THE MARKET VALUE OF REMNANT NATIVE VEGETATION IN A CLEARANCE REGULATED ENVIRONMENT

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ABSTRACT

The market value of remnant native vegetation (RNV) on rural holdings is assessed. Using 841 rural property transactions over 1983–97 in selected areas of South Australia, it was found that the presence of non-heritage RNV does not reduce market value, while the presence of heritage RNV does not add to market value. Depending on the region, reductions in property price of $36–$295 per hectare occurred for non-heritage RNV placed under a heritage agreement.

Keywords: Rural valuation, vegetation management, heritage agreements, hedonic price modeling.

INTRODUCTION

The management of remnant native vegetation[1] (RNV) in Australia varies widely between the States and Territories, and largely reflects different institutional arrangements and differences in the extent and status of RNV across the jurisdictions[2] (Griffin, 1999). In the context of privately owned rural establishments, there is generally a lack of knowledge on the contribution that is made to the market value of a property by its component of RNV. Furthermore, there is a lack of knowledge on the impact to market value that may result from the protection of remnant native vegetation by the registration of a heritage agreement over a property's certificate of title. This gap in knowledge has the potential for unexpected policy outcomes in relation to RNV management. In relation to these two issues, the research focused on transactions of non-irrigated rural holdings[3] in South Australia that have a component of RNV. The impact of heritage agreements was examined in the South Australian context and in doing so, put forward two hypotheses:

1. The presence of RNV not under a heritage agreement neither increases nor reduces the market value of a rural holding;
2. The presence of RNV which is subject to a heritage agreement, neither increases nor reduces the market value of a rural holding.

[1] Remnant native vegetation for the purpose of this research refers to the remaining indigenous vegetation excluding indigenous grasses.

[2] The current regulatory approach to RNV management in the different jurisdictions can be found by going to the web link http://www.ea.gov.au/land/vegetation/management/introduction.html

[3] Rural holdings are defined as properties used in the business of primary production to derive the primary source of personal income for the landowner.

To test these hypotheses, the research analysed market transactions of non-irrigated rural holdings in three regions of rural South Australia: South East, Murray-Mallee, and the Eyre Peninsula, over a time frame from June 1983 to December 1997. Since May 1983, there have been restrictions on the clearing of vegetation in South Australia and therefore any transactions of property in this time frame will reflect the changed utility. Within the framework of hedonic price theory, the price of a property was defined as a function of production, consumption, location and vegetation attributes. Subsequently, Least Squares Regression was used to estimate the coefficient values for the attributes to reveal the implicit market prices for remnant native vegetation.

The paper begins with a brief overview of the values attributed to RNV and moves on to discuss remnant native vegetation management controls on private land in South Australia. It proceeds to describe the rural real estate market. Subsequently the paper discusses the research method, the data used, and the results of analyses. The paper concludes with a discussion of the affects the findings have for remnant native vegetation management policy.

VALUES ATTRIBUTED TO REMNANT NATIVE VEGETATION

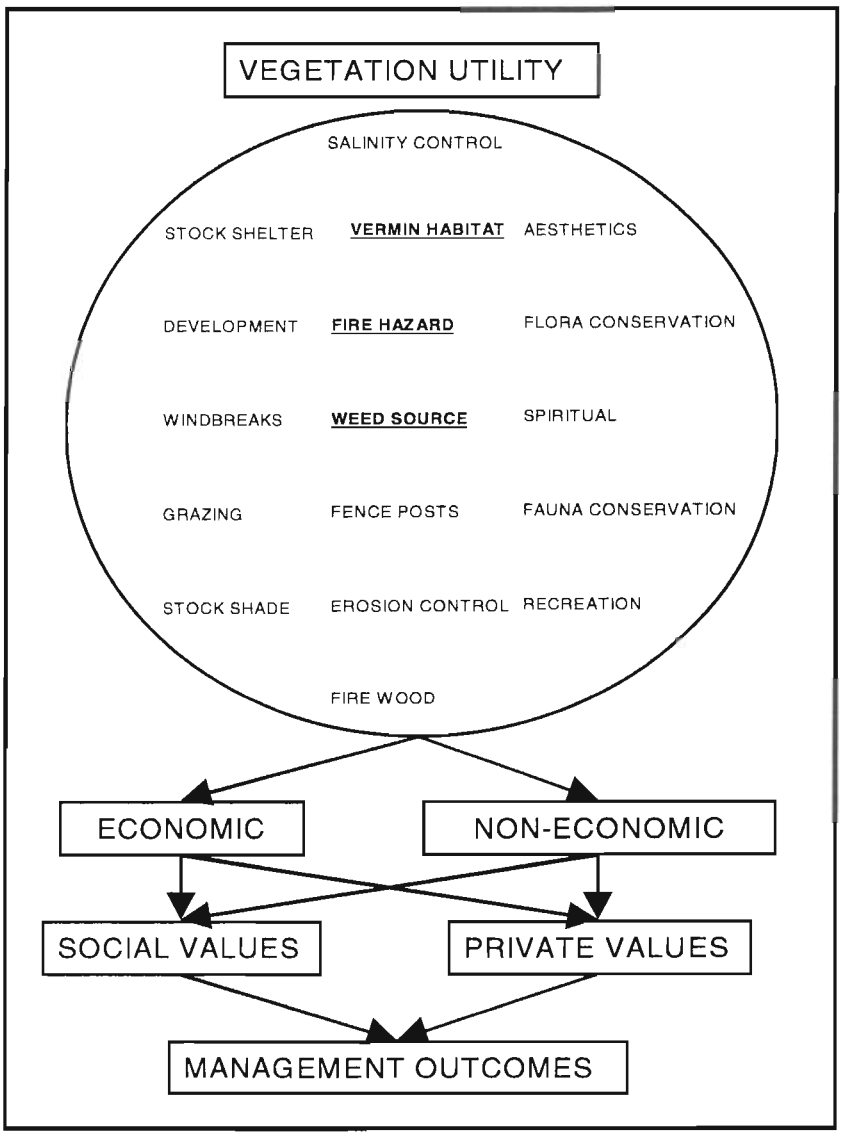
RNV on private property has a range of private and social values. Private value is the worth of RNV on a property as perceived by the owner (purchaser). Social value is the worth of RNV as perceived by the community. Both can be expressed as an economic or non-economic benefit. There is an underlying recognition of both public and private sector benefits from retention of remnant native vegetation on farms. By and large, the broader public benefits far exceed the private benefits to individual landholders (Slee, 1998). This contention is supported by the Cost Benefit Analysis study of Lockwood *et al.* (1999).

