Native grassland: at what cost?

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Abstract

The on-farm conservation and management of native grasslands, especially those that are botanically diverse or support threatened species, is now an important policy issue for State and Commonwealth Governments. Economics is important to achieving public policy goals because farms are primarily about providing a livelihood and an economic return.

The results of interviews with landholders from across south-eastern Australia on farms with native grassland are reported in the paper. These exploratory findings raise many interesting points to be considered in more definitive research and in policy development. They cover the reasons native grasslands can still be found on these farms, the place of native grasslands in farming systems, and factors likely to affect the future of the native grasslands. Appropriate types of incentives and other policy mechanisms which may be required to achieve desired conservation outcomes are also discussed. Some suggestions are made for relevant economic research.

Key words Economics, native grassland, conservation, farm management

Introduction

Two hundred years after European settlement in south-eastern Australia, only small and usually scattered remnants of native grassland retain any similarity to the earlier grasslands as described in early settler accounts (Barr & Cary 1992, Foreman 1993). All have been modified to a greater or lesser extent through grazing by large numbers of hard-hoofed animals, changes in fire regime, the introduction of exotic plants, fertiliser use and altered drainage. The most diverse remnants are now generally found on small public land reserves, rail-lines and roadsides. Very few are in reserves where conservation is the main objective.

Those areas of native grassland on private land that are botanically diverse, or are less diverse but support threatened species such as the Pygmy Blue-tongue Lizard and Red Swainson Pea, have an importance out of proportion to their size. They can be found on very few of the many thousands of farming properties across lowland south-eastern Australia - possibly on 150 properties in Victoria.[1] In some cases, these botanically diverse grasslands

[1] Author's estimate based on discussions with regional conservation officers in the Department of Natural Resources and Environment, Victoria.

on farms also have introduced clovers and medics, and some have considerable numbers of weeds.

More typical across this area than the diverse relatively intact grasslands are pastures with a small number of native grass species. Forbs are less frequently present. Garden et al. (1993) found the area of native pasture on the central and southern tablelands of New South Wales to be over one million hectares. These areas are a major source of agricultural income. They may also have conservation value, providing genetic diversity within species, buffers for the high conservation value areas, and some habitat for native wildlife.

The need to actively manage and protect native grasslands is receiving increasing recognition, for instance in the National Biodiversity Strategy and the national Grassland Ecology Program, and equivalent state strategies and programs. Some native grasslands are on public land, but not many. Few lands in the more productive areas of the state once occupied by native grasslands were reserved for public use or conservation. Given the high costs of doing so, it is unrealistic to expect a significant additions to the conservation estate. Accordingly, strategies to achieve conservation goals on private land are very important.

Long-term success with conservation of native grasslands on farms requires that the economic aspects of conserving native grassland on farms be addressed because for their occupants farms are primarily about providing a livelihood and an economic return, not about conservation. An introduction to these issues is made in this paper by reporting on interviews with 28 farmers across south-eastern Australia. These interviews addressed: the reasons the grassland areas can still be found; how farmers are utilising these areas now; their perceived benefits and disadvantages; how they repeatedly fit into the overall farm operation; whether current management is likely to continue; whether farmers will be able to continue current management without missing significant opportunities. A research program aimed at testing each claim that is made about the role of native grassland could be undertaken (expensively). An alternative strategy of testing the effects of retaining native grassland on whole farm returns by comparison to alternative uses is proposed. The paper then addresses whether incentives are necessary to achieve conservation of these remnant grasslands, and what form any incentives should take.

Defining native grassland and its management requirements

There are several terms in currency to describe areas on farms that have native grasses and forbs - native grassland, herblands, native pasture and natural pasture (eg Lodge and Whalley 1987, Mott and Groves 1994). In this paper, the term 'native grassland' is generally used as being most appropriate for high conservation value areas. However, it is sometimes used interchangeably with 'native pasture' though it generally refers to the less diverse areas with low conservation value.

Oddie (1994) presents a classification useful for practical management purposes in which he distinguishes native pasture according to the diversity of native species found and their proportion relative to introduced species. His categories are: 100% native (high or low diversity), 70% native (high or low diversity) and 30% native.

Until research into the effects of management changes can be undertaken, scientists recommend historical management practices as the most desirable as these are the conditions in which the grasslands have persisted (Foreman & Diez 1996). In most cases, this means continued light grazing, no fertiliser and no cropping. A limited number of trials are

underway testing the effects of management variations including stocking levels, burning and rest breaks. Programs coordinated by the Murray-Darling Basin Commission, the Land and Water Resources Research and Development Corporation, and the Meat Research Corporation now recognise that the more widespread native pastures may have a role in production and in addressing salinity, acidification and erosion on certain land classes. Some research is being funded into alternative practices involving rest periods, fertiliser application, and stocking to manipulate species composition.

Farmer interviews

Interviews with farmers were conducted in the Riverina, eastern South Australia, western Victoria and northern Victoria. 28 properties were visited, seven in each area. A common factor was the low intensity management of the grassland areas, even on farms where other areas were run much more intensively. As a rule, the grassland areas had not been sown to introduced grasses, though exotics have self-sown, and no or relatively little superphosphate had been applied in recent years. One farm in South Australia was a clear exception - there is a significant clover presence in the pasture and super applications have been heavy.

Most of the farms had native grasslands that were botanically diverse or crucial for the survival of native fauna such as the Plains Wanderer. Some of those interviewed in the Adelaide Hills and the Albury-Wagga area had native grassland comprising one or two species; conservation assessments of these areas had not been undertaken.

The grasslands in the Riverina and northern Victoria are on the original flood plains of the Murray River and its tributaries. In Victoria, this area stretches from Wodonga in the east to Swan Hill in the west and south to near Bendigo. Farms visited for this survey were from a smaller area, around Mitiamo, north of Bendigo and west of Echuca. Soils underlying the grasslands are usually brown to red duplex, though sometimes grey (Foreman 1995). The rainfall is between 400 and 450 mm annually, possibly lower into New South Wales. Average winter rainfall is only marginally higher than summer rainfall, which is much more erratic and intense. The vegetation today is characterised by a range of diminutive annuals and seasonal perennial herbs; there is no one dominant species (McDougall et. al. 1994, Foreman 1995). Major activities include cropping, and grazing of sheep and to a lesser extent cattle. Significant areas are now irrigated for dairy pasture, rice and other crops.

Several farms in the Albury–Wagga area of southern New South Wales were visited. These farms have grassland on hillsides in former grassy woodlands. Soils vary considerably, and include a white pipeclay and red loams. Rainfall is 550–600 mm. Native grasses include Wallaby Grass (*Danthonia* spp.), Windmill Grass (*Chloris truncata*), Kangaroo Grass (*Themeda triandra*), Weeping Rice Grass (*Microlaena stipoides*), Red grass (*Bothriochloa* spp.), and Spear Grass (*Stipa* spp.). The areas were used for grazing sheep or cattle, in association with cropping activities on flatter country.

The grasslands that extend from Melbourne to Hamilton in western Victoria are situated on the basalt plains which originate from Quaternary lava flows. The soils on the flatter plains are mostly cracking clays, here natural grassland is found; by contrast the stony rises formed from more recent volcanic activity have shallow loam soils and some important (disclimax) grasslands (McDougall, Barlow & Appleby 1994). The latter have not been subject to the same pressures as the more productive and easily accessible lower country. Rainfall averages 600 mm but is as low as 400 mm in the east, close to Melbourne. Kangaroo grass (*Themeda triandra*) is the usual dominant species. Farming activities centre around sheep grazing with cattle and cropping also important.

Two different areas were visited in South Australia. In the northern Mount Lofty Ranges extending to Burra, where the farm visits occurred, the grasslands, which are generally Matt-rush (*Lomandra*)-dominated, are on 'skeletal soils over weathered metamorphics', with deep loams in the valleys (Hyde 1994). Rainfall declines rapidly from 450 mm to the west down to 350 mm a few kilometres to the east. Farming activities include cropping on flatter areas in association with grazing sheep and cattle.

