



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

## ULYSSES REVISITED — A CLOSER LOOK AT THE SAFE MINIMUM STANDARD RULE

J. C. ROLFE\*

*Faculty of Business, Central Queensland University,  
Emerald, Qld.*

The Safe Minimum Standard (SMS) Rule has been developed as a decision rule involving environmental assets, particularly species, that face some risk of extinction. The SMS rule has been presented by Bishop (1978) (1979) and Randall (1991) as a better decision process than the use of cost benefit analysis (CBA). This paper explores the relationship between the SMS rule and CBA. It shows that there is a tandem effect in operation because the use of both rules rely on the same underlying preferences in society. There is potential for the two rules to achieve the same results, and doubt over whether the SMS rule is an independent control over CBA.

Instead, the SMS rule may simply operate as a flagging mechanism for issues of particular interest. Its use can be seen as a signal to switch to a more intensive examination of costs and benefits, and justified in this format because the benefits of more accurate decisions outweigh the costs of operating the SMS rule. The application of the SMS rule will vary according to the justification for its use.

### *Introduction*

The field of ecological economics has developed as a response to the desire to include some form of sustainability as a goal alongside the more normal efficiency criteria that is pursued by mainstream economics. To ensure sustainability goals are met, ecological economics has generally suggested constraints be imposed on the set of choices to which efficiency criteria can then be imposed. A variety of constraints have been suggested, ranging from moral imperatives (Taylor, 1986) through to rules about the use of exhaustible resources (Pearce and Turner, 1990).

One important form of constraint that has been suggested is the Safe Minimum Standard (SMS) rule, originally suggested by Ciriacy-Wantrup (1952), and developed by Bishop (1978) (1980), and Randall (1991). Ciriacy-Wantrup (1952) argued that the population and habitat of a species faced a minimum threshold level, that once breached, led to inevitable decline. The irreversibility of species extinction, and the uncertainty of flow on effects and unrealised benefits meant that society should adopt a Safe Minimum Standard of conservation to ensure that threshold levels

\* An earlier version of this paper was presented at the 38th Annual Conference of the Australian Agricultural Economics Conference in Wellington, 7-11 February 1994. The paper has benefited from the helpful comments of Jeff Bennett, Richard Bishop, Alan Randall and an anonymous referee. The remaining errors are the author's responsibility.

were protected. Bishop (1978) developed this into a more general decision rule where 'the SMS should be adopted unless the social costs of doing so are unacceptably large' (p.10). While the SMS rule is generally associated with potential species extinction, it is also applicable to a wider range of resource issues (Bishop 1978).

Randall (1991) has argued that decisions about environmental matters should follow a two stage process. Decisions should normally be made on the basis of costs and benefits, but switch to a SMS decision making process as soon as a minimum threshold level has the potential to be breached. Randall (1991) suggests the use of the SMS rule as a caveat to the role of benefit and cost comparisons in decisions about resource allocation can be defended as an example of binding behaviour in the same way that Ulysses, sure that attraction to the siren's songs would lure the *Argo* to the rocks, had himself bound to the mast so that he could not capitulate to his short term desires.<sup>1</sup>

The simplicity of the Ulysses example paints an attractive appeal for the SMS rule to be adopted. Referral to the rule will stop us from choosing extinctions for short term gains. As well, adoption of the SMS rule circumvents many of the problems besetting the use of costs and benefits (Cost Benefit Analysis) in environmental resource issues. An additional benefit is that its rules based approach captures some of the middle ground in the debate between economists and environmentalists. Randall (1991) argues that the dual approach has broad appeal across many of the philosophical traditions in Western thought.

However, the very simplicity of the Ulysses metaphor does not promote a clear understanding of the relationship between the SMS rule and the use of Cost Benefit Analysis (CBA). Environmentalists may gain some pleasure from picturing what they regard to be the fickle and myopic results of CBA being controlled by the fixed rule approach of SMS. However they are unlikely to realise that the implementation of the SMS rule is reliant on many of the same human preferences which are embodied in CBA. Thus the differences between the two approaches may not be all that large, especially if we are to be consistent in setting the values underlying each rule. As well, the outcomes of each rule are likely to change in tandem as the underlying preferences of society vary.

