Pacific Rim Real Estate Society (PRRES)
Conference 2000

Sydney, 23-27 January, 2000

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

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FUNDED BY
LAND AND WATER RESOURCES
RESEARCH AND DEVELOPMENT CORPORATION
AND ENVIRONMENT AUSTRALIA

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Keywords: rural **v**aluation, vegetation management, heritage agreements, hedonic price function

INTRODUCTION

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 remnant native vegetation (RNV). Furthermore, there is a lack of knowledge on the impact to market value that may result from the protection of remnant 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 non irrigated rural holdings[1] in South Australia that have a component of RNV and in doing so put forward two hypotheses:

1. That 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;

To test these hypotheses the research analysed market transactions of non irrigated rural holdings in four regions of rural South Australia: South East, Murray-Mallee, Eyre Peninsula, and Kangaroo Island, 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, Ordinary Linear 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 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 vegetation management policy.

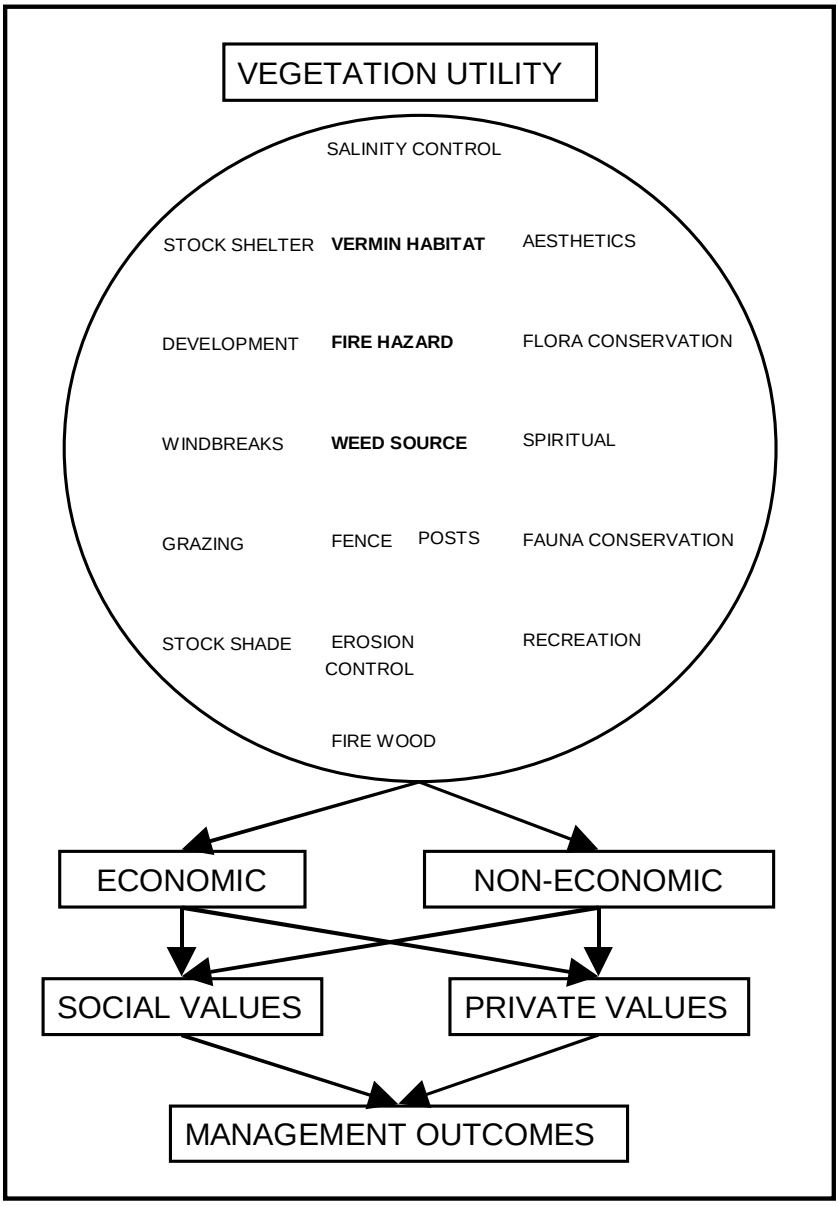
VALUES ATTRIBUTED TO REMNANT NATIVE VEGETATION

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 Benefit Cost Analysis study of Lockwood *et.al.* (1999). Figure 1, displays a paradigm for managing RNV that includes both positive and negative (in bold) values. The existence of these values are generally recognised by both private land owners 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 economics. 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 D 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

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

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 lost utilities results in a loss of property value then it is reasonable to compensate the loss. This is the very situation that occurred in South Australia and subsequently followed in other states of Australia. An overview of RNV policy in Australia is provided in Slee (1998)

FIGURE 1. A vegetation management paradigm



CLEARANCE RESTRICTION AND HERITAGE AGREEMENTS IN SOUTH AUSTRALIA

South Australia has had a long history of concern regarding 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 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 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).