In the Adelaide Hills, in the southern Mount Lofty Ranges, secondary grasslands are now found in former grassy woodland. Rainfall ranges from 600 to 750 mm in the west. Native grasses include Wallaby Grass (*Danthonia* spp.), Windmill Grass (*Chloris truncata*), Kangaroo Grass (*Themeda triandra*), Weeping Rice Grass (*Microlaena stipoides*), and Spear Grass (*Stipa* spp.).Activities include sheep and cattle grazing, and some cropping. Extensive sub-division is occurring.

Prima facie case against native grasslands

As an initial proposition, it is assumed that native grasslands have low profitability or low productivity, and that net private returns will not be sufficient to justify landholders retaining existing areas of native grassland solely on criteria related to grazing income. There are several reasons for adopting at the outset such an apparently pessimistic view.

Firstly, most opinion within Australasian agricultural circles in the last 50 years has been that, compared to sown pasture, native grassland has relatively little to offer farmers in 500 mm+ rainfall areas (but see Mitchell 1994, Jones 1995, Simpson & Langford1996).

Secondly, the benefits of native grassland claimed by farmers, and explored in this paper, are largely untested either directly through research or indirectly in terms of effect on whole farm system outputs

Thirdly, a focus on the many benefits of native grassland that have been cited may lead to an over-estimate of the private benefits, and under-estimate of the publ' ffort necessary if threatened grasslands on private land are to be conserved.

Fourthly, recently conducted interviews on 28 farms across south eastern Australia (Crosthwaite 1997) suggest that, while native grassland may now complement or underpin commercial farming operations, this could change on most of these farms if management changed - hence conservation status isn't secure.

Reasons why native grasslands remain on farms

Given the efforts of the majority of farmers to transform their pastures in the last 50 years, why do any areas of native grassland remain, and why are there some of relatively high conservation value grassland?

A major reason for interviewing landholders was to ascertain the extent to which such factors were within their control (eg. management) or beyond their control (eg. climate, terrain). Factors external to landholder control would be more likely to hold into the future, so greater importance of external factors should equate to relatively secure future prospects - unless

price or technical change makes a different form of farming more profitable. Conversely, it was reasoned that the more influence landholders had over land use, the more likely it was that the grasslands had survived by chance, or because of historical factors that wouldn't necessarily apply in future. In the latter case, survival of the grasslands would more likely depend on action by landholders specifically directed at their protection.

As well as indicating their possible future, determining reasons for the persistence of native grasslands can also give insights into the benefits farmers receive from them. From the limited number of properties visited during this project, many reasons were identified. These are summarised below (see Bowers *in prep* for a similar analysis of UK conservation farming).

Technical feasibility of alternatives.

Many landholders view the native grasslands as technically the most feasible of options. In some cases, this is where native grassland occupy the more marginal parts of the farm - where it is rocky and steep, possibly with skeletal and even acidic soils. In other cases, particularly in the drier areas around Burra, Mitiamo and Jerilderie, the native grassland may be the basis of the farming systems, except possibly for some cropping. Feasibility has changed with technical advances in cropping techniques, aerial sowing methods, etc.

Management approach

Management approach is a major factor explaining why native grasslands remain, especially high diversity ones.

a) Some landholders indicated how use of native grassland matched their risk averse management approach, or their preference for low inputs or complemented their strategy of confining use of high inputs to other parts of the property for cost or other reasons.
b) For some, the native grassland was compatible with past owners' expansion strategies—either enough land was available already, or more land was purchased as an alternative to more intensive use of native grassland areas.
c) In one case a small native grassland area had been and was preserved as a valuable relic of what had once been there.

Relative profitability of alternatives

Even where sown pasture or cropping was technically feasible, its profitability had been questionable in the past. For instance, in areas where rainfall is erratic and low, and on hill country where aerial sowing has been possible but adopted by few farmers.

a) Most of the interviewed landholders in each area identified how the native grassland had been the best use of non-arable land, and identified how it complemented sown pasture and/or cropping. This however begs the question of why other farmers in the area didn't see it that way, whether the farms are very different, or whether one group 'got it wrong'.
b) Once capital had been sunk into a particular farm layout (sheds, fencing, water), it sometimes favoured retention of native grassland in particular areas such as the shearing paddock. In a few cases, native grassland had been protected by how paddocks and sheds were organised, by previous lack of water, or by distance from the main farm.

Resource constraints

Farmers may not have had the resources to adopt an otherwise profitable course of action.

a) Profitable investments may not be pursued if investments funds are not available, the debt burden is judged too high, or if pay-back period is too long.

b) Availability of labour, or capacity to manage employed labour, on the family farm is an important factor in investment decisions. In one case, ill health had prevented sowing new pasture.

The place of native grasslands on the farm

Why native grassland can still be found on some farms was addressed in the previous section. Now the features of native grassland that may give them a place are further elaborated. Their disadvantages are also touched on. Many of the points made about native grassland need to be tested in one of two ways - research directly on the individual claim, or indirectly on how native grassland and its alternative influence whole farm returns. The latter is the subject of research currently being undertaken by the author with funding by the Land and Water Resources Research and Development Corporation and Environment Australia.

Climatic

Native grassland may be carried along on many farms in the better years, and its value only identified in financial terms during the poorer seasons. Australia has some of the most seasonally unpredictable and extreme weather conditions found on earth. The importance of farming systems which reduce risk is being increasingly recognised. In the drier years, the response of native species to any rainfall events is noticed. The characteristics of stability and persistence come into play during and after years of poor or unreliable rains. Farmers commented that during the recent drought, only native grasses showed any sign of green (see also Millar & Curtis 1995). Extension officers have also commented how the drought has sharpened interest in native grassland. Research should quantify these benefits through pasture growth comparisons.

The advantages of a low-input/output system may be more apparent in years of drought because of the native grasslands' evolutionary capacity to handle extreme seasonal fluctuations. In poor years and in the recovery period there may be significant costs associated with alternative farming systems, including supplementary feed costs, pasture renovation, and stock purchase - these costs may or may not outweigh the higher returns in the good years.

Input costs

Native grassland allows low input farming, on at least part of the property. Native grasses can grow on poor soils and survive without fertiliser, though they may also be responsive to small quantities (C. Langford pers comm)[2]. Furthermore, native grassland naturally reseeds and regenerates. By contrast, sown pastures may require periodic renovation; sowing pasture is costly unless done with a cover crop and even though the crop can produce high returns it also carries more risk of failure and a loss of investment. The higher stocking rates achieved with introduced pasture are likely to also require additional fixed costs for fencing and water provision.

[2] Department of Agriculture New South Wales, Goulburn.

There are unsubstantiated claims of savings associated with running fewer, healthier stock on native pasture. One farmer who was interviewed explained, 'in the short-term, you can look a fool, running 3500 sheep to their 5000. But compare the end of year results. Stock are healthier and of better quality. Quality brings resistance. Going for quantity means trucking-in costs, and more labour.' In terms of outlays, they claim to be ahead of neighbours who have to run extra sheep to cover super costs, but who aren't getting the wool cut, and quote another neighbour as saying that it is 'the first three sheep/acre which give the high returns, the next three are very marginal.' Farmers with introduced pasture may question this, and the effects if any may relate more to low-input management than to native pasture as such.

It is important not to overlook the inputs required for native grassland. The major one is management. Farmers have to learn to identify the native species present in their pastures and their growth pattern. Once this is done, the principles of pasture management are essentially the same for native or introduced species - though there may be particular management problems with native pastures (Millar & Curtis 1995). Nevertheless, time spent on native pasture may have an opportunity cost. Many farmers will not have the time or inclination, being busy elsewhere on the farm where returns per unit of effort are higher. However, incorporating native pasture considerations into field days and other group learning situations can help overcome the barriers to farmers adopting effective management of native pasture.