Figure 1 displays a paradigm for managing RNV that includes both positive and negative (underlined) values. The existence of these values is generally recognised by both private landowners and the broader community; however, in decisions relating to management, the relative importance placed on the values by each group often differs. These differences are associated to the scale of economies. Farmers are generally concerned with annual farm income produced from their farm and generally remain unconvinced that the retention of larger areas of remnant native vegetation on their farms will add to annual farm income (Slee, 1998). The overall value of RNV held by landholders, in the rural holding market, is largely conditioned by short to medium term on-farm economic considerations. In contrast, social values tend to be associated with long-term views and weighted more heavily by catchment and regional considerations. When management for private value jeopardises the social value, it could be argued that there is justification for the implementation of education, incentives, or regulations to realign the private and social values to a more acceptable position.

The interventions in South Australia have resulted in changes in the utilities possessed by RNV. The introduction of clearing restrictions has eliminated broadacre RNV clearing for farmland development as a land use option; while, heritage agreements have, in addition, prevented sites for building, and the grazing of domestic animals as land use options. Heritage agreements also place management responsibilities onto

owners. If the reduced set of utilities result in a loss of property value, then it is reasonable to compensate the loss. Diminished property rights as a consequence of the registration on land titles of RNV heritage agreements has been recognised in South Australia. Between 1983 and 1991, landholders who entered a RNV heritage agreement were offered financial assistance to offset losses in property value.

Figure 1: A remnant native vegetation management paradigm



CLEARANCE RESTRICTION AND HERITAGE AGREEMENTS IN SOUTH AUSTRALIA

South Australia has had a long history of concern regarding remnant native vegetation clearance for rural development. The first signs of clearance controls, other than through state acquisition to preserve desirable natural areas, emerged in 1972 with proposed Environment Preservation Regulations for Kangaroo Island under the State Planning Act (Interdepartmental Committee on Vegetation Clearance, 1976).

As a result of overwhelming local opposition, the proposal never succeeded but it led the way for the formation of the Interdepartmental Committee on Vegetation Clearance in 1974. The committee made several recommendations, one of which was for heritage agreements and financial assistance to prevent remnant native vegetation being cleared. No government action eventuated and clearing continued. In 1980, the government introduced the Voluntary Heritage Agreement Scheme (Fowler, 1986). The scheme had a slow take-up rate and up to May 1983, only 2% (18,000 hectares) of the 1980 vegetated area had been committed to heritage agreements.

On the 12th May 1983, the Government by amendments to the Planning Act 1982 introduced restrictions on clearing RNV. No compensation was awarded for decisions that disallowed owners to clear remnant native vegetation. Rural landowners lobbied for compensation and on 21st of November 1985, the Native Vegetation Management Act became law and provided for financial assistance subject to the following conditions:

1. An application to clear land has been refused,
2. The landowner must enter a heritage agreement in respect of such land,
3. The land must have been purchased by the owner prior to the 12th May 1983,
4. The land is not held under a Miscellaneous Lease or Licence from the Crown,
5. The area of land refused clearance must be greater than 12.5% of the total holding,
6. Financial assistance was determined as "the loss in market value of the land as a result of the Authority's clearance decision, LESS a percentage equal to 12.5% of the total holding divided by the area refused clearance". The 12.5% factor is waived where clearance was refused solely on biological grounds and in cases where landowners suffer extreme economic hardship as a result of the clearance controls,
7. Properties made non-viable by a decision to refuse clearing to be purchased outright,
8. Financial assistance payments for loss of pollarding, woodcutting, brushcutting and charcoaling businesses.

The main provisions of a heritage agreement prevented the land from being cleared, used for stock grazing, developed with any structures, and made the owner responsible for its management. Heritage agreements are registered on the certificate of title and bind the owner and all subsequent owners (Marano, 1991).

