing the scale of operation and matching land use to 'land class' was a strategy adopted by a number of case study farmers.

- A larger farm could offer greater flexibility to match land use to land capability and gain spatial complementarity in land use by establishing vegetation in areas that were the least productive for agriculture.
- Converting 'odd paddocks', 'corners' and 'triangles' to vegetation after allocating productive areas to cropping was claimed to provide both production and environmental benefits, such as those summarised at appendix A.
- Farm forestry was cited as an opportunity to gain complementary production and environmental benefits from land that was not profitable to farm. However, the viability of this option would depend on the demand for logs, availability of market opportunities and appropriate management, such as trimming, to achieve the necessary quality of logs to suit market needs.

vegetation, sustainable management and succession planning

- Vegetation management was seen as an integral part of sustainable farming and the long tem viability of the business, including succession planning.
- All case study farmers noted that vegetation improves the aesthetic value of the farm and that in turn could enhance resale prospects as most buyers would prefer a 'well maintained property' to a 'rundown farm'. This was seen as

particularly important for farms located around urban areas where nonfarm development prospects were more likely.

- The landholders' motivation for vegetation management stems from their desire to increase profitability, asset value and lifestyle benefits.
- This motivation has led to management approaches that consider both the short run viability and the longer term asset value to varying degrees across the case studies.
- Sustainable practices reduce long term costs, particularly as costs escalate once degradation sets in. For example, revegetating an average block costs around $600 per hectare, but on severely degraded blocks it is likely to cost much more. The costs and benefits involved would vary widely, depending on site characteristics.

benefits of collective action

As discussed in chapter 2, landholders are unlikely to fund activities where the benefits are primarily offsite or public. Therefore, individual effort alone may fail to provide the level of on-farm vegetation that is desired by society as a whole. To account for this, various government programs support collective actions as a means of achieving greater public benefits.

- It was evident from the survey that government natural resource management programs and various incentives are encouraging landholders to invest in on-farm vegetation.
- NRM programs, influence from children, family members and peers, and general community awareness of the importance of native vegetation have also led to a change in attitude by many toward a more holistic approach to farming. In these cases, any incidental costs are often seen as an investment in safeguarding future prospects rather than a cost that could be avoided (box 1).
- It was evident from the case studies that support available through government natural resource management programs has created a positive environment for investment in vegetation improvement in terms of sharing costs, promoting awareness and encouraging adoption of practices that are attuned to local conditions (box 1).

box 1 Upper Torrens land management project

The Upper Torrens land management project is one where the private and collective interests of landholders have been successfully managed to achieve complementary public good outcomes. The project, comprising around 80 landholders, has addressed a range of resource management issues by focusing on land management planning as a tool to promote sustainable land management practices.

- The project has coordinated on-ground works within local catchment groups to improve agricultural productivity, to rehabilitate saline lands and improve biodiversity in the region.
- A key feature of the project has been the involvement of several local catchment groups implementing an integrated program of on-ground works, property planning and capacity building as part of the investment strategy for the region's natural resource management plan.
- The project has demonstrated sustainable land management practices that increased the agricultural productivity and the environmental performance of individual properties and the catchment. Anecdotal evidence, such as stock agents' feedback to landholders, indicates that the quality and the number of stock being turned off have improved each year over the past three to four years in the Upper Torrens catchment, particularly in properties undertaking better land management practices.
- Activities that have been based around individual property plans that documented current and planned infrastructure and proposed activities using a geographic information system (GIS) have included targeted revegetation, fencing off discharge areas and control of invasive species. The project also canvasses protecting individual trees in paddocks with post and rail fencing to facilitate the development of an understorey and groundcovers, thus contributing to biodiversity, preventing soil erosion and reducing and containing the impacts of salinity.
- The project has encouraged monitoring as an ongoing activity where piezometers have been drilled on properties to monitor groundwater levels and develop an understanding of the linkages between on-farm and regional hydrology.
- These activities have been coordinated by a dedicated project officer, who also acted as a community broker who linked the landholders with access to financial incentives, and provided advice consistent with the specific needs of individual properties and the common issues affecting the Upper Torrens catchment.
- The planning process has enabled individual landholders to prioritise their activities while also considering catchment level outcomes, providing opportunities to achieve complementary public good outcomes from coordinated private action.

continued...

box 1 **Upper Torrens land management project** *continued*

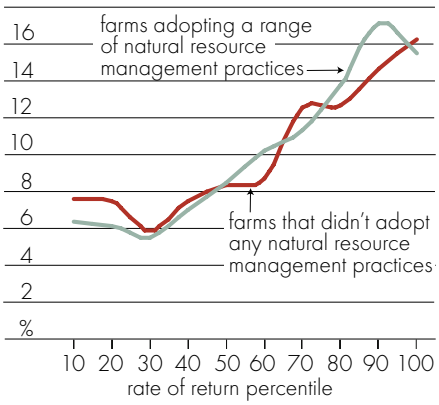
- A focus on selecting appropriate management actions to match resource conditions and other constraints specific to the location with land use has minimised conflicts and reduced the risks of failure. In this case, the project has helped landholders to operate in ways that are consistent with community expectations.
- The catchment is an important source of urban water for Adelaide.

The program is in its eighth year and is run in conjunction with various funding authorities, including the Natural Heritage Trust, Mount Lofty Ranges Catchment Program, Torrens Catchment Water Management Board and the Upper River Torrens Landcare Group Inc. Two local government bodies, the Barossa Council and the Adelaide Hills Council, support the project with their contribution of office and administrative support and cash and in-kind support.

insights from farm survey analysis

In 2005, ABARE conducted a survey of natural resource management on broadacre and dairy farms. In general, farms that undertook various natural resource management practices did not differ much from farms that did not undertake these practices. For example, distributions of both groups of farms by rate of return were virtually identical (figure A).

fig A **distribution of farms, by rate of return**



While more detailed analysis reveals that there were small groups of farms undertaking a range of natural resource management practices that differed significantly from farms that did not undertake those practices (such as pastoral zone farms), no useful comparisons could be made in a scale relevant to this study. This suggests that there is likely to be considerable variation in the cost of conserving native vegetation among farms, particularly when the other environmental trade-offs such as salinity, climate and hydrological benefits are considered in tandem with benefits of vegetation management.

