Threshold Value Analysis of Non-Use Values

Southern Region

A project undertaken as part of the NSW Comprehensive Regional Assessments

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THRESHOLD VALUE ANALYSIS OF NON-USE VALUES OF FOREST PRESERVATION

SOUTHERN REGION

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A project undertaken for
the Joint Commonwealth NSW Regional Forest Agreement Steering Committee
as part of the
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PROJECT SUMMARY

This report describes a project undertaken as part of the comprehensive regional assessments of forests in New South Wales. The comprehensive regional assessments (CRAs) provide the scientific basis on which the State and Commonwealth Governments will sign regional forest agreements (RFAs) for major forest areas of New South Wales. These agreements will determine the future of these forests, providing a balance between conservation and ecologically sustainable use of forest resources.

Project objective/s
This project aims to:

- provide information on the non-use values associated with forest areas
- provide estimates of the threshold values associated with forest reservation for the Southern CRA
- provide an indicative breakdown of these economic benefits into “use” and “non-use” values components

Methods
The TVA is consistent with the notions of economic efficiency that underpin benefit cost analysis (BCA). In TVA however, the benefits of forest protection are not estimated. The BCA logic is thus converted to a threshold value logic. The decision rational under TVA is:

“*dedicate the forest reserves if the decision makers believe that the benefits to society from their protection exceed the estimated benefits derived from extractive uses of those forests that are foregone.*”

TVA therefore involves the estimation of the foregone extractive benefits of the forest area proposed for reservation and the setting of that estimate in a format that is useful to decision makers

The analysis contained in this report has two basic components. These include a “static” threshold value analysis and a “dynamic” threshold value analysis. The static TVA is the basic form of TVA under which the foregone extractive benefits of the forest areas being considered for reservation are estimated. Although the dynamic analysis is based on the fundamentals of static TVA, the dynamic TVA takes into account the potential for streams of benefits from forest protection and forest extraction to change asymmetrically overtime.

Results
For the Current Commitments outcome, using the dynamic value model, the protection value thresholds (in the current year) of the forests which are proposed under that scenario for reservation range from $1485 to $3923 (mid point $2704). Decision makers must consider the likely magnitude of the forest protection values generated in the current year relative to their threshold values estimated here. The likely extent of these forest protection values have been put into some context through the use of the benefit transfer technique.

A parallel analysis of threshold values was not caried out for the Tumut sub-region. The forest management outcome in the sub-region provided gains in both forest proptection values and timber extraction values. In such a situation, the threshold value concept is inappropriate as there are no trade-offs for the community to choose between alternate value streams.

1. BACKGROUND

1.1 THRESHOLD VALUE ANALYSIS

The economic efficiency of alternative allocations of forest resources between extractive and protective uses can be assessed through the application of benefit cost analysis (BCA). In a BCA, the various implications for the well-being of the community of alternative forest resource allocations are estimated in dollar terms and aggregated. The technique's application is often problematic because the estimation of non-market benefits and costs in dollar terms can be difficult. Whilst methods designed to provide such monetary estimates are available – for instance, contingent valuation, choice modelling and hedonic pricing – they can be expensive and time consuming to implement. In addition, their application has, on occasion, been controversial (Bennett 1996).

In circumstances where BCA is problematic, one way to provide decision makers with information that will assist in the assessment of the economic efficiency aspects of alternative forest resource allocations is through a Threshold Value Analysis (TVA).

TVA is best explained in the context of a decision involving an extractive option and a protection option for a forest resource. Whilst the costs of foregoing the extractive option can usually be estimated from market information, the benefits arising from the protection option are likely to be non-marketed and not so readily estimated. In a TVA, the value that the non-market benefits of protecting the forest would need to reach for it to be in the community's best interest to forego the extractive benefits is estimated.