While the Act had a provision that reduced financial assistance by the 12.5% factor, this was never applied, as all cases were deemed to be refused clearance solely on biological grounds.

In 1991, the Native Vegetation Act replaced the Native Vegetation Management Act, 1985. The new act makes no provision for financial assistance for loss in market value. It does provide, however, for management assistance if the owner enters a heritage agreement.

THE RURAL REAL ESTATE MARKET

The characteristics of rural land are such that they appeal to a broad cross section of the population for a variety of different purposes. The land uses range from traditional rural enterprises to recreation and leisure activities. The motivations of purchasers

include economic and non-economic factors. Economic factors include production costs and returns. Non-economic motivations include the desire to leave the stress of the city behind, improved quality of life (Drynan *et al.*, 1983) and retirement. In the USA, as much as 44% of all farmland and ranch land was owned by non-farmers and 14% was held by retirees (Healy and Short, 1981). This makes the study of rural land markets using traditional valuation approaches and contemporary hedonic price functions problematic. All methods are based on the assumption that all participants in a market will consider all properties in that market. In the overall rural land market, this assumption is violated; however, stratification of the market into its submarkets overcomes this problem.

It is a widely thought that the rural real estate market is comprised of three distinct markets: those properties used for the business of primary production to derive the primary source of personal income (herein after referred to as rural holdings), those used for hobby farms, and those that undertake little or no primary production and are used primarily for a "lifestyle".

Researchers in the study of farmland prices have tended to deal with the issue of sub-makets in two ways:

1. Use a single model for the overall market and account for the sub-market issue by including location and purchaser characteristic variables. Studies using this approach usually include dummy variables for location and purchaser type (Vitaliano and Hill, 1994).
2. Recognise the rural market as comprising of a number of independent submarkets and for each, estimate separate hedonic price functions. Research using this approach have classified submarkets based on the following criteria: economic and non-economic motivations to purchase (Henning, 1998), property size (Drynan *et al.*, 1983; Gray and Prentice, 1982; Jennings and Kletke, 1977), distance to population centres (Gardner and Barrow, 1985; Blase and Hasemann, 1973; Hartman and Anderson, 1963) and sale price (Payne *et al.*, 1994).

Each of the approaches has some merit, but this study used the second approach. A survey of purchasers was conducted and the rural holding submarket was determined from the analysis of the responses.

PURCHASER SURVEY

The objectives of the survey were to identify the:

- nature of the real estate market for agricultural properties with RNV,
- attitudes of purchasers to RNV on property,
- intended and actual use of RNV on the property,
- importance of production, consumption and locational factors in price determination.

Sample selection

Property transfers for the three study regions were extracted from the UpMarket sales database[4], if they met the following criteria:

1. Transfers had to be registered with the Lands Titles Office between 1st June, 1983 and the 31st December, 1997,
2. Properties transferred had to have a rural land use code[5],
3. The sale price represented an open market transaction.

Circumstances deemed to be not representative of an open market transaction include those where:

1. The vendor and purchaser are related,
2. A Government agency was a vendor or purchaser,
3. A charitable organisation was the vendor or purchaser,
4. A religious group was the purchaser or vendor (Rost and Collins, 1993).

Sales of this nature together with sale prices registered at extraordinarily low amounts or at suspicious amounts[6] were identified and eliminated from further analysis. Subsequently, using Arcview 3.0 geographic information system (GIS) software, all land parcels comprised in each land transfer were matched to the digitised cadastre data base (DCDB)[7]. Those sales that had no link to the DCDB were removed from the analysis. Then the digitised boundaries for remnant native vegetation in South Australia[8] were imported into the GIS; consequently, an automated procedure in the software calculated for each sale, the area in hectares that was covered by RNV.

Sales from the resultant sample were selected for the survey based on the following criteria:

1. South East region; greater than 5% of total holding area or greater than 10 hectares covered in RNV,
2. Murray Mallee; greater than 20 hectares covered in RNV,
3. Eyre Peninsula; greater than 20 hectares covered in RNV.

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[4] UpMarket is a sales database developed and maintained by the University of South Australia. It contains all land transfers in South Australia, that have been registered with the Lands Titles Office since 1981. Each transfer record includes: sale price, sale date, vendors name and address, purchasers name and address, transfer document number, and Land Use Code.

[5] Rural land use codes classify land used in primary production. They do not distinguish rural holdings from hobby farms, or lifestyle blocks.

[6] Suspicious amounts are amounts not transferred in multiples of one hundred; e.g., $15 342. This could have resulted in the elimination of some genuine sales such as those that may have been auctioned in dollars per hectares, but such practices are very rare in South Australia.

[7] The DCDB is a digitised database, created and administered by the Land Information Group, Department of Administrative and Information Services, that contains the property boundaries of all parcels of land created in South Australia.

[8] The digitised remnant native vegetation maps for the South East and Murray Mallee were obtained from the Department of Housing and Urban Development. They were produced from colour aerial photos at 1:40000 scale. The digitised remnant native vegetation map for the Eyre Peninsula was produced from landsat imagery at 1:100000 scale. These digitised maps were the best available data.

