The Safe Minimum Standard for Environmental Choices: Old-Growth Forest in New South Wales

M F Rogers
Environmental Management and Development Program
National Centre for Development Studies
Australian National University

J A Sinden
Department of Agricultural Economics and Business Management
University of New England

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M F Rogers

National Centre for Development Studies, Australian National University,

Canberra, Australian Capital Territory, Australia 2600

J A Sinden

Deparatment of Agricultural Economics and Business Management,

University of New England, Armidale, New South Wales, Australia, 2351

Conflicts over environmental management are due partly to differences in goals, and partly to differences in ways to characterise goals. The safe minimum standard is a criterion for environmental choice that bridges economic and environmental goals, and provides a characterisation that is common to both. The safe minimum standard is a risk-averse criterion which states that society should assure the survival of an ecosystem unless the costs of doing so are unacceptably large. In this application to the debate over management of old-growth forest in New South Wales, the problems of defining "unacceptably large", and of defining ecological scenarios are explored. The local populations of Armidale and Dorrigo in northern New South Wales were surveyed to determine acceptable levels of economic and ecological trade-offs. A majority of those surveyed were prepared to forgoe some regional income to ensure the survival of endangered species.

Keywords:- safe minimum standard, environmental choice,old-growth forest.

1. Introduction

Natural resources are a foundation of economic well-being. As such, a natural resource maybe defined as those biophysical components that have direct 'use' in the process of capital formation and economic development. But what of the innumerable array of species which remain either unknown or 'useless' in terms of economic development? In this context, a more relevant definition of a natural resource encompasses all that exists within an ecosystem and not just those components that are economically useful at the

present time. Exclusion of presently uneconomic species has resulted in the wanton loss of many plants and animals. Their loss is a permanent contraction of the resource reservoir and may lead to a permanent and irreversible reduction in future options. All the same, policies that give full consideration to environmental components, but which provide no economic return, place a high cost on today's society. Conversely, to allow species to become extinct may render an even greater future cost. The 'Safe Minimum Standard' approach to environmental choices attempts to address the central question in these issues - 'how do we maximise the benefits to the present generation while maintaining options for future generations?'.

In economic terms, the cost of ensuring species survival is analogous to an insurance premium to guard against the loss of assets. Like all insurance premiums, the immediate costs are weighed against potential future losses. Similarly, the cost of preventing the extinction of species must be weighed against increasing environmental uncertainty and risk associated with many development options. The assessment of risk, and probable outcomes, is particularly difficult when dealing with ecological stability. However, to minimise the risks associated with biological decline, species survival can be ensured by appropriate management strategies.

The Safe Minimum Standard was advanced by Ciriacy-Wantrup (1960) as a criterion for environmental choices in just this sort of situation. In essence, society should assure the survival of environments unless the costs of doing so are unacceptably large. The game-theory specification of this criterion is discussed below, as are empirical challenges in its application. Despite the difficulties, it provides a bridge between the development and preservation viewpoints because it focuses on protection strategies (which are a major concern of the preservationist) and on measurement of the opportunity costs of those strategies (which are usually easier to estimate than benefits of preservation). Further, both preservationist and economist can usually agree on the notion, concept and importance of opportunity costs.

The objectives of this paper are therefore (a) to illustrate the application of the safe minimum standard, (b) to explore the concept of unacceptably large loss, which is a major conceptual difficulty with the method, and (c) to contribute to a particular environmental choice namely management of old-growth forest in New South Wales..

2. Guidelines for Environmental Choices

To reduce the risk of extinction, while also minimising the economic cost of preservation, Randall (1987, p314) suggests that conservation levels be set just "sufficiently high to reduce the probability of extinction to a very low level". The concept of 'Safe Minimum Standard' (SMS) had also set a required level of preservation to that just above the extinction threshold. Extinction occurs when the number of individuals declines beyond their ability to reproduce, which is not solely dependent on the survival of a breeding couple. Therefore, the level of preservation required is the minimum habitat or species numbers that just ensures survival. Although the definition of 'level of preservation' is full of uncertainties in itself, it does provide a basis for defining a protection strategy.

