ECONOMIC VALUE AND REGIONAL ECONOMIC IMPACT OF MINNAMURRA RAINFOREST CENTRE, BUDDEROO NATIONAL PARK

Robert Gillespie

Manager, Environmental Economics Policy Unit, NSW National Parks and Wildlife Service

ABSTRACT

National Parks, such as Budderoo National Park, are often thought of purely in terms of their biological attributes and the recreation and tourism opportunities they provide. However, such parks can also have significant economic values and contribute considerably to regional economic activity. It is important that these economic consequences are recognised and quantified, where possible, so that decision makers recognise that the creation and management of national parks and other protected areas can provide net welfare benefits to society and have positive regional development benefits.

Using the travel cost method, this study found that the economic value or consumer surplus of the recreation use of Minnamurra Rainforest Centre, Budderoo National Park, was approximately $28 to $44 per person, or $3.9M to $6.2M per year. On the conservative assumption that the annual level of these recreational use benefits remains constant over time, the present value of this benefit is in the order of $55M to $89M .

Using input-output analysis, it was found that annual expenditure by the NPWS in managing the Minnamurra Rainforest Centre and expenditure by visitors to the rainforest centre contributed to the Kiama economy an estimated $2.2M to $4.2M in output or business turnover, $1.2M to $2.1M in value added including $0.8M to $1.4M in household income. Between 70 and 120 local jobs were generated. This represented between 1% and 2% of gross regional output, 1.2% to 2.2% of value added (or gross regional product), 1.3% to 2.4% of regional household income and 1.9% to 3.2% of regional employment.

These results are compared to other similar studies of protected areas and some implications of this information for environmental policy development, park management and regional development planning are discussed.

INTRODUCTION

National Parks such as Budderoo National Park are often thought of purely in terms of their biological attributes and the recreation and tourism opportunities they provide. However, such parks also can have considerable economic values. These comprise use values associated with recreation and tourism, education, scientific research, water supply protection etc. as well as non use values such as option and existence values. It is important that these economic values are recognised and quantified where possible so that decision makers recognise that the creation and management of national parks and other protected areas can provide welfare benefits to society.

Apart from the net national benefits that National Parks may provide, they may also have an important regional dimension. Expenditure by the National Parks and Wildlife Service (NPWS) in managing national parks and expenditure by visitors to national parks may make a significant direct and indirect contribution to the economic activity within the local region.

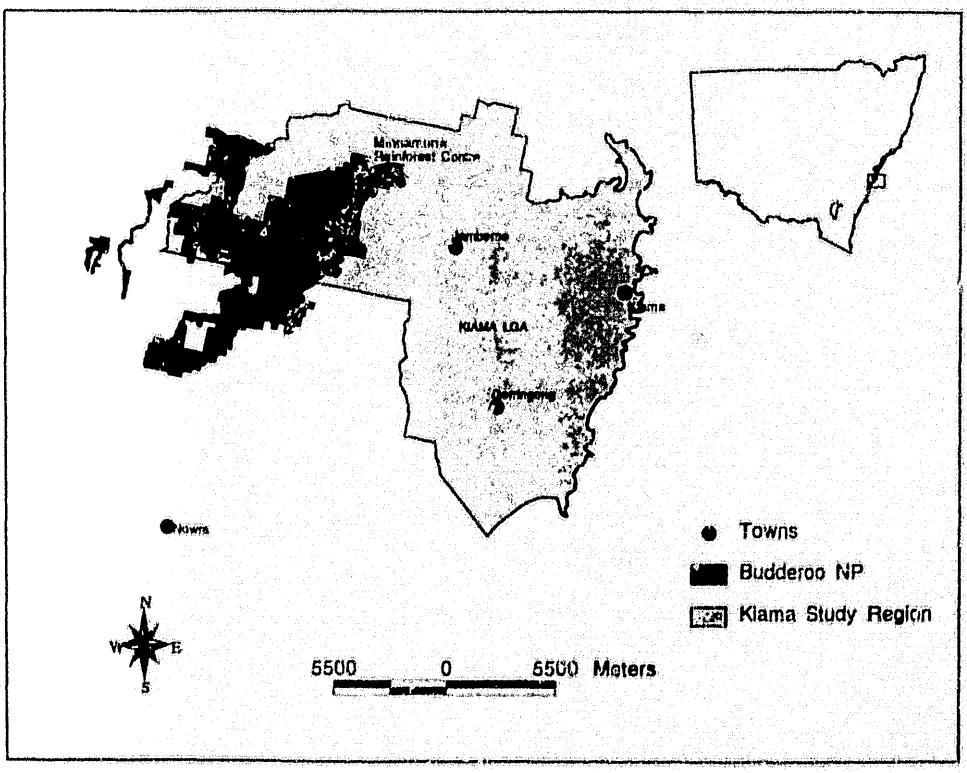
The NSW National Parks and Wildlife Service recently undertook two economic studies of the Minnamurra Rainforest Centre, Budderoo National Park to examine some of the economic consequences of protected areas. A travel cost study of visitors to Minnamurra Rainforest Centre was undertaken in order to gauge the economic value of one of the use values of this facility i.e. recreation. An input-output analysis was also undertaken to determine the contribution that Minnamurra Rainforest Centre, Budderoo National Park, makes to the regional economy.

