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**Graduate School of Agricultural and Resource Economics
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School of Economics**

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In Moree Plains Shire, New South Wales**

by

J A Sinden

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Who Pays To Protect Native Vegetation? Costs To Farmers In Moree Plains Shire, New South Wales

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Abstract

The Native Vegetation Conservation Act was introduced on January 1st 1998 to limit the clearing of native grassland and woodland in NSW. The Act has limited clearing and development to crops, has protected biodiversity, and may have enhanced soil and water conservation. But this analysis of the prices paid for land in Moree Plains Shire shows that the Act has reduced land values by some 21 per cent and has already reduced annual incomes by 10 per cent across the whole Shire. This reduction in annual incomes may well reach 18 per cent by 2005. This decrease in income means that farm households in the Shire currently must give up 15.6 per cent of their household income because they must protect native vegetation on their farms. In contrast, urban households in Australia must give up only 0.55 per cent of one per cent of their income through taxes for the same purpose. The Act has imposed these costs on farmers who are already struggling financially, has made the distribution of income in the community less equal, and has made farm families bear far higher costs than urban families. Do these outcomes enhance an objective of equity, or fairness within the community?

Keywords: native vegetation, opportunity costs, land values

**The author is an Associate Professor in the School of Economics, and in the Graduate School of Agricultural and Resource Economics at the University of New England.
Contact information: School of Economics, University of New England, Armidale, NSW 2351, Australia. Email: jsinden@pobox.une.edu.au.

Introduction

The broad goal of environmental policy is to increase the benefits to society as a whole from the use of Australia's natural resources. But gains in benefits to the whole community are often accompanied by losses to particular groups within the community. Governments therefore assess policy options against the following specific objectives.

- *appropriateness* is government intervention justified?
- *effectiveness* is the policy likely to achieve its objective?
- *efficiency* do the benefits of the policy exceed the costs?
- *equity* how will it affect the distribution of benefits and costs?

The Native Vegetation Conservation Act NSW was introduced on 1st January 1998 to reflect the growing community concern for the future of native vegetation. The Act was designed to prevent inappropriate clearing, to manage the remaining native vegetation sustainably, to prevent further economic loss, to streamline the administration of native vegetation management, and to encourage landholder and community involvement in vegetation management (NSW Department of Land and Water Conservation, February 1998).

The Act removes the farmer's rights to clear or develop native woodland or native grassland, except for certain minor exemptions such as cutting seven trees per hectare for farm purposes. The Act then permits development on application by the farmer and consent from the Department of Land and Water Conservation (DLWC). State Environmental Planning Policy 46 (SEPP 46) had been introduced in August 1995 with the same objectives and the same restrictions, to begin the process of policy formulation.

The balance between protection and clearing will be determined through the Regional Vegetation Management Committees that were established under the Act. These committees are in the process of preparing regional vegetation management plans, which must identify the social and economic aspects of native vegetation management, and consider the economic viability of land uses (NSW Department of Land and Water Conservation, July 1997). Efficiency and equity are therefore to be addressed at the level of the regional committee and the regional plan.

During the process of formulating this policy, the objectives of appropriateness, effectiveness, efficiency, and equity have all been recognised and discussed. Government intervention was necessary to protect native vegetation, the policy option was likely to achieve this objective, and the planning process was to explicitly consider efficiency (the sum of benefits and costs) and equity (the distribution of benefits and costs). Indeed, all these issues are covered in the underlying white paper (NSW Department of Land and Water Conservation, July 1997) and a series of Factsheets (such as NSW Department of Land and Water Conservation, 1998). They were also all covered in the many meetings sponsored by the DLWC to introduce the Act to farmers and the community throughout the state.

The requirement to retain native vegetation on farms can impose several kinds of cost on the landholder, all of which bear on the equity objective. The costs include the loss of income because use of land with native vegetation is restricted to grazing, and the associated loss of land value. They also include the ongoing costs of maintaining on-farm conservation reserves, and all the different kinds of costs that accompany applications to the DLWC for consent to develop land with native vegetation. Six years have passed since original SEPP 46 was introduced and so all these costs will have become apparent. A formal assessment of how the Act has affected the distribution of costs is therefore timely, and an intensive case study covering the whole area of a regional vegetation management committee, is a useful way to do this.

The objectives of the paper may therefore be summarised as follows:

- to assess the loss in farm income and the loss in farm land value due to the Act,
- to assess the importance of these losses to farm families, and
- to assess farmers willingness to protect native vegetation in the face of these costs.

The price that farmers actually pay for land is a measure of their expectations from it and reflects the whole set of values implicit in the land - - as seen by the farmer. The price will therefore “capture” the immediate income earning capacity of the land, and any long term benefits from reductions in land degradation due to the retention of trees and other vegetation. Further, prices are actual measures of worth because they are actually paid in the market and land is the main capital asset of the farmer. The analysis is therefore based on prices paid for farm land in Moree Plains Shire NSW. This area has been characterised by the active clearing of native vegetation up to the introduction of the Act, and the environmental sensitivity of

many of the remaining areas of native vegetation. The Shire is also characterised by the diversity of its agriculture and the changes in its agricultural enterprises from year to year.

Literature Review

There is a rich Australian literature on policies to encourage the protection of native vegetation on farms, and a limited literature on the costs to farmers of achieving this community goal. Both these areas are now reviewed to set the analysis in context. In terms of the objectives for national policies, the writers agree that some kind of intervention is appropriate, and offer a wide range of potentially-effective policies. But they offer far less information on the actual efficiency or equity impacts of their suggestions.

A range of policies

There are three broad kinds of policy to protect native vegetation, namely monetary incentives and disincentives, regulations to restrict farm activities and mandate conservation measures, and changes to the ownership of property. They all address the basic issue of the decline in quantity and quality of native vegetation throughout rural NSW and the underlying causes of increasing rural poverty, the need to expand cropping, and the lack of visible economic incentives to the farmer (Nadolny et al (1995). They can all provide the support that landholders need at the “crunch times” of land purchase, family crisis, crop failure and falling prices (Crosthwaite 1995).