SURVEY METHOD

Information was obtained by mail questionnaire that included a pre-paid, self-addressed envelope. The questionnaire had four parts:

- Part 1 contained questions relating to the circumstances of the sale, how well the purchaser knew the property, and the reasons for purchase.

- Part 2 contained questions relating to the production capability of the property, the condition and usefulness of structural improvements and the relative importance of various property related factors in the determination of price.

- Part 3 contained questions relating to the intended and actual use of RNV on the property, the purchaser's agreement or disagreement with provided statements about RNV, and management aspects of RNV.

- Part 4 contained questions about the characteristics of the purchasers.

The questionnaire included a plan of the land title boundaries that delineated the sale. Mailing addresses for the purchasers were obtained from the sales records and checked with local governments. Follow-up procedures to non-respondents included reminder letters four weeks after the initial mail out, telephone reminder at six weeks and a second reminder letter at eight weeks.

Analysis of the survey responses show that the main reasons for purchase were overwhelming for farm expansion (approximately 70% of respondents), followed by adjusting existing farm operations and establishing children in farming (approximately 20% of respondents), while life style and tax benefit considerations were reasons for purchase for less than 10% of respondents. The ranking and weighting by respondents of price influencing factors indicated productive capability of the land and distance to other property they owned as being prime influences, while views and distance to town were of minor importance. Over 80% of respondents owned other rural property, about 70% were members of farmer organizations, and about 90% had more than 5 years experience as farm managers. Based on the survey responses, sales were classified into rural holding, hobby farms, lifestyle property or related sales. The classification of the respondents and response statistics appears in Table 1.

Table 1: Purchaser survey statistics

Region	Total participants	Related party sale	Rural holding	Hobby farm	Lifestyle
South East	158	26 (16%)	116 (73%)	10 (6%)	6 (4%)
Eyre Peninsula	135	12 (9%)	103 (76%)	12 (9%)	8 (6%)
Murray Mallee	125	6 (5%)	103 (82%)	8 (6%)	4 (3%)

Examination of the property characteristics pertaining to rural holding, hobby farm, and lifestyle blocks reveals some generalisations. Rural holdings in the South East region tend to have greater than 30 hectares of cleared land, while in the Murray Mallee and Eyre Peninsula regions they tend to have greater than 100 hectares of cleared land. The majority of lifestyle properties have the following characteristics: coastal frontage, sea views, river frontage, or large proportions of RNV; therefore sales with these attributes are not included in the final sales selection. Table 2 shows the final criteria used to select sales for the regression analysis in each region. All sales occurred between 1st June 1983 and 31 December 1997.

Table 2: Sales selected for regression analysis

Region	Sales selected	Criteria
South-East	269	• greater than 30 hectares of cleared land, and • greater than 5% or 10 ha of RNV.
Murray Mallee	290	• greater than 100 ha of cleared land, and • greater than 20 ha of RNV.
Eyre Peninsula	282	• greater than 100 ha of cleared land, and • greater than 20 ha of RNV

DATA ANALYSIS

As it is well understood that sale price of a rural property in a competitive rural real estate market depends on its characteristics, the rural property market can be analysed within the general hedonic equation framework examined by Rosen (1974). In this framework, each sale property in the rural holding submarket has a vector of characteristics or attributes, z, that defines each property. Different properties have varying quantities of the attributes, z_i, that make up z. As purchasers compare market prices of properties with different amounts of each attribute z_i, the market implicitly reveals a function $p(z) = p(z_i, z_2, \ldots\ldots z_n)$. Within this framework, decomposition of residential property prices by regression has been widely used to examine the impacts of environmental amenities, such as air quality (Nelson, 1978; Graves *et al.*, 1988; Freeman, 1974), airport noise (Nelson, 1980), power lines (Colwell, 1990), environmental benefits (Freeman, 1979; Maeler, 1977) and vegetation (Garrod *et al.*, 1992; Powe *et al.*, 1997) on residential property values.

In studies of farmland prices, production, building improvements and location characteristics are usually used to explain the variation in price among properties (King and Sinden, 1988; Miranowski and Hammes, 1984; Peterson, 1986; Payne and Tisdell, 1994; Walpole *et al.*,1998; Bjornlund, 1998). The productivity of a rural property is determined by a number of factors such as soil fertility, slope, soil pH, soil salinity, size, irrigation feasibility, aspect, wind breaks, shelter belts, sunshine hours, growing months, water-logging capacity and precipitation. Structural improvements include fences, cattle and sheep yards, water infrastructure, houses, machinery sheds, barns, wool sheds, silos, piggeries, dairies and sundry sheds. Measurement of these improvements is problematic. The problem can be overcome by using only transactions of property with no structural improvements (Schott and White, 1977; Roos, 1996). This is usually not practical, as there are too few sales of this nature for

adequate analysis. Alternatively, the value of improvements can be derived from the valuations used by rating and taxing authorities for local and state taxes (Crouter, 1980; Miranowski and Hammes, 1984; Peterson, 1986). In all studies, location is measured as a series of distance variables, such as distance to towns, distance to markets, distance to schools, distance to property already owned (Bjornlund, 1998; Walpole et.al, 1998; King and Sinden, 1988).