The purpose of this paper is to show that the SMS rule is in fact less binding on CBA than a first interpretation of the Ulysses story would imply. While this outcome may be disappointing for some, it helps to focus attention on the practical application of the SMS rule. Use of the rule as a flagging mechanism for important decisions, or to check that decision mechanisms have reflected all the relevant preferences mean that most applications of the SMS rule can be justified by the use of costs and benefits. Most importantly, the application of the SMS rule will vary

<sup>1</sup> Randall (1991) used the Ulysses metaphor to illustrate a consequentialist justification for the SMS rule. In this paper, the Ulysses example is presented as a more general description of the operation of the SMS rule.

sharply according to the philosophical framework adopted. The Ulysses metaphor remains, in economics and in literature, a myth.

### *Safe Minimum Standard*

The SMS rule provides a constraint for society to follow where conditions of irreversibility and massive uncertainty apply. It suggests that 'a sufficient area of habitat should be preserved to ensure the survival of each unique species, sub-species, or ecosystem, unless the costs of doing so are intolerably high' (Randall 1991 p.66). Bishop's (1978) formulation of the rule means that society is not bound to the constraint of the SMS. At a point where costs become unbearable, society can choose to violate the standard.

At first glance, the SMS rule satisfies some general sustainability criteria demanded by ecological economics.<sup>2</sup> Bishop (1978) justified the use of the rule on the basis of the minimax principle. Strategies should be chosen that minimise maximum possible losses. Thus policies that sacrifice species for short term gains would be unlikely to be passed by the SMS rule because of the risk of some future disastrous consequences. The SMS rule codifies 'strong aversion to really big risks such as extinction' (Randall and Thomas, 1991 p.17).

Another major advantage to the SMS rule from an ecological economics perspective is that it involves some sort of public decision making process to allow relaxation to occur. Randall and Thomas (1991) characterise it as 'an extraordinary decision process' that provides a 'Time Out' contrast to the business as usual flavour of CBA. Bishop (1978) implies that this extraordinary decision process better allows the needs of future generations to be considered. Bishop and Woodward (1994) argue that the decision involves a choice between a current level of sacrifice and enhanced endowments for future generations (and that economists may have a very limited role to play).<sup>3</sup> Thus the SMS rule can be viewed as a way in which future generations can be better represented in the decision making process.

The third major advantage for the adoption of the SMS rule is that it draws support from a wide range of philosophical positions. Randall (1991) appeals to several broad strands of philosophy to argue that resource decisions should generally be made on the basis of benefits and costs, but subject to a SMS caveat. He poses the problem of how protection can be offered to the environment without offering it trump status. Here, Randall's arguments are summarised.

In the instrumentalist utilitarian tradition, species and natural systems have value because of their various uses, their store of genetic value and

<sup>2</sup> Ecological economics is bounded by the dual goals of sustainability and efficiency. It is essentially a search for where limits exist that involves technical and ecological issues as well as those of intergenerational equity (Costanza 1989).

<sup>3</sup> Bishop and Woodward (1994) argue that these tradeoff 'decisions involve value judgements beyond those that most economists are comfortable making' (p.29).

their contribution towards waste assimilation and environmental stability. One of the major criticisms of CBA is that the preferences of humans which underlie CBA may not be fully rational. Environmental assets may be squandered for short term gain at the expense of major long term losses. Ehrlich and Ehrlich (1981) use a rivet popper analogy to illustrate this. Here their rivet popper continues to remove rivets from aeroplane wings on the justification that no planes have been lost yet. While we might not know the point at which rivet removal causes disaster, we are certain that the practice will lead to catastrophe. Extension of the analogy to the environmental debate shows how the continued loss of species and systems contributes to the likelihood that the next loss is disastrous.