These studies continue a NSW NPWS program of economic studies of protected areas in NSW.

MINNAMURRA RAINFOREST CENTRE, BUDDEROO NATIONAL PARK

Minnamurra Rainforest Centre, Budderoo National Park is located 130 kilometres south of Sydney and 15 kilometres west of Kiama at the foot of the Illawarra escarpment. Refer to Figure 1.

Figure 1 - Location of Minnamurra Rainforest Centre, Budderoo National Park



The geology underlying the park comprises Permian strata including sandstone, shale and volcanic sequences, while the escarpment above the park consists of Triassic hawkesbury sandstone.

The variable depth and fertility of soil supports vegetation, that is dominated by sub-tropical and warm temperate rainforest types, and provides habitat for 70 bird, 20 mammal and 11 reptile native fauna species. The National Park is also of some Aboriginal significance (Worboys etal 1995).

The park is 5,700 hectares in size and contains the Minnamurra Rainforest Centre comprising:

- a visitor centre;
- 1 6 kms of raised boardwalk;
- a 2 6 kms return access route to view Minnamurra Falls;
- an outdoor classroom in the rainforest;
- cafe and picnic/barbecue facilities

(Worboys etal 1995).

In 1993, 1994 and 1995, after development of the facilities, Minnamurra Rainforest Centre won the "Environmental Tourism" category of the NSW Tourism Awards for Excellence (Worboys etal 1995).

Park visitation has increased from 72,000 in 1992 to 140,000 in 1995. A survey in 1995 by Eco-Research indicated that the majority of respondents were from Sydney and the Illawarra/Shoalhaven region (70%), aged between 31 and 40 years (82%), employed (98%) and educated to a tertiary level (50%) Approximately 59% of respondents were married or living in a defacto relationship with 56% of respondents having children. 57% were visiting the park with their family while 27% were visiting with their friends. The mean income bracket of respondents was $25,001 - $$35,000 with 26% earning over $45,001(Eco-Research 1995).

To facilitate consideration of some of the economic values of Minnamurra Rainforest Centre, Budderoo National Park, and the contribution the Rainforest Centre and park makes to regional economic activity, Eco-Research was requested to include some specific questions in its 1995 visitor survey. These questions were developed from a comprehensive economic questionnaire trialed for economic studies of Gibraltar Range and Dorrigo National Parks in 1995 (Bennelt 1995; Powell and Chalmers 1995).

The survey adopted a face to face interview approach and took place between 28 August and 29 October 1995. The survey used a stratified probability sampling approach with midweek and weekend stratifications both during and outside school holidays.

A total of 396 surveys were completed (Eco-Research 1995) although with respect to the particular questions required to enable the economic studies to be compluted, not all the surveys were useable.

ECONOMIC VALUE OF RECREATION

The Travel Cost Method

The revealed preference valuation technique known as the travel cost method (TCM) was used to measure the economic value of recreation at Minnamurra Rainforest Centre, Budderoo National Park. This technique was reportedly developed conceptually by Harold Hotelling and reported by Prewitt in 1949 (Sinden and Worrell 1979; Bennett 1995 etal and Clawson and Knetsch 1966). The approach was subsequently modified and applied by Marion Clawson in 1959 (Bennett etal 1995).

The travel cost method can generally be thought of as comprising two steps. The first step is to examine the relationship between the rate of visitation to a site and the return costs of traveling to the site (and in some instances, other socio-economic variables) i.e.

$Qi = f (TC, X1, ..., Xn)$

where: - Qi is the visitation rate (number of visitors per 1,000 population in zone i);
- TC is travel costs; and
- X2....Xn are a number of socioeconomic variables including income, level of education etc. (Hufschmidt etal 1983, p 217).

This first step leads to what is referred to as the "whole experience" demand curve (Sinden and Worrell 1979; Hufschmidt etal 1983). This information can be used to define one point on the true demand curve for the subject site i.e. the number of visits to the site at the current nominal or zero price level (Hufschmidt etal 1983).

The visitation rate - travel cost relationship can then be used to estimate other points on the demand curve i.e. the number of visits that would be made to the site if varying levels of a hypothetical park fee were to be charged (Bennett etal 1995). This step allows the entire Marshallian or normal demand curve to be derived. The area under the demand curve estimates the consumer surplus or economic benefit that accrues to the visitors to the site. Where the entry fee is zero, the area under the demand curve is the total and net consumer surplus to the visitors. Where an entry fee applies, the area under the demand curve is the total benefit to consumers and the net benefit to consumers is the area under the demand curve and above the price line.

However, before applying the TCM, there are a number of issues that require consideration. These include:

- whether an individual or zonal model should be used;
- what the appropriate recreation quantity variable is e g. hours or days of recreation, number of visits etc.;
- what travel costs to include and how to measure them;
- the treatment of travel and onsite time;
- identification and treatment of onsite congestion;
- dealing with intervening recreation opportunities; and
- selection of an appropriate functional form for the travel cost- visitation rate relationship and the demand curve.

Application of the Travel Cost Method to Minnamurra Rainforest Centre

With respect to the use of a zonal or individual model, a previous study by Bennett (1995) for Dorrigo National Park and Gibraltar Range National Park. indicated that the average number of visits made by groups to the respective parks in the last 12 months was less than one. On the very plausible assumption that this result also holds for the Minnamurra Rainforest Centre, Budderoo National Park, the travel cost survey questions were designed for application of the zonal model[1] of the TCM.