5

synthesis and way forward

Agricultural systems vary considerably across the landscape and over time. The level of environmental benefits achievable in a given landscape will be determined by the nature and composition of agricultural activities and associated land uses in that landscape. In this respect, grassy woodlands, for example, that extend across the mixed livestock–crops farming belt provide significant opportunities to achieve complementary agricultural and environmental benefits through appropriate management. McIntyre et al. (2002) discuss a range of opportunities to harness environmental benefits in these production systems. However, at any given scale, achieving environmental benefits becomes increasingly costly after a point.

In a landscape that encompasses many properties and agricultural systems, alternative configurations of farming activities may provide cost effective opportunities to improve environmental outcomes. The complementarity and competitive relationships in the joint production of environmental and private goods are important determinants of cost effective land use combinations (Lockwood, Walpole and Miles 2000).

The economic analysis in this report uses the concept of joint production to examine the nature of production relationships involving complementarity and competitiveness in the provision of agricultural and environmental outcomes on a farm (box 2).

In this chapter, a synthesis building on the insights drawn in the previous chapter in the context of the joint production framework is provided. Whether socially efficient nonbroadscale land clearing, that does not involve inefficiently high environmental costs, can occur is addressed through a set of options available to manage cost–benefit tradeoffs.

The joint production model (box 2) used in this study to examine the linkages between vegetation and agricultural outputs derived from farm land was equally applicable across all case study farms. The stylised production relationship is presented in figure B.

The relationship between agricultural output and environmental benefits, as a way of illustrating the vegetation management issues considered in this report, is shown in figure B. The shaded area represents the possible output combinations of the environmental services and agricultural goods that can be produced on a farm, using existing resource endowment and technology.

box 2 joint production model

Commercial farming invariably produces both positive and negative environmental outcomes. Land primarily used for agriculture may produce many secondary benefits such as increased visual amenity, carbon sequestration, pest control, soil nutrition, etc. These environmental benefits, or positive externalities, may sometimes come with negative externalities, for example a decline in water quality resulting from soil salinity or soil erosion. In farm management, these positive and negative environmental outcomes can be considered as joint products of farming.

Some features of these joint products are of interest, because they affect the way in which farmers manage their businesses. The first is the public good nature of the environmental benefits – public goods are those that benefit everybody, but are in no individual's full self interest to provide. For example, biodiversity that may be preserved through protecting vegetation from clearance may not be a preferred option for a farmer because farmers are not able to capture the full returns from their investment. Biodiversity that is preserved will be determined by private returns from agricultural production and private environmental benefits. Because the value that society places on environmental benefits is higher than the corresponding value placed by an individual, it is unlikely that the socially optimal level of environmental benefits will be provided by profit maximising landholders.

Second, while agricultural goods and environmental outcomes may be jointly produced, in some situations certain environmental outcomes are complementary while in others they are competitive. In the absence of incentives encouraging environmental protection, however, the level of agricultural production is the main determinant of the level of environmental outcomes that is achieved, whether these environmental outcomes enhance (complementary in production) or reduce (competitive in production) agricultural production.

competitiveness in production

In general, most production activities compete with each other as the production of the goods generally involves competition for inputs. In this case, an increase in the production of one good can occur only at the expense of the production of other goods. In a joint production system, such as a farming system, this usually occurs when an input such as land, machinery, investment capital or management time becomes limiting and thus requires rationing between the activities generating the competing outputs.

A topical example is the presence of dense vegetation on grazing land. The vegetation provides environmental and amenity values, but could also reduce the carrying capacity of the land. The landholder has no incentive to maintain or expand the vegetation as it involves opportunity costs in forgone livestock sales that could

continued...

box 2 joint production *continued*

be generated from the area under vegetation. The loss to the landholder, or the marginal opportunity cost, is the difference in value between the two activities.

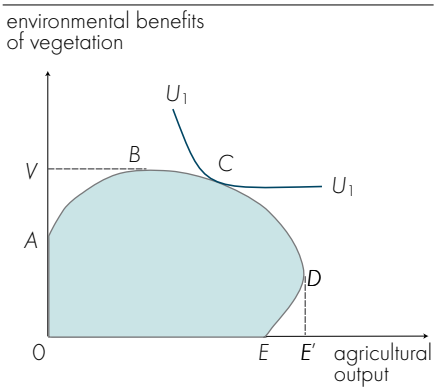
complementarity in production

Complementarity in production arises when a set of common inputs is used to produce multiple outputs. In this case, if an increase in production of one good, such as agricultural output, using land as an input, also concurrently provides environmental services from that land, then agricultural output and environmental outcomes can be considered complementary. Alternatively, improving agricultural output through improved land management could result in an improvement in environmental benefits. When there are such complementary benefits between the agricultural and environmental goods, the costs to landholder of increasing environmental values would be lower than in the case where the two activities compete. For example, strategically placed trees on a grazing property may provide shade to grazing animals while also enhancing visual amenity. However, trees on a cropping block could obstruct sunlight and reduce crop yields.

The segment *AB* indicates that under certain conditions at low levels of agricultural output, an expansion in output may also yield positive environmental benefits, such as enhancing the landscape. This complementary relationship may exist, for example, when land has been reintroduced to agricultural practices after a number of years being rested and has been interpreted as a positive externality of agriculture, or one of the multiple benefits from a production landscape (McIntyre et al. 2002).

Segment *DE*, which is outside the efficient region of production, shows the implication of 'inefficient technology choices' such as fertiliser application rates and inadequate soil and water management measures. Such practices, in this illustration, are assumed to result in fewer environmental services and lower agricultural production compared with, for example, point *D*.

fig B **stylised production relationship between agricultural production and native vegetation**

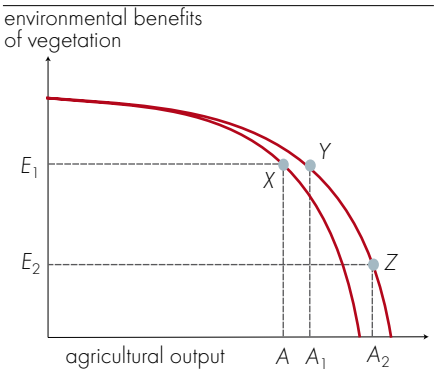


Because social expectations of land management include both agricultural and environmental benefits, the socially optimal level of joint production (point C) lies within segment *BD*. However, in the absence of appropriate agricultural and environmental policies, the social optimum is likely to be missed. This is likely to be the case because the optimal combination of production for a profit maximising land manager would lie to the right of C, because landholders do not receive compensation for producing environmental benefits for others. Landholders more 'conscious' of environmental impacts would be likely to operate in the upper region of *CD* and be willing to trade off more agricultural output for environmental outcomes. Landholders with lower private values of environment outcomes would operate closer to point *D*. Landholders who are not aware of all available land management practices may follow output combinations in the region *DE*.