It has been claimed that native grasslands may be more sustainable in face of future rising costs unmatched by output price increases (Gilfedder & Kirkpatrick 1995). This depends on the extent to which productivity on farms compensates for cost increases, and whether farmers wish to pursue a higher productivity path. It is realistic to expect that the terms of trade facing farmers will continue to decline, and that permanent improvement via international trade agreements is uncertain.

Complementarity with sown pasture or cropping

One of the most striking points to emerge from the farmer interviews was the extent to which native grassland is an integral complement to the sown pasture and cropping on many farms. Based on a similar survey of Tasmanian farmers, but without economic analysis, Gilfedder & Kirkpatrick (1995) suggest that native grassland can add to the balance and diversity of the farm, and hence to its viability.

These complementary factors apply even in south-western Victoria where the advantages of sown pasture seem well understood and more clear-cut. One farmer indicated that native pastures on their south-west Victorian property were not managed in their own right; as the owners 'have been able to use these native pastures as part of strategic pasture management'. The specific advantages he sees are all to do with the role of native pasture in special circumstances, such as on hilly or rocky areas that aren't arable, in a farm system that also includes sown pasture.

Many farmers run their operations to take advantage of the strengths of the native pasture. It may be easier to manage the annual spring flush on farms with some native grasslands because feed production is not so high, and also the native grasslands is supplying relatively more when there are feed shortages (Oddie 1994, Millar & Curtis 1995). Some of the other points made by farmers follow:

- It provides shelter for lambing.
- The native area provides a good stop-gap, while improved pastures are needed for topping fat lambs and steers.

- Autumns tend to be tough on the home block; cultivation starts in April and there can be a feed crisis.
- It can provide a green pick in dry conditions, and dry matter in wet conditions; it is also a good dry place to feed out hay.
- It helps to run sheep there if footrot is likely and to reduce worm problems.
- Wether weaners are run on the native pasture producing finer wool, while ewe weaners are run on improved pasture to build body condition.

Strategic use of native grassland

From an economic viewpoint, there may be a larger complementarity. The Community Grasses project funded by the Murray-Darling Basin Commission has found that some farmers view their native grassland areas on the poorer country as strategic reserves to support the better country in lean years (C. Thomas pers comm[3]). Very few farms are run with the same level of inputs applied to all areas. It may be sound policy if management effort, labour and capital are concentrated onto selected areas, especially given the variation in aspect, slope and soil type that occurs on many farms. Such an approach can take advantage of the specific benefits of native pasture in order to achieve essentially the same outcomes. This issue of complementarity highlights the importance of looking at the whole farm operation, as distinct from conducting a benefit-cost analysis solely on the basis of a given area of native pasture.

Pasture production

Native pasture can have a valuable production role in all areas, but particularly in those less favoured (Mitchell 1993, Simpson 1993). Where rainfall and soil fertility is good, they may help fill gaps in the feed calendar. While sown pasture species will generally out-produce native species where rainfall and soil fertility is good, the difference will vary according to land class and fertility (Simpson & Langford 1995a). New South Wales surveys on poorer soils have found that native pastures with a history of sub-clover and superphosphate application carried 80% of the stock on introduced pastures (Simpson & Langford 1995b).

Apparently, in much of the pasture research in Australia trials have not matched pastures according to age or legume content—'newly sown heavily fertilised improved pasture containing a legume component has been compared with that on old, unfertilised native pastures containing no legume' (Jones 1995). When the experimental conditions were reversed, native pasture production exceeded that of *Phalaris* and *Paspalum* (Jones 1995).

The extent to which pasture improvement practices can be adopted for native pasture with conservation values is a critical issue from the perspective of a farmer wishing to increase production. Further research is needed, however it is likely that major changes to management will cause significant loss of diversity (Foreman 1995). According to S. Diez (pers. comm.)[4] 'For species-rich grasslands, absence of ploughing is the single most important factor in the persistence of such grasslands, while the level of grazing is the next most important'. Garden and Dowling (1995) present data from central and southern New South Wales documenting the effects of management change on pasture composition.

Year-long green perennials like Wallaby Grass (*Danthonia* spp.) and Weeping Grass (*Microlaena stipoides*) can provide green feed most of the year. Rankin (1993) also claims

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[3] Chairman, Community Advisory Committee of the Murray-Darling Basin Ministerial Council

[4] Department of Natural Resources and Environment, Bendigo.

high production from Creeping Saltbush (*Atriplex prostrata*). Trial data for such claims is emerging in some cases, though more needs to be done.

Native pasture can contribute at particular times on the feed calendar (Millar & Curtis 1995). Warm season perennials like Kangaroo Grass (*Themeda triandra*) and Red Grass (*Bothriochloa macra*) provide green summer feed (Johnson 1995, Oddie 1994, Rankin 1993, Garden & Dowling 1995). Weaner sheep growth rates of 100 gm/day have been reported on Red Grass (Simpson & Langford 1995b). One farmer on the northern plains of Victoria suggests that Plains Grass (*Stipa aristiglumis*) can be important in filling a feed gap after the summer months and before the autumn rains (Rankin 1993).

During interviews, farmers made comments such as: 'native grasses responded to the 5-inch January rainfall and it held the soil together. Most of the hill country has cattle length feed, whereas there is none in the introduced country. The rain washed any goodness out of the rank grass, whereas the Spear Grass shot at the base. The sheep are in better nick at the start of lambing than for a long time.'

In some areas, it is suggested that native grassland provides good ground cover which establishes a healthy micro environment for effective use of autumn break rains by other plants (Rankin 1993). It has also been proposed that native microfauna such as earth mite predators resident in native grassland may keep pastures healthier (Oddie 1994).

Improved wool production

There is a view that native grassland may convey a natural advantage in producing finer and/or cleaner wool (Garden et al. 1993). Pasture with lower quality feed is said to produce finer wool, which is inversely related to protein content (Gilfedder & Kirkpatrick 1995, p.11). However, many fine wool producers rely on sown pastures, and so management, genetic makeup of the sheep and pasture species may be more important than 'native' versus 'introduced'.

Graham et al. (1993) outline how pasture characteristics, especially herbage mass, digestibility and species composition, influence sheep production; and graphically illustrates the variation in dry matter required from various pasture types in areas of New South Wales in order to meet the different nutritional requirements of wethers, weaners, lambs and ewes.

Farmers with native pasture may also be able to achieve other favourable characteristics in wool fibre such as good length and strength. However, management rather than type of pasture may be most important, and 'some native pastures are more likely to produce breaks in the wool because of the very seasonal nature of their pasture growth' (C. Langford pers. comm.) Quality feed all year is needed to avoid breaks in the wool, and this requires a pasture with a high species diversity or effective rotation of stock around pastures.

It many be possible to achieve a higher yield (after grease, dust and vegetable matter have been removed) in some regions where the better ground cover of native pasture reduces dust levels; conversely *Stipa* species may contribute to vegetable matter problems. Wool production per head may also increase with lower stocking rates.

Stock benefits

Depending on their composition, native grasslands can provide feed variety, a benefit claimed by several of the interviewed farmers (see also Millar & Curtis 1995). Livestock preferences for some plants is driven first by digestibility and second by palatability (C.

Langford pers comm). Rankin (1993) indicates how sheep favour Black Cottonbush (*Maireana decalvans*) when they enter a paddock and Davidson and Davidson (1993) and Cunningham et al. (1981) describe several native legumes favoured by stock. Stock favour clovers over grasses; clovers and introduced medics may now contribute to the feed variety of much of the native pasture in south-eastern Australia.