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, 1983), and retirement. In the USA as much as 44% of all farm land 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 submakets in two ways.

1. Use a single model for the overall market and account for the submarket 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 and Jennings and Kletke 1977), distance to population centres (Gardner and Barrow 1985, Blase and Hasemann 1973 and 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 four study regions were extracted from the UpMarket sales data base[2], 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[3],
3. The sale price represented an open market transaction.

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

[2] 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.

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

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[4] 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)[5]. 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[6] 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,
4. Kangaroo Island; greater than 5% of total holding area or greater than 10 hectares covered in RNV.

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.

[4] Suspicious amounts are amounts not transferred in multiples of one hundred; e.g., $15342. This could have resulted in the elimination of some genuine sales such as those that may have been auctioned in dollars per hectares.
[5] The DCDB is a digitised data base, 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.
[6] The digitised vegetation maps for the South East, Murray Mallee and Kangaroo Island were obtained from the Department of Housing and Urban Development. They were produced from color aerial photos at 1:40000 scale. The digitised vegetation map for the Eyre Peninsula was produced from landsat imagery at 1:100000 scale. These digitised maps were the best available data.

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. The responses to question 2 (type of vendor), question 13 (reasons for purchase), and question 58 through question 62 (full-time farmer) enabled the sales to be 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 Participant	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%)
Kangaroo Island	54	2 (4%)	23 (43%)	26 (48%)	3 (6%)

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 Kangaroo Island region is more complex. In this region rural living and lifestyle allotments are characterised by allotment size, generally less than 150 hectares, sea views, proximity to coast, remnant vegetation cover, and Cygnet river frontage. Rural holdings tend to be characterised as having greater than 80 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. Table2, 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
Kangaroo Island	77	greater than 80 hectares of cleared land greater than 5% or 10 ha of RNV.
South East	269	greater than 30 hectares of cleared land greater than 5% or 10 ha of RNV..
Murray Mallee	290	greater than 100 ha of cleared land greater than 20 ha of RNV.
Eyre Peninsula	282	Greater than 100 ha of cleared land greater than 20 ha. of RNV

DATA ANALYSIS

As it is well understood that sale price of a rural property in a competeitive rural real estate market depends on its characteristics, then 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), vegetation (Garrod *et.al.* 1992, and Powe *et.al.* 1997) on residential property values.

In studies of farm land prices, production, structural improvements, and location characteristics are usually used to to explain the variation in price among properties (King and Sinden 1988, Miranowski and Hammes, Peterson 1986, Payne & Tisdell 1994, Walpole *et.al.*1998 and 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, and 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. In a recent study of rural land prices in north-eastern Victorian 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 dry foothill forest had a positive influence on property price. (Walpole *et.al.* 1998)

Following these studies the price of rural holdings in the four study areas is specified by the following function:

$$P_{ij} = f(\text{Prod}_{i,}, \text{Struc}_i, \text{Loc}_i, \text{RNV}_i), \qquad \text{Equation 1}$$

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 this data by field measurements 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 sum of the value of structural improvements was deducted from the sale price in each case to arrive at ex-improvement sale price. This is reflected in the modified specification below:

P_{ij} – sum of $Struc_i$ =f($Prod_{i,}$, Loc_i , RNV_i), Equation 2

Which is rewritten as,

$P_{ij\ ex\text{-}improvement}$ =f($Prod_{i,}$, Loc_i , RNV_i), Equation 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 vegetation is not adding any value to the ex-improvement sale price. The equation is therefore rewritten as,

$P_{ij\ ex\text{-}improvement}$ / Cleared area =f($Prod_{i,}$, Loc_i , RNV_i)/ Cleared area Equation 4

Which is rewritten as,

$PPCLHA_{ij\ ex\text{-}improvement}$ =f($Prod_{i,}$, Loc_i , RNV_i)/ Cleared area Equation 5

The sales data spans a long time period (1993-1994) 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 can substantially eliminate some of 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.[7] 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[8]. (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.[9] Therefore, the final model specification is as follows:

ADJUSTED PRICE =f($Prod_{i,}$, Loc_i , RNV_i)/ Cleared area Equation 6

Data Collection

The property characteristics expected to ADJUSTED PRICE were defined, and data was captured for each sale.