Monetary incentives and dis-incentives include financial assistance with fencing and management costs, payments for stewardship of the land, reductions to Shire rates, and income tax incentives. Dobbin (2000), National Manager of the Primary Industries Bank of Australia, advocates interest–rate subsidies to farmers who adopt good farming practises. McKay (1995), representing the Tasmanian Farmers and Graziers Association, promotes a wide range of monetary incentives to protect native vegetation. Her policies include low interest loans, direct grants, tax credits for woodland management, and rebates on state land tax and shire rates for those who protect.

Christoff (1995) and James (1997) review the use of such market-based policy incentives in Australia and in environmental management. These instruments are increasingly being used in the economy as a whole, but they have played only a minor role so far in environment management. The Standing Committee on Environment and Heritage (2001) highlights a reason for this minor role. Monetary incentives require a long-term fund dedicated to rural conservation, but changing and uncertain government budgets cannot provide such funds.

Governments have used regulations to protect endangered species of flora and fauna by restricting other competitive activities. There are many circumstances where direct regulation is the only practical option to ensure protection. Indeed, the Australian Conservation Foundation (1995) advocates that all States introduce strict regulations to control clearing. But these controls pay insufficient attention to the nature and quality of habitat being protected and provide no incentive to improve degraded habitat. They also impose unnecessary costs when a particular habitat is already over protected (Industry Commission, 1998).

Regulations may provide an essential safety net to assure some minimum level of conservation if voluntary measures fail (Young et al 1996). Yet as Hodge (1991) points out, this kind of policy may target effectiveness at the expense of the efficiency and equity objectives. Administrators may know little about the situations faced by farmers and so impose costly constraints on them - - a problem that is being examined in the present paper.

The practical and theoretical advantages of changes to property rights are discussed by MacAuley (1996) and Young et al (1996). Changes can include covenants, conservation easements over freehold land, management agreements that involve clearing controls, and development of systems of tradeable development rights to limit development at least cost to the community. But the cost of some kinds of changes can be high. Whitby and Saunders (1996) report that the costs to create management agreements with farmers to conserve Sites of Special Scientific Interest in Britain totalled some 95.7 pounds per hectare of agreement, when all the administrative costs and compensation to farmers were included.

Choice of policies

The choice of policies should rest on the outcomes of each on the four community objectives and the trade-offs between the objectives. Policies should then

be chosen to provide the best set of outcomes on the set of four objectives. There are many difficulties with this process, and the information needs are obvious. A major problem concerns the competition between objectives. For example, policies to promote effectiveness may decrease efficiency or equity. Mues, Moon and Grivas (1996) indicate that current taxation incentives allow accelerated depreciation on water storages and 100 per cent deductions on capital works for prevention of land degradation. Some 40 per cent of broadacre and dairy farmers used these tax provisions in 1993 –1994, indicating their effectiveness. The current system therefore has encouraged the treatment of land degradation. But Mues, Moon and Grivas (1996) showed that the biggest tax benefits went to a small group of individuals with the highest taxable incomes, and 10 to 20 per cent of farmers got no benefit at all. A significant proportion of broadacre farmers rarely earned sufficient income to take full advantage of these measures, so other kinds of tax incentive such as tax rebates and tax credits should be explored. The existing system would be a valuable policy when used in conjunction with other policies to enhance resource management.

Young (1995) steers the debate toward the identification of trade-offs by arguing that biodiversity may be conserved at greater efficiency by a combination of government reserves and off-reserve policies to encourage changes in land-use practises. He provides a reason why a mix of policies is to be preferred and the trade-offs should be considered - - a mix of policies should lead to a set of complementary outcomes on the set of national objectives. Economic policy measures in combination with changes to property rights, institutional arrangements, and enforceable regulations, can simultaneously achieve all four national objectives. “A mixed approach is necessary so that all policy instruments acting in concert produce an efficient, equitable, dynamic, dependable and politically acceptable outcome.” (Young, 1992, p157).

A mix of the three kinds of policy seems to be essential to meet the national objectives, and this balanced approach has many advocates. Miles, Lockwood and Walpole (1998), Farrier (1995), Milham (1994), Panayotou (1992), Hodge (1991), and Wills (1987) have all reviewed the range of policies to protect native vegetation from their different perspectives. They all seem to agree that a mix is better able to meet the set of community objectives. For example, Miles, Lockwood and Walpole (1998) promote a package of monetary incentives (grants to pay for fencing and

annual management costs, tax incentives and lower shire rates) and changes to property rights (through binding and non-binding management agreements).

In a comprehensive review of a wide range of current government policies, including compensation and payments for management, Farrier (1995) advocates a balance of regulations and incentive payments for management. He argues that government conservation reserves may satisfy domestic needs for effective biodiversity conservation, but international obligations require that biodiversity is also protected on farmland. Bennett (1995) reviews the role of the private sector in protecting natural areas through the marketplace and monetary incentives. A combination of private and government initiatives is better able to meet the set of objectives, and so a shift in government policy to allow for a greater role of the individuals and corporations is advisable

Policies will inevitably interact with each other, to enhance or reduce the outcomes on the community's four objectives. The Industry Commission (1998) argued that much has already been done to advance the sustainable use of natural resources in agriculture. But the incorporation of ecological sustainability into policy has been ad hoc, incomplete, piecemeal, and tentative. Australian governments, at all levels, must implement a comprehensive and closely integrated set of policies to attempt to enhance outcomes on all objectives.

The Australian Conservation Foundation (1995) recognised this same interaction when they advocated changes to Commonwealth taxation policies to actively reduce the encouragement for tree clearing. The Commonwealth should use cross-compliance measures to ensure one kind of programme complements another. The Commonwealth should review the effects of its funding programmes where these counter the effectiveness of conservation laws. The Commonwealth should apply covenants more frequently to control land use where public funds are used, and should directly support local government planning through reimbursements for rate rebates.