In the presence of site congestion, the TCM by itself would be unreliable in determining consumer surplus since it would be necessary to consider both the demand for visits and the marginal social costs associated with crowding (Bennett etal 1995b). However, with respect to the Minnamurra Rainforest Centre, Eco-Research (1995) confirmed that congestion was not a major problem with 86% of visitors surveyed indicating that enjoyment was not affected by encountering other walkers on the boardwalk.

The recreation quantity variable used in this study was visits. This was largely a pragmatic consideration since the survey and annual visitor data available relate only to number of visits.

On the basis of the findings of Bennett (1995), multiple purpose trips were dealt with via a subjective assessment by respondents. People were asked to identify how important the visit to Minnamurra Rainforest Centre was relative to the other things they were doing on their return trip. Five answers were possible: sole purposes of the trip; very important; somewhat important; a little important; and not very important. These were converted to the following quantitative conversion factors for travel costs: 1 if the visit to the site was the sole purposes of the trip; 1/2 if the visit was very important; 1/3 if somewhat important; 1/4 if a little important and 1/5 if not very important.

[1] The zonal approach uses the relationship between the number of visitors per head of population from a geographic zone and the costs of travelling from that zone whereas the individual approach uses the relationship between visitation frequency of individuals and their travel costs.

The average variable return travel costs from zones were calculated following consideration of the different transport modes of groups. Where the transport mode was via car, the transport costs of the group were based on the variable costs of running a medium sized family car. This was determined as 15.16c per km (NRMA 1995).

Where people arrived at Minnamurra Rainforest Centre by motor cycle the variable cost of running a medium sized motor cycle was used. This information was provided verbally by NRMA and amounted to 4.3c per km.

A number of visitors to Minnamurra Rainforest Centre arrived by bus, either minibus or coach. For these visitors, it was not appropriate to use the variable costs of running the vehicle, since this is not the fee that the traveller must bear. It was considered that the appropriate expression of travel costs for these people was the fee that they had to pay to travel in the bus. This was determined on the basis of the zones from which the people originated and inquiries to minibus rental and coach hire places as to the level of rental and hire costs.

Information on other travel costs such as "per visitor day costs of recreational supplies, fees for camp or trailer, sites and boat launching, fish bait, and extra cost of food, lodging, and other services beyond those that would be incurred at home" (Hufschmidt etal 1983, p219) were not available and were therefore not included.

The inclusion and costing of travel time is a vexed issue. Nevertheless, following Hufschmidt (1983) and Lockwood and Tracey (1995), it is considered that inclusion of travel time yields a theoretically superior model. Models including travel time were therefore examined, in addition to those solely based on travel costs. In models where time was included, the travelling time of visitors from different zones was estimated from the return distance of the zone from Minnamurra Rainforest Centre and the application of an average speed i.e. 70km/hr. For adults the opportunity cost of time was estimated to be 30% of the gross hourly wage of adults in NSW i.e. $5.50. This is consistent with the approach recommended by Cesario (1976) and Abelson (1986). An opportunity cost for children's time was also considered appropriate. Following the approach recommended by Cesario (1976) and subsequently used by Read and Sturgess (1994), one quarter of the value used for adults was used i.e. $1.40. No opportunity cost value for time spent on the site was considered appropriate.

On the basis of the above, the following models were tested:

- basic vehicular travel cost model; and
- basic vehicular travel costs plus the opportunity cost of travel time model.

Linear and double log functional forms were tested for each of the models.

Table 1 summarises the regression analysis of the travel cost - visitation rate models using both a linear and double log functional form.

Table 1 - Regression Analysis of the Travel Cost - Visitation Rate Relationships

Functional Form	Independent Variable	Co-efficient (t stat.)	Constant (t stat.)	R squared	F Stat.
Linear					
	Vehicle Cost	-0.685110 (-1.474)	61.097378 (3.084)	0.23676	2.17146
	Vehicle and Time Cost	-0.356072 (-1.642)	64.371993 (3.226)	0.27808	2.69641
Double Log					
	Vehicle Costs	-0.961767 (-5.725)	5.769833 (11.822)	0.82400	32.77177
	Vehicle and Time Costs	-0.928656 (-6.179)	6.445553 (11.593)	0.84505	38.17613

Notes:

- "a 't' statistic, indicated in brackets under the coefficients and the constants, over 1.96 in absolute value terms indicates significance at the 95% level.
- The R squared statistic indicates the percentage of variation of the dependent variable that is explained by the estimated equation.
- The F statistic indicates the significance of all coefficients in the equation. A value over 3.84 indicates significance at the 95% level."

(Bennett 1995, p 17).

Because the travel cost-visitation rate relationship for the different estimations of travel cost was asymptotic to both axes, the double log functional form of the two models was statistically superior to the linear functional form, with a high correlation coefficient and significant t and F statistics.

The double log functional form of the travel cost-visitation rate relationship was therefore adopted for the purposes of deriving the demand curve. The preferred travel cost - visitation rate relationships are reproduced below.

