THE IMPACT OF NOOSA NATIONAL PARK ON SURROUNDING PROPERTY VALUES: AN APPLICATION OF THE HEDONIC PRICE METHOD

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This study deals with the valuation of a National Park in an urban area. The hedonic price method is used to estimate the impact of the headland section of Noosa National Park (NNP) on nearby unimproved land values. Unimproved land values of 641 house blocks surrounding NNP were used in a variety of regressions to provide values for both proximity and view of the park. The study found that a glimpse of NNP generates an increase of 7% in the land value. However, being in close walking distance to NNP has little impact upon the value of land. Properties located south of NNP headland were found to be valued at only 85% of comparable properties to the north. The variables with the greatest impact on price are direct distance to the ocean and a view of the ocean. If properties are closer to another urban park (not a national park), there is a strong negative relationship between price and distance to the park. But properties closest to NNP do not experience this relationship. It is suggested that disamenities of such a well-known park, including parking problems and 'unsavory characters' may result in the direct distance to NNP not being a significant explanatory variable in relation to price. This information is useful to local governments with national parks within their borders who want to estimate the value of the park to their area, e.g. in relation to rates.

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1. INTRODUCTION

Various methods are available for carrying out a non-market valuation of a forested area or a National Park. There is, however, a lack of applications of the hedonic price method to the valuation of forested areas within Australia, though it is a relatively common form of revealed preference assessment of North American and some European national parks, forested and natural areas (e.g. see Doss and Taff 1996; Garrod and Willis 1999). This lack of Australian applications may arise from the limited number of studies of urban national parks, most studies being of natural isolated and remote areas in Australia, e.g. Dorrigo and Gibraltar National Parks (Powell and Chalmers 1995).

The hedonic pricing technique measures the recreational and aesthetic values of urban parks to local residents. Urban parks within Australia have largely been ignored within non-market valuation techniques due to the difficulties that arise in implementing particular techniques such as the travel cost method, though Lockwood and Tracey (1995) have successfully applied the technique to Centennial Park in Sydney. Some of Australia’s greatest national parks and recreational areas are found within urban areas – e.g. Sydney Harbour National Park, Royal National Park, Kuringai Chase National Park and Brisbane Forest Park – due to their location have been largely ignored within the valuation literature.

This study investigates the use of unimproved land values to estimate the value that landowners place on protected areas, specifically Noosa National Park (NNP) headland section, as shown in Figure 1. The study investigates influences on unimproved urban land values, particularly those associated with the presence of a national park. Noosa’s most prominent headland forms a relatively small (454ha) part of the Noosa National Park, which is located just 1km from the centre of the resort town. The town itself is located 175km north of Brisbane, on the Sunshine Coast of southeast Queensland. Noosa National Park is surrounded on two sides by a rugged coastline, with walking tracks joining rocky headlands to quiet coves and sandy beaches. The other two sides of the National Park abut residential homes, apartments and tourist accommodation. The park, through planning regulations, architecture, community action groups and general ‘ambience’, has influenced the development of Noosa and its surrounding locales, rendering it an important aspect of the town (Cato 1987). However, the town is also located on the coastline affording the community access to extensive beaches, estuaries and accompanying green spaces for their use. An investigation of the residential areas of the Noosa headland would be incomplete without accounting for views and the distance to the ocean and other attractive environmental features.

Most studies on national parks have focused on tourists and the estimation of social or public values, frequently using a contingent valuation approach (e.g. Hundloe 1990). This study investigates the value attached to NNP by the people living nearby, referred to as ‘residents’ – implying that they are property owners, but do not necessarily have their primary residence in the area.

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2 Noosa National Park is scattered down the coastal strip between Noosa and Coolum on the Sunshine Coast; this study only investigates the area known as the ‘headland section’.
In urban areas it is known that houses located near lakes and oceans are highly desirable (as expressed by property price premiums) yet there is no a priori reason to expect that houses located near forested areas or national parks are similarly desirable. Studies have shown that tourist destinations are not always desirable places to live (Jakus and Siegel 1997; Cooper and Morpeth 1998), and Noosa is a tourist town. NNP may provide amenities such as open and recreation space, natural views and possible wildlife sightings, e.g. koalas and goannas living within the park are a major attraction to visitors. However, it also generates disamenities including parking problems, nuisance animals, and an abundance of people, weeds and insects (Queensland Parks and Wildlife Service 1999). Thus, even though NNP may be a drawcard for tourists to the area, it may not be as desirable for local residents.