Administrative arrangements must promote the implementation of policies. Binning and Young (1997) offer three independent principles for designing policies to protect vegetation: partnerships between the people involved, costs to be shared amongst beneficiaries, and secure tenures to land. NSW Farmers (2000) suggest a policy-review process to smooth the introduction and development of policies. Farmers face a shrinking bottom line, increasing regulation to provide outcomes for

others, yet are seeking to build partnerships with other groups across the political spectrum to conserve biodiversity. Their target is to build trust between the farming community, governments and urban interest groups.

Policies and the farmer

The role of farmers, who manage the land that has native vegetation, must be addressed explicitly. Do they have an obligation to protect the vegetation? Do they have a right to compensation if they are forced to retain vegetation? To ensure protection of native vegetation on the farm, policies should provide feedback mechanisms that reward resource conservation and environmental improvement (Young, 1992).

The use of financial incentives together with voluntary protection may suit the farmer but does not guarantee protection. If protection is to be assured, the community must devise incentives to reward the farmer for doing so. Hanley et al (1995) studied principles for the supply of environmental amenities from farmland, in nine countries of the Organisation for Economic Co-operation and Development. They found that a large proportion of the governments pay farmers to provide amenities from agriculture and rural land use in general, and few ask the beneficiaries to pay. To obtain these payments, farmers must follow certain guidelines and restrictions, as for example, reductions in herbicide use, maintenance of stone walls, and establishment of broad-leaved woodland plantations. Some of the schemes include:

- the North American Water-fowl Management Plan funded by taxpayers in the United States of America and Canada,
- the National Fund for the Protection of Rural Landscapes in Switzerland. Similar schemes exist in Sweden, Ireland, the Netherlands and Austria, and
- the Environmentally Sensitive Areas scheme and Management Agreements under the Wildlife and Countryside Act in the United Kingdom.

The principle of incentive payments to farmers who produce environmental goods is well established in the Organisation for Economic Co-operation and Development. The principle of voluntary production of these goods, as opposed to mandatory production, is also well established. The United Kingdom, for example, has preferred the voluntary approach with monetary incentives and has avoided uncompensated regulations to preserve woodland. Cary (1995) applies these lessons

to Australia. The impetus for such programmes in Europe comes from active urban concern for the state of rural landscapes and the viability of disadvantaged rural communities. “Such concerns need to be fostered in Australia as a necessary but not sufficient condition for public funding contributions for more active maintenance of vegetation on private land.” (Cary, *op cit* p 44).

The landholders’ viewpoints on policies to protect native vegetation have been well represented in New South Wales. NSW Farmers (2000) argues that the provision of public-good outcomes by the landholder should be accompanied by appropriate measures to offset the costs. They acknowledge farmers do and should have a duty of care to protect the environment, but protection beyond this level should trigger public funding to ensure equity within the community (NSW Farmers. 2001).

This issue of compensation may have to be addressed more formally to meet efficiency and equity objectives. The community may feel that farmers may have an entitlement to their reference income, if they follow the perceptions of households in a surveys undertaken by Kahneman, Knetsch and Tversky (1986). This income is their earnings at a given reference point, which presumably would be the years immediately prior to the introduction of a change such as the Act. Hodge (1989) suggests that compensation may be justified when farmers face a change in their reference point to meet a new set of responsibilities to provide environmental services for the public.

Costs to farmers

The benefits and costs from the protection of native vegetation provide the necessary information to judge the contribution of policies on the efficiency and equity objectives. The benefits of retaining vegetation are hard to measure. But the assessment of costs, even just to those who provide the environmental services, remains useful information to judge outcomes on the equity objective.

In a comprehensive benefit-cost analysis of retention of native vegetation in southern NSW and northern Victoria, Lockwood and Walpole (1999) assessed the different kinds of costs to farmers. The cost of retention in NSW (40 year scenario, 4 per cent discount rate) was allocated as follows. Thirty-eight per cent comprised direct costs of management such as fencing, 24 per cent was the opportunity cost of lost income because farmers are unable to develop to pasture or crops, and 38 per cent was the loss of benefits elsewhere on the property. While these costs totalled \$66.5 as

a net present value, the benefits to the community and the local catchment were even higher. Protection of this native vegetation met the efficiency objective, even though farmers bore the costs to provide environmental benefits for others.

Middleton et al (1999) estimated the loss in income imposed by the Act on landholders in three shires in Northern New South Wales. Much freehold woodland remains on the south and western parts of Walcha Shire near the eastern fall. If this woodland must be protected, landholders will forego income they could otherwise have earned by clearing and developing to pasture for livestock. But 65 per cent of the sample would in fact lose nothing because they did not wish to develop, and another 10 per cent would lose between \$1 and \$50 per ha. Overall, a large proportion would lose little while a small proportion lose considerable amounts.

Scott (1998) and Brosnan (1999) both analysed the costs of the restrictions of the native vegetation conservation acts on individual properties. In the Hunter Valley of New South Wales, Scott found that the restrictions of the Native Vegetation Conservation Act reduced annual incomes by some seven per cent on a 810 ha property with 230 ha of native woodland of various types and slopes. If the same restrictions were in place in southern Queensland, losses in annual income would vary between 10 and 14 per cent on a pastoral property of 16 700 ha in the western Darling Downs where 11 100 ha are still in woodland of various kinds.

The value of livestock output in the Gunnedah area of northern New South Wales is at a maximum when 34 per cent of the farm is under tree cover (Walpole, 1999). Gross value of output increases up to this point and decreases thereafter. A similar trend has been reported for the northern tablelands of New South Wales (Sinden and Jones, 1985). Income from livestock output increased with increasing amounts of live tree cover up to a maximum, but decreased as the quantity of live tree cover increased thereafter.