So whilst the decision rationale under the BCA is:

protect the forest if the estimated benefits to society derived from its protection exceed the estimated benefits derived from its development,

the decision rational under the TVA is:

> *protect the forest if the decision makers assess that the benefits to society from its protection exceed the estimated benefits derived from its development.*

The TVA therefore involves the estimation of the marketed benefits of forest resource extraction and the setting of that estimate in a specific format. Decision makers are asked to address the question:

> *are the benefits of protecting the forest greater than the value of the extraction benefits that will be given up?*

Central to the TVA is the estimation of the benefits of the extractive option that are foregone when the protection option is selected. This "opportunity cost" is the difference between the (monetary) value of extractive benefits under the extractive option and the (monetary) value of the extractive benefits yielded by the protection option.

Under a TVA, the burden of estimating the non-market value to the community of protecting the resource is placed before the decision makers in a way that makes the implications of their decision quite clear. Hence, if the decision is made to protect theforest, it is explicitly recognised that the benefits of resource protection are judged to exceed the "threshold" of extractive benefits foregone. Conversely, if it is decided to allow the extraction of the resource, then it is clear that the decision makers have concluded that the protection benefits of the forest are below the "threshold". One way of assisting decision makers in their assessment of whether the protection values are in excess of the threshold is through the analysis of protection benefit estimates generated by other studies. This is known as the process of benefit transfer.

In June 1999, the New South Wales Resource and Conservation Division commissioned a TVA as part of the Regional Forest Agreement (RFA) process for the forests of the Southern New South Wales CRA / RFA region. The TVA contributed to the towards the comprehensive assessment of the forest usage and reservation scenarios for the region, in effect informing discussions relating to the extractive and non-market benefits associated with various forest management regimes.

The Threshold Value Analysis of Non-Use Values of Forest Preservation project aims to provide a threshold value analysis of the outcomes of the comprehensive regional assessment process for the Southern NSW CRA/RFA region.

Due to the nature of the outcome in the Tumut sub-region, it was possible to perform a TVA for the South-Coast sub-rion only. This was because under the outcome for the Tumut sub-region, there was an increase in both the area of forest under protection and an increase in the volume of timber being harvested in that sub-region. This situation results in a "win-win" situation for the community, as there is no trade-off between protective and extractive benefits. Thus a TVA investigation if trade-offs was not applicable for the Tumut sub-region.

In this report, the TVA for the coastal sub-region is outlined. For consistency with linked project reports, the outcome for the South Coast sub-region is referred to as "Current Commitments". This outcome is defined in terms of the volumes of timber allocated to mills, thus implying particular areas of forest being allocated to reserve status. The per annum timber volume harvested under this outcome amounts to 135,310 cubic meters of saw logs and pulp logs.

This outcome is considered relative to a "reference option" which is defined as the actual level of timber supplied from State Forests for the sub-region in 1998/99. This is the amount of timber allocated by State Forests to the hardwood timber industry in the financial year 1998/99 and amounts to 136,155 cubic meters for the year. It should be noted that this amount is higher than the "Current Commitments" outcome. Furthermore, the composition of the timber allocated under the reference and protection options differs. Whilst pulp wood volumes are identical between the two, saw log allocations differ.

The opportunity cost calculation that is central to the TVA relates to the differences between the extractive values under the "Current Commitments" outcome and the "reference option". The extraction values relating to each were estimated by Gillespie (1999) in the Industry Response Modelling project and reported on in the Regional Economic Impact Assessment project for the Southern RFA/CRA region.

The extractive values considered relate solely to the timber harvested from the forests under consideration. It should be noted that other extractive values may be foregone with the introduction of the scenario assessed for the South Coast. For example, mineral resources that are currently available for exploitation may become inaccesible following a change in land tenure. Likewise, some forms of recreation and tourism – such as horse riding and four wheel driving – may not be permitted, grazing leases within forest areas may be cancelled, and so on.

The effect of excluding these non-timber extractive values from the threshold value assessment is to increase the opportunity costs associated with any forest protection scenario considered. The extent of the underestimation that results from the exclusion is difficult to estimate given the lack of data on these activities and will vary between differing levels of forest reservation. Some qualitative assessment is possible. For instance, the tourism and recreation opportunity costs are likely to be small because of the availability of substitute areas. Similarly, the grazing costs will be minimal because of the low density of grazing that can be undertaken in such forest areas.