The use of benefits and costs to evaluate decisions fits neatly into the instrumentalist utilitarian framework. However to avoid consequences of CBA that we are sure that we (or future generations) will regret, Randall suggests that the SMS rule be used as a constraint over the CBA process. The SMS rule would not be absolute, but a comprehensive process would be needed to relax it. This process is also a defence against the piecemeal approach of CBA where projects are assessed on an individual basis and approved if assessed benefits outweigh assessed costs. By insisting on the 'Time Out' perspective that the SMS rule implies, Randall is guarding against the possibility that quasi-option and other non-use values have not been accurately valued under CBA.

A contractarian basis for the SMS rule derives from the notion that all parties to a contract have rights, or enforceable claims. Arrangements that respect the rights of all affected parties are legitimate. The starting point for an arrangement should ideally be agreed to by all parties. Using a vehicle such as Norton's (1989) thought experiment along the lines of Rawlsian contract<sup>4</sup> which took representatives from unknown generations and species, it is straightforward to show that all parties would press for the continued existence of species to maximise their chances of existence. Thus the SMS rule would be likely to be a component of a just constitution.

Randall also argues that the use of benefits and costs (subject to the SMS rule) remains plausible with contractarian thought. Because preference satisfaction counts, and many decisions in society are too complex to be satisfied through individualistic methods, the maximising approach of CBA can be supported as a second best result where at least benefits outweigh costs.

In a moral deontic approach, preserving the environment could be classed as a moral duty for humans. However it is unlikely that this duty should trump other moral duties such as those relating to the life prospects of humans. It could be argued that humans have a duty to make substantial, but not unlimited, sacrifices for the environment. On this basis, the SMS rule is justified without granting the environment trump status. Once we move away from a SMS threshold, decisions about resource allocation

<sup>4</sup> See also Tacconi and Bennett (1993) for an example of this approach.

from a moral perspective should give some weight to the satisfaction of human preferences. Because the satisfaction of human preferences is morally worthy, the use of CBA has some validity from a moral deontic framework.

In summary then, the SMS rule helps to ensure sustainability goals are met by acting as a caveat to the operation of CBA. It is acceptable in this role because it is adverse to conditions of irreversibility and ignorance, its relaxation requires an extraordinary decision making process, and because it appeals to several broad strands of philosophy. As well, it presumes a priori that environmental preservation is beneficial (Randall and Thomas 1991), and has the advantage of simplicity.

The use of the Ulysses metaphor captures this role for the SMS rule. Binding behaviour (the SMS rule) protects us from short term desires that are irrational but overwhelming. As Randall (1991) points out, the SMS rule will protect us from actions that '. . . we (or future generations of people we care about) will regret . . .' (p.66). The role of the SMS rule has been cast as a safety net because the ability of CBA to handle potential extinctions is suspect.

#### *The Relationship between the SMS rule and CBA*

Criticisms of the ability of mainstream economics to handle environmental problems are not new. Indeed, the existence of ecological economics as a field of research is evidence of that dissatisfaction. Problems of intergenerational equity, inappropriate discount rates, the undervaluation of poorly understood impacts, and the omission of values because of the difficulties of measuring non-marketed factors are all major sources of dissatisfaction with CBA (Schulze 1994).

At the same time, theoretical developments have been extending the ability of CBA to provide information on environmental matters. On one side, there has been the recognition that a range of non-use values exist alongside use values. For example, option values equate to an insurance premium (positive or negative) for conserving the environment in case it provides a future, but as yet unknown, use value. Quasi-option values reflect the irreversible nature of many uses of environmental resources in the face of uncertain knowledge. Existence values indicate the satisfaction humans derive just from knowing that a certain species exists, independent of any use or option values.

On another front, developments in measurement techniques for non-marketed values means there is increased ability of economists to estimate these non-use values. In particular, contingent valuation has the potential to provide estimates of the full range of conservation benefits (Mitchell and Carson, 1989). The referenda models of contingent valuation seem particularly appropriate for capturing the preservation versus development scenarios that the SMS rule is designed to address (Hoehn and Randall 1989, Bennett and Carter 1993). Thus there is the potential for an extended CBA to provide substantial information on the preservation choices facing society.