The segments *AB* and *DE* represent inefficient combinations. Production combinations represented in the segment *BCD* are all efficient. If the motives of the landholder could be represented by the utility curve U_1U_1, a level of output combination C would become optimal for that landholder. Most of the landholders surveyed in this study could be located on the segment *BCD* of this curve.

Across the case studies investigated, the landholders achieved improved vegetation outcomes with no or limited impact on agricultural production. This situation can be explained in terms of technology choice. Changes in the available technology will alter the production relationships. For example, it may be possible to introduce improved technologies and land management practices that change the ratio of environmental outcomes and agricultural output produced. A production system that would achieve greater synergies can yield increased agricultural production and increased environmental outcomes – or, at the very least, an increase in either environmental outcomes or agricultural production with no reduction in the joint output.

fig C **improvement in technology that allows increased agricultural production for every level of environmental outcome**



First, considering the efficient production possibility set in figure C for a change in technology that maintains the level of environmental benefit at every level of agricultural production, a landholder can

choose to operate at point *X* and contribute E_1 level of environmental benefits and an agricultural output at level *A*. Then, for example, by adopting a new technology that will allow relocating activities on farm to more consistently match landuse to land capability the landholder is able to produce an increased level of agricultural output denoted by A_1, while maintaining the level of environmental benefit at E_1. On the other hand, depending on the preference of the landholder, the same technology may allow another farmer to adopt output combinations E_2 and A_2 by operating at point *Z*.

Therefore the range of production patterns depicted in figures B and C reflect a combination of possibilities that are determined by the stage of development of a farm and the nature of technology being adopted.

It was also noted that degraded land for various reasons relating to previous management can be restored profitably through the application of new knowledge. This situation was clearly evident in case study 4 where the current owners have adopted a progressive restoration strategy resembling a move from the inefficient zone *ED* in figure B to segment *DB*.

no net loss and net gain policies

The policy objective in state vegetation legislation is to achieve a balance between development and biodiversity. In attempting to strike this balance, vegetation is often used as a surrogate for biodiversity, and the policy guidelines stipulate a requirement to achieve 'no net loss' or 'net gains' in biodiversity in granting approval for development activities.

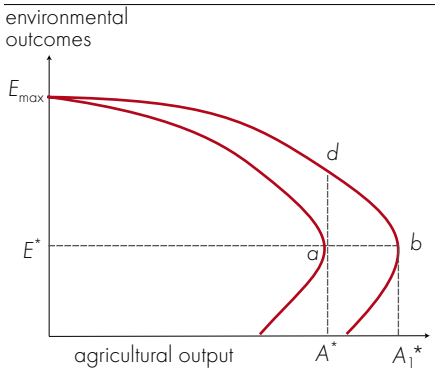
In the case of agriculture, the need to alter existing vegetation arrangements usually arises when farmers are considering new technologies that result in either a change in land use intensity or spatial rearrangement of existing activities or both. The net result is a shift in production to a higher level than was previously possible. The environmental outcomes associated with these productivity increases may take different forms.

For illustrative purposes, in figures D and E, a case is considered where a production increase has been gained with no change in net environmental benefits. It should be noted that other technological changes and change in the production relationship are possible (see appendix D).

For an investment in new technology, the relationship between likely production and environmental outcome that is allowed under existing legislation may resemble one of two general situations (figure D):

- no net loss – an increase in agricultural production with no net loss of environmental outcomes, which involves a move from the assumed initial production point *a*, to any point along the new production relationship between (and including) point *b* to point *d*.
- net gain – an increase in production with a net gain in environmental outcomes, which involves a move from the assumed initial production point *a* to any point along the new production relationship between point *b* and point *d* (including point *d*).

fig D **no net loss vs net gain requirements**



The subtle difference between these situations is the flexibility available to a farmer to extract the greatest increase in agricultural production from the change in technology. Point *b* in figure D represents the point of maximum potential benefit under a 'no net loss' scenario. Under a 'net gain' policy, farmers must sacrifice some of the benefits of increased production to provide for a net increase in environmental benefits. It should be noted that there are situations when there is no welfare effect on farmers from imposing a 'net gain' policy.

When a farmer's private value of environmental outcomes has increased with the technology change, then it will be in the farmer's interest to improve environmental outcomes with agricultural output. Additionally, when the new production relationship is such that the maximum level of agricultural production occurs with a net gain in environmental benefits (figure F, appendix D), environmental outcomes will be increased from the initial level while agricultural output is still maximised. It was also noted in the case study investigations, where farmers were willing to set aside larger areas of land than required to meet the approval conditions for irrigation development.

effects of losing support

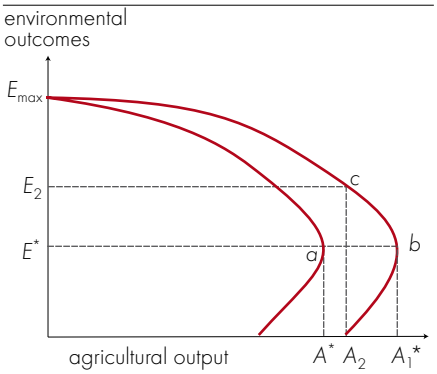
Improvements in farming technology such as the introduction of centre pivot irrigation systems in the south eastern South Australia studies is a topical example of the effect of technology on possible environmental and production relationships on private land. The production relationship observed in case studies in this region is represented in figure E.

Irrigation technology has allowed an increase in the maximum level of agricultural output achievable from A^* to A_1^*. Allowing for efficient offsets to be established on the property, it is likely that the increase in agricultural output could be achieved with no net loss in environmental outcomes. That is, E^* level of environmental outcomes are sustained. (Note that net vegetation and environmental outcomes may be maintained even with nonbroadscale clearing and no offsets if the use of centre pivots is more environmentally beneficial than say flood irrigation.)

The effectiveness of policy measures to garner landholder support is important in optimising the level of environmental benefits produced on private property. For example, one of the common issues raised in the case studies was that farmers were willing to increase the level of environmental production on their properties above the no net loss requirement to gain approval to introduce new technology to increase long run profitability. This is illustrated as a move from point *a* to point *c* – an increase in agricultural production (from A^* to A_2), with improvements in environmental outcomes (from E^* to E_2).