Native grassland are said to have positive health effects for stock. Gilfedder and Kirkpatrick (1995 p.12) cited Tasmanian graziers as reporting that their stock on native pastures had 'few problems with parasites, worms, blowflies, corby grubs or cockchafer beetles', although it is unknown whether this is due to the decreased stocking rates or the native grasslands species. It may also be because grazing takes place on the more upstanding plants rather than at ground level, although it has been suggested that some *Chenopodium* plants may have a natural worming effect (Rankin 1993).

The tussocky nature of native grassland means it can provide shelter, especially for lambing and post-shearing. Such benefits will only apply on farms where there is no alternative shelter.

Fire risk

Native grassland may have a lower fire risk because it carries less fuel and is more likely to be green in summer (Johnson 1995, Rankin 1993) and can also provide a summer fire refuge area (Oddie 1994). Introduced pastures are likely to contain significantly more dry material, and hence carry a higher fire risk, in years where extended periods of dry, hot weather follow a very wet spring and early summer. In other years, the fire risk will depend on grazing management.

Soil and water protection

Rankin (1993) claims that 'the plants which make up a native pasture offer answers to many basic problems, such as rising water tables, salinity control, soil erosion and falling soil pH'. Native pasture may or may not be better than alternative methods (eg. introduced perennials, trees) at reducing some of these forms of land degradation. Management may be the key variable rather than the pasture type itself. Nonetheless, one major program, LIGULE, is currently underway to select native grasses which may have a role in addressing land degradation (Johnston et al. 1995, Mitchell 1993).

Some of the particular claims that have been made about the possible role of native grassland are now outlined. Being summer active and deep-rooted, summer-growing native grasses are opportunistic water users; they are likely to have a role in salinity control because some native species are salt tolerant.

In particular locations, native species may be effective in preventing erosion (Millar & Curtis 1995). One farmer commented:

> Silver Tussock looks untidy but it has value. It will grow where lots of water flows. It is deep-rooted and stops soil erosion. *Phalaris* can't hold the soil as well. Often people plough the tussock areas and sow down. But this can lead to erosion, even where *Phalaris* is present, and Silver Tussock only gets eaten down if there is no other food. Whether this is an advantage or disadvantage depends on the climatic season.

Native grasslands are associated with improved soil structure (Mitchell 1994, Rankin 1993). It has also been suggested that mosses have a possible role in soil water infiltration and

storage (Oddie 1994), while micro landforms such as gilgais may assist in maintaining biodiversity (Oddie 1994).

Rankin (1993) argues that the mass of native grasses reduces wind speed and therefore evaporation and soil erosion; he also suggests their activity prevents excessive moisture entering the watertable. Species with a high salt content remove more soil water than lucerne and benefits of erosion prevention and control should be considered (Johnson 1995).

Native grasses are acid tolerant (Simpson & Langford 1995a, Simpson 1993) and may have a role in preventing acidity (Rankin 1[illegible] Mitchell 1994).

Personal factors

Like other lower input systems, native grassland may offer lifestyle benefits in terms of reduced working hours and stress levels. However, they may be adversely affected by any reductions in income, unless the time savings are spent on other income-earning activities 'on' or 'off-farm'.

Conservation values may be recognised and felt by landholders. Examples of the original vegetation, aesthetic values and biodiversity value may be recognised by graziers (Gilfedder & Kirkpatrick 1995).

Not all farmers are risk averse, but for those who are native grassland offers a management system that is less prone to large fluctuations in output and input requirements.

Problems with native grasslands

Native grassland has some specific disadvantages that must be taken into account: wool and carcass damage is caused by some *Stipa* spp. and there may be toxicity problems with other species; and pastures dominated by warm season perennials, which are summer growing and frost sensitive, are likely to have poor growth and quality in winter (Garden & Dowling, 1995). This can result in low growth rates and weight loss by stock.

Interviewed farmers made the following comments about the disadvantages of native pasture:

- They're not much good for putting weight on ewes. [This will depend on pasture composition and maturity of the pasture.]
- There aren't any problems, except for the volume of feed.
- It is more prone to weed invasion than sown pastures.
- Wool takings are $34/acre c/f. $60 for the introduced.
- In the rough crabhole country, water sits for weeks in mid-winter, adversely affecting pasture production.
- Wool is bright and white, but there is more of a vegetable problem (seeds) interfering with price.
- Natives don't like over grazing.
- Grasshoppers seem to love it.
- Seed can't be obtained for Red Grass. There is a harvest problem.
- Windmill Grass grows, seeds and is gone within two to three weeks.
- In the cold and wet of winter sheep don't graze the Red Grass.,they tend to bare the ground.
- There are no problems with them, except they run out a bit earlier.
- Problems include too much residual dry grass in wet summers.

Whether current management is likely to continue

Irrespective of whether native grassland has a place on a particular farm, as discussed in the previous section, there are many other factors influencing whether current management is likely to continue. This section explores some of those issues. It is found that native grassland isn't secure, and that management on most, if not all, farms could change to the detriment of conservation values.

Long-term considerations and decision-making

The interviewed farmers can be grouped according to the likely importance of short-term factors in their decision-making. This is not to say that short-term factors overwhelm long-term considerations, and in fact they may be less important. Rather, it is a judgement about the potential of short-term factors—if something goes wrong or new opportunities present themselves, will they have a major influence on how a farmer's grasslands are managed? Of the 28 farmers interviewed, it was judged that fifteen were strongly subject to short-term factors, eight were fairly so, while five were likely to be only slightly affected. Factors influencing this categorisation include debt levels, family commitments and age. This was not a topic deliberately considered prior to the interviews; rather its importance emerged from the results.

Stages in the family life cycle

Over the time a family occupies a property, factors 'internal' to the family such as income requirements, availability of family labour, expectations about children taking over the farm, and paying out other family members will greatly influence the farming approach. The entrepreneurial farmer of early years may manage the farm very differently in later life.

Native grassland may represent an obstacle to the farmer striving for maximum returns at a particular stage of his or her farming career. In later years, the low-input requirements of systems based on native pasture may perfectly suit the declining capacity of the farmer to work 'long and hard' hours and this may continue until the next generation begins to work on the farm, or until total retirement if there is no heir to take over the property.

Eighteen of the 28 farmers interviewed were supporting children. Three had sons or daughters now working on the farm, while another four were supporting an older generation. Three properties were owned by people in their late 50s, or older, who did not have children likely to farm that property when they retired. The final two properties were run by managers; in one case, the manager was a nephew of the owner.

Inheritance and land sale options

Once a new manager takes over, the prospects for native grassland must be seen as insecure. Historic management practices that may have continued for the full occupancy of the previous manager may or may not continue. It is likely that the new operators will be under pressure to generate income for family needs and paying debts, or they may simply have new ideas on how they want to run the farm.

It is not clear if family members who take over the farm are more favourably disposed to continuing past management practices compared to property buyers. Based on several studies, it has been estimated that about 50% of farms change hands through the market and 50% are inherited in any thirty-year period (Crosthwaite 1989).

Most of the farmers interviewed are supporting children, and are thus unlikely to sell soon because of age. Nevertheless, in the Mitiamo area only three of the seven interviewed farmers had young children, and one of these farms has since been sold. Another farmer whose children work elsewhere is contemplating selling, and three farmers aged 60+ do not have successors in the process of taking over running the farm.

Off-farm linkages

Australian farms are not islands unto themselves. With very few exceptions, Europeans colonised grassland areas with the intention of selling the bulk of their produce. Although mostly family run and worked, they have been subject since European colonisation to off-farm pressures and interactions. The extent to which family farmers exert control over their own operations has been subject to considerable debate, family farmers being regarded as small capitalists or as effectively wage labourers. Neither accurately captures the essence of family farming (Crosthwaite 1989, 1992).

The range of interactions between farm, community, advisers, and other economic units has greatly expanded in recent years. The prospects for conserving native grassland cannot be considered outside this context.