For this study it is assumed that a national park can have several residential amenities associated with single-family housing blocks in the area. These amenities may take the form of views of the National Park or being in close proximity to the park so that it can be used for recreational purposes. Several studies have found that buyers are willing to pay a premium for a ‘natural view’ (e.g. Gillard 1981; Cassel and Mendelsohn 1985; Do and Sirmans 1994), though only recently have ‘views’
been assessed by both type and quality (Benson et al. 1998). Previous studies have also shown that distance from a house to a natural amenity has a positive influence on property values within cities (Doss and Taff 1996; Lee and Linneman 1998). This study estimates the impact on single-family, residential unimproved land value, of a national park through both its view and physical distance. While other property-related impacts - such as increased commercial property values - might arise due to the presence of NNP, which in turn bring more business from out of town, such issues are not addressed in this study.

The structure of this paper is firstly to investigate the application of hedonic pricing to unimproved property values. The steps necessary to apply the hedonic price method to the Noosa location, and the resulting estimates, are then discussed. Finally, conclusions are drawn about use of the hedonic pricing to examine the impact of protected areas on property values, in an Australian context.

2. APPLICATION OF THE HEDONIC PRICE METHOD USING UNIMPROVED PROPERTY VALUES

Pearce and Markandya (1989) observed that the hedonic approach has potentially two stages of analysis. The first stage identifies how much of a property value is due to a particular environmental good or service. The second stage infers how much people are willing to pay for an improvement in the environmental quality, and what is the social value of the improvement.

The first stage of hedonic price analysis, as used within this paper, takes the conventional assumptions that each house may be described as a package of various characteristics, which include property related variables \([P]\), neighbourhood variables \([N]\), accessibility variables \([A]\) and environmental variables \([E]\). Symbolically

\[
H = f ([P], [N], [A], [E])
\]  

where \(H\) is the dependent variable which represents the total value of the house.

Hedonic price analysis is widely used in both the economic and property valuation research to estimate the shadow prices of attributes that are not openly traded in a market, through disaggregation of the values of a traded asset. A common application is estimating the value of environmental goods, such as noise pollution or traffic interference, via the property market (Tomkins et al. 1998). The United States dominates the investigation of impact of natural environmental attributes on housing values, some relevant studies being:

- distance to an urban wetland (Darling 1973)
- distance to a lake (Brown and Pollakowski 1977)
- distance to a wetland and type of wetland (Doss and Taff 1996)
- view of a lake, mountain or sea (Bensen et al. 1998; Rinehart and Pompe 1999)
- endangered species habitat and land prices (McKenzie-Smith 1994; White 1996).

The second stage of analysis is to identify how much people are willing to pay (WTP) for an improvement in the environmental quality, and what is the social value of the improvement. However to estimate WTP requires data from multiple,
distinct markets, and information on individual purchasers of the land (Palmquist 1998). Many multiple regression studies of house prices that use a large number of variables have estimated WTP and hence the demand curve associated with environmental variables (e.g. Colwell 1991; Kask and Maani 1992; White 1996; Grudnitski and Do 1997; Dombrow et al. 2000). However, the identification of distinct markets and information on individual purchasers will be difficult to identify and collect in the case of national parks.

This study is confined to the first stage of analysis, estimation of how much of the unimproved land values associated with single-dwelling houses in Noosa around NNP are due to NNP. This is due to the limitations imposed by the available type of data collected, i.e. unimproved land value and lack of personalised information associated with these data. No second regression incorporating individual attributes of each house is produced within this study.

2.1 Unimproved property values

A factor that makes the investigation of property markets particularly cumbersome within Australia is the lack of centralised data on the value, location, number and type of houses sold (Beer and O'Dwyer 2000). This is the reason for the limited studies that use housing prices to estimate values of non-market goods or services in Australia. Exceptions include Abelson (1997), who compared house prices in Sydney suburbs from the 1970s to 1990s, and Fraser and Spencer (1998) who applied the hedonic price method to a small sample of new house blocks in the same area on Western Australia's coast.