There has been only one study which has examined the impact of RNV on rural property price (Walpole *et al.,* 1998). In their study of rural land prices in north-eastern Victoria and South-Eastern New South Wales, it was found that RNV at a proportion greater than 50% of the property area had a negative influence on property price, while the presence of RNV as dry foothill forest had a positive influence on property price.

In this project, the price of rural holdings in the three study areas is specified by the following function:

$$P_{ij} = f\ (Prod_i, Struc_i, Loc_i, RNV_i) \qquad (1)$$

where for region j for property i, P is the sale price, Prod are the production characteristics, Struc are the structural improvements, and RNV are the remnant native vegetation characteristics. Because of the expense involved in collecting structural improvement data by field measurement, it was decided to use the values as determined by the Valuer-General for rating and taxing purposes. The values collected were as follows:

HOUSE1	= Value of the main house
HOUSE2	= Value of a second house
WOOLSHED	= Value of the wool shed
MACHINERY SHED	= Value of the machinery shed
PIGGERY	= Value of the piggery
BARN	= Value of the barn
DAIRY	= Value of the dairy
HAYSHED	= Value of the hay shed
SUNDRY SHEDS	= Value of the other sheds

The improvement values for fencing and water improvements were not supplied for the analysis. Given that irrigation properties have been excluded from the analysis, valuers and agents suggested that, on a rate per hectare basis, the added value of these improvements at a maximum would be five per cent of the ex-improvement rate per hectare value of the property and, at a minimum, would add nothing to the value of a property. To test the impact of the omitted variables, random values were generated for fencing and water and the regression analysis was rerun with the adjusted price including the simulated value of fencing and water improvements. This process was repeated a hundred times, with new random values generated each time. The impact on the estimated coefficients from the model that had the omitted variables was minimal. The coefficients for all variables in the models remained stable, as did their significance levels and standard errors. Therefore, at worst, the effect of the omitted variables is an overestimation of the coefficients by approximately 5%.

The sum of the value of structural improvements was subtracted from the sale price in each case to arrive at ex-improvement sale price. This is reflected in the modified specification below:

$$P_{ij} - \text{sum of } Struc_i = f(Prod_i, Loc_i, RNV_i) \qquad (2)$$

which is rewritten as:

$$\text{Pij ex-improvement} = f(\text{Prodi, Loci, RNVi}) \qquad (3)$$

Furthermore, discussions with agents and valuers indicate that purchasers make comparisons between properties based on rates per hectare or price per unit of production. Analysis on this basis is also standard valuation practice (Rost *et al.*, 1993). Therefore, equation 3 above is divided by cleared land area. This assumes that RNV is not adding any value to the ex-improvement sale price. Equation 3 is therefore rewritten as:

$$\text{Pij ex-improvement / Cleared area} = f(\text{Prodi, Loci, RNVi}) / \text{Cleared area} \qquad (4)$$

which is rewritten as:

$$\text{PPCLHAij ex-improvement} = f(\text{Prodi, Loci, RNVi}) / \text{Cleared area} \qquad (5)$$

The sales data spans a long time period (1983–1997) during which there have been many externalities that influence price; for example, changes in bank overdraft rates, changes in farm products and inputs, drought, to name but a few. Adjusting the price to a common base year substantially eliminates these affects. This usually requires the application of a constant quality price index. At the regional level, there is no such index for rural South Australia, so one was constructed. For each region, sales were identified that met the market and rural holding criteria.[9] The improvement values determined by the Valuer-General were deducted from the sale price. The ex-improvement sale price was divided by its area of productive land to derive at an ex-improvement cleared land per hectare rate ($PPCLHA_{ij\ ex\text{-}improvement}$). The $PPCLHA_{ij\ ex\text{-}improvement}$ prices were aggregated by year of sale and the Tukey biweight M-estimator calculated[10] (Norusis, 1990). The sale price index was calculated using 1996 as the base year. Subsequently, $PPCLHA_{ij\ ex\text{-}improvement}$ for each sale in the regression analysis was adjusted by the index and are referred to as the ADJUSTED PRICES. Therefore, the final model specification is as follows:

$$\text{ADJUSTED PRICE} = f(\text{Prodi, Loci, RNVi}) / \text{Cleared area} \qquad (6)$$

DATA COLLECTION

The property characteristics expected to be related to ADJUSTED PRICE were defined, and data was captured for each sale on the following production, location and RNV characteristics:

[9] 747 sales in the South-East, 654 sales in Eyre Peninsula, and 772 sales in the Murray Mallee were used to construct the sales price indices. Sales for the index construction were not restricted by RNV presence and therefore there is a greater number than those used in the regression analysis (Table 2???).
[10] Tukey biweight M-estimator is a robust measure of central tendency.