Preferred Vehicle Cost Model
LnV = 5.769833 - 0.961767 LnTC

Preferred Vehicle Cost Plus Time Cost Model
LnV = 6.445553 - 0.928656 LnTC

where: - Vi is the number of visiting groups per 1,000 head of population from zone i; and
- TC is the return distance from each zone multiplied by the average variable cost per km of travellers from each zone and multiplied by the qualitative apportion factor (in the latter model the opportunity cost of travel time is included as part of average variable cost per km).

The demand curves for visitation to Minnamurra Rainforest Centre were derived by adding varying amounts of additional travel costs to simulate the imposition of varying entrance fees[2] (as well as subtracting some travel costs to simulate a reduction in entrance fees) and using the travel cost - visitation rate equations to estimate the total number of visits, from people across all zones, that would still be made to the park. This relationship between the hypothetical fee level and resultant visit numbers was then estimated using regression analysis. Again both a linear and double log functional form were used.

Table 2 shows the results of the regression analysis. Again, the relationship between hypothetical entrance fee and visits was asymptotic to the axes and therefore the double log functional form was statistically superior.

Table 2 - Regression Analysis of Demand Curves

Model	Independent Variable	Co-efficient (t stat.)	Constant (t stat.)	R squared	F stat
Linear					
Vehicle plus time cost model	Visit number	0 0007 (-9 131)	101 77 (15 274)	0 8065	83.36879
Vehicle cost model	Visit number	0 0004 (-5 027)	71 441 (10 805)	0 5582	25.26609
Double Log					
Vehicle plus time cost model	Visit number	-2 731477 (-12 801)	33 849021 (14 134)	0 92650	163 87672
Vehicle cost model	Visit number	-1 796687 (-21 450)	21 548811 (25 664)	0 96034	460 08124

Notes:

- "a 't' statistic, indicated in brackets unde, the coefficients and the constants, over 1.96 in absolute value terms indicates significance at the 95% level
- The R squared statistic indicates the percentage of variation of the dependent variable that is explained by the estimated equation
- The F statistic indicates the significance of all coefficients in the equation. A value over 3 84 indicates significance at the 95% level."

(Bennett p 17)

The preferred demand curves are reproduced below.

Preferred Vehicle Cost Demand Curve
LnFee = 21.548811 - 1.796687 LnVisits

Preferred Vehicle Cost Plus Time Cost Model
LnFee = 33.849021 - 2.731477 LnVisits

[2] Simulated entrance fees of $0 i.e. a reduction in fee, the current average entrance fee per person i.e. $1.50 per person, and fees of between $5 and $100 were used.

Economic Value of Recreation

When a fee is charged, as is the case at Minnamurra Rainforest Centre, the economic value of recreation or consumers' surplus is the area under the demand curve but above the fee charged. Table 3 summarises the estimates of consumers' surplus based on the linear and double log specifications of the travel cost and travel cost plus time cost models.

Table 3 - Consumer Surplus Estimates

Model	Economic Value of Recreation Per Visit	Economic Value of Recreation Per Annum
Linear		
Vehicle Costs Only	$36 00	$5M
Vehicle and Time Costs	$50 00	$7M
Double Log		
Vehicle Costs Only	$28 00	$3 9M
Vehicle and Time Costs	$44 00	$6.2M

If it is assumed that the annual level of benefits continues over time then the present value of this benefit (based on the statistically superior double log specification) is in the order of $55.7M to $88.6M .

However, this can be considered to be a conservative estimate of the present value of recreation benefits from the Minnamurra Rainforest Centre, Budderoo National Park, since with increasing population, higher levels of income and a continuing shift of community preferences towards environmental goods, recreational benefits from Minnamurra Rainforest Centre will actually grow over time up until the point where congestion becomes a serious problem (Fisher, Krutilla and Cicchetti 1972; Saddler, Bennett, Reynolds and Smith 1980; Streeting and Hamilton 1991).

The results of the travel cost study also need to be considered in the context of the total economic value of the Minnamurra Rainforest Centre and Budderoo National Park. The TCM measures just one of the use values of the park. Apart from other use values of the park there are also non-use values.

Some indication of the relative value of non-use benefits compared to use benefits can be gauged from examining other studies in Australia.

The Resource Assessment Commission inquiry (RAC 1991) into the forest and timber industry undertook both a travel cost study and contingent valuation study of forest of south-eastern Australia. The results of the studies indicated "that the willingness to pay or consumer surplus per person per year for the preservation values were approximately three times the willingness to pay per person per year for recreation values[3] "

[3] It should be noted that the implication here is that visitors to the site are likely to have a willingness to pay for preservation of the resource in the order of three times their willingness to pay for recreation. Non-visitors are also likely to have a willingness to pay for preservation (Bennett and Carter 1993).

(RAC 1991,p. E22). The RAC (1991, p. E22) identified that this is "a common outcome when the two methods are applied simultaneously" (Bennett etal 1995, p133).

Great caution must be taken in extrapolating this finding to Minnamurra Rainforest Centre, Budderoo National Park. Nevertheless it does highlight the fact that in addition to economic values of recreation, the economic values of the preservation benefits of national parks, such as Budderoo National Park, may be substantial.