Absence of the flexibility provided by the offset arrangements may lead to a suboptimal outcome for both the landholder and society. A scenario expressed by some landholders is that if approval to introduce the new technology and to offer offsets to compensate for the vegetation providing environmental benefits in other areas of their land is not granted, farmers may be forced to wait, producing at the current production level *a* in figure E, until the vegetation has died off naturally (thus gaining flexibility to relocate dead trees that may be providing bird breeding habitat if required) and

fig E **introduction of irrigation technology with an offset scheme**



then introduce the new technology, having circumvented the regulation process. Under these circumstances, production levels will move from point A^* to point A_1^* – an increase in agricultural production with no improvements in environmental outcomes, or a reduction in environmental outcome represented by a downward movement along the vertical segment of the new production curve below E^*.

It was, however, evident in the discussions that coordinated action can mitigate the likelihood of such suboptimal outcomes. In particular there are opportunities to appropriately use information, incentives, suasion and regulatory mechanisms to achieve a socially optimal regional allocation of land uses. In this regard, integrated assessments that take into account the linkages between resource management objectives across property, regional, state and national scales could offer significant opportunities to gain spatial complementarities in land use. That would also permit the flexibility to use regulatory mechanisms as the instrument of last resort, whereas coordinated action – such as voluntary compliance and spatial tradeoffs in allocating different activities across different areas of the property become the primary tools for land use allocation decisions.

The role of the market as a coordinating mechanism of individual preferences remains crucial in developing appropriate and efficient solutions. Voluntary approaches such as Bush Broker and Bush Tender may be the appropriate choice of instruments in a broad range of situations. On the other hand, involuntary approaches such as direct regulations may be more appropriate when the environmental damage may involve thresholds beyond which catastrophic or irreversible damage could occur.

6

conclusion

The case studies examined in this report suggest that in many cases, nonbroad-scale native vegetation management offers net benefits to landholders, with operational costs being offset by increased productivity, increased asset value and improved aesthetics. Some of these benefits also accrue to the wider community as complementary benefits of sustainable farm production.

The case studies also revealed that the primary motivators for on-farm vegetation management were profitability, asset value and lifestyle benefits. The landholders also recognise the need for some regulatory compliance, and the benefits of natural resource management programs for sustainable and profitable farming. Landholders are concerned, however, about increasing information requirements and monitoring and compliance costs. In particular, landholders are frustrated with the administrative arrangements and inefficiencies in approval processes, such as those relating to land use change involving permits for clearing scattered trees to install centre pivot irrigation systems.

Property management planning aligned to regional priorities could identify emerging issues and offer flexibility for landholders and the community to minimise management conflicts and reduce overall costs in natural resource management. Despite its clear intent and the flexibility attached to the offset provision, regulatory processes, such as those applied in the Bordertown region case studies, could run the risk of alienating landholders. If a process results in poor landholder cooperation and high regulatory costs, it could increase the risks to native biodiversity that the regulatory system is designed to protect.

In developing appropriate and efficient solutions, the role of the market as a coordinating mechanism of individual preferences remains crucial. Voluntary approaches such as Bush Broker and Bush Tender may be the appropriate choice of instruments in a broad range of situations. Offsets also offer significant potential to address tradeoffs between production and environmental outcomes. Involuntary approaches, such as direct regulations, may be more appropriate when the environmental damage involves thresholds indicating catastrophic or irreversible damage. It is important that the community and landholders work collectively to develop innovative and cost effective solutions that provide greater flexibility to landholders and better environmental outcomes to society.

A appendix

benefits of remnant vegetation

Remnant native vegetation on private property contributes to a range of market and public goods and services that accrue to the landholder and society, either directly or indirectly. The nature of these benefits plays an important role in shaping community expectations for native vegetation management on production landscapes.

The benefits from native vegetation on private property can be classified as production and environmental benefits. The benefits associated with retaining or improving native vegetation on private property could arise for improved productivity or environmental quality or both. The benefits of improved productivity accrue mainly on-farm, although they can accrue to other landholders (for example, reduced salinity). The environmental benefits associated with native vegetation are largely a public good that accrues to the wider community, including landholders.

onsite benefits

The economic benefits provided by vegetation on-farm are linked to increases in crop, pasture and stock productivity, opportunities for commercial products and increases in land value. The benefits vary from farm to farm, depending on the location, type of vegetation, nature of agricultural activities and other farm characteristics.

productivity benefits

Productivity benefits associated with remnant native vegetation in crop and livestock production may arise through improvements in the biophysical environment. These include:

- providing shade and shelter for crops, pastures and livestock. Shelters reduce wind speed, which helps maintain soil moisture, leading to improvements in plant growth. Shelters protect stock from temperature extremes, thus reducing stress related productivity losses and mortality. During cold weather, shelters could help reduce energy loss, leading to higher weight gains. Other reported benefits provided by shelters include improved fertility in sheep and improved milk production in cattle (Bird et al. 1992).

- trees and shrubs, particularly along streams banks and slopes reduce soil erosion, nutrient runoff and sediment flows, and contribute to maintaining water quality, with consequent improvements to animal health.
- preventing and controlling salinity, soil acidification, water and wind erosion, soil structure decline, nutrient depletion, and water logging. These have been associated with higher crop production, better pastures and better health in the farm animals.
- providing habitat for crop pest predators that play an important role in pollination and pest control services. For example, shelterbelts with ground cover appear to harbor a diversity of beneficial organisms that suppress pest numbers in adjacent pastures (Tsitsilas et al. 2006).
- providing fodder for livestock during drought.

Various studies have estimated the productivity gains of remnant native vegetation to agriculture and the local economy. For example, Lockwood et al. (2000) found that 20 metre high native remnant vegetation contributes to a 20 per cent increase in the gross margin for crops in a 40 metre zone around this vegetation. The same study and also many other studies (Lynch and Donnelly 1980; Dengate 1983; Bird et al. 1984; Richmond 1992; Fitzpatrick 1994) found that remnant vegetation on-farms contributes to increases of up to a 20 per cent in stock production through enhanced livestock health and pasture production.

Lockwood et al. (2000) estimated that the average benefits measured in net present value terms of remnant native vegetation over a 40 year period at $2420 per property in Victoria and $95 800 in New South Wales. The difference in net benefits between the states reflects the differences in spreads of costs and benefits – in Victoria, from –$330 000 to +$250 000; in New South Wales from $220 000 to over $1 million.