In a similar way, the Precautionary Principle originating from the Bergen Declaration (1990) advocates that "cost effective measures to prevent serious and irreversible environmental degradation should not be postponed because of a lack of full scientific certainty". This principle addresses the question of environmental risk by shifting the onus of risk assessment away from those seeking environmental protection, towards those wishing to use natural resources for development. The acceptance of this shift is somewhat reflected in the more stringent environmental standards which developers must now adhere to ensure their activities are environmentally benign (Boer, 1992).

The Safe Minimum Standard approach argues that allocation of resources to development be permitted so long as the population of affected species and ecosystems are maintained at levels above a safe minimum standard. However, like the precautionary principle, the SMS approach imputes an infinite value to all species and ecosystems regardless of the socio-economic consequences. In reality, caveats temper both approaches by exhorting that serious or irreversible damage to the environment should be avoided, but only where economically practicable; in other words, only where the cost of doing so is acceptable (Inter-governmental Agreement, 1992; Ecologically Sustainable Development, 1992). These approaches raise important questions about what the social costs of preservation are, what society considers to be an acceptably large and unacceptably large cost, and who bears the costs?

Ciriacy-Wantrup and Phillips (1970) applied the SMS approach to a conflict between agriculture and wildlife where the Tule Elk of California was on the verge of extinction. The Tule Elk population had declined to 250-300 head. Ciriacy-Wantrup and Phillips

compared the social benefits and social costs associated with the expansion of Tule Elk numbers to a level where the possibility of extinction was minimised. Estimates of social benefit from preservation were derived from tourism and hunting opportunities, and their scientific significance as an important gene pool. The social costs of expanding the free-roaming herds onto publicly-owned land were also derived for the purpose of comparison. Ciriacy-Wantrup and Phillips (p28) found that the "maximum possible losses which would result from not adhering to a safe minimum standard of conservation in managing Tule Elk are large in relation to the costs that must be expended in order to guarantee" their survival.

In applying SMS to this and other issues such as water quality (1961) and competing types of agricultural land use (1964), Ciriacy-Wantrup found that the conflict between interests had little relevancy to the ecological and economic aspects of the situation. Management strategies can be identified whereby both economic and ecological goals are achieved at minimum cost to society. For example, the expansion of the Tule Elk population onto agricultural land was thwarted, herd numbers were managed at a sustainable level, and the economic and social benefits derived from the Tule Elk were retained. By determining the safe minimum standard, and presenting the basic information, the conflict of interest was viewed differently and the cost of species survival clearly identified.

3. The Conceptual Framework

Game theory provides the fundamental tenets of the SMS approach, in which opposing sides aim to minimise their losses (Friedrichs, 1970). In environmental applications, the opponents are society and nature and the trade-off objectives can be defined in two ways (Ready and Bishop,1991). Firstly, the cost of implementing the SMS is viewed as an insurance premium paid against future unforeseen losses. By viewing the cost of preservation in this way, it is assumed that species will lead to a solution to solving future problems but the problems themselves are not certain to eventuate. Secondly, and as an alternative approach which adopts a lottery analogy as opposed to an insurance one, it is assumed that future problems will occur but it is not certain that preserved species will lead to a solution. Neither the lottery nor insurance approach captures the nature of the problem better than the other, but each provides a useful perspective with which to view the issues.

The insurance game - a premium against future losses

Two opposing strategic options are identified; namely development that leads to extinction of species, and preservation that leads to retention of species to the safe minimum standard. If we assume that only two possible future outcomes exist, a) that the species never become a valuable resource, and b) that the species do become a valuable resource, then we can set up the matrix of loses (Table 1) to help choose the strategy that minimises the maximum possible loss can be determined.

If the habitat is logged and the lost species do not become valuable, there is a net gain which is the benefit of logging (B_{lg}). The table is a matrix of losses so this benefit of ($+B_{lg}$) is recorded as $-B_{lg}$ in the table. Alternatively, if the species do become valuable but were lost through logging, the cost to society is the loss in value of the extinct species (L_x)less the benefits derived from logging and so this net cost is symbolised as (L_x-B_{lg}), assuming that the benefits from species are greater than the benefits from logging.