A substantial debate exists over whether an improved CBA approach provides satisfactory answers to environmental problems involving irreversibility and uncertainty.<sup>5</sup> The formulation of the SMS rule by Bishop (1978) (1979) clearly implies that CBA does not provide satisfactory information on the tradeoff points between preservation and development. He argues that the decision about whether to preserve or not involves more than economic analysis because issues of intergenerational equity are involved. 'Because the choice problem involves a value judgement about intergenerational equity, economics is not equipped to address the problem of how large costs would have to be before they become unacceptably large' (1979, p.377). Efficiency measures are based on the existing allocation of endowments in society, and an infinite number of Pareto states are possible with different allocations of endowments. From an intergenerational equity perspective, only some of those endowment allocations will enable intergenerational equity goals to be realised. CBA is only an efficiency measure based on the preferences of the current generation. The SMS rule allows intergenerational endowments to be considered and is a mechanism for considering the wishes of future generations.<sup>6</sup>

In a similar vein, Randall and Thomas (1991) refer to an extraordinary decision making process that society should take to decide whether costs are intolerable, implying as Bishop does, that the process is beyond economics. Randall and Farmer (1993) argue that adoption of the SMS rule 'places biodiversity beyond the reach of routine trade-offs, where to give up ninety cents worth of biodiversity to gain a dollars worth of ground beef is to make a net gain' (p.14).

The Ulysses example of binding behaviour may be readily accepted as indicative of the relationship of the SMS rule to CBA. As soon as possible extinctions loom, the SMS rule binds society to protecting biodiversity, only allowing exemptions in the case of intolerable costs. Economics has no real role to play in making the decision about when intolerable costs are reached. The SMS rule then provides an independent control over the use of CBA for resource allocation decisions.

There are several difficulties with this approach of viewing the two decision rules as independent entities. One purpose of this paper is to show that a close relationship actually exists between the two rules. In an operational sense they move in tandem like dance partners as the underlying preferences of society direct their steps. As well, there is substantial potential for the SMS rule to be simply a special application of CBA. To

<sup>5</sup> Krutilla (1967) explores the relationship between mainstream economic theory and conservation of natural resources. Smith and Krutilla (1979) and Bishop (1979) debate the appropriateness of this approach compared to the SMS rule. Samples of the more general debate over the appropriateness of mainstream economic theory can be found in the *Journal of Environmental Economics and Management* and in *Ecological Economics*.

<sup>6</sup> I am indebted to Richard Bishop for suggesting some of these points.

show this special relationship, we move to the theoretical basis for the SMS rule, and then to the similarities between it and CBA.

### *The Theoretical Basis for the SMS Rule*

No solid theoretical foundation exists for the SMS rule (Ready and Bishop 1991, Hohl and Tisdell 1993), unlike CBA which is based on the potential Pareto improvement criteria. Bishop (1978) used game theory as a basis for the SMS rule. By minimising the possibility of maximum losses, it could be shown that conservation was the preferred option in most cases where a disastrous outcome was possible. However Ready and Bishop (1991) show that the use of game theory will not always favour the selection of the SMS rule. They argue that this does not imply rejection of the rule as a decision making tool because society may adopt it as 'the right thing to do' (p.311).

Randall's (1991) justification for the SMS rule on the basis of an appeal to several streams of philosophical thought echoes this appeal from Ready and Bishop (1991). The SMS rule is an acceptable compromise from utilitarian, contractarian and deontic frameworks because it tries to 'do the right thing' for biodiversity without seriously conceding human interests. In each case, the SMS rule is a second best solution to the problem of choosing between a number of important objectives.

Bishop and Woodward (1994) present the SMS rule as a 'second best, practical strategy' for achieving a goal of a fully efficient sustainable economy (p.28). Adoption of the SMS rule would ensure that future generations would receive a larger resource endowment than would otherwise be the case. Because operation of the rule does not incur unlimited costs, improved endowments to future generations will occur 'without large sacrifices in efficiency and social progress' (p.28).