Walpole (1999) reported annual benefits of $13.95 per hectare from remnant native vegetation at Gunnedah, north western New South Wales. A benefit of $4.41 per hectare was attributed to shade and shelters and $9.54 per hectare for benefits arising from a reduction in land degradation. Fitzpatrick (1994) reported that a shelter belt of one kilometre for an average wool producing farm on a bare windswept area of southern Australia could return a net present value of $4660 over a 40 year time period. These benefits need to be viewed in the context of the upfront costs and other opportunities that farmers have to forgo to gain productivity improvements.

commercial opportunities

Various studies indicate that remnant native vegetation, under some circumstances, may also provide commercial opportunities. These include:

- honey, resulting from increased availability of nectar for bees
- cut flowers and foliage
- essential oils (teatree oil, eucalyptus oil, etc)
- sandalwood
- fruit and nuts
- timber for firewood and construction timber for fencing – for example Fitzpatrick (1994) calculated that a single shelter belt of one kilometre of native vegetation could generate $15 580 in net present value terms over 40 years from production of timber for firewood and fencing.

land value

Remnant native vegetation improves the aesthetic value of a farm, which may lead to an increase in property value. However, Lockwood et al. (2000) found that neither area nor the proportion of remnant vegetation has a significant bearing on market values of land.

offsite benefits

Preservation of remnant native vegetation on-farm may lead to economic gains for downstream rural and urban communities through amelioration of land degradation associated with salinity, water quality decline and soil erosion. These factors may increase the productivity of downstream properties through improvements in crop and livestock enterprises. For example, Whish-Wilson and Shafron (1997) estimated that the average annual cost for nonfarm businesses affected by salinity and raised watertables was $26.

Another potential economic benefit from remnant native vegetation comes from opportunities for carbon sequestration.

environmental and landscape benefits

Environmental and landscape benefits are generally referred to as public benefits as they are often associated with public goods. For example, the aesthetic value of a vegetated landscape is one of the public goods provided by remnant native vegetation.

Remnant native vegetation is a clear source of biodiversity that provides a natural habitat for many plants and animals. For instance, in South Australian agricultural regions, 125 native bird species have been found in paddock trees (SA Government 2004). Similarly, about 100 species of birds, excluding waterbirds, and fifteen species of mammals have been located in rural Victoria (Breckwoldt 1983).

In addition, remnant native vegetation could contribute to a better farming environment, thus enhancing the quality of life of farmers and rural communities. Other benefits of remnant native vegetation are attributed to its role as a barrier to noise and wind, and in improving water and air quality (Williams and Cary 2001).

use and nonuse benefits

The public good environmental benefits generated by remnant native vegetation can be viewed in terms of use and nonuse values. Use values of remnant native vegetation result from the utility derived from the actual use of the ecosystem – for example, for bird watching, observing scenery and recreation.

Nonuse values represent potential utility associated with the conservation benefits of environmental goods. Nonuse values generated by remnant native vegetation could include several components:

- option values – associated with the utility that people may place on the option to use remnant native vegetation in the future
- existence values – these reflect the value that people may derive for simply knowing that something exists, even if they will never see it or use it
- bequest benefits – of passing environmental resources to future generations.

B appendix

native vegetation policies in southern Australian states

The management of native vegetation across southern Australian states is overseen by a number of legislative arrangements, policies and guidelines administered by the three levels of the Australian governments and natural resource management authorities. Some of the key policies are summarised below, drawing primarily on publicly available information on various government web sites.

Commonwealth

Environment Protection and Biodiversity Conservation Act 1999.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) came into force on 17 July 2000. It is Commonwealth legislation that provides a national framework for environmental protection, particularly matters of national environmental significance. It streamlines national environmental assessment and approvals processes, protects biodiversity and integrates management of important natural and cultural places.

National framework for the management and monitoring of Australia's native vegetation (2001)

The Native Vegetation Framework (NVF) outlines a coordinated national approach to native vegetation management. The framework is a joint initiative of the Australian, state and territory governments, and is designed to provide a mechanism through which the native vegetation management commitments agreed to by all Australian governments can be progressed.

- A reversal in the long term decline in the extent and quality of Australia's native vegetation cover by:
    - conserving native vegetation, and substantially reducing land clearing
    - conserving Australia's biodiversity
    - restoring, by means of substantially increased revegetation, the environmental values and productive capacity of Australia's degraded land and water.

- Conservation and, where appropriate, restoration of native vegetation to maintain and enhance biodiversity, protect water quality and conserve soil resources, including on private land managed for agriculture, forestry and urban development.
- Retention and enhancement of biodiversity and native vegetation at both regional and national levels.
- Improvement in the condition of existing native vegetation.

(Department of the Environment and Heritage 2006).

New South Wales

Native Vegetation Act 2003

The New South Wales *Native Vegetation Act 2003* sets a framework for the management of native vegetation on a regional basis. The act defines different classes of native vegetation such as regrowth, remnant vegetation, and protected regrowth. The act is designed to protect areas of high conservation value native vegetation and includes provisions to reward farmers for good land management and encourage revegetation and rehabilitation of land with native vegetation (Department of Infrastructure, Planning and Natural Resources 2003).

The act is designed to prevent broadscale land clearing, except where the overall net effect is to improve or at least maintain the environment. The act is administrated through catchment management authorities. These authorities assist landholders with the preparation of property vegetation plans. A property vegetation plan is a legal agreement that clarifies the management of native vegetation on a property.

South Australia

Native Vegetation Act 1991, Native Vegetation (Miscellaneous) Amendment Act (2002) and the Native Vegetation Regulations 2003

The *Native Vegetation Act 1991* has an emphasis on remnant native vegetation in order to control the clearance of native vegetation to prevent biodiversity loss and land degradation. The act limits the clearance of native vegetation to specific allowable circumstances, including circumstances in which the clearance will facilitate the management of other native vegetation or will facilitate the sustainable use of land for primary production.

Significant amendments have been made to the act in 2002, 2004 and 2006, along with the introduction of the *Native Vegetation Regulations 2003*. The 2004 amendment to the act includes new provisions enabling the Native Vegetation Council to consent to the clearance of native vegetation for permitted activities where benefits outweigh the value of retaining the vegetation. The 2006 amendments allow greater flexibility in the management of regrowth on agricultural land.

Western Australia

Environmental Protection Act 1986

In 2004 the *Environmental Protection Act* was amended by the introduction of *Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA)*. Amendments to the *Environmental Protection Act 1986* require that clearing of native vegetation is done under the authority of a permit, unless the clearing is for an exempt purpose. Landholders are not required to obtain a permit for clearing native vegetation if the cleared area does not exceed one hectare in any financial year and the clearing is for an allowable purpose. Other exceptions include day to day clearing activities, such as maintenance of existing cleared areas around infrastructure, clearing to maintain existing cleared areas for pasture, cultivation or forestry, fire breaks and fire control, and emergency clearing. It also allows clearing upto 1.5 metres on crown land to provide access to construct or to maintain fences (Department of Environment 2006). Land owners who clear land without authorisation are required to restore vegetation at their own expense.