Table 1

Matrix of losses for the insurance game[a]

	Future Outcome		
Alternatives	No species value	Species has value	Maximum losses
Develop (log)	$-B_{lg}$ gain	$L_x - B_{lg}$	$L_x - B_{lg}$
Preserve to SMS (no logging)	0	0	0

If it is assumed that there is no current logging in the area and therefore no opportunity cost of preservation, the losses incurred under a safe minimum standard strategy are zero regardless of future species value.

The relevant information has now been set out in matrix form, and the choice can be characterised. If there is no opportunity cost of preservation (that is, there is no benefit from logging), or the value of species(L_X) is always greater than the value of development, the value of (L_X-B_{lg}) is positive. The game theory solution is to minimise losses and a loss of 0 is clearly less than a loss of (L_X-B_{lg}), and so the safe minimum standard of preservation should clearly be adopted. Given these baseline assumptions and adoption criterion, the safe minimum standard would be chosen even if the benefits from logging were only one dollar more than the benefits from preservation because the maximum possible loss of species extinction has still occurred.

The decision rule, which suggests that SMS is to be chosen to minimise the maximum possible loss, raises important questions about how high opportunity costs would have to be before they were considered excessive. In the context of insurance, only the present generation can decide how high a premium it is willing to pay to reduce uncertainty for themselves and for future generations.

The lottery game - a gamble against future losses

The baseline for the lottery (Table 2) is a situation of no development and no cure for a disease. The disease is then assumed to occur, but there is uncertainty embodied in the state of nature that the preservation of species will lead to a cure (Ready and Bishop 1991).

If the habitat is logged, the gain is B_{lg} so the loss is $-B_{lg}$ for both outcomes - - irrespective of whether the disease can be cured. If the safe minimum standard is chosen, and Lx symbolises the loss from extinction (so $-L_x$ is the gain from preservation through adoption of the SMS), the loss is $-L_x$ if the species will cure and 0 if it will not cure. Observation of these entries in Table 2 suggests that the maximum loss under development is $-B_{lg}$ and the maximum under the safe minimum standard is zero. The sum $-B_{lg}$ is less than 0, so 0 for the SMS is the larger loss.

The strategy to minimise the maximum possible losses is now to pick development because - B_{lg} is the smaller loss.

Table 2

Matrix of losses for the lottery game

Alternatives	Future outcome: Species will cure	Future outcome: Species will not cure	Maximum losses
Develop	$-B_{lg}$	$-B_{lg}$	$-B_{lg}$
Preserve to SMS	$-L_x$	0	0

In this research, the Safe Minimum Standard approach is applied to the problem of allocating old growth forest between two conflicting uses, logging and preservation. As an alternative to quantifying the social welfare from preservation, and to measuring ecological benefits in terms of hectares preserved, the cost of protecting identified species from extinction is examined. The question is then whether the maximum possible losses from not preserving a safe minimum area of old growth forest habitat are large in relation to the costs incurred in order to guarantee species survival. The SMS approach was applied to the conflict at Chaelundi State Forest in New South Wales where 18 threatened and rare flora and fauna were to be traded for the returns from logging. The study aimed to identify society's perception of what constitutes an unacceptably large economic and environmental loss. Hence, the estimated social cost of preservation enabled a comparison.

4. The Old-Growth Forest Problem

The policy alternatives

The New South Wales Forestry Commission considers old-growth forest to be natural forest, with few or no signs of disturbance by humans, with stems of dead trees standing or present on the forest floor, and with many specimens of trees in the upper story which are overmature, are in the upper limits of their longevity and which carry frequent hollows suitable for nesting or roosting sites for wildlife. As with many biological resources,

different agencies adopt different definitions, and so different agencies will suggest that different areas of the resource remain. But staying with the Commission's definition, there are some five million hectares of old growth forest in New South Wales, two million of which is already protected in national parks. There remains considerable public conflict over the use of the remaining three million hectares.