(1) Production Characteristics

Reciprocal of cleared area	=	1 / The cleared area of land included in the sale (1/ha).
PC land class$_i$	=	Area not covered in RNV that is of land class type i divided by cleared land area, then expressed as a percentage.
Season	=	Type of season in which the sale occurred measured as the standard deviation of the annual value of productivity for the year of sale from the mean annual value of productivity for the period 1983 to 1997[11]. Negative values are associated with poor seasons and positive values with good seasons.
Average monthly rainfall	=	Average monthly rainfall for the growing season April to October as recorded by the Bureau of Meteorology. The record at the nearest recording station was assigned to each sale (mm).
Average annual wheat yield	=	Average annual wheat yield for the period 1983 to 1997. It was calculated at the hundred level using ABSAGCD data (yld/ha).
Average barley yield	=	Average annual barley yield for the period 1983 to 1997. It was calculated at the hundred level using ABSAGCD data (yld/ha).
Stocking rate	=	Average annual stocking rate for the period 1983 to 1997. It was calculated at the hundred level using ABSAGCD data (dry sheep equivalent/ha).
Wool yield	=	Average annual wool yield for the period 1983 to 1997. It was calculated at the hundred level using ABSAGCD data (yld/ha).

(2) Locational Characteristics

Local town[12]	=	Distance to a town with a population less than 3000.
Big town	=	Distance to a town with a population greater than 3000, but less than 10000.

[11] Value of productivity was calculated at the hundred level, in 1996 dollars, using the major rural enterprises in each region. The yields per hectare were derived from the Australian Bureau of Statistics, Annual Agriculture Census Data (ABSAGCD), 1983-1997.

[12] Non-linear transformation of distance were analysed; however they did not enhance the overall models. Driving times were not used due to the cost of capturing the data. Also in the study areas, the landscape provides few natural barriers for the good network of rural roads that provide reasonably efficient access to town.

Regional town	=	Distance to a town with a population greater than 10000.
Access	=	Distance measure that incorporates distance to big town and distance to small town. Calculated as follows: BIG TOWN –[(BIG TOWN – SMALL TOWN)*.5]. The smaller the value, the greater the accessibility.
Population density	=	Population density calculated at the collector district level. Each sale is allocated the value of the collector district it is located in (Source: ABS 1996).
Median household income	=	Median household income. Each sale is allocated the value of the collector district it is located in (Source: ABS, 1996).
Median age	=	Median age of the population. Each sale is allocated the value of the collector district it is located in (Source: ABS, 1996).

(3) RNV Characteristics

PC heritage area	=	Area of RNV subject to a heritage agreement divided by cleared land area, then expressed as a percentage.
Other RNV	=	Area of RNV not subject to a heritage agreement divided by cleared land area, then expressed as a percentage.

RESULTS

Least squares estimates of the linear functional form was undertaken using a stepwise variable selection procedure in SPSS. The results are presented in Table 4. Analysis of the variables revealed no significant multicollinearity between any of the variables[13]. For the Murray Mallee region, tests indicate that the models are potentially mis-specified; however the signs and magnitudes of the coefficients appear reasonable and any problem in mis-specification is unlikely to have a significant effect on the coefficient estimates.

[13] Variance inflation factors were used to examine for multicollinearity which is a violation of the assumption of independence between independent variables.

Type of SEASON	51.17	12.24	4.18	0.00
Stocking rate per hectare	116.82	13.41	8.71	0.00
Reciprocal of cleared area	25341.62	3152.24	8.04	0.00
Population density	247.98	67.68	3.66	0.00
Median age	-21.38	6.61	-3.23	0.00
% Sand rises to cleared land	-1.74	0.78	-2.23	0.03
% Sand range to cleared land	2.62	1.13	2.32	0.02
% Red Range cleared land	-1.76	0.59	-2.99	0.00
% Deep Sand cleared land	-2.00	0.93	-2.15	0.03
% Black Flat to cleared land	2.29	0.61	3.76	0.00
% of other veg. to cleared land	2.95	1.14	2.58	0.01
% Heritage Area to cleared land[##]	-3.59	2.39	-1.50161	0.13444
R square	0.7342			
R square adjusted	0.7217	58.917f		
Ramsey Reset Test	1.4449	0.230p		
White test	82.5658	0.585p		

Eyre Peninsula Region	**282 sales**			
Variable	**Coefficient**	**Std. Error**	**T-ratio**	**Sig.**
Constant	-92.25	22.90	-4.03	0.00
Reciprocal of cleared area	39815.37	4637.88	8.58	0.00
Average monthly rain (growing season)	5.18	0.65	7.91	0.00
% Class l Ironstone Soil to cleared area	1.21	0.24	4.99	0.00
% Class 2 Ironstone Soil to cleared area	1.06	0.42	2.54	0.01
% Very rock soil to cleared land	-0.93	0.17	-5.41	0.00
% High Calc. Sands to cleared land (wind erosion)	-0.65	0.15	-4.30	0.00
% Arable loamy soils over clay to cleared land	0.48	0.18	2.70	0.01
% Shallow loamy soils to cleared land	0.44	0.17	2.61	0.01
% Shallow soils over calcrete to cleared land	-1.41	0.55	-2.54	0.01
% High CaIc. Sands to cleared land	-0.31	0.12	-2.48	0.01
% Jumbled Dunes to cleared land	-0.61	0.30	-2.00	0.05
% Heritage Area to cleared land	-1.26	0.34	-3.68	0.00
% of other veg. to cleared land[##]	0.21	0.22	0.95	0.34
R square	0.723			
R s square adjusted	0.710	53.934f		
Ramsay Reset Test	2.189	0.090p		
White Test	67.00	0.785p		