Victoria

Planning and Environment Act 1987.

The clearing of native vegetation in Victoria is regulated by the *Planning and Environment Act 1987*. The act provides a framework for planning the use, development and protection of land across the state. It establishes a system of planning schemes across local, regional and state jurisdictions and provides a mechanism to link appropriate controls for the use, development and protection of land through instruments such as planning permits and landowner agreements (appendix C). The provision for offsetting clearaing is included in the *Draft Operational Guidelines for Achieving Net Gain in Planning Decisions*.

C appendix

policy tools for vegetation management

The native vegetation policies in southern Australian states summarised in appendix B are administered through a number of regulatory instruments. There is a wide array of policy tools being used by different Australian states to guide sustainable native vegetation management. The Bush Broker model presented below has a number of useful features that merits further consideration in developing a national approach to vegetation management in Australia.

Bush Broker

A system of native vegetation credits registration and trading in Victoria

In 1997, Victoria's Biodiversity Strategy established a policy of 'net gain' in the extent and quality of biodiversity as a planning objective. Victoria's *Native Vegetation Management – A Framework of Action,* which was introduced in 2002 and incorporated in planning schemes in July 2003, partly implements this policy by stipulating planning approval for all development activities that affect on native vegetation. The framework extended the use of offsets in the approval process and also enabled the use of managed remnant vegetation as offsets.

what is Bush Broker?

Bush Broker, being developed by the State of Victoria to allow registration and trading of native vegetation credits across landholders and developers, provides a mechanism for potential suppliers of native vegetation to register their intentions. Potential buyers who seek parcels of native vegetation to meet offset requirements could identify suitable parcels from the list for purchase as credits at a mutually agreed price.

The scheme, managed by the Department of Sustainability and Environment, will administer the property rights through a set of covenants and management agreements. The department will also provide information to enable matching of the quality and other characteristics of native vegetation between development sites and offset localities to ensure the offset criteria applied to clearing of native

vegetation in Victoria are met. The department itself will not be involved in trading native vegetation credits; rather it will act as a quasi-clearinghouse, essentially to facilitate potential trades between buyers and sellers or their agents. In this capacity, it will develop rules and standards for the creation of credits, exchange of rights and the use of credits to meet offset requirements (State of Victoria 2006).

the rationale

The proposed statewide system for identifying native vegetation credits and trading offers a mechanism to reveal the supply costs of biodiversity and natural habitat on private land in Victoria, based on quasimarket transactions. However, there are many issues that arise in the development of contracts between government and landholders to provide environmental services. The main issue arises from information asymmetry, where farmers know what their land is capable of producing while the program managers do not know the land nor do they have a clear understanding of what the true benefits of the vegetation credits being sought.

On the other hand, being able to offer native vegetation improvements for sale as credits, landholders will have an added incentive to protect and restore native vegetation on their properties, in addition to their private values. Provided the initial administration and the information difficulties are managed effectively, this system has the capacity to partly address issues of undersupply of native vegetation as a public good. Success, however, will depend on the extent to which prices paid will reflect the scarcity of, and the demand for, particular vegetation types and qualities. In part, in the absence of actual markets for biodiversity, the system could improve the community valuation of environmental benefits of vegetation through a process of informed preferences, elicited in 'constructed' markets.

key features

Bush Broker is designed to mitigate losses incurred in permitted land use change activities and forms a critical component of a broader strategy of vegetation management in Victoria. It therefore complements the other two features of the Victorian vegetation management strategy to minimise costs, namely avoidance through project selection and location, and minimisation through design and management. Its key features include:

- Where permit applicants are unable to meet offset requirements on their own property, offsets could be generated elsewhere.

- These third party offsets will generally be located on land of the same tenure although public land may also be permitted in limited circumstances as offsets for clearing on private land. In all cases, offsets are to be matched using habitat hectares as a unit of measurement and a set of like for like rules to achieve the offset criteria.

» Generally offsets are to be provided in kind, but payment in lieu may be made where in kind provision is not possible.

- This flexibility may go in some way to expand the potential market for offsets, because it could attract corporate sector or benevolent organisations that might seek to purchase credits to demonstrate social responsibility.

» The assignment of native vegetation offsets as credits will follow a two part process. First, gains need to be generated either through management action over existing patches of native vegetation or by investment to increase the extent by revegetation. The credits may then be established by specifying and registering secure agreements that specify the nature and extent of vegetation on offer and the management plans to maintain them in perpetuity.

- At present, legal security for such agreements are derived through the *Planning and Environment Act*; the *Conservation, Forests and Lands Act*; and the *Victorian Nature Conservation Trust Act*. As the scheme becomes established, there may be advantages in unifying these provisions under one piece of legislation.

» The flexibility to source credits across different locations and from third parties is achieved by the use of a set of 'like for like' rules.

- This is a particularly strong feature of the scheme, as well as an area of potential vulnerability. The use of surrogacy principles in 'like for like' matching may confront resistance from ecologists because of potential irreversibility concerns. While better information could mitigate such concerns, other instruments such as buybacks or forgoing development opportunities may become more feasible and less controversial options in such situations.

policy effectiveness

Bush Broker can be considered a potentially effective policy instrument in environmental management for a number of reasons:

- Offsets feature prominently in the vegetation management toolbox of several Australian states. And the concept of trading natural resource access rights is familiar among landholders, particularly in relation to water, and the national market based instruments pilot scheme. Acceptance by policy makers and familiarity among potential players could prove useful if it were to be considered as a model applicable across the nation.
- Inclusion of third parties makes the system more widely acceptable. In particular, this may be the key to address 'thin market' concerns that are generally associated with constructed markets. By opening the market to benevolent and corporate sector for instance, the system could expect to draw greater participation as well as attract a broader range of preferences on vegetation management, reflecting those of the broader community that the two sectors as a whole represent.

Tradable credit systems have been in operation for some time to mitigate unavoidable environmental consequences of desired development activities. They include legally binding as well as voluntary measures that aim to achieve a no net loss in environmental condition. However, a number of areas of uncertainty could hamper widespread acceptance of this approach as a cost effective instrument in vegetation management.