An area of 561 hectares of old growth forest situated in the Chaelundi State Forest of the Dorrigo Forestry Management Area has been found to contain many rare and endangered species. The area also contains some of the last remaining stands of high quality Tallowood (*Eucalyptus microcorys*), which is an important resource for the Dorrigo timber industry. The Tallowood resource contributes more than 50 per cent of the profit of the three sawmills in the district. The sawmillers therefore argue "that if the supply of large, high quality Tallowood logs is interrupted, they will be unable to maintain market supply" (Forestry Commission of NSW, EIS, 1990). As a consequence, the mills will lose customers who also purchase products across a range of other species. According to the environmental impact assessment conducted by Margules and Partners on behalf of the NSW Forestry Commission, the forestry industry provides the "basis for around $19 million of annual economic production generated by the region" (p95). If the old growth in the region is not logged, 600 workers will be lost from a forestry-related workforce of 3000. This was considered significant in terms of the potential impact on regional economic productivity (p95). An estimate of the immediate loss to sawmills from not logging the 561 hectares is $900,000 profit plus 4 forest worker positions.

From an environmental perspective, the 561 hectares of unlogged old growth forest are a haven for 18 threatened and rare species. This figure was supported in the Environmental Impact Statement, although the Forestry Commission did not believe that these species could not be found elsewhere, or that multiple use logging strategies were not compatible to wildlife conservation objectives.

If the unqualified SMS approach and the precautionary principle were applied, the forestry industry should be allowed to harvest timber so long as species are not threatened with extinction. In the Chaelundi case, the species are already in danger of extinction and therefore the prohibition of logging in this area would be justified on this basis. However, the caveat in both the SMS and precautionary principle states that conservation measures should be adopted "unless the social cost of doing so is unacceptably large". Therefore, this study attempts to apply the SMS approach to determine what the community

considers to be an unacceptably large loss in terms of species, jobs and regional income and so to address a major issue in applying the approach.

The game-theory context

The key information to the problem concerning old growth can now be combined with the game-theorey framework. The benefits of preservation may sometimes derive mainly from the continued existence of species and habitats. These benefits can be assessed by contingent valuation, and applied to the choice through the conventional net present value criterion as in the larger study (Rogers, 1992). But the major issue to which uncertainty applies is the possibility that species will provide good solutions to future problems, like cures for disease. When the occurence of the disease is uncertain, the insurance game can be applied.

The information for the old growth problem suggests that L_x can be represented as the loss in beneift if the 18 threatened and rare species become extinct. The amount ($900,000 and 4 jobs) is a readily-understood representation of the basic initial annual benefit of logging B_{lg}.

In the insurance game of Table 1, the maximum loss from preservation remains at zero given the same baseline of no logging yet in the 561 hectares at Chaelundi. The maximum loss from development to logging will still be symbolised by (l_x - B_{lg}). The actual amount of this loss will vary with the relative size of L_x and B_{lg}. If L_x exceeds, or is perceived to exceed, the benefit of ($900,000 and 4 jobs), the loss of (L_x - B_{lg}) is positive. In this case, this loss exceeds the loss of 0 from preservation and sothe decision criterion of avoiding the maximum loss indicates that preservation (the SMS) be adopted.

If L_x is less than, or is perceived to be less than, the benefit of ($900,000 and 4 jobs), the loss of (L_x - B_{lg}) is actually a net gain. This net gain exceeds the 0 loss from preservation. The same decision criterion indicates that development should be adopted to minmise the maximum loss.

Resolution of this old-growth conflict, in essence, turns on community perceptions of whether the loss of 18 threatened and rare species is larger than the loss of $900,000 plus four jobs. Data were collected to compare these perceptions.

5. Data Collection

To determine the necessary community preferences, a sample of the local population was questioned about its preparedness to forego jobs and regional income to ensure the survival of 18 rare and threatened species (questionnaire in Appendix 1). The community was also questioned about its preparedness to see rare and threatened species become extinct to ensure the survival of economic benefits (questionnaire in Appendix 2). Accordingly, the residents of Dorrigo, who are directly affected by the Chaelundi forest decision, and the residents of Armidale, the major town some 200 kilometres south-west of Chaelundi, were surveyed.

As in most environmental conflicts, information is always partial and facts are often in dispute. The second questionnaire (Questionnaire 2 in Appendix 1) was developed to reflect the Forestry Commission's belief that the endangered species were not in fact endangered but could be found elsewhere. This wider sphere of influence was examined by reframing the trade-off scenario as a general state-wide situation, as opposed to the specific Chaelundi State Forest conflict This second questionnaire was presented to the residents of Armidale only. The population size of each sample was:-

- Dorrigo - Questionnaire 1- specific conflict 50
- Armidale 1 - Questionnaire 1 - specific conflict 80
- Armidale 2 - Questionnaire 2 - general state-wide 80

The structure of the questionnaire was modelled on similar questionnaires developed by Imber et.al. (1991) for the Kakadu Conservation Zone study, and Sinden (1987) for an assessment of community support for soil conservation. To assess the upper limits of what society considers to be an acceptable cost in terms of economic benefits and individual species the questions were structured as incremental, dichotomous choices. For each increment in cost, the respondent was required to answer either yes or no, or to choose between income and species.