Debt levels can exert a major influence over how farms are managed, by restricting freedom to manoeuvre in financially difficult situations. Eleven of the interviewed farmers clearly indicated they had a significant level of debt that would greatly influence their property management, while eight more probably had a similar debt problem although they did not clearly indicate it. Eleven are thought to have either no debts or insignificant debts.

Connections to the external world can in some instances ease the pressure to 'mine' the farm. Most of the farms visited had income sources other than the farm; these might include sizeable investments in financial institutions or other sectors of the economy, off-farm work by one or more family members, or share-cropping or harvesting for other farmers. In two cases, farmers were in family partnerships which have properties in other parts of Australia. Such income has been important in evening out peaks and troughs in family income, and it may indicate that at least a proportion of farmers have a better capital base from which to address land management issues than has been previously suggested (Campbell 1994). The information collected through this project is very limited.

Major farm/family decisions

One question requiring further research is the extent to which loss of native grassland with high diversity is primarily a process of slow attrition or one related to major decisions or events such as property purchase, property hand-over to the next generation, family crisis, crop failure, drought and falling prices. At times of major events, it is likely that many factors (bank managers, personal instincts, family needs or neighbours) may cause land managers to react with measures that can involve the loss of grassland. Providing information, support, or assistance for landholders with native grassland at 'crunch' times may be highly appropriate. The increasing tendency of landholders to invest and work off-farm may be an ameliorating factor.

The interviews suggested there was a strong likelihood of major decisions influencing native grassland on all but about six of the selected properties. In three cases, changes were likely to involve utilising the native grassland in new ways such as harvesting seed or for ecotourism. In the remaining cases, changes were likely in pasture management, which will possibly

involve sub-division and cropping. On those properties found likely to change ownership within the next 10 years, major changes are probable.

Farming approaches

Grazing native grassland is essentially low input/output farming. Some interviewed farmers are acutely aware of how cost increases associated with introduced pastures have outstripped increases in product prices. They described feeling as though they were on a treadmill; their attempts to increase production were rewarded with less and less returns because of the ever-rising production costs and variable product prices. After recent crises in the wool and wheat industries, many farmers are now more likely than ever to scrutinise possible farming systems for a better approach. Management systems that reduce costs or keep them stable could be very important to enable the farmer to avoid an ever rising cost-input price spiral.

By contrast, entrepreneurial farmers may not be unduly concerned about the level of costs they deal with provided the 'bottom-line' means an adequate return to their own capital and management, while achieving a safe equity level and a relatively short pay-back period. This is not to say that entrepreneurial farmers will automatically choose a high-input path; it is more likely that they will judge each strategy by its expected performance. Several of the interviewed farmers could be characterised as entrepreneurial and argued emphatically that their production system, based at least partly on native pasture, maximises returns.

Option value

One question that occupies landholders with native grassland, and one which has undoubtedly been stimulated by publicity about native grassland, is 'what might I miss out on if I lose it'. There is an option value involved in deciding whether and how to manage native pasture. Option value stems from 'the combination of the individual's uncertainty about their future demand [for the grassland in this case], and uncertainty about its future availability' (Chisholm 1988). Option value from a private viewpoint can be either positive or negative, depending on how the individual weighs up different risks. The negative value can arise if the individual attaches a high value to the risk of not benefiting if options are kept open.

Some interviewed landholders clearly attached great value to the chance of native grassland making a difference to their fortunes. This value is likely to increase as uncertainty over future benefits falls. The extent of opportunities potentially foregone will also influence the value. Stage of lifecycle and levels of debt are also likely to influence the value—some farmers will feel they cannot afford to miss certain development opportunities in favour of more nebulous future possibilities. Ironically, it may be older farmers who do not need the cash flow, but who may not live to realise the benefits.

Environmental attitudes

How landholders see their remnant grasslands will vary according to the farming system context. This is reflected in the variety of reasons given for the very existence of the grassland on their property and in the perceived role on the farm. However, it has been generally found that farmers' actions in relation to remnant vegetation are driven mostly by practical considerations unrelated to specific conservation objectives (Barr & Cary 1992). Even where farmers may be conservation-minded, practical matters take precedence. "The adoption of conservation behaviours appears to be driven by factors such as technical feasibility, economic costs and benefits involved, and the social acceptability of engaging in the practice among the farming "sub culture"' (Goldney & Wilson 1995). The above studies would suggest that most farmers are utilitarian in their attitude towards nature. Hence it is

possible for farmers to have strong pro-environmental attitudes yet be taking decisions that cause loss of remnant vegetation.

The key point of relevance to this paper is that conservation of grasslands will be driven by how farmers perceive the remnants in the context of managing the whole farm system, as well as their perceptions of the specific benefits and (opportunity) costs of managing the remnant. These perceptions will at least in part depend on what understanding and information they have about how to best manage the remnants (in the context of their farming system).

The interviews conducted as part of this study were not structured to allow statistical analysis of environmental attitudes. However, a 'commonsense' interpretation of the interview reports confirms these points. The majority of interviewed farmers seem to hold primarily utilitarian attitudes to nature conservation (Kellert 1985), with only one or two at most holding either exploitative or 'nature for its own sake' views. Those with utilitarian values can possibly be split into three groups. First, there are those for whom the grassland is 'just there' and to be managed appropriately in the whole farm context. Second, some farmers have, or are developing, an interest in understanding the ecological dynamics of their managed grasslands. Third, some farmers have a 'softly-softly' approach to managing their farm. Conditions may have forced farmers in drier areas to consider ecological questions more than others. The second group are perhaps more likely to be becoming interested in nature conservation for its own sake. Several of the Victorian properties were registered in the Land for Wildlife scheme (which apart from the sense of pride it engenders and a display sign has no direct benefits for farmers apart from advice via a regular newsletter and access to a field officer).

Rationality of farmer behaviour

Many factors will influence how farmers perceive and act upon a single issue like retaining native grassland. These will include knowledge but also previous farming experience, testimony of others, attitude to risk, family needs and indebtedness. Nevertheless, new knowledge can be a very powerful factor, and we should look to the marketing strategies proposed by Goldney and Watson (1995) to maximise the chances of it being effective.

However, we should avoid seeing the issue as simply one of getting appropriate information to farmers, and consequently shifting the blame to them if the recommended or implied course of action isn't followed.

Decisions made by farmers are generally rational within the context in which they operate, although this may not be obvious. An example is the failure of farmers to adopt the extension message that, because it is a deep-rooted perennial, sowing lucerne is a solution to dry-land salinity. The slow adoption rate has been difficult to understand. However, lucerne can be difficult to establish and a recent economic study shows that a failure in one season is sufficient to almost wipe out the benefits (Madden & Crawford 1994).

Preliminary estimates of profitability and financial feasibility

Preliminary estimates of the profitability and financial feasibility of alternatives to native grassland have been made by the author for south-west Victoria (Crosthwaite 1996) and north-central Victoria near Mitiamo (Crosthwaite 1997). In south-west Victoria, budgeting

exercises show that for any given 100ha of native grassland that is arable, it is clearly profitable to sow introduced pasture. Given the rainfall and soils, it is reasonable to assume that this will also hold for aerially sowing rocky outcrops at least if wool prices are reasonable. The crucial question is whether replacing these last areas of native grassland on the farm involves opportunity costs that are not captured in a partial budget, and how high will these opportunity costs be. A whole farm analysis which can indirectly account for many of the complementarities outlined in earlier sections of this paper is necessary to determine whether replacing the native grassland carries significant benefits.