Most of the hedonic pricing studies have used the actual sale price of the property and hence have directly followed the property market. A few studies have used vacant land sales, e.g. Fraser and Spencer (1998) and Rinehart and Pompe (1999). Rinehart and Pompe (1999, p. 58) observed that 'the advantage of using vacant lots is that amenity evaluation is not affected by housing characteristics'. For this reason, vacant land value estimates of environmental goods are more accurate than estimates including housing characteristics within the analysis.

Every state in Australia has its own uniform statewide process for assessing land for rating purposes. In Queensland this value is called the 'unimproved property value', and is provided annually by the state Department of Natural Resources and Mining (NRM) as a basis for calculating rates within local government areas. The Valuation of Land Act Qld 1944 (as in force on 10 February 2000, last amended 1999) states that unimproved value of land means:

In relation to improved land — the capital sum which the fee simple of the land might be expected to realise if offered for sale on such reasonable terms and conditions as a bona fide seller would require, assuming that, at the time as at which the value is required to be ascertained for the purposes of this Act, the improvement did not exist.

This means that the land is valued as if it was a bare block of land, stripped of all its improvements (i.e. of houses, landscaping) but given all neighbourhood variables, such as surrounding houses, shops and beach. This valuation takes into
account the ownership status of the land (i.e., private or protected land) and the zoning restrictions placed upon the land (Meeking and Blackwell 1997). The Act includes a clause stating that if two or more parcels of adjacent land have only a single dwelling then the value should be adjusted to reflect one ownership and one house, as opposed to two (Trimboli 1979).

The legality of this measurement has been upheld numerous times within the Australian court system (Hyam 1995). In the case of State Government Insurance Office (Queensland) vs Valuer-General (1981 7 QLCR 171 at 180), the Queensland Land Court stated that:

It is relevant to keep in mind what has to be valued in the subject case. It is the subject land notionally stripped of its improvements and viewed in its natural state but in the environment (with all its inherent advantages, facilities and services, etc) in which the subject land is actually situated at the relevant data of valuation.

The legality of the unimproved land 'value' reassures the user that a systematic process is undertaken by the valuer to arrive at this figure, following much the same process used to value any normal house (DiPasquale and Wheaton 1996). There are however a list of restrictions that apply to the use of unimproved values, including the following:

1. Because no one pays for unimproved property values, a hedonic demand curve cannot be estimated in terms of actual willingness to pay, but only in terms of probable willingness of the market to pay if the land were bare. In this way only the first stage of analysis using hedonic price functions can be undertaken.
2. Any land parcel larger than normal block size cannot be used within the analysis because land is discounted if it only has a single dwelling on it no matter how large or small.
3. Unimproved land values mirror the market price that would be paid 'if the land was bare'. This does not take into account the landscaping or any aesthetic features of the land or house.
4. Depending on how hedonic pricing is used, variables measured within the analysis can only be those that are considered when the valuer is making their valuation of that property. Therefore, issues such as unexpected property market movements or property developments are not accounted for within the valuation.
5. Only land portions zoned for houses can be included within the analysis, not land for units or other dwellings under different valuation schemes (e.g., business premises, industrial and rural).

3. APPLYING HEDONIC PRICE METHOD TO NOOSA PROPERTY VALUES

Although there is no uniform design for hedonic pricing surveys, the Noosa survey was constructed along the generic lines suggested by most proponents of the technique. The survey size was determined by established land usage in Noosa and
the survey involved visual on-site assessment of each property to be included within the analysis. The most important aspect was the identification of variables to be included within the analysis and specification of the functional form.

3.1 Sample survey method

There is a system of major roads and public access areas around NNP, and it was decided to confine the sample to east of Noosa Junction and David Low Way, south of Hastings Street and north of Sunshine Beach shopping centre (see Figure 1). There is a large difference in the price of property inside to outside the designated survey area, which could have led to bias in regards to the changing characteristics of house blocks.

The field survey was conducted between 29 July and 10 August 1999 and 662 blocks were surveyed. Some of these blocks were later discarded due to either not being zoned as single dwelling or being two blocks of land under the same ownership, which results in a reduction in the unimproved value associated with the block, 641 blocks being used in the analysis. Using only one enumerator (the first author) provided consistency in the ratings and rankings of variables throughout the process. The initial 50 houses surveyed were used as a test of consistency and were re-surveyed as the last 50 houses.

