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# A combined site proximity and recreation index approach to value natural amenities in the South Australia Murray-Darling Basin

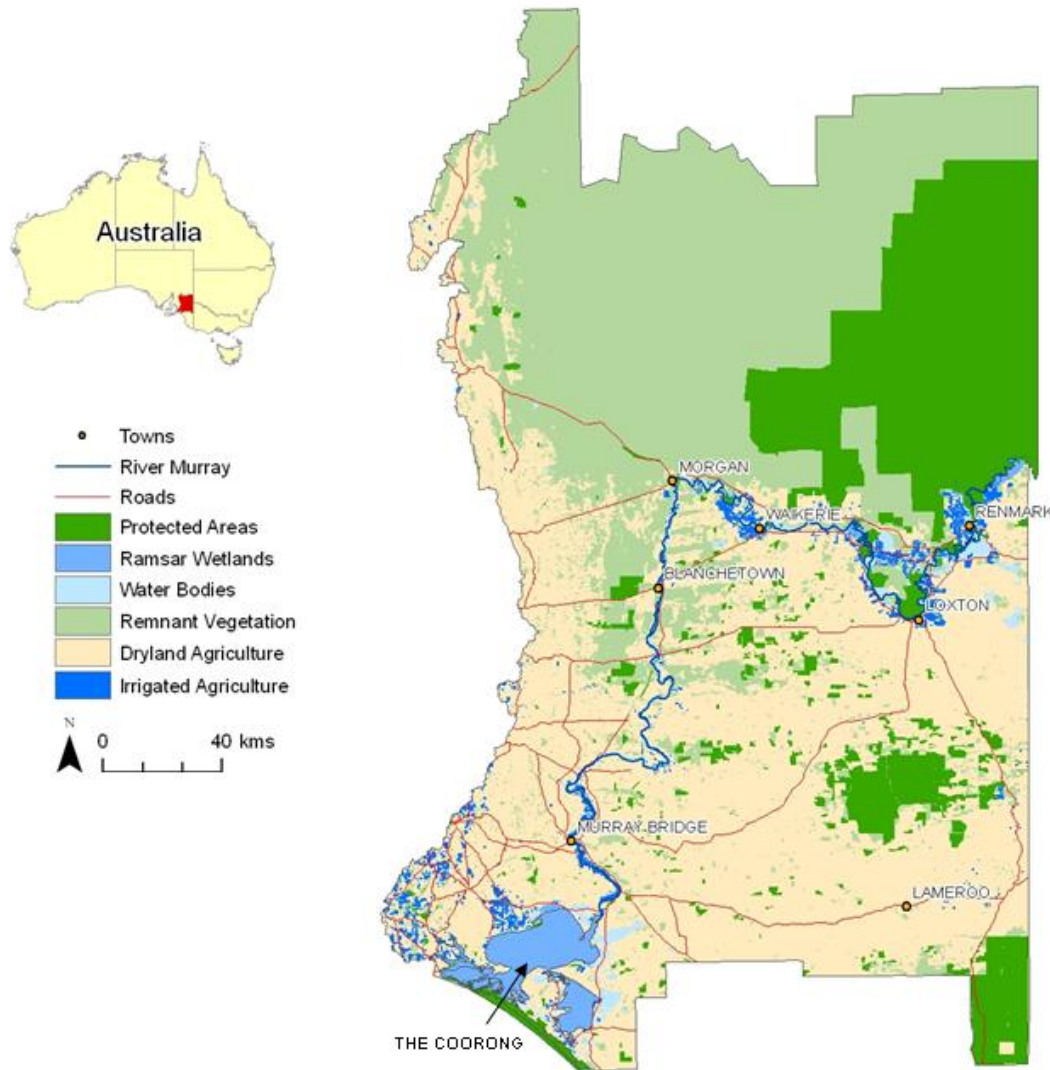
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# Research question

- **How to allocate water to the various users**
  - Agriculture
  - Urban
  - Environment
- **What is the environmental value of water?**
  - To inform the optimal amount of annual flow
- **What are the values of these environmental assets?**
  - Perennial and ephemeral lakes/wetlands
  - River system
  - Forest parks

# Study site



Area: 56,000 km<sup>2</sup>

Population: 81,000

Ramsar wetlands:

- Lake Alexandrina
- Lake Albert
- The Coorong

# Hedonic model specification

$$P_i = f(S_i, NH_i, E_i, L_i, Q_i, D_i)$$

$P_i$  Sale price of property  $i$

$S_i$  Structural characteristics of the house

$NH_i$  Neighbourhood characteristics

$E_i$  Environmental attributes

$L_i$  Land use characteristics

$Q_i$  Latent variable for recreation score of each nearest amenity

$D_i$  Binary variable for time of sales (year and quarter)

# Data collection

- **Property sales and neighbourhood data**
  - Structural
  - Distance to key sights
  - XY Coordinates
  - Town facilities
- **Environmental data**
  - Distance via road network to nearest point of entry
  - Area/ size
- **Recreation data**
  - River recreation activities/facilities
  - Park recreation facilities

# Recreation data (river activities/facilities)

<b>Variable</b>	<b>Factor1</b>
Canoeing and kayaking	<b>0.9536</b>
River cruising	<b>0.6105</b>
Water skiing	<b>0.931</b>
Fishing	<b>0.8983</b>
Other water sports	<b>0.7351</b>
% of variance explained	98.20

# Recreation data (park facilities)

Variable	Factor1 (Short visit)	Factor2 (Day visit)	Factor3 (Over night)
Picnic and barbecue	0.3003	0.0298	0.4849
Information centre	0.4387	0.3512	0.366
Toilets	0.4045	0.4018	0.2333
Caravan access	-0.2127	0.4933	0.4411
Carparks	<b>0.5955</b>	-0.0414	0.3266
Walking trails	<b>0.7339</b>	-0.1196	0.0643
Disabled toilets	-0.2297	<b>0.8609</b>	0.1932
Snack bars/restaurants	0.029	<b>0.6377</b>	-0.0338
Lookouts	0.2785	<b>0.7046</b>	-0.3209
4WD access	0.0117	<b>0.6284</b>	-0.1112
Washing and drinking	-0.0475	<b>0.8198</b>	0.1218
Guided tours	0.3574	<b>0.6065</b>	0.0312
Camping areas	0.1791	0.0058	<b>0.7176</b>
Campfires	-0.0373	-0.0177	<b>0.8308</b>
Boating and canoeing	0.1426	0.0814	<b>0.8034</b>
Swimming and fishing	-0.0382	0.0341	<b>0.911</b>
% of variance explained	20.09	41.62	43.09

# Recap



# Diagnostic test

# Spatial diagnostic test

	OLS		SAR
Variable			
Moran's I (error)	0.0253	***	0.0009
LM (lag)	19.3956	***	
Robust LM (lag)	16.8024	***	
LM (error)	2.9941	*	
Robust LM (error)	0.4009		
R <sup>2</sup>	0.6728		0.6809
Number of observations	752		752

\*\*\*, \*\* and \* indicating 1%, 5% and 10% level of significance respectively

# Spatial hedonic

$$P_i = \rho W P_j + X\beta + u$$

- $\rho$  Spatial autoregressive parameter on the spatial lag of the dependent variable
- $X$  Matrix of explanatory variables
- $W$  Spatial weight matrix which defines the neighbourhood for each observation
- $u$  Error term

# Results (structural & neighbourhood attributes)

Variable	OLS		SAR	
	Coef	St Err	Coef	St Err
Autoregressive parameter ( $\rho$ )			0.2730 ***	0.0662
Rooms	0.0783 ***	0.0099	0.0774 ***	0.0097
Bathrooms	0.1360 ***	0.0246	0.1243 ***	0.0241
Log of land area	0.1573 ***	0.0129	0.1583 ***	0.0126
Age	-0.0006 *	0.0003	-0.0009 ***	0.0003
Presence of barn	-0.1324 ***	0.0341	-0.1292 ***	0.332
Distance to Adelaide	-3.42E-06 ***	3.35E-07	-2.52E-06 ***	3.90E-07
University/college	0.1422 ***	0.0336	0.1169 ***	0.0331