As well, some limitations exist for the practical application of the SMS rule. Tisdell (1990) points out that while the rule favours the preservation of as many species as possible, it does not provide a guide for determining which species should be conserved. Hohl and Tisdell (1993) argue that there is no definite safe minimum standard of preservation in an ecological-biological sense but rather an increasing probability of survival as the availability of favourable factors improves.

The lack of a theoretical basis for the SMS rule means there is some potential for the form of the rule to vary according to circumstances. This is not considered for instance by Randall (1991), who implies that the same SMS rule is derived from the different philosophical backgrounds. As well, the practical criticisms offered by Tisdell (1990) and Hohl and Tisdell (1993) are at odds with the impression given by Bishop and Ready (1990) and Bishop and Woodward (1994) of an easy and ready to use rule. In addition, the lack of a theoretical justification means that there is no clear basis from which to argue that the SMS rule provides an independent control over CBA.

There are several groups of problems in the depiction of the SMS rule as a steadfast control over CBA. The first deal with problems of imple-



mentation because the application of the SMS rule will vary according to the shortcomings in CBA that it is supposed to cover. The second group of problems relates to the similarities between the two rules while the third emphasises how the operation of the SMS rule can vary according to its setting. These groups of problems are outlined in the following sections.

### *The Introduction of the Decision Rule*

In the Ulysses example of binding behaviour, the costs and benefits of the binding option were well anticipated. Elster (1977) has shown how binding behaviour can be consistent with both rational behaviour and utilitarianism (Randall 1991). Binding behaviour is a technique that people use to guard against irrationality and weakness of will.

An alternate focus of binding behaviour under the SMS rule is to guard against unpredictable outcomes (Bishop 1979). Here binding behaviour minimises the risk that some terrible, but as yet unknown consequences follow from allowing environmental extinctions to occur. The SMS rule in this case would ban the Ehrlichs' rivet popper from operating.

These two justifications for the SMS rule lead to very different implementation rules. The first example is the classic Ulysses case where we are sure that environmental extinctions are 'bad', but that the short sighted and irrational nature of human behaviour blinds us to longer term considerations. The introduction of a fixed rule against extinctions will guard against myopic behaviour.<sup>7</sup> The rule needs to be very inflexible because humans, following classic rent seeking behaviour patterns, will present arguments and evidence to justify exceptions.

This justification presents two small difficulties as well as the comparison to the more flexible approach. The first difficulty with the fixed rule approach is that it presupposes that extinctions are 'bad' and preservation is 'good'. This Ulysses approach to preservation, complete with prior knowledge and no subsequent new information, characterises only those economic examples that assume perfect knowledge. The problem is that we would expect a complementary CBA approach to pick up the same weighting towards preservation. The fact that it does not is explored in the next section.

The second problem is that it is by no means clear that we have to leave an economic framework to solve problems of irrationality and weakness of will. Binding behaviour can clearly be justified in terms of costs and benefits and people commonly precommit themselves to maximise their long term benefits.<sup>8</sup> The Ulysses metaphor is really a CBA of binding behaviour. If we have, or can assume perfect knowledge about environ-

<sup>7</sup> The aim of the environmental ethics debate is to find justification for some fixed rule. Ehrenfeld (1988) for example, 'would like to see (conservation) find a sound footing outside the slick terrain of the economists and their philosophical allies'.

<sup>8</sup> Most rule based behaviour at both individual and society level can be justified in terms of costs and benefits because it minimises transaction costs.

mental outcomes, then binding behaviour can easily be justified in terms of costs and benefits.

The alternate justification for the SMS rule is that it guards against uncertainty and lack of information. Here, in the absence of perfect knowledge, the emphasis is on improving information and maintaining options. In this case it makes little sense to impose binding patterns of behaviour. If a set rule was in place, new and additional information would be worthless because it would have no influence. Decisions should logically be updated as relevant information comes forward. If the SMS rule imposed a binding pattern of behaviour, it would be impossible for subsequent information to have any relevance.