REGIONAL ECONOMIC IMPACTS

Introduction

Economic impact assessment is primarily concerned with the effect of an impacting agent on an economy in terms of a number of specific indicators, such as employment, income, value added and output. An impacting agent may be a change to a local economy or may be an existing activity within an economy (Powell etal 1985; Jensen and West 1986). This study of regional economic impacts was concerned with an existing activity within a local economy i.e. the operation of Minnamurra Rainforest Centre, Budderoo National Park.

The economy on which the impact is measured can range from a township to the entire nation (Powell etal 1985). In selecting the appropriate economy regard needs to be had to capturing the local expenditure associated with management of, and visitation to, the Minnamurra Rainforest Centre but not making the economy so large that the impact of the Minnamurra Rainforest Centre becomes trivial (Powell and Charmers 1995).

Having regard to the location of the Minnamurra Rainforest Centre, Budderoo National Park, 15 kilometres west of Kiama and in reasonably close proximity to the towns of Gerringong and Jamberoo, it was decided to consider the impact of the Minnamurra Rainforest Centre on the Statistical Local Area or local government area of Kiama. The Kiama SLA is shown in Figure 1.

There are a range of methods that can be used to examine the economic impact of an impacting agent on an economy. These include Economic Base Theory, Keynesian multipliers, econometric models, mathematical programming models and input-output models. This study adopted the use of input- output analysis.

Application of Input-Output Analysis to Minnamurra Rainforest Centre

Input-output analysis essentially involves two steps:

- construction of an appropriate input-output table; and
- identification and measurement of the initial impact and transformation of this to a form that is compatible with the input-output equations so that the input-output multipliers and flow-on effects can then be estimated

(West 1993).

The input-output table or transaction table indicates the purchase and sale of goods and services between sectors in an economy over a period of time, usually 1 year, and therefore provides a detailed picture of the inter-sectoral linkages of the economy (West 1993). For this study, the Centre for Agricultural and Regional Economics (CARE) Pty Ltd were engaged to develop an appropriate 1993/94 input-output table for Kiama SLA. CARE utilised the 'hybrid', Generation of Regional Input-Output Tables (GRIT) procedure, developed by the University of Queensland and recognised internationally.

The initial impact or stimulus from the management and operation of the Minnamurra Rainforest Centre, was considered to arise from two sources:

- expenditure by the NPWS associated with management of the facility; and
- expenditure by visitors to Minnamurra Rainforest Centre.

Information on the different categories of expenditure by the NPWS in managing Minnamurra Rainforest Centre, Budderoo National Park, and the proportion of this that is expended within the Kiama regional economy was obtained by means of a detailed questionnaire completed by the Manager of Rainforest Centre. These expenditures were then allocated to input-output sectors.

For the purpose of determining the total (direct and indirect) impact of NPWS management expenditures, the Kiama input-output table was manipulated by inserting a new sector, namely the National Parks Management Sector, and adjusting the remainder of the table to avoid double counting of expenditures. Because the NPWS is located in the personal services sector, this sector's expenditures was modified to take account of NPWS management expenditures isolated in the new National Parks Management Sector. Expenditures by the NPWS on shop and cafe supplies were not included in the National Parks Management Sector to avoid double counting with visitor expenditure data.

Information on the disaggregated expenditure, in the Kiama SLA, of visitors to Minnamurra Rainforest Centre was obtained by way of the

visitor survey undertaken by Eco-Research. Some problems with the ultimate survey design implemented by Eco-Research led to the need to consider a range of expenditures per visitor. This arose because although the survey question sought to elicit the expenditure of the individual, in practice it is likely that many, particularly those visiting with members of their family, may have responded on behalf of the group.

If it is assumed that people actually responded on behalf of the group, the average expenditure per visitor in the region was $12.43. If it is assumed that people responded as an individual, the average expenditure per visitor in the region was $104.94. This is a substantial range.

The real situation is likely to lie between the two figures. To get some indication of where in the range the likely correct expenditure figure lies, it is useful to refer to similar studies undertaken for Dorrigo National Park and Gibraltar Range National Park (Powell and Charmers 1995) which actually relied on a survey question aimed at eliciting group expenditure data. Powell and Charmers (1995) found that the average expenditure in the local region for each visitor to Dorrigo National Park was $20.10. The equivalent figure for visitors to Gibraltar Range National Park was $25.13.

For this study a range of $12.43 per person to $25 per person was therefore used. This amounted to annual expenditure in the Kiama LGA by visitors to Minnamurra Rainforest Centre of between $1.7M to $3.5M. This expendure data was able to be disaggregated between different categories of purchases and allocated to local final demand sectors

Economic Impact of Minnamurra Rainforest Centre

The total (direct and indirect) impacts of Minnamurra Rainforest Centre on the Kiama economy in terms of output, value added, income and employment were calculated from the above information on direct impacts and by the use of multipliers derived from the relationships identified in the input-output tables[4]. Multipliers are a commonly used quick means of estimating the effects of a change in final demand of sectors on the level of activity in the overall economy and in particular sectors (Bennett etal 1996).

The results are shown in Table 4 and 5.