This report is structured in three parts. In the first part, a "constant value" TVA is outlined. This is the basic form of a TVA under which the foregone extractive benefits of the forest areas being considered for reservation are estimated. Within this part of the paper, the fundamental principles underpinning the TVA are explained in brief.

In the second part of this paper, a "dynamic value" TVA is presented. While based on the fundamentals of the "constant value" TVA, the dynamic value version takes into account the potential for the streams of benefits from forest protection and forest extraction to change asymmetrically over time. The second part therefore begins with an explanation of these differential rates of change over time and a description of the model that incorporates them into a TVA. This is followed by the application of the model to the case at hand. Some benefit transfer results are included in section 3 in order to place the threshold values into some "order of magnitude" perspective.

2. CONSTANT VALUE TVA

2.1 THRESHOLD VALUATION PRINCIPLES

The opportunity cost suffered as a result of taking forest areas out of production for protection purposes is made up of lost producers' and consumers' surpluses. By excluding areas of forest from timber production, the overall supply of timber products is reduced. This results in the formation of a new market equilibrium. The price of timber products would rise and the level of output would decline. Those producers whose output is cut lose producer surplus. Consumers are also worse off[1]. Their surplus declines because of the higher price paid and the reduction in quantity available. There are some off-setting gains. Those producers who maintain their access to production forests achieve higher prices for their products and so experience a rise in producers' surplus.

2.2 ESTIMATION OF FOREGONE PRODUCER SURPLUS

The foregone producers' surplus resulting from the reservation of forests is defined as the difference between the marginal costs of production and the price received for the units of output that would have been sourced from the reserved forests. The modelling of timber mill operations in the region carried out by Gillespie (1999) affords the estimation of the value of this opportunity cost.

The foregone producers' surplus values for the forest scenario over a fifty year time horizon are reported in Table 1. Estimates under two discount rates (i) are reported.

TABLE1 **: FOREGONE PRODUCER SURPLUSES ($ 1999)**

i	Current Commitments
5%	408,071
8%	272,047

2.3 ESTIMATION OF FOREGONE CONSUMER SURPLUS

Bennett (1991) estimated the consumers' surplus effects resulting from forest management options for Fraser Island. It was found that the lost consumers' surplus ranged between 5 and 10% of the concurrent losses in producers' surplus, depending on the degree to which the price of sawn timber could be expected to rise following supply reductions. On the basis of this result, lost consumers' surpluses resulting from the protection scenario for the South Coast sub-region

[1] The exception is when the demand is perfectly elastic. Then there is no consumer surplus loss.

are reported in Table 2. All estimates are based on an assumption that consumers' surplus losses are in the order of 8% of producers' surplus losses.

TABLE 2**: FOREGONE CONSUMER SURPLUSES ($ 1999)**

i	Current Commitments
5%	32,645
8%	21,763

2.4 THE THRESHOLD

Aggregating the lost producers' (adjusted for profits expatriated overseas) and consumers' surplus yields an estimate of the total surplus foregone due to the alternate forest usage. These estimates are presented in Table 3.

TABLE 3**: FOREGONE EXTRACTIVE VALUES (MILLION $ 1997)**

i	Current Commitments
5%	440,716
8%	293,810

The data in Table 3 can be interpreted for each cell in the following manner. Using a discount rate of 5%, the present value of the cost to the Australian community that would result from the maintainence of current commitments is in the order of $441,000. In terms of the TVA, this implies that unless the community is judged to gain additional benefits of forest protection greater than $441,000, then timber extraction should be permitted to continue. The critical question facing the decision makers for this scenario (at a 5% discount rate) is therefore:

Is the present value to the community of the benefits of protecting the forests under this scenario worth more than $441,000?