Eucalypt dieback, which cleared the woodland on well-wooded grazing properties in Walcha, Uralla and Dumaresq Shires on the northern tablelands of NSW, increased farm incomes in total by \$1.7m per year. As Tisdell (1984) says, this does not imply that it is economic to allow the dieback and clearance of trees. Rather, the increase in farm income must be weighed against the loss in benefits from clearing. Do the loss of biodiversity, increase in land degradation, and lower water quality that follow dieback, cost the community even more than \$1.7m per year? But

the estimation of the costs of retaining native vegetation is the first step in this discussion.

The relationships of land value with native woodland in NSW have been explored in the southern border areas, Liverpool Plains, and Northern Tablelands. Walpole (2000) analysed sales of 124 farms spanning southern NSW and northeast Victoria. She observed that many factors affect the price paid for farmland. She found that size of property, presence of a house, fences with good condition and placement, and purchase of an additional property all significantly raised the price that was paid. But the influence of native vegetation could not be definitively identified.

In his role as a land valuer, Spackman (2000) compared recent individual sales of cleared-and-cultivated properties and uncleared grassland properties in the Liverpool Plains. A hectare of cultivated land typically sold for \$600 more than a hectare of land with native grasses that had to be retained under the Act. Protection of native vegetation lowers land values in this area.

The dieback of eucalypts in on the Northern Tablelands in the 1970s and 1980s led to increases in the value of farmland (Sinden, Jones, and Fleming, 1983). There was still some 16 per cent of the property covered in healthy native woodland. Land value increased with decreases in the quantity of live trees, and with increases in the percentage of woodland with advanced dieback in scattered trees. But land value increased with the variety of species in the remaining live trees remaining, with decreases in altitude, and with closeness to a town. Buyers were balancing, inter alia, the increased income from a larger grazing area and the benefits of retaining a variety of species in the remaining live woodland.

Method

Governments formulate policies in terms of the objectives of appropriateness, effectiveness, efficiency and equity. The present study concerns just the equity objective, with an intensive case study to measure the effects of the Native Vegetation Conservation Act NSW on the distributions of income. To assess these effects, we must now select criteria to judge the fairness of distributions and to measure farm income.

Principles and criteria for equity

Economics, and the other social sciences, have developed several principles to judge the desirability of distributions of benefits and costs. None of these principles, or the criteria to apply them, are fully satisfactory and there are options and ambiguities in specifying the criterion criteria (Page, 1997). But each of the principles offers a basis to judge the desirability of changes, and each is a used particular contexts. They are described here in terms of both welfare (better off or worse off) and monetary income. They are used to compare changes in distribution with respect to the current distribution and not with respect to some minimum desirable levels of income.

Protect, in fact, levels of welfare of all individuals (Pareto criterion) A policy is desirable if it makes one or more people better off, without actually making anyone else worse off.

Protect, potentially, levels of welfare of all individuals (Kaldor-Hicks criterion) A policy is desirable if the gainers could potentially compensate all the potential losers and still be better off.

Improve the distribution of welfare to selected groups (Rawls criterion) A policy is desirable if it redistributes income to selected groups in society, such as the sick, the poor, or future generations (Rawls, 1971).

Improve the distribution of welfare to the whole community - - to make people more equal (Lorenz criterion) A policy is desirable if it makes the income of everyone in the community more equal.

Improve the distribution of welfare to the whole community- - to make people more equal without making any group worse off (Constrained Lorenz criterion) A policy is desirable if it makes the income of everyone in the community more equal without decreasing the income of any individual group.

To many, the concept of equality and Lorenz' principles are adequate and reasonable grounds for judging the issues of equity. Two guidelines have been developed to apply these egalitarian principles and compare distributions of benefits and costs.

- *Treat equals equally (horizontal equity)* A policy is desirable when people on equal income are treated equally. With respect to protection of native vegetation, the criterion is met when people on the same income receive the same benefit or pay the

same cost of protection. The criterion is violated if people with similar income levels in different parts of the state receive different net benefits or pay different costs.

- *Improve minimum levels of welfare (vertical equity)* A policy is desirable if it makes one or more people better off without disadvantaging those in society who are already worst off. Vertical equity concerns the treatment of unequals. If the benefits or costs of a policy are distributed in proportion to income, the distribution is said to be proportional. If the poor receive a larger share of the benefits (or pay a smaller share of the costs), the policy is progressive - - and so desirable. But if the poor pay a larger share of the costs (or receive a smaller share of the benefits), the policy is regressive - - and so undesirable. Conventionally, regressive policies violate the vertical equity criterion.

The Lorenz principle, that more-equal distributions are better distributions, provides an egalitarian basis to judge the incidence of benefits and costs. But a caveat is in order. These concepts of fairness and equity are used in a “conditional” sense. A policy that meets this equity objective is desirable, because we have followed the Lorenz principle of fairness and the notion of egalitarianism. In this context, policies that violate horizontal equity, and regressive policies of vertical equity, are both unfair and undesirable because they decrease equity. These two criteria can readily be used to assess the distributional impacts of introducing a new policy on a given group of people, as in the present study.

Measures of income

Gross margin, net farm income, and return to capital invested in the land are three, standard, complementary measures of annual farm income. Gross margin per hectare (GMPH) is defined as:

$$\text{GMPH} = \text{Gross money revenue} - \text{variable money costs} \quad (1)$$

In the case of crops for example, the variable costs include expenditures on seed, fertiliser and fuel. Net farm income (NETINC) or farm business profit is defined as:

$$\text{NETINC} = \text{Gross margin} - \text{fixed costs} - \text{depreciation} - \text{return to capital} - \text{owners salary} \quad (2)$$

The return to capital is the rate of interest on a loan if capital is borrowed to purchase the land, or the foregone interest if the capital were available but could have invested elsewhere. The return is set at 8 per cent, which reflects the rate at which

many of the farmers were borrowing. The owner's salary was set at \$80 000 per year, an estimate of the potential earnings in alternative employment such as the public service or business.