In total, expenditure by the NPWS in managing Minnamurra Rainforest Centre and expendditure by visitors to the rainforest centre contributed an estimated $2.2M to $4.2M in output or business turnover, $1.2M to $2.1M in value added including $0.8M to $1.4M in household income. The total employment impact ranged from 70 to 120 local jobs. These impacts represented between 1 and 2% of gross regional output, 1.2 to 2.2% of

[4] The Input-Output Analysis Version 7.1 program developed by West (1992) from earlier versions of the Generation of the Regional Impacts (GRIMP) program also developed by West, was used.

value added (or gross regional product 1.3 to 2.4% of regional household income and 1.9 to 3.2% of regional employment.

Table 4 - Regional Economic Impacts of Minnamurra Rainforest Centre - Conservative Option

	Direct Effect	Production Induced	Consumpt. induced	Total Flow-on	TOTAL EFFECT	% of Region
OUTPUT ($'000)						
NP. Mgt Exp	211	24	81	105	316	0.2
Visitor Exp	1,381	249	276	525	1,906	0.9
TOTAL IMPACT	**1,592**	**273**	**357**	**630**	**2,222**	**1.1**
INCOME ($'000)						
NP. Mgt Exp	148	6	25	31	179	0.3
Visitor Exp	448	76	84	160	608	1.0
TOTAL IMPACT	**596**	**82**	**109**	**191**	**787**	**1.3**
VALUE ADDED ($'000)						
NP. Mgt Exp	178	11	38	49	227	0.2
Visitor Exp	673	122	129	251	924	1.0
TOTAL IMPACT	**851**	**133**	**167**	**300**	**1,151**	**1.2**
EMPL. (No.)						
NP. Mgt Exp	19	0	2	2	21	0.6
Visitor Exp	38	5	6	11	49	1.3
TOTAL IMPACT	**57**	**5**	**8**	**13**	**70**	**1.9**

Table 5 - Regional Economic Impacts of Minnamurra Rainforest Centre - Estimate Based on Other Studies

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT	% of Region
OUTPUT ($'000)						
NP Mgt Exp	211	24	81	105	316	0.2
Visitor Exp	2,778	500	556	1,056	3,834	1.8
TOTAL IMPACT	**2,989**	**524**	**637**	**1,161**	**4,150**	**2.0**
INCOME ($'000)						
NP Mgt Exp	148	6	25	31	179	0.3
Visitor Exp	900	153	170	323	1,223	2.1
TOTAL IMPACT	**1,048**	**159**	**195**	**354**	**1,402**	**2.4**
VALUE ADDED ($'000)						
NP Mgt Exp	178	11	38	49	227	0.2
Visitor Exp	1,354	245	260	505	1,859	2.0
TOTAL IMPACT	**1,532**	**256**	**298**	**554**	**2,086**	**2.2**
EMPL (No.)						
NP Mgt Exp	19	0	2	2	21	0.6
Visitor Exp	78	9	11	20	98	2.6
TOTAL IMPACT	**97**	**9**	**13**	**22**	**119**	**3.2**

Consistent with the results of similar studies of Dorrigo National Park and Gibraltar Range National Park, expenditure by park visitors was the major contributor to regional economic activity.

Because of the importance of visitor expenditure to regional economic activity, it is useful to express the contribution of visitors on a per visitor or 1,000 visitors basis (per 10,000 visitors in the case of employment).

The value of 1,000 park visitors to the Kiama region ranged from $14,000 to $27,000 for business turnover, from $7,000 to $13,000 in value-added including $4,000 to $9,000 in household income. Total employment impacts ranged from 4 to 7 jobs per 10,000 visits.

Table 6 - Regional Impacts of Visitor Expenditure

	Direct Effect	Production Induced	Consumpt. Induced	Total Flow-on	TOTAL EFFECT	Type 11A Ratio
OUTPUT ($/1000 visitors)						
Conservative Opt	9,864	1,779	1,971	3,750	13,614	1.38
Estimate	19,843	3,571	3,971	7,543	27,386	1.38
INCOME ($/1000 visitors)						
Conservative Opt	3,200	543	600	1,143	4,343	1.36
Estimate	6,429	1,093	1,214	2,307	8,736	1.36
VALUE ADDED ($/1000 visitors)						
Conservative Opt	4,807	871	921	1,793	6,600	1.37
Estimate	9,671	1,750	1,857	3,607	13,279	1.37
EMPL. (No./10,000 visitors)						
Conservative Opt	3	0	0	1	4	1.29
Estimate	6	1	1	1	7	1.26

Disaggregating the impact of visitor expenture it is clear that impacts are felt across most of the sectors in the economy with the major output impacts being on the personal services and trade sector, and to a lesser extent the food manufacturing, community services, transport, communications, finance and public administration sectors.

Park management expenditure is distributed across most of the sectors in the economy with the major output impacts being on the food manufacturing, trade, finance, public administration, community services and personal services sectors.

Income, employment and value added impacts are also felt mainly in the abovementioned sectors although to varying extents.

DISCUSSION AND CONCLUSIONS

Before drawing conclusions from the travel cost and input-output studies for Minnamurra Rainforest Centre, Budderoo National Park, it is useful to briefly consider how these results compare to those of other studies.

The TCM has been applied widely, especially oversees. Table 7 summarises the consumer surplus figures for some other travel cost studies of natural areas in NSW, together with some overseas estimates.