This implies that the operation of binding behaviour depends on the justification for the SMS rule. If the introduction of the rule is justified on some prior assessment of outcomes, then some binding pattern of behaviour may be necessary to ensure that desired outcomes are achieved. This 'Ulysses' case though can be justified by costs and benefits, and the SMS rule is simply an application of CBA. However, if the introduction of the SMS rule is justified for precautionary motives, then the extent of binding behaviour may simply be the adoption of the SMS rule to avoid the complications of CBA. Thus, the operation of the SMS rule has the potential to vary widely according to the purpose for which it is adopted.

#### *Benefit Setting Under the SMS Rule*

From a utilitarian economic framework, the adoption of the SMS rule 'presumes a priori that preserving species and ecological communities is beneficial' (Randall and Thomas 1991). For the introduction of the SMS rule to be considered, the implication is that CBA has not valued environmental benefits highly enough. There are several reasons why this may occur.

The first reason draws on the Ulysses example where humans are myopic when they value environmental goods. Use of the SMS rule will guard against this myopic value setting. Yet if by implication people are myopic about the benefits of preservation why should society or the government on their behalf set benefit values for SMS artificially high but not adjust benefit values in a CBA? If we are so certain that value setting is myopic, then we should be revising preservation benefits upwards.

As well, the ability of government to impose values on society is limited. To be successful, the institutionalising of rules such as the SMS is really the formalisation of opinion and convention within society. A society which provides a political climate for the SMS rule to be introduced will also reflect a high level of preferences for preservation issues. A duality of operation between the SMS rule and CBA thus exists. When a society is concerned about the future it may adopt the SMS rule, but we would expect those concerns to be also reflected in a CBA measurement of existence, use, option and quasi-option values. If society placed no weight on the future, not only would the SMS approach be rejected, but

low non-use values would be expected in a CBA. As a society strengthened its preferences for the environment we would expect both support for the SMS rule and relevant benefits under CBA to increase in tandem.

Other reasons why CBA may not value environmental benefits highly enough include measurement problems and the trivialisation of poorly understood effects.<sup>9</sup> Two major points can be made. The first is that the more accurately that environmental benefits are measured in CBA, the less that the SMS rule is preferred over CBA. The second is that if both rules measure the benefits of conservation accurately there is potential for them to achieve the same results.

At some point there must be a limit to the range of environmental values that mainstream economics can accept. Given the roots of mainstream economics in anthropocentrism, consequentialism and individual preferences, that point seems to be reached where people care, in one form or another, for future consequences or beings. If people do not care for the future, then there is a limit for what economics, (and political processes), can prescribe. Because we do not know the actual demands of future generations, any estimate of the rights of future generations is limited to current perceptions. Thus the 'extraordinary decision process' that is used to set SMS levels is based on the same perceptions and preferences of society as that used by CBA. The potential for differences in the application of the two rules is limited.

### *Cost Setting Under the SMS Rule*

The common elements to both CBA and the SMS rule become even clearer when costs are considered. The SMS rule exists only while the costs remain bearable. Yet the definition of where the limit to tolerable costs falls is likely to rest on the preferences of people. Again, some potential for myopia exists, but the situation will generally be similar to that of CBA. The level of tolerable costs is that which is below the level of benefits. Costs will vary according to the preferences of people, which in turn will be influenced by considerations of income, perceptions, information and other factors. Thus the underlying preferences of people will determine the implementation level for both CBA and SMS. As the preferences of people vary, so will the actual decisions taken under both approaches.

However, the definition of intolerable costs for the SMS rule is likely to vary according to the philosophical framework chosen. Under a consequentialist framework the emphasis of the decision rule is on avoiding large disasters. Thus the definition of unbearable costs is related in some way to the scope of the disaster. Under the more precise instrumentalist framework, the definition is related closely to the preferences people have for alternative goods. A workable definition of unbearable costs under this

<sup>9</sup> A substantial literature exists in this area. Hoehn and Randall (1989), Cropper and Oates (1992) and Schulze (1994) are a sample.

framework might be a 'grossly disproportionate' test<sup>10</sup> where the comparison of excessive costs to benefits is deemed to be intolerable.