3. DYNAMIC VALUE TVA

3.1 DIFFERENTIAL RATES OF CHANGE

The TVA undertaken in the first part of this report assumes that the demands for both the extractive and protective uses of the forest areas are constant through time. This is clearly not the case in reality. A more appropriate analysis involves these values changing through time to reflect changes in economic and social circumstances. Importantly, recognition should be given to the ways in which the rates of change applying to extractive and protection values differ. In this part, such a "dynamic value" TVA is undertaken. A consideration of the factors that may underpin differential rates of change is outlined first.[2]

3.2 EXTRACTIVE VALUES

The extractive uses of the forest involve the conversion of natural resources into intermediate products that in turn satisfy demands for the production of final products. For instance, hardwood timbers are cut and converted into structural timbers in order to satisfy the demand for products such as house frames. Wood chips are harvested to produce pulp and thence paper and card. In all cases, the outcomes are "producible" goods. This implies that the supply of these goods (both at the intermediate and final stages) can be enhanced over time. Furthermore, substitutes for both the final and the intermediate products exist. This improves the potential for supply enhancement over time. Hence, any increase in the demand for house frames may be met by enhanced production from existing hardwood forests, especially with the introduction of more advanced growing, harvesting and milling methods resulting from technological improvements. In addition, supplies of laminated softwoods or even alternative non-timber products such as steel may meet those increases in demand.

These characteristics imply that the value of the benefits derived from extractive uses of the forest may fall through time. The nature of the fall is dependent on the rate of technological advancement. When this falling value is discounted, it is clear that the present value of extractive benefits under the dynamic value model will be less than that calculated under the constant value model. The static model therefore overestimates the extent of the opportunity costs associated with protecting the forest. The threshold value that the protective values must exceed for forest protection to be a superior resource allocation to forest extraction is lowered under the dynamic value model.

3.3 PROTECTIVE VALUES

The situation where protective uses of the forest resource are involved is in marked contrast to the case described above for extractive values. For protective uses, the services provided by the forest enter directly into the utility function of the individual. That is, the benefits of forest protection are enjoyed directly by people. Furthermore, the services supplied by protected areas

[2] The analysis that follows is based on the work of Krutilla and Cicchetti (1972) and the subsequent Australian application carried out by Saddler, Bennett, Reynolds and Smith (1980).

are not producible. Hence, their supply cannot be increased in response to increasing demands. It is also the case that once the supply has been reduced (say due to extractive use) it may be the case that the reduction is irreversible. That is, the regrowth of the forest after harvesting may not be able to supply the same services as the original, old growth forest.

The implication of these characteristics is that substitutes for the protective use of the forest are not as readily forthcoming as they are for the extractive use products. Hence, as demand for the protective use increases through time, the benefits so derived will increase.

A feature of this relationship is that the growth rate acts to counteract the effect of the discounting process. If the rate of growth of the protective values is greater than the discount rate, then the present value of the stream of protective values through time is infinite. Under the more reasonable scenario of the growth rate being positive but less than the discount rate, the effect is one of moderating the rate at which future values are discounted.

A number of factors influence the rate of growth of protective benefits. These are, in essence, the factors that drive and constrain increases in the demand for protective values. It is likely that, because of these factors, the growth rate will be non-uniform. In other words, because the factors driving and constraining demand increases will change through time, the rate of growth of protective benefits will vary through time.

To understand the way in which the growth rate varies through time, it is important to understand the factors that affect and define the demand for forest protection. First, demand is affected by the rate of growth in peoples' willingness to pay for any given level of forest protection. This, in essence, is a reflection of changing tastes in the community and can be effectively proxied by the rate at which per capita income is growing (*w*). A factor that can be used to define demand growth is the rate at which forest protection services have been growing given a zero price (*c*).

The growth in demand that these two factors indicate is likely to slow through time. As far as direct use of the protected areas is concerned, the primary reason for this slowing is the carrying capacity of the areas. The value of *c* must therefore be carefully defined through time to account for the impact of the capacity constraint. Four different phases through time can be expected for the value of *c*:

1. From the outset to the time at which the carrying capacity constraint is reached (in year *k*), *c* could be expected to be maintained at current levels;
2. After the capacity constraint is reached, *c* could be expected to decline over time (as c*) until it falls to equal the rate of growth of the population (in year *m*);
3. For a further period of time (until year *z*), *c* remains equal to the rate of growth of the population (c_m); and,
4. The final phase involves no growth at all.