3.2 Definitions of variables

Abelson (1996, p. 65) noted ‘an enormous problem is selection of variables for inclusion in the analysis, too many variables usually implies multicollinearity, whilst too few variables leaves a biased result’. Pearce and Markandya (1989) proposed that four categories of characteristics should be included, viz. property describing variables, neighbourhood describing variables, accessibility variables, and environmental variables.

To select variables in this study, a literature search was first conducted of the most closely related studies and all the variables used within each of these studies were tabulated under the above characteristics, studies identified including those of Correll et al. (1978), Grundnitski and Do (1994), Doss and Taff (1996), Fraser and Spencer (1998), Lee and Linneman (1998) and Mahn et al. (2000). These variables were then compiled into a written questionnaire which was sent to the NRM land surveyor for the Noosa area to ask which variables he felt contributed to the explanation of unimproved land values of Noosa.

For this study the first category of variable (property describing) is not as comprehensive as in other studies because no housing characteristics are included in the analysis due to the use of unimproved property data. This category consisted only of the area for each block (in square metres), the frontage for each block (metres) and the zoning for each block (designated by the Noosa Council zoning regulations, as either detached housing or semi-detached and attached residential). Block and frontage data were available from NRM in cartographical form. The zoning measure was gained from the Shire of Noosa Strategic Plan (1997).

Neighbourhood describing variables include whether a block has a corner location, street type, aspect of block and slope of block. Corner block was a simple
binary code, street type was based upon Fraser and Spencer (1998) using three different levels of traffic flow, viz. 1 = major thoroughfare, 2 = minor access road, 3 = limited access road (i.e. cul-de-sac). Aspect of block was a simple coding scheme based upon North being 1 and then clockwise for every 45 degree rating, i.e. North east = 2, East = 3. The final neighbourhood variable was slope of block, based upon Fraser and Spencer’s (1998) view matrix and classified as in Table 1. It was discovered during implementation of the matrix that the codes 4 and 7 were not used because it was impossible to have sloping land level with the road.

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATRIX FOR SLOPE OF BLOCK</strong></td>
</tr>
<tr>
<td>Elevation</td>
</tr>
<tr>
<td>No slope</td>
</tr>
<tr>
<td>Moderate slope</td>
</tr>
<tr>
<td>Steep</td>
</tr>
</tbody>
</table>

Accessibility variables included distance to amenities – i.e. shops, beach, NNP and general green area, both walking and direct distance (i.e. "as the crow flies") – and also a location variable indicating whether the property was north or south of the NNP, similar to Correll et al. (1978). The modern approach to the measuring of distance is by a geographical information system or other spatial computer modelling package (Geoghegan et al. 1997). Presently, Australia does not have an interface between property values and their spatial location (i.e. within a GIS) although this capability is available for specific areas.

Environmental variables included view of ocean, view of NNP and view of hinterland. Previous studies have found that it is not only the type of view but also how much view and its potential to be built out that effects prices (Fraser and Spencer 1998). For this study the four point scale as used by Bensen et al. (1998) was adapted, with 0 = no view, 1 = poor partial view, 2 = good partial view, 3 = excellent partial view, and 4 = full unobstructed view.

3.3 Specification of the model

Multiple regression is the most common form of analysis used within hedonic price studies (e.g. Arimah 1992; Galster and Williams 1994; Hamilton and Schwann 1995) and was used in this study. Regression models require that interactions between variables be specified in advance and be of a particular additive or multiplicative form. Many functional forms are possible, e.g. linear, semi-log, log-log, hyperbolic and exponential. As recognised by Milton et al. (1984), functional form specification is an important consideration in hedonic amenity valuation.

A search procedure (trial and error) is used to determine which form provides the best fit in any particular study. For this analysis the approach follows Huh and Kwak (1997) who based their choice upon the dominant independent variable,
defined as the variable with the greatest impact upon price change. Initially a descriptive investigation of the variables was undertaken, using scatter plots. It was found that the dominant independent variable was direct distance to ocean from the house block.

Due to property prices being a non-normally distributed variable (as most price variables are), a transformation of this variable was undertaken for it to be 'acceptable' for most statistical tests. The log of price (base 10), which is a common transformation undertaken within hedonic studies (e.g. Bensen et al. 1998; Dombrow et al. 2000), was used for analysis.