The return to the land (RETL) is defined as:

$$\text{RETL} = \frac{(\text{Gross margin} - \text{fixed costs} - \text{depreciation} - \text{owners salary})}{(\text{Price paid for land})} \text{ expressed as a percentage} \quad (3)$$

The farm business is profitable if RETL exceeds the loan rate of eight per cent

All three measures of profit were assessed for a "good" year, using the farmers' best prices and yields from the last three years (1998, 1999, and 2000). They were also assessed for 2000, a bad year in the Shire. An average income over the three years was estimated from the local maxim that "two bad years follow every good year". The main results are set in terms of a good year to present a strong test on the equity criteria.

Data Collection

Choice of study area

Farm land in Moree Plains Shire is characterised by extensive clearing of native vegetation (up until recently), the diversity of agriculture, and the environmental sensitivity of many of the remaining areas of native vegetation. The farm land market in the Shire is very active and between August 1995 and December 2000, 370 parcels of land were exchanged. Of this total, some 180 were exchanges of land between different farm families and the remainder were exchanges involving business companies with headquarters in a state capital, transfers within a family, and purchases of closed roads. The study focussed on farm families who had bought land from other farm families, since the original restrictions were introduced under SEPP 46 in August 1995. The first 51 of the buyers, with whom appointments could be made, were interviewed to obtain data on prices, yields, costs, areas of different kinds of vegetation, and other farm characteristics. All the buyers in this sample lived on their properties, and their farms were their main source of income. They were scattered widely across the Shire and are considered representative of family owned and operated farms in Moree Plains Shire.

Farm characteristics

The price paid for land (LVALUE) was expressed per hectare in the dollars of December 2000. Data were obtained from the Valuer-General on all exchanges of land in the Shire since January 1991. Since that time, prices had been rising steadily at eight per cent per year, so the prices paid were inflated at this annual rate to the common date of December 2000. The area of the purchased land was expressed in hectares (AREA). The distance from the nearest large town, Moree Narrabri, or Goondiwindi, was a measure of the residential amenity of the purchase (DIST).

Following standard definitions, native forest was defined as woodland where the tree canopy covered more than 20 per cent of the ground. Native woodland was defined as vegetation where tree canopy covered less than 20 per cent. The farmers estimated the percentages of their purchase under native forest, native woodland, native grassland which had not been cultivated in the last 10 years, native grassland that had been cultivated in the last ten years, and land in cultivation - - all at the time of purchase. These characteristics provided useful descriptions of the farms, and information for the following two variables for the analysis of land prices.

OACT was the average loss in gross margin due to the Act, calculated per hectare over the whole area of the purchase. The loss occurs, of course, because the farmers could not develop their native forest, native woodland, or native grassland which had not been cultivated in the last 10 years. The values were calculated with each farmers preferred enterprise mix, with his good prices yields and costs.

SUSTAIN was a measure of the capacity of cropland for sustained production. A scale of 1 (very incapable) to 5 (very capable) was described in terms of factors such as the prevention of sheet erosion of soil due to floods, the need for fertiliser application, and for weed control. Native vegetation is very effective in the Shire in reducing soils erosion from floods and may be effective in the longer term in reducing other kinds of land degradation. The chosen rating was multiplied by the percentage of the purchase under crops and itself expressed as a percentage.

Results

A context in which to assess equity

The current distribution of income within the sample provides the context in which to assess the impacts of the Native Vegetation Conservation Act. Current

incomes are, of course, affected by the Act. The three measures of income were first calculated for each farm for a good year and the 51 farms were ordered by their percentage return to land (RETL). The farms were then aggregated from the ranking into ten groups, and the mean value of each of the three measures was calculated per group (Table 1).

The average return to land for the whole sample (8.4 per cent) only just exceeded the costs of borrowing (7 to 8 per cent). In a good year therefore, with the farmers' own expectations of yields, costs, and prices, and under the present provisions of the Act, farmers are only just breaking even. Farmers in the lowest two income groups all earn negative returns to the land, and farmers in the lowest five groups all earn less than the cost of borrowing capital -- so the net incomes (column 3) of the lowest five groups are all negative. Overall then, half the farmers are losing net income even in a good year.

The average value of each measure was also calculated for the year 2000, when yields and many prices were poor due to two floods throughout most of this very flat Shire. In 2000, the average return to land was -1.5 per cent, the average net income was -\$83 per ha, and the average gross margin was \$28 per hectare. If good years are one in three, and the two bad years follow the 2000 data, the average return to land is 1.8 per cent (the average of 8.4, -1.5, and -1.5 per cent). Similarly the average net income is -\$54 per hectare (the average of +\$5, -\$83 and -\$83). These results may be summarised as follows.

Kind of year	Return to land %	Net income \$ per ha	Gross margin \$ per ha
Good	8.4	5	\$125
Average	1.8	-54	60
Bad	-1.5	-83	28

On this basis, the two conventional economic indicators of *net* earnings (return to land and net income) suggest that farming across the Shire is unprofitable - - farmers are struggling financially.

The problem of equity between farm types

The mean values of the basic farm characteristics and the measures of income are summarised in Table 2 for the overall sample, and for three types of farm. The differences between farms may be summarised as follows.

- The average price paid for land was \$793 per hectare. The price paid by cotton farmers was about double that paid by grain farmers, and almost three times that paid by livestock farmers.
- The differences in prices paid for land between farm types directly reflects the differences in gross margin and net farm income.
- The opportunity cost of the Act is \$55 per hectare, 44 per cent of the annual gross margin, and this cost falls most heavily on the livestock farmers.

The restrictions on land use, and the reasons for these opportunity costs imposed by the Act, may be illustrated as follows. In a good year, sustainable grazing of grassland might yield a gross margin of \$15 - 30 per hectare whereas development to crops might yield a gross margin of \$200 - 250. The Act restricts this clearing and development of native vegetation, and so reduces the farmer's gross margin by \$185 to \$220 per hectare. But further constraints on grazing, to follow strict conservation guidelines, might restrict earnings from grazing of grassland to \$1 - \$10 per hectare - in a good year. These constraints lead to higher reductions in income.

The difficulties that are created by the current distribution of native vegetation may be summarised as follows.