6. Results

An acceptable level of environmental loss

As a direct application of the insurance game approach to the safe minimum standard, respondents were asked to compare a loss from logging (a given 18 species) against a loss from preservation ($900,000 income and 4 jobs), and to nominate which was the greater loss. At this stage, no information was provided on who would bear costs or whether the species were preserved elsewhere. The preliminary findings reflect an overwhelming concern for the protection of environmental benefits (Table 3). A majority of respondents indicated that the species loss was the greater, given that no economic cost was made explicit.

To further substantiate this finding, the Armidale and Dorrigo group, under both the specific and general state-wide trade-off scenarios, expressed a preference for species protection when the cost of doing so was cited at $900,000 regional income and 4 jobs (Table 3). A small but statistically significant decrease was recorded in the number of respondents who preferred species over income when they were told the species could be found elsewhere (Armidale 2).

Table 3

Preferences for protection of species versus income and jobs

Alternative	The loss	Armidale 1 %	Armidale 2 %	Dorrigo %
Develop to Logging	18 rare species	95.0	86.3	58.0
Preserve to SMS	$900,000 income and 4 Jobs	5.0	13.7	42.0
		100.0	100.0	100.0

As expected, more people in the Dorrigo community preferred the economic benefits derived from logging, but a majority (58 per cent) still expressed a desire to see endangered species protected. Therefore. it would appear that $900,000 of regional income and 4 jobs is not considered to be an unacceptably large loss in this context. What then is considered an acceptably or unacceptably large economic cost of preservation?

More than 54.0 per cent of respondents expressed the view that no habitat of threatened or rare species should be lost in the pursuit of economic gains (zero species loss results in Table 4). But respondents were less prepared to forego economic gains to protect species when those species could be found elsewhere. Of the Armidale 2 sample, where the questionnaire stated that species could be found elsewhere, 81.3 per cent preferred zero species loss as opposed to 67.5 per cent.

Table 4

An acceptable level of environmental loss

Acceptable level of loss	Armidale 1 %	Armidale 2 %	Dorrigo %
Zero species loss	67.5	81.3	54.0
Some species loss			
1 species	13.7	1.2	1.2
6 species	0	2.5	1.2
12 to 18 species	1.2	1.2	1.2
> 18 species	4.7	6.3	28.0
Don't know	12.9	7.5	14.4
	100 %	100 %	100 %

The number of rare and endangered species which were threatened by logging was then raised systematically to determine what was an acceptable level of environmental loss. This systematic iterative procedure is illustrated in Question 19 of Appendix 2, where the

losses are raised to 24 and 31 rare and threatened species, and Question 18 where losses are lowered to 12. Respondents were then asked what was an acceptable level of environmental loss when species could not be found elsewhere (Armidale 1). Of the Armidale 1 group, only 19.6 per cent (13.7 + 1.2 + 4.7) were prepared to accept some species loss. Of the Armidale 2 group, with the state-wide scenario, only 11.2 per cent were prepared to accept some loss. In Armidale 2 (Table 4), when the speices are said to be found elsewhere, more people say that zero species loss is acceptable (81.3 per cent). This could be interpreted as a need to err on the side of caution until there is a greater understanding about species distribution.

An acceptable level of economic loss

A series of incremental increases in potential opportunity costs of species preservation were presented to respondents. The stakes were made much greater for the general state-wide scenario than for the specific Chaelundi case (refer to Appendix 1). The percentage of the surveyed population, who chose species protection or income as the greater loss, at each increase in dollar and employment costs, are shown in Tables 5a and 5b

A majority of people in both Armidale samples expressed a preparedness to forego $2 million in regional income to ensure species protection in both scenarios, namely 95 per cent in Table 5a and 75 per cent in 5b. However, these two percentages display a 20 per cent shift away from species protection when respondents were told that the species could be found elsewhere (state-wide scenario). This may indicate a 20 per cent premium against extinction at these levels of economic loss. The Dorrigo results also reflect a majority preference for species protection (56 per cent). However a high proportion of this surveyed population (44 per cent) were not prepared to forego any income.