The effect of this process is, overall, to decrease the impact of the discounting process on the extent of the present value of protective benefits. The exact magnitude of this impact is determined by the values of all the parameters that define the model.

3.4 RE-ESTIMATING FOREGONE EXTRACTIVE VALUES

To re-estimate the foregone extractive values detailed for the constant value analysis in a dynamic value context, an additional piece of information is required: the rate at which substitution is possible between the existing output of the South Coast sub-region forests and alternatives. This rate, to a large extent, is driven by the rate of technological advance. Estimates of this rate are very difficult to derive. In the past, substitution for hardwood products has been made possible by numerous technological advances, primarily relating to the use of plantation softwoods in the construction industry and in the production of papers and packaging. As a conservative estimate, it is assumed that the rate of technological change affecting the timber products industry will be in the order of one per cent per annum.

In Table 4, the foregone extractive values relating to the scenario for the South Coast sub-region is displayed given a one per cent change in technology every year, at two discount rates.

TABLE 4: **FOREGONE EXTRACTIVE VALUE UNDER TECHNOLOGICAL CHANGE ($ '99)**

i	Current Commitments
5%	408,058
8%	272,039

3.5 FOREST PROTECTION VALUES OVER TIME

The calculation of the present value of a stream of forest protection benefits in the dynamic value context depends on:

- the magnitude of the initial year's protection benefit
- the discount rate; and,
- the factors that influence the extent to which the benefit grows through time: w, c, k, z, c_m, and c^*.

The values of these parameters are now discussed.

w

The rate at which willingness to pay for protected forests increases is defined in w. It is an estimate of the rate at which the demand curve shifts up the vertical axis through time. Krutilla and Cichetti (1972) argue that this rate should be a reflection of the rate at which per capita real income is growing. In Australia, this rate has in recent times averaged between 3 and 5% per annum. The model estimated below uses the 3%, 4% and 5% rates to test for sensitivity of the results to this parameter specification.

c

The rate of growth of consumption of protected forest benefits at a zero price, up to the carrying capacity, is defined as c. There are few studies that have investigated this rate. Krutilla and Fisher (1975) report US data indicating a range from 10 to 45%. Saddler *et al* (1980) use a more conservative range of estimates between 7.5 and 12.5%. This is in line with the more recent findings of Worboys (1997).

k

The carrying capacity of the protected forests is defined as k. There are little data regarding current use levels and even less regarding what can be regarded as a carrying capacity. Necessarily, the latter is a subjectively defined parameter because of differing perceptions of what is the carrying capacity. The approach used by Saddler et al (1980) is advocated here. The carrying capacity is assumed to be at 20 times the current use level. Combining this judgement with the assumed values for c and it can be calculated that k is 40 years when c is 7.5%, 30 years when c is 10% and 25 years when c is 12.5%.

m

The time at which the rate of growth of consumption falls to the population growth rate is defined as m. There is little on which to base this estimate. 50 years is used by Saddler et al (1980) for Australia over 10 years ago. Hence 40 years is used here.

z

The time at which no further growth is experienced. Again, an assumption is made that this occurs at 50 years.

c_m
Population growth rates in Australia are assumed to be stable at around 0.6% in 30 years time

*c**
The rate of growth in consumption is assumed to decline between time period k and time period m. This rate c* is therefore determined by the parameters k, m and c_m. The decrease in c*, using a straight line decay function is:

when c = 7.5%   c* decreases at 0.0 % per annum (note: k=m)
=10.0%   "   0.94 %   "
= 12.5%   "   0. 79 %   "

The model is implemented by calculating the present value of $1 initial year's benefit from the protected forest areas under the range of parameter values specified above. Through this process, the sensitivity of the results to changes in the values of the parameters can be tested. The results of the model calculations are presented in Tables 5 and 6.