- Distribution of remaining vegetation is uneven between farm types, so the impact of the Act is uneven.
- The opportunity cost of the Act for livestock farmers, measured as foregone income is more than double that for grain or cotton farmers.
- Most remaining vegetation is associated with livestock farming, so the livestock farmers are affected worst.

Several of the farmers in each of the three groups had applied for consent to clear and crop areas of native vegetation. In all cases, their applications had been denied or the requested area had been reduced in size. The livestock farmers are most affected (they have the highest opportunity cost) and are least able to bear the cost (they have the poorest income). They have more native vegetation, where clearing is restricted, so the Act impacts more heavily on the poorest farmers.

Impacts of vegetation protection on the price paid for land

The literature, and information collected to formulate the problem, suggested that the price that farmers would pay for land would vary with short term profits (GMPH), size of purchase (AREA), long-term sustainability of cropland (SUSTAIN),

distance from a town (DIST), and the opportunity costs of the Act (OACT). The influence of these variables on price paid was determined by estimating the following equation from the data for all 51 farms.

$$LVALUE = f(\text{GMPH}, \text{AREA}, \text{SUSTAIN}, \text{DIST} \text{ and } \text{OACT}) \quad (4)$$

There are several ways to specify this function, and the most appropriate was determined through econometric tests of goodness of fit. The function was estimated with each specification and the explanatory powers of each were compared through the adjusted R squared, F, and t statistics. On this basis, the simple arithmetic function was used, but AREA was converted to natural logarithms to capture the expected curvilinear relationship of price with size of the purchase. The estimated form of this function was:

$$\begin{aligned}
 LVALUE = & \quad 3.904 + 2.412 \text{ GMPH} - 75.415 \text{ AREA} + 1.949 \text{ SUSTAIN} \\
 & \quad (3.9) \quad (5.7)^{***} \quad (1.9)^{**} \quad (1.5)^* \\
 & \quad - 1.893 \text{ DIST} - 0.749 \text{ OACT} \quad (5) \\
 & \quad (1.6)^{**} \quad (1.3)^*
 \end{aligned}$$

The adjusted R squared statistic was 0.714, the F statistic was 25.942 and the t statistics are shown in parentheses. All the variables were statistically significant in explaining variations in the price paid. The superscript *** indicates significance on the t statistic at one per cent or better, ** indicates significance at five per cent or better, and * indicates significance at 10 per cent or better. The signs on the variables indicate that price paid varies in the following manner:

- an increase in annual gross margin increases the price paid,
- an increase in size of the purchase reduces the price paid,
- an increase in the sustainability of cropland increases the price paid,
- an increase in the distance from town reduces the price paid, and
- an increase in the opportunity cost of the Act decreases the price paid.

This latter result indicates that the Act has reduced the price paid for land, throughout the sample - - and hence throughout the Shire. The Native Vegetation Conservation Act has therefore led to a reduction in land value. Lower prices reduce the role of land as collateral for a loan, and the restrictions of the Act make the land harder to sell. Lower prices may also reduce the ability of the Shire to raise rate income.

But how important is this opportunity cost imposed by the Act and how large is the associated change in price paid for land? The relative importance is shown by the levels of significance of the variables in equation (5). The opportunity cost of the Act (OACT) is the least important of the five variables (significant at 10 per cent) while gross margin (GMPH) is the most important (significant at one per cent). The actual importance, or actual magnitudes, of the impacts is shown by the coefficients of the model:

- a \$10 gain in income, from a \$10 rise in GMPH, increases price paid by \$24.1 , and
- a \$10 gain in income, from a \$10 fall in OACT, increases price paid by \$7.5 per ha.

Thus, the effect of the Act on price is only some third the effect of gross margin. The \$10 gains are of course identical increases in income, but they translate into very different changes in the price paid. Farmers are valuing a gain in net income from an increase in gross margin much more highly than the same gain from the lower opportunity cost. The former is a relatively certain gain but the latter is an unlikely gain unless consent is granted to develop the land. The difference (24.1 to 7.5) is a measure of the discount farmers place on the uncertain gains from the consent process.

If we assume that these results can be expanded arithmetically, we can calculate the following results from the equation (5).

Scenario: with or without the Act	% actually cultivated	% native vegetation retained	Land value \$ per ha	Loss in land value %
With: as at present	up to 59	41	793	0
Without: scenario 1	80	20	941	20.4
Without: scenario 2	85	15	949	21.3

For the “Without: scenario 1” for example, the land value would be 20.4 per cent higher without the Act, and so the Act has led to a loss in land value of 20.4 per cent.

Both sustainability of cropland and the opportunity costs of the Act were significant in the model, and both result from the retention of native vegetation. Buyers pay more for land on which cropping is more sustainable, and the level of sustainability relates partly to the retention of native vegetation. Retention therefore has a role in enhancing land values. Buyers pay less for land that has a higher proportion of native vegetation. Retention of native vegetation therefore has a role in

reducing land values. Buyers of land are therefore balancing the benefits and costs of retaining native vegetation.

Impacts of vegetation protection on farm income.

Unless specific consent has been granted to develop the land, the Act will reduce income because uses are restricted to grazing native grassland and native woodland - - instead of the more profitable cropping. So farmers bear a direct loss of income from the protection of native vegetation. But what is the magnitude of this loss over the whole farm?

The size of the loss was estimated by comparing the existing gross margin with the Act to potential gross margins without the Act (Table 3). The average gross margin, at present with the Act, was \$125 per hectare, using yields, prices and costs for each farm in a good year (Table 2). The same prices and costs were then used to estimate gross margins without the Act and with further restrictions under the Act. As at December 2000, 59.1 per cent of the land in the sample could be cultivated under the Act, because it was already under cultivation (42.2 per cent) or had been native grassland for less than 10 years (16.9 per cent).