In a deontological setting, human subsistence may count as a moral good of equal significance to that of species preservation. Thus the intolerable cost of the SMS rule for a moral universalist is one that threatens human subsistence. A similar relaxation point emerges from a contractarian position. If a SMS rule was adopted under some form of Rawlsian contract, we would envisage that parties to the contract would be very reluctant to allow extinction and to effectively play Russian roulette with their own existence prospects. Only at a point where human subsistence is threatened and the choice is between extinction or survival under very miserable circumstances would we envisage the trade-off being contemplated.<sup>11</sup>

These sharply different views of intolerable cost lead to very different applications of the SMS rule. For very large disasters, there will be little difference in the relaxation of the SMS rule under either a consequentialist framework (the grossly disproportionate costs test) or a deontic framework (the cost large enough to threaten human subsistence test). Reductions in the scope of the disaster leads to divergence in the application of the SMS rule. Smaller prospective disasters (a smaller number of potential extinctions) leads to lower tradeoff positions under the consequentialist framework, but not from a deontic framework. For small disasters the different applications of the SMS rule become striking because a grossly disproportionate costs test will cut in long before threats to human subsistence emerge.

Hence the difficulties of setting the SMS rule as an independent standard become more intense. The idea of a switch away from CBA towards some other decision process falters when it becomes clear that the outcome of the decision process will depend on the ethical stance taken.

CBA fails to be an ultimate decision rule because it is essentially a criteria about efficiency rather than equity. In particular, CBA accepts the current allocation of endowments and reflects only the preferences of those that are alive now. Bishop (1978) (1979) views the SMS rule as more suited than CBA to issues involving intergenerational equity. Yet acceptance and implementation of an SMS rule still rests on the preferences of current members of society. To argue that the SMS rule provides a more equitable allocation of endowments for future generations than would CBA, it is necessary to show how the process of weighing those preferences of current members of society produces more desirable results.

<sup>10</sup> Alan Randall (personal correspondence) suggests that the current 'grossly disproportionate' test in United States environmental restoration law provides an indication of the application of this test.

<sup>11</sup> I am indebted to Alan Randall for suggesting some of these points.

Here it becomes clear that the SMS rule as it stands is not really a complete decision rule. It provides a test for deciding whether a particular environmental asset is worthy of special attention, and establishes a guiding beacon for making choices. But until it sets out the theoretical basis by which it assesses the level of 'unbearable' costs, we have no real means of establishing whether the SMS rule better addresses issues of intergenerational equity than does CBA. As well, adoption of the SMS rule does not remove the role for economics in providing information about extinction decisions. Where society has to make a choice about which level of 'unbearable' costs to accept, there is a role for economics to play in assessing the options. The SMS rule is really a way of pointing out that economics is not a complete decision process when issues of equity and intergenerational equity are concerned.

The real value in the SMS rule may not be that it provides a better decision rule than CBA. Instead, it may be more easily justified as a signalling device used to flag attention to particular issues. This simpler basis for the SMS rule is explored in the following section.

#### *An Alternative Justification for the SMS Rule*

The formulation of the SMS rule as a second best constraint over resource allocation choices (Bishop and Woodward 1994) diverts attention from the principle attractions of the rule. These attractions relate to the rule's ability to flag attention to preservation issues rather than to establish some extraordinary decision process. Most preservation issues already fall under the guise of public policy, and it is possible to argue that many current institutional structures represent a form of social decision making. The important role for the SMS rule to play may not be to recommend a new form of decision making, but to flag the preservation issues that are worthy of more detailed attention. However in this role, the SMS rule can be justified in terms of costs and benefits.

Because benefits flow from correct decisions, and losses from incorrect ones, economics has some interest in an efficient decision making process. Economists are well aware that most economic transactions do not incorporate all the relevant information, principally because of the transaction costs involved in doing so. As well there is always the danger that some effects are externalised or ignored, or that assessment mechanisms are insufficient or inappropriate. In terms of CBA, there is always the possibility that it has not been performed in an extended version and that only a narrower more technical version of costs and benefits have been measured. Of particular concern here are the cumulative effects of piecemeal decisions where analysis of individual projects have failed to incorporate wider costs and benefits.