PRODUCTION CHARACTERISTICS

RECIPROCAL OF CLEARED AREA = 1 / The cleared area of land included in the sale. (1/ha)

[7] 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 vegetation presence and therefore there is greater number than those used in the regression analysis (Table 2) .

[8] Tukey biweight M-estimator is a robust measure of central tendency.

[9] The sales on Kangaroo Island were adjusted by the South East index as there were insufficient sales to calculate an index for Kangaroo Island.

PC LAND SYSTEM$_i$ =Area not covered in RNV that is of land system[10] type I divided by cleared land area, then expressed as a percentage.

SEASON = Type of season in which the sale occurred. It measured as the standard deviation of the annual value of productivity[11] for the year of sale from the mean annual value of productivity for the period 1983 to 1997. Low standard deviations are associated with poor season and high standard deviations with good seasons.

AVERAGE MONTHLY RAINFALL = Average monthly rainfall for the growing season April to October as recorded by the Bureau of Meterology. 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).

LOCATIONAL CHARACTERISTICS

LOCAL TOWN =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.

REGIONAL TOWN =Distance to a town with a population greater than 10000.

ACCESS =Distance measure which 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)

VEGETATION CHARACTERISTICS

PCHERITAGE AREA = Area of RNV subject to a heritage agreement divided by cleared land area, then expressed as a percentage.

[10] Land systems have been classified for the South East, Murray Mallee and Eyre Peninsula Region by the Department of Primary Industries and Resources of South Australia (PIRSA). A land system is an area of land with a particular set of features that are distinguishable from surrounding land. The features include geology, soils, topography, climate, and vegetation. They are closely related to limitations to land capability and potential for land degradation or erosion. (Central Eyre Peninsula District Soil Conservation Board, 1995). Digitised maps were provided by PIRSA and imported into GIS. The maps were produced at the 1:100000 scale using color aerial photos at the 1:40000 scale. The Valuer-General's land classifications were used for Kangaroo Island.

[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.

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

THE REGRESSION ANALYSIS

Ordinary least squares estimates of the linear functional form was undertaken using a stepwise variable selection procedure in SPSS. The results are presented in Table3.

Table 3: Hedonic price functions for farmland prices in four South Australian rural regions

[ab]Kangaroo Island Region	77 Sales			South-East Region	269 Sales		
Variable	**Coefficient**	**t-ratio**	**Sig.**	**Variable**	**Coefficient**	**t-ratio**	**Sig.**
Constant	-68.43	0.97	0.80	Constant	225.21	0.61	0.54
Reciprocal of cleared area	155132.22	2.85	0.00	Wool Yield	112.50	1.55	0.12
Cleared Arable land *quality	0.49	3.19	0.00	Type of SEASON	51.17	4.18	0.00
Cleared Grazing land *quality	0.28	3.39	0.01	Stocking Rate per hectare	116.82	8.71	0.00
Ratio of creek veg. to cleared land[##]	1029.96	1.64	0.11	Reciprocal of cleared area	25341.62	8.04	0.00
Ratio of other veg. to cleared land[##]	685.71	1.00	0.32	Population density	247.98	3.66	0.00
Ratio of heritage veg. to cleared land[##]	33.33	0.12	0.90	Median Age	-21.38	-3.23	0.00
				% Sand Rises to cleared land	-1.74	-2.23	0.03
				% Sand Range to cleared land	2.62	2.32	0.02
				% Red Range to cleared land	-1.76	-2.99	0.00
				% Deep Sand to cleared land	-2.00	-2.15	0.03
				% Black Flats to cleared land	2.29	3.76	0.00
				% of other veg. to cleared land	2.95	2.58	0.01
				% Heritage Area to cleared land[##]	-3.59	-1.502	0.134435
R square	0.45256			R square	0.7342		
R square adjusted	0.43006	20.12	f	R square adjusted	0.7217	58.917	f
Ramsey Reset Test	7.10580	0	p	Ramsey Reset Test	1.4449	0.230	p
White Test	na.			White test	82.5658	0.585	p