Table 7 - Summary of Results of Other Travel Cost Studies

Study	Author and Reference	Consumers' Surplus
Grampians State Forest	Greig (1977) as reported in NSW EPA (1995)	$3 per visitor day ($1990)
Warrumbungles NP	Ulph and Reynolds (1981) as reported in NSW EPA (1995)	$200 per visitor day ($1990)
Green Island, Great Barrier Reef Queensland	Economic Associates Australia (1983) as reported in NSW EPA (1995)	$29 per visitor day ($1990)
Gerringong-Gerroa, NSW	James etal (1993) as reported in NSW EPA (1995)	$104 per visitor day ($1990)
Gibraltar Range National Park (average stay is almost 2 days)	Bennett (1995)	$19 per visit ($1995)
Dorrigo National Park (average stay is 1/2 a day)	Bennett (1995)	$34 per visit ($1995)
Grampians National Park	Read and Sturgess (1994)	$75 per visit or $18 per visitor day ($33 per visit or $7.80 per visitor day if onsite time costs excluded ($1994)
South East Forests	RAC (1991)	$8.90 per visitor ($1992)
Various recreation uses	Walsh etal (1992) as reported in Read and Sturgess (1994)	$13-73 per recreation day ($A 1994)

It is clear that the consumer surplus derived for Minnamurra Rainforest Centre, Budderoo National Park, lies within the range determined in other studies. However, great care must be taken in attempting to draw any conclusions from the comparison of travel cost studies.

As discussed earlier, there are numerous issues in the application of the TCM. Comparison of travel cost studies is complicated by how these issues are dealt with within the individual studies.

For instance, whether or not the opportunity cost of travel time is included can make a considerable difference to consumer surplus estimates. Cesario (1976) found that "benefit estimates obtained by explicitly considering travel time substantially exceed estimates made when travel time is ignored". This is confirmed in this study which undertook both approaches. Depending on whether a linear or double log functional form was used, the benefit estimation was in the order of 40 to 60% greater when the opportunity cost of travel time was included.

The level of the opportunity cost of travel time and the inclusion of an opportunity cost of onsite time can also influence the outcome. The large consumer surplus figure derived by Ulph and Reynolds (1981) in their study of the Warrumbungles National Park can be at least partly explained by the inclusion of travel and on-site time costs valued at the full average wage rate (NSW EPA 1995).

The large willingness to pay per visitor day obtained by James etal (1993) can be partly explained by the use of a travel cost variable more closely aligned to average vehicle cost than marginal vehicle cost. A nominal 10c

per kilometre for the opportunity cost of leisure time was also included (NSW EPA 1995).

Ignoring intervening recreation opportunities, will also lead to higher estimates of consumer surplus.

Other complications in comparing the results of studies include the differing specifications of the quantity variable i.e. whether visitor days, visits or per annum figures are reported.

One area that is very unclear in many travel cost studies is how different travel modes such as tour buses, charter buses, minibuses, motorcycles etc. are dealt with. The implicit assumption in many studies seems to be that all visitors arrive at a site by car. However, this may not be the case and could influence consumer surplus estimates.

The functional form used to specify the demand curve can also influence consumer surplus estimates. In this study, the linear specification of demand for the vehicle cost and vehicle cost plus time cost models led to consumer surplus estimates that were 13% to 28% higher than the double log specification.

While there are numerous methodological reasons which make direct comparison of travel cost studies difficult, *ceteris paribus*, it would be expected that the consumer surplus associated with sites that have different facilities and recreation opportunities and/or differing socio-economic characteristics of visitors would vary.

The travel cost study for Minnamurra Rainforest Centre, Budderoo National Park, is the third recent application of the TCM to a national park in NSW, using essentially the same approach. Other parks that have been studied are Dorrigo and Gibraltar Range National Parks.This facilitates some comparison of results and subsequent conclusions to be drawn regarding the TCM.

Dorrigo National Park and Gibraltar Range National Park are both part of the Central and Eastern Rainforest Reserves (Australia) World Heritage Areas yet provide very different recreation experiences (Bennett 1995).

Dorrigo National Park has relatively highly developed visitor facilities including a rainforest centre, skywalk through the canopy of the forest, picnic facilities, electric BBQs and high standard walking trails. It caters predominantly for day visitors. The park receives approximately 160,000 visitors per year (Bennett 1995).

Gibraltar Range National Park is more remote, offers basic facilities and primarily caters for long stay campers. 85% of the park is declared wilderness. Gibraltar Range National Park receives approximately 40,000 visitors per year (Bennett 1995).

The experience offered at Minnamurra Rainforest Centre, Budderoo National Park is not dissimilar to that provided at Dorrigo. It has relatively highly developed visitor facilities including a visitor centre; 1.6 kms of raised boardwalk; a 2.6 kms return access route to view Minnamurra Falls; an outdoor classroom in the rainforest; cafe and picnic/barbecue facilities (Worboys etal 1995). Minnamurra Rainforest Centre caters for day visitors, of which it receives approximately 140,000 visitors per year.

From this information, it could be intuitively expected that visitors might be willing to pay a greater amount to visit sites such as Dorrigo National Park and Minnamurra Rainforest Centre which have more highly developed visitor infrastructure and fewer substitutes. Furthermore, it might be expected that given the similarities in the type of visitor experience offered at Dorrigo National Park and Minnamurra Rainforest Centre that visitors to these locations would have a similar willingness to pay.