Table 5(a)

Assessment of acceptable economic loss: based on the Chaelundi Scenario

Income and job losses	Percentage who said species loss exceeded the income and job loss			
	Armidale 1		Dorrigo	
$0 and 0 jobs[a]		100.0		100.0
$2m and 4 jobs	95.0		56.0	
Chose income as higher loss throughout	5.0		44.0	
		100.0		100.0
$5 m	2.9		4.0	
$10m	18.2		10.0	
$100m	23.2		10.0	
$ infinite	50.7		32.0	
		95.0		56.0

a A question for this level of loss was not included in the survey but it was assumed that at $0 income and job loss, 100 per cent of respondents would choose to preserve species.

Of those who continued to choose species over income as the greater loss at each increment of income loss, just over half of those responding to the Chaelundi scenario reported a willingness to forego 'whatever income it takes' to ensure that species are not lost (Table 5a). These were the 50.7 per cent who are recorded as "$ infinite". The percentage was significantly less for the Armidale 2 group (22.2 per cent) who were responding to the general state-wide scenario where the endangered species were said to be found elsewhere (Table 5b).

Table 5(b)

Assessment of acceptable economic loss based the general state-wide scenario

Income and job losses	Percentage who said species loss exceeded the income and job loss Armidale 2	
$0 and 0 jobs[a]		100.0
$2m and 10 jobs	75.0	
Chose income as higher loss throughout	25.0	
		100.0
$19m and 600 jobs	38.0	
$50m and 1500 jobs	1.2	
$100m and 3000 jobs	6.1	
$200m and 6000 jobs	7.5	
$infinite and 27 000 jobs	22.2	
		75.0

a. A question for this level of loss was not included in the survey but it was assumed that at $0 income and job loss, 100 per cent of respondents would choose to preserve species.

The idea that species are infinitely more valuable than human welfare maybe as an extremist view which does not stand up to testing. How then should we interpret the high level of community preference for doing 'whatever it takes' to ensure species survival? One interpretation is that society understands the relationship between cost and the search for substitutes and alternative technologies. A preference for species over an infinite income loss may be a statement more about the need for innovative new approaches to environmental management than a statement about a preparedness for self deprivation.

Based on these results, it would appear that community attitudes require that the onus of proof rests with those who wish to develop rather than with those who wish to protect the environment. However, the level of trade-off is dependent on the level of direct economic impact. The people of Armidale (some 200 km away from Chaelundi and Dorrigo) in response to the Chaelundi specific scenario, were prepared to forego $100 million or more to protect as many species as possible from extinction. Those in Armidale who were asked to respond to the general, state-wide case where the threatened species were said to

be found elsewhere were prepared to forego 'only' $19 million or more to protect as many species as possible from extinction.

Nature of the payment

The results can be interpreted in terms of the incidence of costs, hence offering some perspective of who is prepared to pay. If no opportunity costs are involved, a majority of people (58.0, 86.3 and 95.0 per cent in Table 3) favoured protection of species and indicated that a loss of 18 threatened and rare species would be the greater loss.

When the opportunity cost of regional income and employment is revealed, the preferences of those most directly affected are of considerable interest. Dorrigo is a township which relies on the timber industry for a fair portion of its regional income with fifty-two per cent of respondents being directly involved. Forty-four per cent of Dorrigo respondents (Table 5a) were not prepared to forego any income to protect species from extinction indicating that the income loss was the greater loss to them. However, more than half of those who were prepared to make some economic sacrifice (42 per cent), considered it not unacceptable to forego $100 million or more to protect as many species as possible.

These findings suggest that even those who have the most to lose economically from endangered species protection policies consider species protection to be of considerable importance,.and are prepared to make economic sacrifices.