There was a strong relationship between log of price and all the ocean variables, such as direct distance to ocean and walking distance to ocean. Because of its impact, it is important that the functional form of the relationship between direct distance to ocean and log of price be clearly identified. A scatter plot of direct distance to ocean by log of price was initially used to investigate the relationship between the two variables (Figure 2). A negative relationship existed between log of price and direct distance to ocean up to about 550m. Beyond that point, distance from the ocean had little if any impact upon the log of price. The relationship shown

FIGURE 2
LOG OF PRICE VERSUS DIRECT DISTANCE TO OCEAN
is not a direct linear relationship and could potentially be modelled by one of four different functional forms, viz. kinked linear, hyperbola, simple exponential and asymptotic exponential.

To investigate the variables that had an impact on the value of land, divorced from the impact of the ocean, a LOWESS smoother was fitted to direct distance to ocean. The deviations from the trend line were then plotted against each of the categorical variables to investigate whether the property and neighbourhood describing variables had an impact on price, adjusted for distance to ocean. The expected results were: (i) land with a north or easterly aspect is preferable (with a higher value) to south or westerly facing land; (ii) land to the north of NNP has a higher value than that to the south; and; (iii) land located on busy main thoroughfares has lower price compared to quieter streets.

A number of unexpected patterns were revealed. It seems that a view of the ocean is only worth more if it is an absolute full waterfront view, otherwise there was no significant change in property price. There was no significant difference in unimproved land value between a glimpse of water and no view at all. A good partial view of NNP had a significant and positive impact upon price and a full panoramic view provides the greatest impact. Other grades of NNP view all had the same minimal impact, though no view of NNP results in a slightly lower value on the property than a place with even a glimpse. There was a minor increase in price with an increase in a view of the hinterland. The variables that appeared to have no impact are slope of the land and zoning.

The continuous variables that are highly correlated, as discerned by a correlation matrix, and hence cannot be used in conjunction with each other within a regression equation, were found to be direct distance to ocean and walking distance to ocean.

Using the knowledge gained by the above process, more complex models of price were constructed. Firstly, all categorical variables were re-coded as 0-1 indicator or dummy variables. Starting from a base function relating log of price to direct distance to ocean, the effects of other independent variables were then included as additive shifts.

The functional forms have been validated in two steps. First, the regressions endeavour to use the least number of independent variables for the best explanation of the dependent variable (Abelson 1996). This means that only independent variables with a significant relationship to price are included. The second step involves evaluating 'model fit' statistically by comparing actual and predicted prices, usually done by investigating the coefficient of multiple determination, R². However, use of R² can be criticised because: (i) some (e.g. cross-sectional) sample data may not have the same parameters as the population, and (ii) a model may have a high prediction accuracy but may be biased against particular types of variables, due to the

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1 Only three functional forms were tested, the exponential form being discarded

4 LOWESS stands for Locally Weighted Scatter Plot Smoother. The LOWESS routine takes the points from the graph, calculates a smoothed line relationship between them, then displays only the smoothed line (Cleveland 1985).
functional form chosen (Reynolds et al. 1981; Gujarati 1995). The root mean square error (RMSE) and mean absolute error (MAE) provide an alternate test of model validity and have been calculated for all the models reported in Table 1. Mayer and Butler (1993) have stated that both measures are appropriate for estimating the relative degree of deviation of estimated values from observed values.