Eyre Peninsula Region	282 sales			[ab]Murray Mallee Region	290 sales		
Variable	**Coefficient**	**t-ratio**	**Sig.**	**Variable**	**Coefficient**	**t-ratio**	**Sig.**
Constant	-92.25	-4.03	0.00	Constant	-535.10	-11.54	0.00
Reciprocal of cleared area	39815.37	8.58	0.00	Average monthly rain (growing season)	14.19	9.22	0.00
Average monthly rain (growing season)	5.18	7.91	0.00	Reciprocal of cleared area	42792.60	8.94	0.00
%Class1 Ironstone Soil to cleared area	1.21	4.99	0.00	Distance (m) to regional centre	-0.00082807	-2.38	0.02
%Class2 Ironstone Soil to cleared area	1.06	2.54	0.01	Median Household income	0.23	3.27	0.00
% Very rocky soil to cleared land	-0.93	-5.41	0.00	Average barley yield	132.80	3.29	0.00
% High Calc. Sands to cleared land (wind erosion potential)	-0.65	-4.30	0.00	% Stoney Flats to cleared land	1.13	2.51	0.01
% Arable loam soils over clay to cleared land	0.48	2.70	0.01	% Sand flats to cleared land	1.55	1.94	0.05
% Shallow loamy soils to cleared land	0.44	2.61	0.01	% High Sandhills to cleared land	-1.53	-2.03	0.04
% Shallow soils over calcrete to cleared land	-1.41	-2.54	0.01	**% Heritage Area to cleared land**	-0.36	-3.15	0.00
% High Calc. Sands to cleared land	-0.31	-2.48	0.01	**% of other veg. to cleared land[##]**	-0.11	-1.44	0.15
% Jumbled Dunes to cleared land	-0.61	-2.00	0.05				
% Heritage Area to cleared land	-1.26	-3.68	0.00				
% of other veg. to cleared land[##]	0.21	0.95	0.34				
R square	0.723			R square	0.666		
R square adjusted	0.710	53.934	f	R square adjusted	0.655	62.040	f
Ramsey Reset Test	2.189	0.090	p	Ramsey Reset Test	5.794	0.001	p
White Test	67.009	0.785	p	White Test	na.		

In all models the dependent variable is cleared price per hectare

[a]Results Corrected for heteroskedasticity

[b]Model is potentially mispecified

[##]Not significant at .1 level

Results

Analysis of the variables revealed no significant multicollinearity between any of the variables[12]. For Kangaroo Island and the Murray Mallee regions tests indicate that the models are potentially mis-

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

specified. The results for Kangaroo Island are particularly unstable and reflect the paucity of data available for the region. The model should therefore be disregarded. The Murray Mallee model indicates signs as expected for all variables and the estimated coefficients appear to be reliable. In respect of the vegetation variables, Table 4 below summarises the findings in relation to the two hypotheses put forward.

Table 4: Summary of results

Region	Vegetation without a heritage agreement (RNVNH)	Vegetation with a heritage agreement (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 reduces the price by $125

Vegetation not subject to a heritage agreement increases the value of rural holdings in the South East, and has no impact on price in the Murray Mallee and Eyre Peninsula regions. 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. This reinforces the grazing utility of RNVNH in the South East compared to the other two regions. The responses to the question on the condition of RNV indicate that the RNV in the South East has a higher level of disturbance than that in the other two regions. Again reflecting the grazing utility in the South East compared to the other two regions. It would appear that the utility of RNVNH for the type of primary production being carried out has an impact on the implicit market value of RNVNH.

Remnant native vegetation which is subject to a heritage agreement, 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 a higher proportion of farmers use their RNV for recreation or as a sanctuary than compared to the other two regions. This utility may balance the responsibilities of management that come with RNVH. Some management activities varied across regions but the time spent on management in all regions was similar. Responses to other questions regarding the utility of RNV were also similar. The evidence in relation to why there is a difference in the implicit market price for RNVH across the regions is not conclusive but could be related to non economic values; such as, recreation and conservation. The fact that RNVH does not increase the price of rural holdings suggests that the benefits of native vegetation for salinity and erosion control are considered to be “off farm” benefits rather than “on farm benefits” or that the “on farm” benefits are outweighed by management costs.

TRANSFERABILITY OF RESULTS

The results are only relevant to 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 States will depend on similarity of the

following factors: farmer's attitudes to RNV, the extent of restrictive controls put in place, and the uses to which RNV can be put. The market value of RNV on hobby farms and lifestyle allotments is expected to be substantially different as the factors that influence the values of these properties include non economic factors such as asthetics and recreation values.

IMPLICATIONS

These results have a number of implications.

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. In spite of legal obligations, it may be difficult to get the majority of farmers to responsibly manage heritage agreements as farmers perceive no private economic benefit when purchasing a property. Further research should be undertaken to examine if there is a relationship between price paid for RNVH and appropriateness of management actually undertaken.
3. The use of revolving funds as a mechanism for securing heritage agreements 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.
4. Rate relief as a financial incentive for entering a heritage agreement has no financial impact as the research found that RNVH on rural holdings has no market value.
5. 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.
6. Market values for RNV across regions are not equally affected by restrictions on clearing and introduction of heritage agreements. The introduction of clearing restrictions and heritage agreements that exclude activities such as grazing can have unexpected equity outcomes.

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