[ab]Murray Mallee Region	290 sales			
Variable	**Coefficient**	**Std. Error**	**T-ratio**	**Sig.**
Constant	-535.09983	43.67	-12.25	0.00
Average monthly rain (growing season)	14.19450	1.13	12.59	0.00
Reciprocal of cleared area	42792.59793	4564.79	9.37	0.00
Distance (km) to regional centre	-0.00083	0.00	-2.54	0.01
Median household income	0.23453	0.07	3.50	0.00
Average barley yield	132.80385	33.35	3.98	0.00
Stone Flats to cleared land	1.13214	0.37	3.06	0.00
% Sand flats to cleared land	1.55293	0.59	2.63	0.01
% High Sandhills to cleared land	-1.53088	0.67	-2.30	0.02
% Heritage Area to cleared land	-0.36337	0.15	-2.47	0.01
% of other veg. to cleared land[##]	-0.11452	0.12	-0.96	0.34
R square	0.666			
R square adjusted	0.655	62.040f		
Ramsay Reset Test	5.794	0.001p		
White Test	Na.			

In all models the dependent variable is price per cleared hectare
[a]Results Corrected for heteroskedasticity
[b]Model is potentially mis-specified
[##]Not significant at .1 level

Table 5 summarises the findings in relation to the two hypotheses put forward.

Table 5: Summary of results

Region	Non heritage RNV (RNVNH)	Heritage RNV (RNVH)
South-East	For the average property, each additional hectare of RNV increases the price by $295	No significant influence on price
Murray Mallee	No significant influence on price	For the average property, each additional hectare of RNV reduces the price by $36
Eyre Peninsula	No significant influence on price	For the average property, each additional hectare of RNV reduces the price by $125

MAIN FINDINGS

1. The presence of RNVNH on rural holdings does not reduce their market values.

- In the South-East Region, the presence of RNVNH on a rural holding increases its market value.
- In the Murray Mallee and the Eyre Peninsula, the presence on a rural holding of RNVNH neither increases nor reduces their market values.

2. The presence on a rural holding of RNVH does not add to the market value of a rural holding.

- In the South-East Region, the presence of RNVH on a rural holding neither increases nor reduces the market value of rural holdings

- In the Murray Mallee and Eyre Peninsula regions, the presence of RNVH on a rural holding reduces its market value.

3. Consistent for each region is a reduction in value for every hectare of RNVNH that becomes RNVH.

- In the South-East, the reduction in property price is $295 for every hectare of RNVNH that is placed under a heritage agreement.
- In the Murray Mallee, the reduction in property price is $36 for every hectare of RNVNH that is placed under a heritage agreement.
- In the Eyre Peninsula, the reduction in property price is $125 for every hectare of RNVNH that is placed under a heritage agreement.

Across the regions, the reasons for the differences in RNVNH, RNVH and the loss in market value associated with placing RNV under a heritage agreement values are far from conclusive and is an area for further research. However, there are some generalizations which may be useful starting points in attempting to understand the values.

First, the dominant land use of the sales in the South-East was grazing, whereas it was cropping or cropping/grazing in the Murray Mallee and Eyre Peninsula regions. The survey of farm purchasers conducted for the research found that 35% of farmers in the South-East use the RNVNH for grazing, whereas in the other regions, it was 16% and 22% respectively. Farmers were asked why they had not applied to have their RNV made subject to a heritage agreement; 63% of farmers from the South-East responded that they did not want to lose management control, compared to only 32% and 35% from the Murray Mallee and Eyre Peninsula regions. Therefore, the utility of RNVNH for the type of primary production being carried could be one of the influences affecting the implicit market value of RNVNH. Further, in the South-East, there was a greater use of RNV for non-economic activities, such as recreation and conservation.

When RNVNH is placed under a heritage agreement in South Australia, some of the uses which the farmer benefits from are lost or perceived to be lost, such as grazing and management control. Other benefits such as usefulness in salinity and erosion control, recreation and conservation are not diminished. The fact that the market value of RNVNH declines when it is protected by a heritage agreement suggests that the remaining benefits of RNVH are considered to be "off farm" benefits rather than "on farm benefits" or that the benefits of having RNVH are outweighed by the perceived costs. If time spent on management is assumed to be a reasonable surrogate for cost, then the later is not likely, as the analysis of the survey responses did not find any significant difference across the regions in time spent managing RNVH.

In the context of farms that already have RNVH, RNVH reduces the value of rural holdings in the Murray Mallee and Eyre Peninsula and has no impact on price in the South-East region. In the South-East region, a significantly higher proportion of farmers use their RNV for recreation or as a sanctuary than compared to the other two regions. This use and the benefits of RNVH in assisting the control of soil erosion and salinity balance the responsibilities of management. Therefore the result is no impact on price. In the Murray Mallee and Eyre Peninsula regions, the results indicate the benefits from RNVH outweigh the perceived management responsibilities and potential costs, therefore resulting in a reduction in price. But across the three regions,

the survey responses indicated agreement on the beneficial effects of RNV in reducing soil erosion and salinity on farms. Therefore, it could be argued that the difference in the implicit market price for RNVH across the regions is related to non-economic values, such as recreation and conservation (greater percentage of farmers in South East agreed that conservation was important) and aesthetics of vegetation (statement RNV was pleasing to look at was related to RNV purchase price in the South East), the amount of extension work by native vegetation officers (more farmers in the South East had advice on managing their RNV from the native vegetation management branch) or education(more farmers in South-East had post secondary education and more belonged to professional groups). But this is not conclusive, as there are other differences across the regions such as vegetation systems, extent of remaining RNV (the South-East region has the smallest amount of RNV and as it is scarcer, it may be more valued), physical and climatic factors.