\*\*\*, \*\* and \* indicating 1%, 5% and 10% level of significance respectively

# Results (environment and recreation attributes)

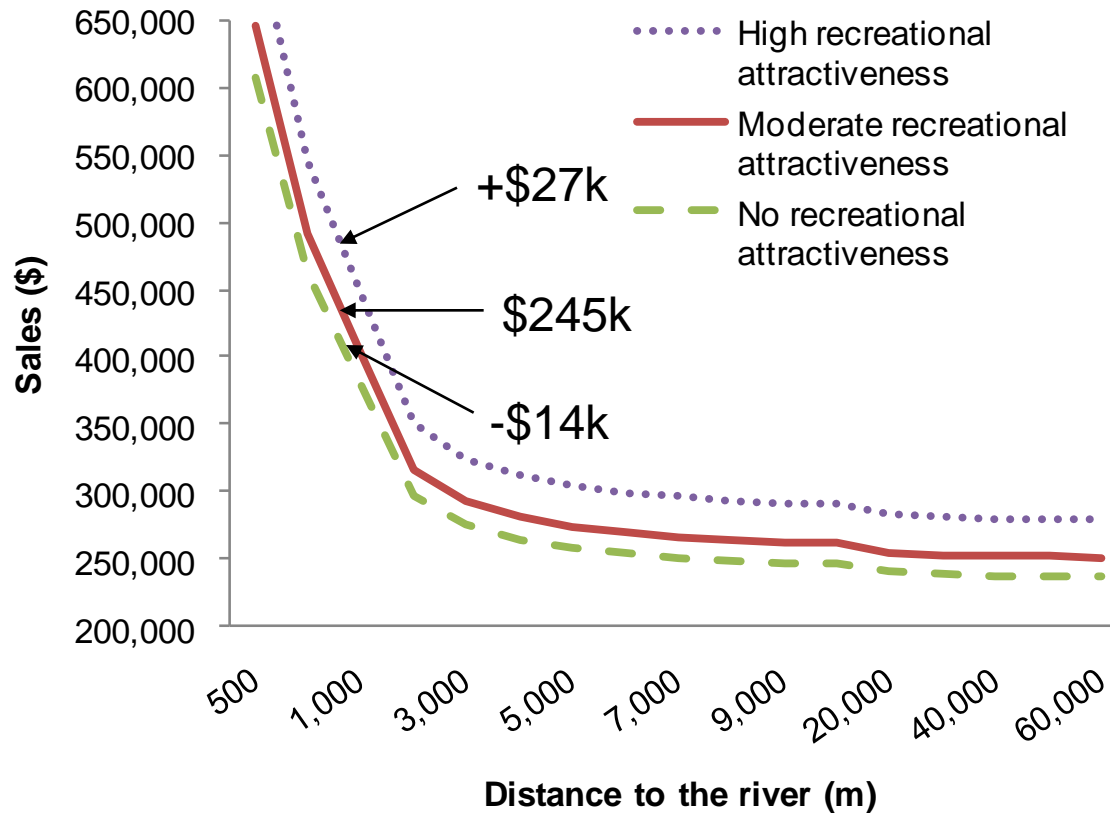
Variable	OLS			SAR		
	Coef		St Err	Coef		St Err
<b>Environment</b>						
Distance to river <sup>-1</sup>	442.3957	***	150.5550	346.4026	**	147.1164
Distance to natural park	2.89E-06	**	1.32E-06	2.78E-06	**	1.28E-06
<b>Recreation</b>						
Park day visit facility <sup>-1</sup>	0.0602	**	0.0093	0.0510	***	0.0092
Park overnight stay facility	0.1217	***	0.0253	0.0994	***	0.0252
River recreation index	0.0512	**	0.0195	0.0552	***	0.0191

\*\*\*, \*\* and \* indicating 1%, 5% and 10% level of significance respectively

# Marginal implicit price

<b>Variable</b>	<b>Mean (std dev)</b>	<b>MIP (\$)</b>
Room	5.55 (1.23)	29,907
Bathrooms	1.34 (0.51)	48,060
Land area (sqm)	3,643 (28,584)	16.79
Age (years)	37.03 (32.45)	-333
Presence of barn	0.09 (0.29)	-50,194
Distance to river (km)	20,423 (10,491)	320
Distance to natural park (km)	16,989 (10,754)	1,070
Park day visit facility	0.99 (1.33)	20,130
Park overnight stay facility	0.31 (0.78)	38,411
River recreation index	-0.17 (0.93)	21,338
Distance to Adelaide (km)	102,196 (79,621)	-980
University/college	0.18 (0.38)	42,821

# River value



# Conclusion

## Even for rural properties:

- **Proximity to environmental amenities improves sales price**
- **Man-made facilities increase the value of environmental amenities**
- **Environmental amenities used for recreation has higher value than amenities without**
- **Policy implication: Sufficient flow for recreation**
  - Social benefit from recreation/tourism
  - Economic benefit from capitalise value in property prices

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# Thank you

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