**TABLE 2**

**REGRESSIONS AND PROMINENT VARIABLE COEFFICIENTS FOR LOG PRICE**

<table>
<thead>
<tr>
<th>Statistic or variable</th>
<th>Linear model</th>
<th>Kinked-linear model</th>
<th>Hyperbolic model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$y = a + bx$</td>
<td>$y = a - b_1x (x &lt; d)$</td>
<td>$y = a - b_2x (x \geq d)$</td>
</tr>
<tr>
<td>RMSE</td>
<td>0.09345</td>
<td>0.08727</td>
<td>0.086046</td>
</tr>
<tr>
<td>MAE</td>
<td>0.06912</td>
<td>0.06348</td>
<td>0.062398</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.774</td>
<td>0.805</td>
<td>0.810</td>
</tr>
<tr>
<td>$a$</td>
<td>5.5281</td>
<td>6.49776</td>
<td>5.11632</td>
</tr>
<tr>
<td>$b$</td>
<td>0.0003</td>
<td>-0.00051</td>
<td>0.669517</td>
</tr>
<tr>
<td>$d$</td>
<td>(-27.129)</td>
<td>699.02</td>
<td>0.03845</td>
</tr>
<tr>
<td>Location</td>
<td>-0.180</td>
<td>-0.1740</td>
<td>-0.1591</td>
</tr>
<tr>
<td></td>
<td>(-19.785)</td>
<td>(-17.562)</td>
<td>(-18.036)</td>
</tr>
<tr>
<td>Ocean view 4</td>
<td>0.287</td>
<td>0.2381</td>
<td>0.2465</td>
</tr>
<tr>
<td></td>
<td>(22.797)</td>
<td>(19.1146)</td>
<td>(17.109)</td>
</tr>
<tr>
<td>Ocean view 3</td>
<td>0.081</td>
<td>0.0072</td>
<td>0.0910</td>
</tr>
<tr>
<td></td>
<td>(7.800)</td>
<td>(7.0208)</td>
<td>(7.811)</td>
</tr>
<tr>
<td>Ocean view 2</td>
<td>-</td>
<td>-</td>
<td>0.0428</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>(3.728)</td>
</tr>
<tr>
<td>Direct Distance to NNP</td>
<td>-0.0001</td>
<td>-</td>
<td>-0.00023</td>
</tr>
<tr>
<td></td>
<td>(-4.387)</td>
<td>-</td>
<td>(-7.440)</td>
</tr>
<tr>
<td>NNP view 1</td>
<td>-</td>
<td>0.03240</td>
<td>0.0278</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(3.5073)</td>
<td>(2.727)</td>
</tr>
<tr>
<td>Aspect of block N-E</td>
<td>-</td>
<td>0.04167</td>
<td>0.0538</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(5.2326)</td>
<td>(4.4998)</td>
</tr>
<tr>
<td>Direct Distance to a Park</td>
<td>-</td>
<td>-0.0001</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(-2.4096)</td>
<td>-</td>
</tr>
<tr>
<td>Area</td>
<td>0.0001</td>
<td>0.00009</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(4.322)</td>
<td>(3.7110)</td>
<td>-</td>
</tr>
<tr>
<td>Walking Distance to Shops</td>
<td>-</td>
<td>0.0000599</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(4.7937)</td>
<td>-</td>
</tr>
<tr>
<td>Number of variables</td>
<td>6</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: $y$ is the log of price; $x$ is direct distance to ocean in meters, and $a$, $b$ and $d$ are constants. RMSE is the root mean square error, MAE is the mean absolute error, $n=641$, and $t$-values are written in parentheses.
3.4 Results of the hedonic price analysis

The various functional forms for the regression model to predict unimproved land values for Noosa are reported in Table 2. The linear regression has the lowest explanatory power (lowest $R^2$) between log price and direct distance to ocean, while the hyperbolic functional form provides the best fit ($R^2 = 0.81$). RMSE and MAE of both the kinked linear and hyperbolic regression functions are better (smaller) than the linear function. Each model reveals a significant relationship between land values and NNP, whether it be in respect to distance or view. The direct distance to NNP is only significant in the hyperbolic and linear models, and in both cases there is a negative relationship. The coefficient for a glimpse of NNP (NNP view 1) is positive and significant in both the hyperbolic and kinked linear regressions.

The hyperbolic functional form has been chosen as the best fit, to use for prediction purposes. For this model, the only statistically significant continuous variable is DDNNP (direct distance to NNP). The 'base relationship' is:

$$y = 5.116 + 0.6695/(1 + 0.003845*DOcean) - 0.00002324*DDNNP$$  \hspace{1cm} (2)

From this, it is necessary to subtract 0.1591 if the block is south of NNP, and then add 0.2465 (for Ocean view = 4), 0.0910 (for Ocean view = 3) or 0.0428 (for Ocean view = 2). Finally, 0.0278 is added if NNP view = 1 and 0.0356 is added if the block has a NE aspect. Transforming the logarithm to a price, a block on the north of NNP with no ocean view, 1000m from the ocean, 1000m from NNP, no view of NNP and a non-NE aspect would have a predicted price of $105,225.