TABLE 5**: PRESENT VALUE OF $1 INITIAL YEAR'S PROTECTION BENEFIT (I=5%)**

i = 5%	c = 7.5%	c = 10%	c = 12.5%
m = 40	k = 40	k = 30	k = 25
w = 3%	$143.67	$154.45	$181.74
w = 4%	$184.56	$191.99	$222.82
w = 5%	$238.90	$240.15	$274.76

TABLE 6**: PRESENT VALUE OF $1 INITIAL YEAR'S PROTECTION BENEFIT (I=8%)**

i = 8%	c = 7.5%	c = 10%	c = 12.5%
m = 40	k = 40	k = 30	k = 25
w = 3%	$69.33	$80.78	$98.99
w = 4%	$86.24	$98.01	$117.08
w = 5%	$107.34	$119.72	$142.16

Hence:
- at a discount rate of 8% (i);
- with incomes rising at 4% (w);
- consumption of protected forest areas rising initially at 10% (c); and,
- consumption falling to equal the growth in population in 40 years time (m);

the present value of $1 worth of current year forest protection benefits is approximately $98.

3.5.1 The initial year's threshold

To estimate the threshold value for protection benefits in the initial year, the present values of the extractive values foregone, are divided by the present values of protective benefits growing from an initial value of $1 as calculated in the previous section. These dynamic value thresholds are displayed in Tables 7 and 8.

TABLE 7**: CURRENT YEAR THRESHOLD VALUES FOR PROTECTIVE BENEFITS ($ '99): CURRENT COMMITMENTS**

i = 5%	c = 7.5%	c = 10%	c = 12.5%
m = 40	k = 40	k = 30	k = 25
w = 3%	2840	2642	2245
w = 4%	2210	2125	1831
w = 5%	1708	1699	1485

i = 8%	c = 7.5%	c = 10%	c = 12.5%
m = 40	k = 40	k = 30	k = 25
w = 3%	3923	3367	2748
w = 4%	3154	2775	2323
w = 5%	2534	2272	1913

Again using the scenario of:
- a discount rate of 5% (i);
- with incomes rising at 4% pa (w);
- consumption of protected forest areas rising initially at 10% pa (c); and,
- consumption falling to equal the growth in population in 40 years time (m);

then the current year threshold value for the protective benefits provided by the Current Commitments scenario is $2125.

In other words, the protective benefits of the forests reserved under the Current Commitments scenario in the current year, given the situation outlined by the assumed parameter values, would need to be greater than $2125 for the reservation decision to be desirable from a community wide perspective.

The data in Table 7 demonstrates the sensitivity of the threshold values to the range of parameter assumptions that have been made. Of particular note are the impacts made on the threshold values by the choice of:
- discount rate (the increase in discount rate from 5% to 8% causes the threshold value to increase by about 30%)
- income (cutting the rate of income growth from 5% to 3% causes the threshold value to rise by approximately 50%)
- consumption trends (reducing the rate of growth of protected forest use from 12.5% per annum to 7.5% per annum results in an increase in the threshold value by approximately 40%)

The selection of these parameter values is of great importance to the decision making process. However, once they have been chosen, the critical decision for policy makers is whether the protective benefits of the alternative scenarios that will be enjoyed in the space of the current year are worth their threshold values. This determination would be benefited by some quantification of those protective benefits, however, such an exercise is not undertaken here. Rather, an analysis of benefit estimates generated by other studies is used to provide some perspective for the threshold value estimates.

4. BENEFIT TRANSFER

The decision regarding the setting aside of forest areas from timber production still requires an understanding of the likely magnitude of the current year's forest protection value. It is this understanding that enables the threshold value to be assessed.

To provide some understanding of the forest protection values, the results of other studies that have estimated similar values may be analysed. The benefits estimated in these other studies can be considered in terms of their suitability for "transfer" to the South Coast sub-region context. This process of "benefit-transfer" must be undertaken with considerable caution. The physical circumstances in which the original values were estimated may be very different from those existing in the current context. Furthermore, the population of people who enjoyed the originally estimated benefits may have different value structures to those whose values are important in the South Coast sub-region forests. These differences must be taken into account when transferring benefit estimates from one context to another.