- Offsets should remain as a critical component of the overall vegetation management policy to achieve cost effective vegetation management. It is imperative to ensure that tradable vegetation credits will not undermine the efficacy of this policy by artificially increasing the traded value of offsets, thereby making it a more expensive option.
    - Initial prices that may be offered through Bush Broker would reflect the learning behavior inherent to any emerging markets. Pricing would be likely to represent both overshooting and undershooting, which would likely to correct over time.
    - To minimise uncertainties and to avoid strategic responses, initial benchmarks could be set using experimental economics approaches in pilot settings as envisaged in the development of the scheme in Victoria (G. Stoneham, Department of Sustainability and Environment, personal communication, May 2006).

- Comparability – unlike industrial emissions such as sulfur dioxide or carbon credits that are based on measurable chemical equivalents, biodiversity assessments are more complex to measure, and are vulnerable to subjective

judgments (Salzman and Ruhl 2002). Difficulties also exist in determining appropriate monitoring regimes for accepted offsets because of ongoing natural change in biodiversity in line with evolutionary processes.

enhancing policy effectiveness

A statewide system like Bush Broker needs to carefully address issues of scale and location in both its design and administration. The key challenge in its development is to facilitate the revelation of opportunity costs of securing an adequate and representative system of vegetation offsets that will maintain the ecological integrity of biodiversity assets while permitting desirable development activities.

- Therefore offset projects need a strategic focus, and aim to provide net environmental improvements beyond biodiversity, and encourage the creation of environmental co-benefits. This could ensure that offset sites do not contribute to other land degradation issues, such as soil erosion, and weed and pest invasion, and do not affect regional water availability, etc.

In the early stages of development, the quasi clearinghouse that will facilitate the trading of vegetation credits will assume a range of functions corresponding to its role in Bush Broker. These include anticipating and defining the instruments that need to be developed to win the confidence of the trading parties, maintain the ecological integrity of the system to ensure 'net gains' and to facilitate ongoing management of assets to maintain its value in perpetuity.

These functions will also define a subsidiary role for the clearinghouse in gathering, analysing and disseminating information and to develop and share knowledge on best practice. At the initial stages, defining ideas in laboratory settings and testing them through pilot projects as envisaged by the Victorian Government will be an important aspect of its continued improvement. As the system develops, the need may arise for a true independent clearinghouse to manage obligations of buyers and sellers. Following successful statewide trading, and further refinement, it has the potential to be used as a model to facilitate cross border cooperation in biodiversity management.

In general, offset schemes such as Bush Broker provide a mechanism for prospective developers to bear the costs of establishing and maintaining vegetation to compensate for the losses encountered in proposed developments. The current legislation in most states allows these offsets but is largely limited to transactions within a single landholding. Extending these provisions to apply across land-

holders could allow for efficiency gains because those who are obliged to reduce or eliminate their impact on the environment, but find it too expensive or difficult to do so on their own, can thus buy the appropriate amount of offsets instead. In theory, offsetting should reduce the cost of meeting environmental compliance by landholders, by giving those for whom it is cheapest and easiest to provide vegetation the most incentive to do so. More flexibility in applying this theory in practice will maximise the benefits of such policies.

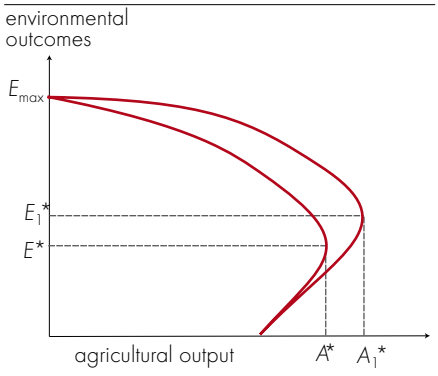
effects of changing technology on production relationships

Changes in available technology will alter production relationships. For example, it may be possible to introduce improved technologies and land management practices that change the ratio of environmental outcomes and agricultural output produced. A production system that would achieve greater synergies can yield increased agricultural production and increased environmental outcomes – or at the very least, an increase in either environmental outcomes or agricultural production with no reduction in the joint output.

The technology change illustrated in figures F and G gives higher agricultural output at every level of environmental outcome. The technology change depicted in these figures is not the only way that technology change can affect the production relationship.

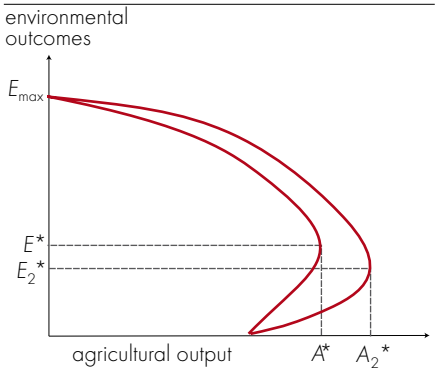
In figure F, the new technology has increased the complementarity of agricultural production through a reduction in the slope of the competitive section of the production relationship, and an increase in the level of environmental outcomes that have a beneficial effect on the level of agricultural production. Under the new technology, the maximum level of agricultural production is increased to A_1*, and the environmental outcomes that are achieved are increased to E_1*. The use of offsets to enhance the areas of concerned vegetation on properties moving from flood to centre pivot irrigation in the Border Towns area resembles this situation.

fig F **technology change that improves environmental outcomes at maximum agricultural output**



However, technology change may also result in a reduction of environmental outcomes at the maximum level of agricultural output. This is illustrated in figure G. (Note that after the technology change, the set of environmental and agricultural outcomes contains the set of such outcomes before the technology change.)

fig G **technology change that reduces environmental outcomes at maximum agricultural output**



It should be noted that the concepts being discussed are predominantly dynamic concepts where actions taken now will affect the level of production possible in the future. For example, if a chosen level of agricultural production is not sustainable, the future production possibility curve would lie everywhere below the current level. That is, future production possibilities would be reduced by unsustainable levels of production now.

Alternatively, it may be possible that reducing agricultural production now could have a beneficial effect on the production possibilities in the future. That is, future production possibilities could be increased due to reduced production now. The conservative stocking rate adopted in case study 1 may be seen as an example of this type.

references

ABS (Australian Bureau of Statistics) 2006, *Natural Resource Management on Australian Farms 2004-05*, cat. no. 4624.0, Canberra.

Bird, P.R., Bicknell, D., Bulman, P.A., Burke, S.J.A., Leys, J.F., Parker, J.N., van der Sommen, F.J. and Voller, P. 1992, 'The role of shelter in Australia for protecting soils, plants and livestock', in Prinsley, R.T. and Allnut, J. (eds), *The Role of Trees in Sustainable Agriculture*, Kluwer Academic Publishers, Dordrecht.