A similar result applies to cropping native grassland in the Mitiamo area. Cropping native grassland areas is worthwhile if crop prices are good and yield failure doesn't occur. However, preliminary estimates suggest that one year of poor yields can make the net value of a cropping exercise less than that of retaining lightly stocked native grassland. The best bet may be to retain the native grassland for its unique contribution, while confining cropping to previously cropped areas on the farm. The change with deleterious conservation effects that is likely to give a more certain and significant increase in profit is increasing the stocking rate on farms that are lightly grazed to the level of nearby farms. Public policy intervention, rather than presentation of economic arguments, may be required in all these cases, but particularly to ensure that those properties that have the highest conservation values resulting from light grazing continue this management.

The future research agenda

There are two clear directions that a research agenda into the place of native grassland in farming could take. The first agenda would be a traditional science-based one which aimed to test each of the claims of farmers about native pasture, and to investigate the economics once scientific results were available. This agenda has problems. In order to research each claim, and define rigorous experimental conditions, it is necessary to abstract from the context of farmer experience - they manage pastures and animals according to feed supply across the farm and animal needs over seasons and in response to market conditions. The problems are confounded if the economic analysis of implementing the research results are also divorced from this context. This sort of research could be used as input into detailed models which specify the relationships between native grassland and whole farm outcomes. However, this is problematic given the dearth of information about native grasslands, for instance, species composition of native grasslands, growth habits of individual species, and response to grazing pressure.

The research to be really useful must account for, or be relevant to, how the native grassland fits into the whole farm system. The second research agenda would begin with the whole farm system. It would look at how native grassland currently fits into a range of farming systems, and how these areas could be alternatively managed, and from this point define which are the most important research questions. Economics can help in this. Estimates of the economic contribution of native grassland can be made if data is available on the stocking of different pasture types on a farm. Also estimates can be made of how this contribution changes if the native grassland is managed differently, or replaced with introduced pasture or crop. This agenda will highlight which factors to do with native grassland are most important, and whether detailed investigation would help improve whole farm returns, or give better estimates of those returns.

The approach suggested above is not to decry research into conservation management of native grassland - this is absolutely necessary and a high priority if public policy goals are to be met. The issue is how to set the research agenda.

Policy directions

The future of remnant native grassland on farms is far from secure. Changes in management, farmer goals, prices or technology - or simply neglect (Bowers 1997) could lead to its loss or further degradation. If public policy goals relating to conservation of remnant native grasslands are to be achieved, intervention of one form or another is required. In a native grassland context, the primary goal of policy mechanisms should be to contribute towards achieving permanent conservation outcomes for high value areas, and to significantly reduce the risk of irreversible loss of others.

Developing ten or twenty year targets for native grassland conservation at a regional level is an important step towards deciding the best combination of policy mechanisms. Having such targets will help ensure that the combination of instruments are actually achieving the goals, and are not masking irreversible losses. There is a need to ensure that mechanisms for native grassland conservation are implemented as part of a strategic plan to address the full range of available instruments and community involvement mechanisms, and that a review mechanism is built into all plans. A comprehensive review of different policy mechanisms available for biodiversity conservation in Australia has recently been undertaken (Young et al 1996).

What form of intervention is most appropriate? Options include:

- changing legal title through land purchase or covenanting
- educating and providing information to current landholders
- regulating to restrict activities that can be carried out
- removing disincentives to conservation
- changing taxation provisions at national, state and local levels
- entering into management agreements with financial payments to landholders
- providing other financial incentives
- promoting a conservation ethic via community-based activity like Landcare

Three of the five mechanisms - changing legal title, regulation and management agreements - appear to offer some form of legally enforceable security. Land purchase by the State will ensure security, provided the required management is carried out; however, this is costly. Covenanting is important as it will appeal to some landholders, but it restricts potential land use, and is unattractive to many. Experience in Europe suggests management agreements have a definite place (Bowers 1997, Colman et al 1992).

Education, removing disincentives, financial incentives, tax changes and community-based activity can be very important in the short-term for some farms - but they will not guarantee protection in perpetuity as circumstances on individual farms will change eg a farm will be sold.

A brief consideration of management agreements

Mechanisms are needed that can address moral hazard and first mover problems in advance for ecosystems like native grasslands where all remaining sites with high conservation value are regarded as critical sites ie essential if public policy objectives for conservation are to be

achieved (Bowers 1997). For ecosystems in which there are many sites sharing similar characteristics, some losses may be acceptable from a 'weak' but not necessarily from a 'strong' sustainability perspective (Crosthwaite 1993).

Both moral hazard and first mover problems revolve around the likelihood that at some stage in the future, it may not be in the interests of the landholder to continue to manage the grassland for conservation values (Bowers 1997). Moral hazard involves the risk of the landholder changing management and blaming factors out of their control. First mover problems arise where circumstances change and landholders perceive and act on new opportunities for profit before the conservation agency knows of or can avert the potential risk.

Management agreements which offer financial incentives are the one mechanism (apart from purchase by the State) which addresses first mover and moral hazard problems associated with conserving native grassland. Regulation requires penalties that are low enough to win public support and for courts to enforce them, but high enough to exceed the potential gain of landholders in breaching them - this is difficult to determine in advance, and adjust flexibly with regulations. Covenants involve legal and 'moral' agreements, but if circumstances change sufficiently, landholders may have an interest in breaching the covenant. Even if they involve a large one-off payment and have a clear legislative base as with heritage agreements in South Australia, covenants do not overcome the first mover and moral hazard problems - at least in principle. The South Australian experience is worthy of study to determine in practice whether the legislation has deterred farmers from breaching covenants and, if not, the conservation implications.

If based on periodic payment and renewal, management agreements can overcome these problems if structured so payments equal or exceed opportunity costs. Nevertheless, management agreements do have problems. In comparison to the economic turnover of the agricultural sector, their cost is likely to be very small. However, they are relatively costly when, as is usually the case, government budgets for conservation are small. Over time, conservation goals may possibly be more cheaply achieved by land purchase (Colman et al 1992).

Agreements tailored to individual circumstances need to specify conditions of management, require notification of intention to change management, and specify payments. Agreements with these characteristics are used to protect Sites of Special Scientific Interest in the UK. These agreements essentially provide payment in exchange for appropriate management of grasslands. It will be argued in the following sections that agreements should go much further in providing additional 'circuit-breaking' incentives for changed management at the farm or business level.

Management agreement schemes need to address the potential problem of landholders, at time of renewal, from holding out the potential loss of biodiversity as a ransom for ever-continuing, and possibly higher, payments (M. Young pers. comm.[5]). Experience with renewal of management agreements under schemes in the UK should be a useful guide on this problem. Innovative approaches to long-term agreements have been proposed (Young 1992). They involve payments for agreed management over X years with a mid-term review that can lead to either continuing the existing agreement, cancelling it or rolling over to a new agreement if conservation objectives are not being met.

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[5] Division of Wildlife and Ecology, CSIRO, Canberra

Adherence to the spirit of the practices specified in the agreement can be a problem. Recently, a shift in emphasis has been promoted in such agreements from compensation for not undertaking potentially damaging operations to rewarding the landholder for active management (Colman et al. 1992, Webster & Fulton 1993, Lomas 1994). Agreements now acknowledge the expertise of the landholder and allow some discretion (eg. by specifying that management action will occur after rain or another natural event, rather than on a particular date). The outcomes are seen to be better conservation results and more interest from landholders.

The position taken in this paper is that, in spite of their weaknesses, individual management agreements with landholders, supported by other mechanisms, may offer the best prospects for securing the future of the grasslands. The value of identifying a primary instrument is that a clear-cut relationship between ends and means can be established. The end is conservation of all native grasslands of conservation significance on private land, the primary means is achievement of a management agreement with all relevant farmers. Two-stage monitoring is involved - on-ground change in conservation status and threat status, and on-paper achievement of the management agreement. While essential, on-ground monitoring can only be periodic and incomplete. Reliance on the on-paper record is very important in reality, and is a proxy for whether or not appropriate management is being maintained, especially if they require landholders to regularly report. Covenanting is the only other instrument where the on-paper change is a reasonably proxy of what is happening to management on the ground. The progress towards conservation goals can be measured in terms of the numbers of agreements or covenants signed. Monitoring the effectiveness of regulation, tax changes, education and community-based approaches is not so simple. Accordingly, where a mix of instruments are used, with no one instrument being given priority, then the on-paper record will reveal little about progress.