4.1 TYPES OF VALUES

The identification of the various components of the forest protection benefits under consideration assists in developing a better understanding of their magnitude. Forest protection benefits can be classified broadly into use and non-use values.

Use values involve beneficiaries experiencing first hand the forest ecosystem. Non-use values are enjoyed even without that direct contact. Use values are mostly associated with tourism and recreation activities such as sight seeing, camping or bush walking.[3]

Non-use values are more complex in their classification. Passive use values do not involve direct contact with the environment and as such are non-use values but they do involve a "second-hand" experience. Hence, those people who enjoy reading books or watching films that are based on the environment enjoy a passive use value. Likewise, people who benefit from scientific advances that have been made through research undertaken in a protected forest are also passive users as are those who enjoy high quality water supplies that have originated in protected forest catchments.

Other non-use values do not even involve this type of indirect contact. These are known as existence benefits and they are held by people who simply enjoy the knowledge that some forest areas have been set aside in reserves even though they have no wishes to visit them. Existence benefits may be held because of a desire on the part of one person that others may experience either the passive use or use values provided. These are vicarious values. Where this desire extends to members of future generations, this value has been described as bequest value.

[3] Note that this type of benefit may extend to what is known as "option value" when there is uncertainty regarding either the availability of the resource or the strength of demand for it. However, it is difficult to predict *a priori* if option value is positive or negative. Quasi option value is enjoyed when a decision to irreversibly alter an environment can be delayed in order to collect more information regarding the net benefit that the community would enjoy from establishing a reserve.

4.2 DIS-AGGREGATED VALUES

It is often difficult to determine the exact composition of the total value of the benefits arising from forest protection. It is clear that the various components of the use and non-use values are heavily interrelated. For instance, the generation of existence benefits is dependent on people learning about a protected area. This may occur because of direct use or from the products of passive use (say the viewing of a television programme featuring a protected area). Those enjoying use values may also hold bequest values for their children. Hence, from a theoretical perspective the distinctions between classifications are fuzzy.

Quantifying the structure of forest protection benefits is even more challenging. Most forest protection value estimation exercises use stated preference techniques. These techniques rely on respondents to a questionnaire indicating their reactions to hypothetical scenarios. For instance, respondents may be asked if they are willing to pay a tax surcharge for certain proposed forest reserves to be established. It is very difficult to construct plausible and realistic scenarios in such questionnaires that target anything but the aggregate of all values that arise from the protection of forests. Even questions which relate directly to the recreation use of a proposed reserve (say asking about the willingness to pay an entrance fee) cannot be guaranteed to stimulate responses that segregate use values apart from non-use values. Respondents may, for instance, be willing to pay an entrance fee to use the reserve and to know that the reserve is available for others to enjoy and as a place for wildlife to inhabit.

What is possible is to draw on the range of studies that have attempted to estimate various types of values in different forest decision situations and generate indicative proportions of total benefits for each benefit type. This provides some guidelines for decision-makers in their efforts to understand more fully the type and magnitude of benefits a forest protection is likely to generate.

Walsh, Bjonback, Aiken and Rosenthal (1990) estimated the proportion of the total value generated by forest quality protection programmes. This was achieved through an application of the contingent valuation method (CVM) together with a sequence of questions whereby respondents were asked to allocate their stated willingness to pay values across four categories of benefit; recreation value, option value, existence value and bequest value. These proportions and the willingness to pay values are set out in Table 9.