Breckwoldt, R. 1983, *Wildlife in the Home Paddock: Nature Conservation for Australian Farmers*, Angus and Robertson, Sydney.

Davidson, A., Beare, S., Gooday, P., Kokic, P., Lawson, K. and Elliston, L. 2006, *Native Vegetation: Public Conservation on Private Land – Cost of Forgone Rangelands Development in Southern and Western Queensland*, ABARE Research Report 06.13, Canberra, September.

Dengate, J. 1983, 'Windbreaks and shade trees help landowners and wildlife', *Habitat,* vol. 11, no. 1, pp. 14–15.

Department of Environment 2006, *Protecting Native Vegetation in Western Australia, 2004*, Environmental Protection Act 1986, Clearing exemptions: How they work, Perth (http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE_ADMIN/BROCHURE_REPOSITORY/CE%20(I).PDF accessed 14.06.2006).

Department of Infrastructure, Planning and Natural Resources, 2003, *Native Vegetation Management in NSW*: *The Native Vegetation Act* 2003, Sydney.

Department of Sustainability and Environment, *DSE Legislation*, Melbourne.

Department of the Environment and Heritage, *Environment Protection and Biodiversity Conservation Act 1999*, Canberra.

Department of Water, Land and Biodiversity Conservation, Government of South Australia 2004, *A Landscape Approach to Determine the Ecological Value of Paddock Trees*, Adelaide.

––2005, *Draft Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the Clearance of Scattered Paddock Trees*, Perth.

Eigenraam, M. 2006, Australia's auctions and banking, Paper presented to the Ninth Public Meeting of the Katoomba Group, 'Making the Priceless Valuable: Jumpstarting Environmental Markets', Portland, Oregon, 7–9 June.

Fitzpatrick, D. 1994, *Money Trees on Your Property: Profit Gained Through Trees and How to Grow Them*, Inkata Press, Sydney.

Hajkowicz, S. and Young (eds) 2002, *Value of Returns to Land and Water and Costs of Degradation*, Final report, National Land and Resources Audit, CSIRO Land and Water, Canberra.

INRMG 2003, *Integrated Natural Resource Management Plan for the Mount Lofty Ranges and Greater Adelaide Region*, Mount Lofty Range Integrated Natural Resource Management Group, Mount Barker, South Australia.

Lockwood, M., Walpole, S. and Miles, C. 2000, *Economics of Remnant Native Vegetation Conservation on Private Property*, Land and Water Resources Research and Development Corporation, Canberra.

Lynch, J.J. and Donnelly, J.B. 1980, 'Changes in pasture and animal production resulting from the use of windbreaks', *Australian Journal of Agriculture,* vol. 31, pp. 967–79.

Mcintyre, S., McIvor, J.G. and Heard, K.M. (eds), 2002, *Managing and Conserving Grassy Woodlands,* CSIRO Publishing, Melbourne.

MCMA 2006, *Catchment Action Plan 2006*, Murray Catchment Management Authority, Deniliquin.

NSW Department of Infrastructure, 2004, *Planning and Natural Resources*, Draft Native Vegetation Regulation 2004 Regulatory Impact Statement, Sydney (http://www.dipnr.nsw.gov.au/nativeveg/pdf/regulatory_impact_statement.pdf accessed 14.06.2006 accessed 14.06.2006).

NSW National Parks and Wildlife Service 2001, *NSW South West Slopes Bioregion Scoping Study*, NSW Biodiversity Strategy, Draft Report, Sydney.

Richmond, E. 1992, *Economic Benefits to the Farmer of Maintaining And Protecting Remnant Native Vegetation On-farms in South-west of Western Australia*, Water Authority of Western Australia, Leederville.

Rolfe, J. and Mallawaarachchi, T. 2003, Market based instruments to achieve sustainable land management goals, Invited plenary paper to the 9th PURSL National Conference: 'Salinity under the Sun – Investing in Prevention and Rehabilitation of Salinity in Australia, Rydges Capricorn Resort, Yeppoon, 29 September – 2 October.

RMCWMB 2003, *Catchment Water Management Plan for the River Murray in South Australia,* River Murray Catchment Water Management Board, Berri.

Salzman, J. and Ruhl, J. B. 2002, 'Paying to protect watershed services: wetland banking in the United States', in Pagiola, S. Bishop, J. and Landell-Mills, N. (eds), *Selling Forest Environmental Services: Market Based Mechanisms for Conservation and Development*, Earthscan, London.

SENRCC 2003, *South East Natural Resource Management Plan*, South East Natural Resource Consultative Committee, Mount Gambier.

State of Victoria 2006, *Bush Broker – Native Vegetation Credit Registration and Trading*, Information Paper, Department of Sustainability and Environment, East Melbourne.

Tsitsilas, A., Stuckey, S., Hoffmann, A.A., Weeks, A.R. and Thomson, LJ. 2006 'Shelterbelts in agricultural landscapes suppress invertebrate pests', *Australian Journal of Experimental Agriculture,* vol. 46, pp. 1379–88.

Walpole, S.C. 1999, 'Assessment of the economic and ecological impacts of remnant vegetation on pasture productivity', *Pacific Conservation Biology,* vol. 5, pp. 28–35.

Whish-Wilson, P. and Shafron, W. 1997, *Loddon and Campaspe Catchments: Costs of Salinity and High Water Tables to Farms and Other Businesses*, ABARE Report to the Murray Darling Basin Commission, Canberra.

Williams, K. and Cary J. 2001, Perception of native grassland in southern Australia', *Ecological Management and Restoration,* vol. 2, pp. 139–144.

RESEARCH FUNDING ABARE relies on financial support from external organisations to complete its research program. As at the date of this publication, the following organisations had provided financial support for ABARE's research program in 2005-06 and 2006-07. We gratefully acknowledge this assistance.

10.06

Agricultural Production Systems Research Unit

Asia Pacific Economic Cooperation Secretariat

AusAid

Australian Centre for International Agricultural Research

Australian Greenhouse Office

Australian Government Department of the Environment and Heritage

Australian Government Department of Industry, Tourism and Resources

Australian Government Department of Prime Minister and Cabinet

Australian Government Department of Transport and Regional Services

Australian Wool Innovation Limited

CRC – Plant Biosecurity

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Dairy Australia

Department of Business, Economic and Regional Development, Northern Territory

Department of Premier and Cabinet, Western Australia

Department of Primary Industries, New South Wales

Department of Primary Industries, Victoria

East Gippsland Horticultural Group

Fisheries Research and Development Corporation

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