Supporting mechanisms

Management agreements based on financial incentives can be used as a free-standing instrument. However, there are problems with such a strategy. Firstly, it risks paying begrudging farmers not to do things they might otherwise do, and desired conservation outcomes are unlikely to continue indefinitely. Second, it is likely to lead to payments much higher than would otherwise be agreed if the farmer was interested and actively involved in conservation efforts. While primacy is proposed for management agreements, other mechanisms must play a supporting role. Given the variation between farms, across the factors outlined earlier in this paper, a policy mix with management agreements at the forefront is likely to increase effectiveness.

Covenants will tap into the willingness of some farmers to take on responsibility under their own initiative - if incentives are to be given for entering management agreements, incentives for covenanting will be needed.

Regulation is difficult in the case of native grasslands because management can be changed subtly and monitoring is very difficult. Nevertheless, regulation can play an important back-stop role, particularly if it involves a precautionary requirement to notify an intention to change management. Management agreements for Sites of Special Scientific Interest in the UK include such requirements. Regulation will reach those unwilling to participate in management agreements (Young et al 1996), and may provide a restraint on recalcitrants who might damage native grassland.

Community-based mechanisms can play a major role in shifting local opinion in support of activities until recently regarded as 'backward' in terms of farming practice. If the process is

perceived as legitimate, and is sufficiently resourced, a long-term strategy for community involvement will reap major dividends, and will produce greater results for any given sum of financial incentives. The multiplier effect of investing small sums in community involvement is very high (Young et al. 1996). Without detracting from the important role of central government agencies, it is necessary to have mechanisms at local or regional levels that allow local people to participate together in planning, decision-making and action towards conservation of native grasslands.

Education and information are needed so farmers know what they are managing and get guidance on how best to do it. A considerable body of experience in designing information packages which increases farmer's capacity to learn about the values and potential benefits to themselves to maximise the likelihood of their adoption has been building up amongst extension officers (see Goldney & Watson 1995 on developing appropriate guidelines).

While financial incentives are an important component of management agreements, they can have a much bigger role than of immediately paying for a particular form of grassland management.

There is much to be done in identifying and removing perverse effects of other programs and policies (eg in tax, agricultural research). Retention of native grassland is less likely if inputs to alternative land uses such as water or fuel are available at below cost or receive tax concessions. Policy options such as taxes and levies on inputs, tradeable entitlements or permits, and pricing of public sector inputs such as water are subject to broad government policy, and cannot be easily targeted in a grasslands context. Catchment management authorities may well use such mechanisms in the future.

The need to pay rates at an 'improved' land rate is one barrier to retention of native grassland. Changes to rating systems, which open up the possibility of lower rates for areas of conservation value, are under way across Australia. Some shires such as Melton in Victoria have already adopted a lower rate for areas of conservation value. Heritage agreements in South Australia result in automatic rate relief.

A broader view of financial incentives

The previous section dealt with management agreements and other supporting instruments. The remaining sections of the paper mainly deal with forms of financial incentives and how they can be targeted at different aspects of a farming operation in order to achieve conservation outcomes.

In aiming to achieve better conservation outcomes, financial incentives to farmers need not be directed only at native grassland management. In this section, consideration is given to incentives which are directed, as *circuit breakers*, at:

- land ownership or property rights;
- local communities as well as individual farmers;
- whole farm management and business investment;
- better management of native grasslands through one-off grants;
- the production of goods and services from native grasslands.

Such incentives might or might not be included as part of a management agreement.

Financial incentives are used with the aim of altering the market conditions faced by landholders and inducing them to either follow a prescribed path or to set a prescribed goal that they can achieve in the least-cost way (Hodge 1991). The difficulties with targeting incentives (Hodge 1991), their unintended consequences (Chisholm 1988), the possibility of higher costs (Buckley 1992) and the risk of hindering a custodial ethic (Campbell 1992) should be noted.

Incentives can be usefully seen as circuit-breakers, rewards, compensation or penalties. Financial incentives can act as *circuit-breakers* in several ways. They may be used to guide farmers towards a new management or investment path that protects conservation values while meeting their other goals. Financial incentives can encourage landholders into accepting restrictions on their activities through a change in property rights, which govern long-term land use. They can contribute to positive attitudes—a small amount of money may be taken as an indication of genuineness and burden-sharing.

Incentives as *rewards* include payments made in return for action to protect the environment, or to avoid damaging actions. Incentives as *penalties* oblige landholders to bear additional costs for damaging nature conservation values. Incentives as *compensation* usually means compensating for loss of opportunity to pursue the land use which will generate the highest return for that given area. However, this opportunity cost will almost certainly be lower if a whole farm perspective is taken. Such a perspective would acknowledge the complementary role of native grassland and that investment elsewhere (on or off farm) may generate higher returns than in the area of native grassland. Further, if successful circuit-breakers are found, then the opportunity costs may fall further. Landholder's interest in compensation may be partly a product of concern about loss of 'freedom' and management prerogative, or about a curtailment of flexibility and the ability to pursue opportunities which may arise in the future. These concerns can only be addressed, or at least reduced, if landholders can participate as part of their local community in key decisions about their future.

Incentives to change land ownership or property rights

Where the policy goal is achieving appropriate conservation management *in perpetuity*, traditionally this has involved gazetting public land for specific purposes, and adding to the public estate where appropriate.

Landholders can preserve the grassland on their properties in perpetuity via covenants on property titles; this means permanently removing a 'farmers environmental damage rights' (Young 1990 p.13) by restricting inappropriate activities. Covenants are potentially a most powerful mechanism for achieving conservation goals permanently on private land; though farmers will break them if they have sufficient economic incentive to do so. Covenants concern landholders because they restrict future options. There are many ways of increasing their acceptability to landholders, particularly using financial incentives. In South Australia, heritage agreements were backed up with payments. Heritage agreements that involve changes to the property title have been in place for many years in South Australia. Covenants can be arranged in Victoria through the Trust for Nature (formerly Victorian Conservation Trust), yet few currently relate to grasslands. The Trust has identified barriers to attracting potential participants to such schemes including the need to pay land transfer fees and high levels of rates.

While covenanting represents one possible solution, targeting policy towards potentially sympathetic land buyers may be appropriate. As Hodge (1991 p.382) explains:

> Most environmental policies seek to influence or constrain the behaviour of existing land owners or producers on the assumption that their interests and objectives differ from

those of the wider public. An alternative approach is to seek in the longer term to promote the types of land owners whose objectives match most closely the wider public concerns.

Hodge (1991) sees a role for trusts to take over the management of land with important conservation values when farmers retire, rather than leaving the market open to younger, more vigorous farmers under pressure to maximise short-term returns. There is a need to reduce the obstacles to individuals, trusts and even local government becoming involved in managing land for conservation. Reducing these obstacles—or 'transaction costs' in economic terms—would create an indirect incentive to become involved. Establishing two registers, operated by government or non-government organisation, would help: one would be a register of properties with high conservation values, noting those likely to be sold within ten years; the other would be of potential buyers, to which individuals or groups could add their name. At present, such a system operates in Victoria at an informal, low-key level. Seed funding directed to such groups is likely to return its value many times over. The case has been made for ownership to be with non-government organisations because of cheaper management costs (Young et al. 1996).