7. Conclusions

The process of formulating the trade-offs in the Safe Minimum Standard games, and the emperical results, provided valuable insights into the old-growth forest conflict. As might be expected, the acceptable level of opportunity cost varies with information provided on species occurrence and the level of direct economic impact involved. Neverthe less, high percentages (95, 75, and 56 per cent) of all population samples in both information scenarios suggests that opportunity costs of at least $2 million are acceptable, with as many people also expressing a desire to see zero species lost.

The message which should be heard by policy makers and those involved in the forest use debate is that the community as a whole believe there is a need to ensure species survival and is prepared to make not insignificant economic sacrifices. However, this message should not be taken to mean that people prefer species survival over their own economic wellbeing, but should be viewed as a call for a higher level of environmental standards and a greater understanding of species distribution and ecosystem representation to facilitate environmentally benign development. Clearly, the community has expressed a preference for erring on the side of caution and adoption of the safe minimum standard.

While the Safe Minimum Standard does not provide an instant solution to environmental conflicts, it does provide a frame of reference with in which to resolve such conflicts (Toman, 1992). In discussing debates concerning intergenerational fairness, Toman emphasises (p.3) the role of the SMS criterion in reducing conflicts in this way.

> " Disparate perspectives on these topics might be bridged through the concept of the safe minimum standard which posits a socially determined demarcation between moral imperatives to preserve and ... the free play of trade-offs."

The particular trade offs in a choice, which must be addressed to resolve any conflict, are now brought to the fore. In this way, attention is focused on possible strategies for environmental protection, on measurement of the opportunity costs of preservation, and on the comparison of opportunity costs of conflicting land uses in the debates. The SMS approach does not rely on measurements of the benefits of preservation, as do the conventional measure of net present value. In this sense, the SMS fails to optimise neoclassical concepts of economic welfare. Nevertheless, in light of the failures of the neoclassical model, and the acrimony of environmental conflicts, the use of the Safe Minimum Standard seems worth further exploration.

Appendix 1

Questionnaire 1

a) Consider the Chaelundi State Forest conflict.

If the 561 hectares are logged, the losses will include:-

- the habitat of 3 threatened and rare plants (flora), and
- the habitat of 15 threatened and rare animals (fauna).

and,

if the 561 hectares are preserved, the loss to the region will be:-

- $900 000 income from timber
- 4 workers in the forest.

which do you consider the greater loss"?

b)

	If the loss from preservation is now:	which do you consider the greater loss.
i.	$2m and 10 jobs	'species' or 'income'
ii.	$5m income	'species' or 'income'
iii.	$10m income	'species' or 'income'
iv.	$100m income	'species' or 'income'
v.	infinite	'species' or 'income'

Questionnaire 2

a) Consider a general trade-off situation, between development and preservation.

If an area of forest is logged and the environmental losses are identified as being:-

- the habitat of 3 threatened and rare plants (flora), and
- the habitat of 15 threatened and rare animals (fauna).

and,

if that area of forest is preserved, the loss to the state as a whole will be:-

- $900 000 income from timber
- 4 jobs and

suppose that these threatened and rare species occur in other areas, such as National Parks within the state, which do you consider is the greater loss?

b) If the loss from preservation is now: which do you consider the greater loss.

i.	$2m income and 10 jobs	'species' or 'income'
ii.	$19m income and 600 jobs	'species' or 'income'
iii.	$50m income and 1500 jobs	'species' or 'income'
iv.	$100m income and 3000 jobs	'species' or 'income'
v.	$200m income and 6000 jobs	'species' or 'income'
vi.	infinite	'species' or 'income'

Appendix 2

Questionnaire 1 and 2

If the forested area is logged, and if the habitat of 18 threatened and rare species is lost, is this an unacceptably large loss?

yes ____No _____ Don't know _____

If you answered yes, go to question 18
If you answered no, go to question 19

18. If the loses from logging were the habitat of 12 rare and threatened species, is this an unacceptably large loss? Yes ___ No ___

If the losses from logging were the habitat of 6 rare and threatened species, is this an unacceptably large loss. Yes ___ No ___

What is the highest level of habitat loss that is acceptable to you? _____

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19. If the losses from logging were the habitat of 24 rare and threatened species, is this an unacceptably large loss? Yes ___ No ___

If the losses from logging were the habitat of 31 rare and threatened species, is this an unacceptably large loss? Yes ___ No ___

What would be an unacceptably large loss? _____

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