Between 1985 and 1994 clearing of woody vegetation had been proceeding in the Shire at a rate of 1.12 per cent a year (Cox, Sivertsen and Bedward, 2001). If this compound rate were to have continued from August 1995 to December 2000, another 7.8 per cent of the area of woody vegetation (or 22 ha) would have been cleared to crops. If we assume that native grassland would have been developed at the same rate, another 22 ha would be under crops - - for a total of 44 extra ha that could be cultivated. The total area of cultivatable land would increase to 62 per cent of the average property across the whole Shire. The authors suggest their rate is an underestimate, so we assume that 65 per cent could now be cultivated. The average gross margin over the whole farm (Scenario 3 in Table 3) would have therefore risen from \$125 to \$137 in 2000 - - a 10 per cent increase. The gross margin has been decreased by the Act by \$12 per hectare, or \$20.4m across the Shire as a whole.

By 2005, clearing would have increased the area that could be cultivated to 70 per cent, following the same trends. The table shows that gross margin would have risen to \$147 per hectare - - an 18 per cent increase over the existing situation with the Act. The gross margin would then have been decreased by the Act by \$22 per hectare, or \$37.4 million across the shire as a whole.

Further restrictions will reduce incomes again. For example, further restrictions to 20 per cent protection, 40 per cent grazing, and 40 per cent cropping, will reduce income by another 29 per cent if they are administered uniformly across the properties.

Costs of protection to farm and urban households

The average gross margin for a good year appears to have been reduced by 10 per cent because of the Act (Table 3), so farmers were contributing 10 per cent of their gross margin to protect native vegetation. How does this compare to the contribution from urban households?

The total income to the farm household in a good year is the \$80 000 allowed for the owner's salary plus payments to other family labour (which averaged \$20 000 from half a year at \$40 000 per year) plus the net income from the farm (which averaged \$6965, from \$5 per ha over 1393ha). The total household income is therefore \$106 965 - - in a good year. The loss of gross margin due to the Act for the farm as a whole is \$16 716 (12 per hectare*1393) which is 15.6 per cent of this estimate of household income.

An equivalent urban household, of 1.5 adult employees would earn 1.5*the full time adult weekly earnings of \$839.2, or a total of \$65 458 per year. The national expenditure from household, government and industrial sources on biodiversity protection and conservation of soil and water was \$108 per head in 1995-96. If there are 3.5 people in the family, the contribution per family is \$361 per year or 0.5 of one per cent of family income. The farm family contribution of 15.6 per cent of household income is 31 times more than this estimate of the urban household contribution.

Discussion and conclusions

Impacts of vegetation protection on equity

The introduction of the Native Vegetation Conservation Act in NSW appears to have reduced farm land values by some 20 - 21 per cent, and already reduced annual farm gross margins by at least 10 per cent on each hectare across Moree Plains Shire. By 2005, the Act may will have reduced annual gross margins by 18 per cent - - if current trends continue. These costs are borne unevenly, because the highest costs from the Act seem to fall on the poorest farmers. Farming is unprofitable in the Shire,

so these costs have been imposed on a group in the community who are already in a very low income class. Further, farm households pay 31 times more for protection of native vegetation than urban households.

The Act has therefore aggravated an equity situation that already needed improvement. The distribution of incomes from the Act makes people in the community less equal and makes a poor group even poorer - - violating the two Lorenz principles and a natural sense of equality. In more detail, costs are imposed on those who are already earning negative incomes so vertical equity is violated, and farmers are treated differently so horizontal equity is violated as well. The situation is further aggravated because the Act imposes certain costs on farmers today to provide uncertain benefits at uncertain times in the future to others in the community.

Willingness of farmers to protect

Yet there remains a substantial willingness amongst the farmers to protect native vegetation, and so all the responses to the Act and to vegetation loss need to be considered. First, the opportunity costs of the Act were least significant of the five variables that affect prices paid for land. Second, these opportunity costs had a smaller absolute impact on land prices than gross margin. Third, farmers who buy land are balancing the benefits and cost of retaining native vegetation. They pay more for land on which cropping is more sustainable, and the level of sustainability relates partly to the retention of native vegetation. Retention therefore has a role in enhancing land values. They pay less for land that has a higher proportion of native vegetation. Retention of native vegetation therefore has a role in reducing land values.

Fourth, farmers clearly consider the long-term sustainability of cultivated land (SUSTAIN) as well as the short term profits (GMPH), when they buy land. This long-term view helps to capture the benefits of retaining native vegetation.

Fifth, and perhaps most important, many farmers appear to have an innate “duty of care”, and so to have already implemented a recent recommendation from the Standing Committee on Heritage and the Environment (2001) to integrate such a duty into national policies. Farmers were asked whether they would wish to develop their native vegetation in the coming years. Thirty of the 51 in the sample were happy to retain at least 15 per cent of their native vegetation. The other 21 wished to retain the option to develop at least part of their native vegetation - - they might not clear

and develop at all, but they needed to retain the option to do so. These attitudes toward protection had an economic basis.

	Gross margin \$ per ha	Percentage native vegetation
The 30 who are willing to protect	50	29.8
The whole sample of 51	125	40.9
The 21 who wish to retain the option to develop	96	59.6

Those who are willing to protect have the highest gross margin per hectare and the least native vegetation on their property, and so are those best able to do so economically. Those who wish to retain the option to develop have gross margins which are considerably lower than average.

This general willingness to protect native vegetation in Moree Plains Shire follows the general trend for protection of on-farm natural resources across all crop farms in the country. In an extensive ABARE survey, Mues, Roper and Ockerby (1994) found that 34 per cent of all crop farmers plant trees and shrubs, 22 per cent exclude stock from areas affected by land degradation, 72 per cent use a conservative stocking rate, and 85 per cent manage crop rotations to minimise degradation. These responses from farmers were based on the farmers' own perceptions, and were not checked against such baselines as underlying carrying capacity. But they do indicate a substantial willingness across all crop farmers to manage the land to protect its natural resources.