When a new owner or farming family member takes over responsibility for running the farm, a different approach may be taken to native grassland management. Loss of conservation values must be considered likely if the new owner has a need for immediate income to repay loans or provide family income. If a management agreement was in place, it may need to be re-negotiated. Assistance with developing management plans which concentrate improvements on other parts of the farm, and provision of expert advice regarding management of the native grassland areas and best use of labour and capital, may be appropriate. Waiving land transfer fees may be appropriate if the outcome is a covenant (M. Young pers comm.), or an agreement which in the long-term will lead to a covenant. Concessional loans from rural lending authorities in such cases should require protection of conservation values.

Incentives to reinforce the role of local community groups

Well-targeted incentives to Landcare and similar groups in areas with important conservation values may play a crucial role because group activities transmit experiences and build social norms. Collaborating in such groups can itself provide an incentive to individuals who are thus assured that they will not be acting alone (Russell 1994). Landholders sometimes receive assistance in the management of nature conservation sites from local field naturalists, 'Friends' groups, the Australian Trust for Conservation Volunteers and similar groups. Providing government support for such groups constitutes an indirect incentive to landholders to protect sites. Young et al. (1996) view the provision of incentives via groups, rather than individual farmers, as an important vehicle for bringing about positive conservation outcomes.

Incentives to improve whole farm management and business investment

The key to protecting native grassland may lie in looking at the whole farm context, rather than at the grassland alone. Helping farmers address problems—and find circuit-breakers—at the level of the farm as a whole may do more to secure grassland conservation than a focus on rewards or penalties for managing the grassland in particular ways.

Business planning and farm management advice may be appropriate targets for incentives directed to landholders or to community groups for organisation of appropriate seminars or workshops.

Tax deductions are available for expenditure incurred in preparing property and land management plans, and for attending relevant courses. There may be scope to offer additional incentives for attending courses specifically on nature conservation issues, for integrating nature conservation values into property management plans, and for demonstrable results on the ground. Alternatively, eligibility could be limited to schemes that give explicit consideration to biodiversity (M. Young pers comm).

One-off grants for management of native grasslands

There is a strong case for providing one-off grants as part of an overall strategy for achieving conservation of native grassland on farms. One-off and largely unconditional payments can sow the seeds for long-term farmer commitment by demonstrating good faith and overcoming initial mistrust or scepticism about the intentions of conservation agencies. Many farmers won't agree to participate in an agreement, but would accept a grant. Such payments are fast, they get things done (monitoring programs are needed to confirm this) and they're administratively easy and are usually small. They build support without conditions—there is no haggling over terms and they can help emphasise 'look we're prepared to put our money where our mouth is about the value of this remnant'. They fit neatly with the bottoms-up approach of Landcare. Finally, there are many such incentive schemes already which aren't targeted at biodiversity, but rather at land protection, for which biodiversity is or should be a key criteria—ie. biodiversity can piggy-back on them.

Incentives directed at production of goods and services from native grasslands

Most native grasslands on private land are used for income-earning. What they are used for, and how, needs to be considered in looking at ways to achieve management which is consistent with nature conservation values.

Outside agriculture, in industries where land is not such an important factor of production, incentives are usually targeted to one or more stages in the production process—from use of inputs to disposal of waste. Several stages in farm production and product marketing can be identified. These include: (i) pre-production (acquisition of inputs and equipment); (ii) production (including disposal or discharge of wastes); and (iii) post-production (sale of output, processing, marketing and consumption). Some of the possible options are canvassed below.

Targeting the inputs to agriculture is central to achieving sustainability (Reeve 1992a; 1992b). Inputs to production and resource management are not only the purchased manufactured goods, but also power, fuel, water, finance, information, advice, education and labour; all of which influence the efficiency of agriculture. Necessary training and advice should not be seen as confined to grassland management but as related to all those elements of the farming business that might have consequences for it. In some circumstances, protection of grasslands will be enhanced more through advice from agronomists, farm consultants and financial advisers than from grassland experts. Education should also be directed at those providing advice to landholders.

Incentives may be appropriate when farmers would otherwise put pressure on their land, eg. during drought or when plants are germinating after drought breaks. Historically, subsidies

on stock feed or agistment have been paid to farmers during drought, but now farmers are encouraged to plan for the eventuality of drought. Payment for competent farm management advice to those farmers with native grassland who are in difficulty may be most appropriate form of incentive. This type of advice would require some training of farm consultants, with conservation input to ensure the farmer and consultant can fully evaluate all options.

Providing assistance to farmers exploring the commercial utilisation of products from native grasslands may be appropriate if compatible with positive conservation outcomes. In some cases, such as wildflower or native grass seed production, the activities might have deleterious conservation effects over time. As markets may also demand a uniform product only available from a cultivated source, conservation might be best secured by providing technical advice and other support to the farmers with native grassland to enable them to establish seed orchards.

Where commercial utilisation of products from native grasslands can be shown to have positive conservation outcomes, this may be best promoted by limited-term incentives directed at developing marketing structures and promotion. Some products from native grasslands may have unique characteristics which are marketable, so as to claim a premium. This is already the case with fine wool from some regions. Anecdotal information suggests quality of beef and lamb reared on native pasture is high. Lack of consistent supply might restrict the scope to exploit such characteristics. Alternative outputs from native grassland include native grass seed which is already harvested on some farms by contractors. Some farms will have potential to attract tourists, particularly if near popular destinations like Echuca. Quail are said to be more frequent in native pasture, which opens up the possibility of managing for quail habitat and selling hunting rights (S. Toops pers. comm.)[6].

Limitations to incentives directed at production practices on native grasslands should be recognised. Unless a long-term agreement or covenant is in place, farmers may undo the good work by changing activity. This will depend on the relative profitability of grazing native grassland compared to alternative land uses will change for better or worse over time with changes in agricultural techniques, cost-price relationships and other factors.

Conclusion

An initial assumption was made that native grasslands are not profitable. Relatively few farms in the 500 mm+ rainfall zone in south-eastern Australia now rely solely on native grassland; most also have sown pasture or cropping. When the reasons native grasslands can still be found on these farms and the place of native grasslands in farming systems, the financial benefits are much more likely to be positive. Economic research is needed to clarify this. In spite of possible economic benefits, there are many factors influencing management - this and the possibility of changes in price and farming technology - mean current profitability is not a guide to security for native grasslands.

It has been argued that policy mechanisms need to take account of moral hazard and first mover problems. There is an in-principle case for management agreements supported by appropriate incentive payments. However, management agreements

[6] Department of Natural Resources and Environment, Melbourne.

require a major funding initiative and they also need to be implemented in the context of other incentives and policy mechanisms. In particular, there needs to be a focus on *circuit-breaking* incentives which to assist in achieving desirable conservation management, may be directed at investment planning as much as at particular land management practices.

Finally, a comment on the likelihood of any one, or combination of, mechanisms being used given the political context is appropriate. It is important to address which instruments have been used before in Australia, their cost, whether they fit into a broader agenda, and whether there is political will to implement them. Long-term management agreements have little history in Australia, apart from heritage agreements in South Australia. Voluntary mechanisms like Landcare, Land for Wildlife and the covenanting program of Trust for Nature are popular. Regulation attracts considerable opposition, but nevertheless is commonly used - in part it fits with a push to wind back the involvement of the state in direct responsibility across many areas, and to push costs onto those directly involved - parents in the case of education, users in the case of telecommunications. The native vegetation retention regulations in Victoria and the SEPP 46 regulations in New South Wales push the responsibility for managing remnant vegetation onto landholders.

This preliminary research into the economics of native grassland on farms has given clear directions for future work in this area. These are:

- the economics of native grassland within a whole farm analysis
- what's best to do with the last bit of 'undeveloped' land given potential complementarities, option values and best use of resources
- the cost of a management agreement program, and of other incentives.
- exploring theoretical and practical ways to address first mover and moral hazard problems associated with conserving native grassland.

In conclusion, the cost of conserving native grassland is not likely to be overwhelming for either landholder or government by way of comparison with their respective budgets. Government action and support is however vital to ensure landholders manage for conservation purposes as well as production.

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