This has been borne out by the travel cost studies undertaken. For Gibraltar Range National Park the consumer surplus per visit (excluding travel time) was $19 with the average visit being almost 2 days in duration (Bennett 1995).

In contrast, the consumer surplus per visit (excluding travel time) for Dorrigo National Park and Minnamurra Rainforest Centre, Budderoo National Park was $34 and $28, respectively. For both these sites the average length of stay was less than 1 day.

It therefore appears that when applied in a consistent manner, the TCM may be able to yield sensible information on the relative economic values of recreation at different national parks.

In contrast to the use of the TCM, input-output analysis has not been widely applied to protected lands. Apart from its application to Dorrigo and Gibraltar Range National Parks in NSW (Powell and Chalmers 1995), use of the technique in relation to protected lands seems to have been limited to a study of the contribution of the Tasmanian NPWS to the Tasmanian economy (Centre for Regional Economic Analysis 1987), repeated in the 1990s, and the economic impact of the parks of British Columbia (Coopers and Lybrand Consulting (1995)).

Input-output analysis has, however, also been used in NSW to look at the contribution of the public lands in the north east of NSW to the regional economy (Resource and Conservation Assessment Council 1996).

It is difficult, however, to draw any comparisons between the Minnamurra input-output analysis and other studies.

The RACAC (1996) study was of all public lands in the upper north east region of NSW, rather than individual national parks, and was based on secondary visitor expenditure data rather than direct surveys. The Tasmanian study(s), while based on some visitor surveys, examined the

economic impact of the Tasmanian NPWS on the State rather than the impact of individual parks to regional economies. The British Columbia study (Coopers and Lybrand Consulting 1995) was undertaken on a district basis rather than a park basis. However, consistent with the Minnamurra Rainforest Centre input-output study, the British Columbia study did find that the majority of the impacts arose from visitor expenditure rather than management expenditure.

Any comparisons between regional impact studies of protected areas is therefore limited to those that have been undertaken by, or on behalf of, the NSW NPWS, using essentially the same approach.

Given the importance of visitor expenditure to the total regional impact of national parks, the comparison here of the NSW NPWS studies focuses on visitor impacts. Table 8 shows the regional impact of national park visitors to Minnamurra Rainforest Centre (Budderoo National Park), Dorrigo National Park and Gibraltar Range National Park.

Table 8 - Regional Impact of National Park Visitors - Comparison of Studies

	Minnamurra Rainforest Centre, Budderoo National Park	Dorrigo National Park	Gibraltar Range National Park
Output ($/1000 visits)	$13,614 - $27,386	$22,279	$29,625
Value-added ($/1000 visits)	$6,600 - $13,279	$12,724	$17,050
Income ($/1000 visits)	$4,343 - $8,736	$8,029	$12,425
Employment (No./10,000 visits)	4 - 7	3 7	6

While the absolute magnitude of the regional economic impacts of Minnamurra Rainforest Centre, Budderoo National Park, per 1,000 visitors is not dissimilar to the findings for Dorrigo and Gibraltar Range National Parks some care needs to be taken in making this comparison. This is because the difficulties experienced with the Minnamurra survey meant that a range of expenditure data for visitors needed to be used, from a very conservative estimate to a total expenditure per visit figure based on the Dorrigo and Gibraltar Range National Parks survey. While it is considered that this approach was appropriate and likely to provide a reasonable estimation, it does lead to convergence of the estimate of visitor impacts for Minnamurra Rainforest Centre with those for Dorrigo National Park.

Further regional impact studies of national parks would therefore be required before conclusions can be drawn on the similarity, or otherwise, of the regional economic impacts arising from visitors to different national parks.

Notwithstanding comparison issues, the results of the studies of the Minnamurra Rainforest Centre show "that national parks can have substantial economic values and can also make a considerable contribution to the economic activity of the region within which the park is located" (Bennett etal 1995). This has policy, management and regional development implications.

From a policy perspective, the substantial economic value of Minnamurra Rainforest Centre, revealed by the TCM, illustrates the importance of ensuring consideration of non-market values if informed decisions are to be made relating to the allocation and use of natural resources. Otherwise it is likely that poor choices will result, to the detriment of the welfare of the community as a whole (Bennett etal 1995)

The results of both the travel cost and input-output study have important implications for the management of visitors. While the consumer surplus per visit can vary considerably between parks, the other factor which greatly influences total recreation value of a site is the annual visitation levels. Similarly, it was clear that the expenditure of visitors is the major contributor to the regional economic impact of parks.

However, if visitation increases to the point where it exceeds the ecological carrying capacity of the land and non use values are threatened, any increase in use values could be at the expense of non-use values. Similarly, if visitation levels increased to the point where social carrying capacity is exceeded the consumer surplus or economic value per visit would also decline (Bennett etal 1995). "In these instances, any increase in the contribution of visitors to regional economic activity would be at the expense of the efficient allocation of resources" (Bennett etal 1995, p. 134).

From a regional development perspective, it would seem that towns and regions can maximise the economic activity they capture from being in a position to supply the inputs required by protected land managers, and more importantly supply the services and facilities, such as accommodation, that are demanded by visitors and represent a large part of their expenditure. There may also be scale effects if the region can provide a range of complementary attractions and support services (Bennett etal 1995).

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