Offsets to promote equity: part of the required policy mix

If the present regulations continue, or if new regulations impose further opportunity costs on the farmer, the case for compensation must be addressed in some way. But monetary compensation for all disadvantaged farmers is unlikely to be available. Fortunately perhaps, the farmers are very interested in the idea of offsets or specific activities that provide a gain for the environment and an improvement in the options for farm management. The survey contained the following two questions, set in the context of protecting 15 per cent of the remaining native vegetation on each farm.

“ Would you voluntarily dedicate land primarily to nature conservation, with limited grazing, no tree thinning no clearing or cropping?” The answers were:

Yes	Probably	Possibly	Probably not	No	Total
23	2	7	1	18	51

The 23 who said yes, includes at least 8 who have already conserved large proportions of their land. Another question concerned dedication of land with some kind of compensation or off-set.

“ Would you be prepared to dedicate land in this way, if it enabled you to have clearing rights over another part of the property?” The answers were:

Yes	Probably	Possibly	Probably not	No	Total
33	3	4	1	10	51

These results indicate that there is widespread support for dedication of land to conservation of native vegetation, and the support increases if there is some equity off-set such as permission to clear elsewhere. But perhaps most interesting of all was the variety of kinds of offset that the farmers themselves suggested. The long and varied list of Table 4 shows a considerable interest by farmers in the idea. The Native Vegetation Conservation Act does appear to impose imposes costs on the farmer and to reduce land values. The offsets would be a practical way to address these substantial questions of equity.

An overview

In conclusion, we now return to the objectives of a national policy, namely appropriateness, effectiveness, efficiency, and equity. The literature, the farmers and agency personnel, all agree that government intervention was appropriate to protect native vegetation - - although not all the groups believe that the Native Vegetation Conservation Act was the best way to achieve this objective. The Act has been effective in reducing the clearing of native vegetation from 6724 ha per year in 1985-1994 to 3517 ha per year since 1998 (Cox, Sivertsen and Bedward, 2001). The efficiency objective would be met too if the annual benefits throughout the community

from vegetation protection in the Shire exceeded the annual costs to farmers in the Shire (the costs are \$20.4m in 2000, rising to \$37.4m in 2005). But the Act has aggravated equity because farm families have had to bear far higher costs than urban families, the distributions of income in the community are made less equal, and costs have been imposed on farmers who are already struggling financially.

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Table 1 Farm incomes in a good year, by three measures of income*

Income class	Measure of income, mean per class		
	Return to land %	Net income \$ per ha	Gross margin \$ per ha
1	2	3	4
1 (Lowest)	-8.9	-129	81
2	-1.7	-47	30
3	1.4	-44	54
4	5.3	-21	112
5	7.5	-4	112
6	9.6	17	142
7	12.5	45	153
8	15.8	66	228
9	17.0	77	196
10 (highest)	23.3	78	143
Averages	8.4%	\$5 per ha	\$125 per ha

* The 51 farms are aggregated by return to land into groups of five, but with six in the highest income class.

Table 2 The problem of equity between farm types

Characteristic	Whole sample	Cotton^a	Grain crops only	Livestock^b
Number of farms	51	6	27	18
<i>The farm as a whole</i>				
Average area ha	1393	1307	1155	1777
Purchase price ^c \$ per ha	793	1459	799	561
Distance from a town kms	63	54	60	70
<i>Measures of income</i>				
Gross margin \$ per ha	125	254	132	73
Net farm income \$ per ha	6	25	13	-11
Return to land %	8.4	8.0	10.6	5.2
<i>Characteristics of the vegetation</i>				
% native grassland	19.9	15.1	11.3	34.3
% native woodland and forest	21.0	11.2	17.2	30.0
total % native vegetation ^d	40.9	26.3	28.5	64.3
% that can be cultivated	59.1	73.7	71.5	35.7
Total percentage	100.0	100.0	100.0	100.0
Opportunity cost of Act \$ p ha	55	37	38	88
Sustainability cropland % scale	45	71	54	23

- a These farms produce mainly cotton, with grain crops also on some of them.
b These farms include those with livestock only, and those with livestock and crops.
c The purchase price is the price paid per ha, in the dollars of December 2000.
d The percentage native vegetation is the sum of the percentage of native grassland and the percentage of native woodland and forest.

Table 3 Changes in gross margin with and without the Act

Scenario	Uses of farm land as %			Total per cent of land	GM \$ per ha	% Change in GM*
	Conserv -ation	Grazing only	Crops			
<i>Potential gross margins without the Act</i>						
1	10	10	80	100	167	+34
2	15	15	70	100	147	+18
3	18	17	65	100	137	+10
<i>Existing</i>	21	20	59	100	125	0
<i>Potential gross margins with further restrictions</i>						
4	20	30	50	100	108	-14
5	20	40	40	100	88	-29
6	30	40	30	100	68	-46

* All changes are calculated from the existing percentage of land uses to the new percentage allocations, and use the same production and revenue data.

Table 4 Suggestions for offsets, from the farmers themselves

	Gain for native vegetation	Offset for farmer: permission to...
<i>On the farm</i>		
1	Plant trees in belts	Clear and cultivate elsewhere
2	Plant native trees on boundaries	Clear elsewhere
3	Keep clumps and strips of trees on boundaries	Clear individual trees elsewhere
4	Keep native grass on part of the property	Crop on another part of the farm
5	Let poorer soil go back to nature	Crop on better soil
6	Retain woodland on hilly part of farm	Thin out native woodland near creek, to manage woodland properly
7	Dedicate to conservation freehold land with endangered wildlife	Continue to graze the area
8	Dedicate to conservation freehold land with endangered wildlife	Clear another part of the property
9	Dedicate to conservation freehold land with endangered wildlife	Intensify production elsewhere, and receive compensation for any net loss
10	Dedicate to conservation freehold land with endangered wildlife	Receive compensation as some % of lost land value
<i>Between farms</i>		
11	Manage vegetation in adjacent TSR	Clear on part of adjacent property
12	Keep native vegetation in one parish	Crop in another parish
13	Keep vegetation in one shire	Clear in another shire