TRANSFERABILITY OF RESULTS

The results are only relevant to non-irrigated rural holdings that have approximately more than 5% or more than 10 hectares of RNV, and that are outside of the real estate influence of major cities. The transferability of the results from this research to other regions of Australia will depend on a multitude of factors such as farmers' socio economic characteristics, farmers' attitudes to RNV, extent of RNV education and extension programs, the extent of restrictive controls on RNV, the extent and type of existing RNV and the uses to which RNV can be put. The market value of RNV on hobby farms and lifestyle allotments is unlikely to have any relationship with these findings. Non economic factors such as aesthetics, views, distance to coast, distance to towns and recreation values are much more important in these markets. Over the study period in South Australia, there have been over two hundred sales of property that are almost completely covered in RNV. The number of sales each year has been progressively increasing since 1983, indicating a general increased demand for this type of property. Also the prices paid have been increasing and they now range from $15000 in the Murray Mallee to over $100000 in some cases in the South-East coastal regions.

EQUITY OF FINANCIAL ASSISTANCE PAYMENTS

Using the implicit prices of RNVH determined from the regression analysis, it is possible to analyse the equity of the financial assistance payments paid under the South Australian Native Vegetation Management Act (1985). Valuers determined the amount of the financial assistance paid. They had to determine the value of the RNV without any clearance restrictions and then value it assuming it was subject to a heritage agreement. Assuming the value of the RNV without any clearance restrictions is the same for both approaches, then comparing the values placed by valuers on the RNVH with the implicit prices of RNVH determined from the regression analysis will assess the differences between the two approaches. Interviews were conducted with valuers to determine the values they set for RNVH. The comparison of the two approaches is shown in Table 6.

Table 6: Equity analysis across regions

Region	Heritage area (ha.) in each region	Average RNVH value per ha. (Valuer General)	RNVH implicit value per ha. (from this project)	Difference	Total Difference (1996 $)
S.E.	44,414	$10	$0	$10	$444,414
M.M.	121,140	$5	-$36	$41	$4,966,740
E.P.	200,868	$2	-$125	$127	$24,907,718

There is a substantial difference in the financial assistance payments between the two approaches across the three regions. In every instance, the value of RNVH determined by the valuer is greater than that determined by the research, therefore underestimating the effect on the market value of the property caused by the Heritage Agreement. The results question the procedure used and the equity of the financial assistance payments and indicate the Eyre Peninsula region was most disadvantaged, while those in the South-East region were least disadvantaged.

PROPERTY IMPLICATIONS AND RECOMMENDATIONS

The results are only relevant to non-irrigated properties used in the business of primary production to derive the primary source of personal income for the landowner. A number of implications flow from the results:

1. If heritage agreements restrict grazing potential, this is likely to lead to loss in market value of a rural holding. Therefore, it is likely that widespread acceptance of this kind of instrument by rural holding landowners will only occur if offered with financial incentives.

2. Heritage agreements should be tailored to the individual property, rather than having a standard one which is applied to all properties For example, grazing should be allowed in RNVH if it does not compromise the integrity of the remnant.

3. In spite of the legal obligations that are part of the South Australian heritage agreements, it may be difficult to get farmers to responsibly manage heritage agreements, as there is no perceived net private economic benefit that flows to the capital value of the farm. This suggests further research to identify if heritage agreements are being appropriately managed in South Australia.

4. The use of revolving funds as a mechanism for securing heritage agreements (with restrictions similar to South Australia) on rural holdings would only work with significant 'topping up" of funds. It is not expected that in the long term, this option would cost less than direct payments of financial assistance for signing heritage agreements.

5. Rate relief as a financial incentive for entering heritage agreements (with restrictions similar to South Australia) has no financial benefit for rural holdings, as RNVH has no market value. However, Binning *et al.* (1999) suggests that in spite of

any financial benefit, rate relief as an incentive recognises the contribution to conservation made by owners in having RNVH.

6. In the study regions, it will be difficult to get new landholders to take up heritage agreements as this will likely result in a loss in market value.

7. The economic benefits of RNV as windbreaks, and in controlling soil erosion and soil salinity need to be made relevant at the farm scale and communicated to land holders.

8. Market values for RNVNH across regions are not equally affected by restrictions on clearing and introduction of heritage agreements. The introduction of clearing restrictions and restrictive heritage agreements can have some unexpected equity outcomes and the economic impacts can be substantial.

9. There is a need to improve communication with landholders about the management responsibilities for RNVNH and what advice is available if they need it.

10. Given the price differentials between RNV lifestyle properties and RNV on farms, farmers could exploit this opportunity where it exists by subdividing and selling their remnant on the lifestyle market. Research is needed on the impacts this may have on the integrity of the remnant and how changes to existing planning regulations may overcome any potential problems.

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