The hyperbolic regression has ocean view 4 with a coefficient of 0.2465, meaning that a block of land with this variable has a price 76% higher than one without an ocean view ($10^{0.2465} = 1.7640$), all other things being equal. Similarly, land with a glimpse of NNP is worth 6.6% more than the same land without the glimpse ($10^{0.0278} = 1.0661$). The location of the property (north or south of NNP) is a statistically significant and important variable with respect to price for all the regressions. The hyperbolic model predicts that if the house is located on the north of NNP then the land is worth 44% ($10^{0.1591} = 1.4424$) more than if the same land was located south of NNP.

4. DISCUSSION AND RECOMMENDATIONS FOR THE USE OF HEDONIC METHOD

This study has found that the hedonic price method is useful for estimating the impact of NNP on local land values. Some non-market valuation techniques do not accommodate 'local' values. This is due mainly to the difficulty in isolating the value of a national park or other protected as opposed to the value of other physical features in the area. Estimates of economic impacts of national parks or forested areas typically do not include the use value to local residents (Powell and Charmers 1995; Gillespie 1997). The hedonic pricing method allows estimates to be made of the local use and non-use values as are exhibited within property prices.

Results of this study are relevant to national park managers and local government authorities and are part of a larger study, which has investigated the economic
impact of Noosa National Park upon the regional economy (Pearson forthcoming). It has been found that National park managers, such as those of the Queensland Parks and Wildlife Service, are constantly searching for reliable and efficient methods to estimate the economic impact of their national parks. Their investigations have focused upon tourism recreation values due to the ease of data collection (Driml and Common 1995; Pearson et al. 2000). The hedonic price method is a relatively straightforward approach to measuring the recreational and aesthetic values that the local residents place on having a park.

Empirical results from Noosa indicate that the presence of an urban national park can increase land values in the vicinity of the park by 6-7%. In some circumstances, this may actually increase the rate base and hence amount of rates collected by the local government authority (LGA). Therefore, despite the negative view of some LGAs in Australia, particularly in Queensland, national parks within local government boundaries need not be a hindrance to income generation by LGAs via rate collection. Net benefits to LGAs may be increased by the presence of national parks even if additional costs are imposed on them, e.g. costs associated with feeder roads and control of pests. Whether or not there is a net benefit to the local council as a result of the presence of national parks or similar areas are analysed in Tisdell and Pearson (2001).

Estimating the value of non-market environmental benefits by analysing unimproved land values with the hedonic price method provides a useful lesson for future applications of the technique. This paves the way for unimproved values to be used for future applications of the method as well as similar consistent valuation techniques that are used in different states of Australia, such as improved land value as used in NSW and Victoria.

The hedonic pricing method also has some associated problems as related to its application with national parks, three of the more important being:

1. The method measures differences in land values due to marginal variations in attributes (environmental and other). It does not register influences on total land value due to a 'total package of attributes' being available in the whole locality considered, which may be reflected in a higher constant value for all properties. In other words, where the presence of a park has a favourable impact on the value of all properties in a local council area, use of this method can understate the total extra value that should be attributed to the presence of a national park in the council area, as is likely to be the case at Noosa.

2. All effects are assumed to be additive within the model, though it is reasonable to assume that some variables are interdependent. The variables with high correlations and exhibiting non-additive functionality need to be discarded early from the analysis. For the inclusion of interactions between the variables, more complex functional forms need to be used.

3. The choice of functional form is critically important to the accurate prediction and modelling of values within hedonic pricing. Notably, many studies discuss the importance of the functional form but fail to adequately
analyse their data or test different forms. This was overcome in this study by finding the dominant independent variable as well as testing different functional forms.

Nevertheless, despite such limitations, the hedonic price method is probably the best technique available for the type of non-market valuation addressed here. Future research could consider integrating the house block values and the landscape in a GIS format, enabling a more accurate and simpler form of measurement for the environmental variables.

In conclusion, it should be stated that this method can be applied to the valuation of any environmental good having an impact on local residents, whether the area be a national park, forested area, lake, or other recreational area. However, the estimation of market environmental values for such cases is just as difficult and complicated as in the above analysis, and the incorporation of the entire variety of factors affecting land values is imperative to gain an accurate prediction from the analysis.

REFERENCES


Pearson, L.J. (forthcoming), Economic Impact of Noosa National Park upon its Local and Regional Economies, PhD thesis, University of Queensland, School of Natural and Rural Systems Management.