Also presented in Table 9 are the proportions of total value that were derived in a study of wilderness values (Walsh, Loomis and Gillman 1984)

TABLE 10: PROPORTIONAL DISAGGREGATION OF FOREST PROTECTION VALUES

	Walsh et al (1990)		Walsh et al (1984)			
			1.2m acres		10m acres	
Value category	Allocation %	WTP per person pa (US$-1988)	Allocation % of total value	WTP per h'hold pa (US$-1980)	Allocation % of total value	WTP per h'hold pa (US$-1980)
Recreation use	27.4	13	46	14	62	14
Option value	21.9	10	16	4.04	11	9.23
Existence value	21.1	10	19	4.87	13	11.14
Bequest	29.6	14	19	5.01	14	11.46

value						
Total non-use value	72.6	34	54	13.92	38	31.83

The two studies reported give different pictures of the proportional disaggregation of the total forest protection value. The earlier study found that the ration of use to non-use values was in the order of 1:1 for lower levels of wilderness protection (1.2m acres protected), rising to almost 2:1 for greater levels (10m acres protected). However, the more recent study estimates the ratio at approximately 1:3. The analysis of forest protection values undertaken by the Resource Assessment Commission for the forest and timber inquiry (see Bennett and Carter 1993) supported the 1:3 ratio and it is this that will be taken as applicable for the current analysis. Similarly, whilst the "disaggregation" categories used by Walsh et al (1990) do not conform exactly with that described above, and as such can be regarded as less than complete, the proportions estimated will be adopted for this analysis.

Taking the mid range threshold value for the current year's forest protection values:

Current Commitments: $2125

the disaggregated thresholds (indicative) are set out in Table 10.

TABLE 11: **DISAGGREGATED DYNAMIC THRESHOLD VALUES FOR THE CURRENT YEAR'S FOREST PROTECTION VALUES ($ '99, APPROXIMATE)**

	Current Commitments
Recreation use value	595
Option value	467
Existence value	425
Bequest value	637

In other words, for the forest protection areas under the Current Commitments scenario to be set up, the additional recreational use values that must be generated are in the order of $595 in the current year.

To put this in perspective, a number of travel cost studies carried out in northern NSW (Bennett 1996) have shown that the value of a day's recreation is in the order of $40. This in turn implies that for the Current Commitments scenario to be socially desirable, an additional 15 days of recreational use would be required[4]. Hence, if more than 15 days of extra visitation would be generated by the declaration of the reserves defined by the Current Commitment scenario, the reserves should be established.

Another helpful source of data for comparison against these threshold values is Loomis, Lockwood and Delacy (1993). In that study, the protection of unreserved National Estate Forests in south eastern Australia was valued at approximately $100 per individual per annum. Given that this value reflects the total value of protecting forest areas, the implication is that to protect the forest areas defined under the Current Commitments scenario would require around 22 people to support the proposal in the current year.

[4] Mid points of the threshold value ranges are used for these comparative analyses.

5. CONCLUSIONS

The threshold values estimated in this paper demonstrate that the protection of the South Coast sub-region forests under the Current Commitments outcome investigated cause costs to the Australian community. These costs are the opportunity costs associated with the surpluses that could otherwise have been generated from forest extraction.

For the Current Commitments outcome, using the dynamic value model, the protection value thresholds (in the current year) of the forests which are proposed under that scenario for reservation range from $1485 to $3923 (mid point $2704). Decision makers must consider the likely magnitude of the forest protection values generated in the current year relative to their threshold values estimated here. The likely extent of these forest protection values have been put into some context through the use of the benefit transfer technique.

A parallel analysis of threshold values was not caried out for the Tumut sub-region. The forest management outcome in the sub-region provided gains in both forest proptection values and timber extraction values. In such a situation, the threshold value concept is inappropriate as there are no trade-offs for the community to choose between alternate value streams.

A number of caveats must be recognised in considering these results.

- The threshold values estimated have been subjected to some sensitivity analyses. It has been demonstrated that the estimates are sensitive to a number of parameters. The values of the parameters used for this analysis may vary outside the range of values specified. Hence, the actual values may differ from those reported here.
- The process of transferring benefit estimates from one study to another context can be problematic.
- The opportunity costs associated with the protection scenario is limited to those associated with the timber outputs of the forests under consideration.

Despite these caveats, the TVA process detailed in this report provides policy relevant information. The results produced embody information on the opportunity costs of forest protection and potential changes in value streams through time.

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