CBA is not a cheap process of evaluation, and attempts to improve accuracy are directly related to increased costs. For this reason, most decisions made in society, whether by market transaction or by public institutions, tend to ignore all but the most important information. This process works well for many recurrent decisions. However there are

substantial costs associated with making incorrect decisions involving irreversible effects and large potential losses. Here a more searching decision process is warranted.

The SMS rule in this guise is a flagging mechanism that brings attention to issues where the full costs and benefits of the alternatives need to be measured. In this role, the SMS rule is a safeguard against the possibility that only a superficial examination of costs and benefits has been made. The justification for the SMS rule to operate is that the benefits of improved decision making outweigh the costs of allowing incorrect resource allocations to occur.

The ability of the SMS rule to flag attention to preservation issues have been outlined by Bishop (1978), Randall (1991) and Randall and Thomas (1991). There are four main points.

- (1) The SMS rule establishes the presumption that preservation is beneficial without needing to document every case. The SMS rule essentially reverses the burden of proof from CBA.
- (2) The SMS rule triggers a much more exhaustive examination of costs and benefits than would normally be the case. It is this sharp break in the 'business as usual' approach that flags an issue as worthy of special examination.
- (3) The SMS rule flags potential tradeoffs that may often be quite modest. Bishop (1978) (1980) points out that only small costs are often needed to preserve many species.
- (4) The SMS rule flags cases where large potential (and irreversible) losses exist.

This economic justification for the operation of the SMS rule is substantially different to that advanced by Bishop (1978) and Randall (1991) because it implies that some efficient decisions can be made on the basis of costs and benefits. Instead of the SMS rule taking over from CBA when extinctions loom, the function of the SMS rule is to signal when society has to switch to a much more careful consideration of the costs and benefits of its actions. An extended evaluation of costs and benefits will be an important input into the decision making process.

Several advantages result from developing a CBA rationale for the SMS rule. Because it is now possible to present an extended CBA as one form of a decision rule, some scope for precision and ranking of priorities exists. This addresses the problem raised by Tisdell (1990) about the need to make choices between preservation options. As well, this formulation of the SMS rule allows the comparison of costs against different standards of preservation. The SMS rule would be able to be flexible in its implementation, and the definition of 'unbearable' costs would a consistent comparison to benefits.

The clearest illustration of the difference between the approaches is by example. Bishop (1978) and Bishop and Woodward (1994) treat the introduction of the SMS rule as the point where economics becomes less relevant. After that point resource allocation issues (setting the level of

unbearable costs) fall into the 'too hard basket' and are best left to some other decision mechanism of society. Randall (1991) emphasises the flagging role of the SMS rule but then leaves the resource allocation question (the level of unbearable costs) to be decided between competing philosophical frameworks. Only in cases with devastating consequences will agreement be reached. As the scope of the disaster reduces, the differences between the philosophical frameworks becomes more pronounced.

In contrast, a SMS rule based on costs and benefits flags the point at which resource allocation decisions become worthy of special attention. The role of economics then is to provide information on the full range of costs and benefits attached to the preservation choices.

### *Conclusion*

Where is Ulysses now? We have seen how underlying preferences influence both the SMS and CBA approaches, and how the decision levels change in tandem for each as the underlying preferences of society change. As well, the operation of the SMS rule depends on the situation. In some cases it establishes a set pattern of behaviour while in others it is imposed for precautionary motives. Most importantly, the operation of the SMS rule will vary according to the philosophical framework adopted. Three main choices have emerged. Under a deontic framework, the SMS rule would only be relaxed when its implementation threatens the life prospects of humans. In contrast the definition of 'unbearable costs' in a consequentialist approach relates to the scope of the disaster. Here a 'grossly disproportionate' test might relate the level of costs to the level of benefits. The third possibility is that there is a 'flagging' role for the SMS rule within the area of environmental economics. The SMS rule in this case would flag the point at which the full range of costs and benefits involved in resource allocation decisions should be considered. It is a cost efficient alternative to conducting extensive CBA exercises as a matter of course.

The general depiction of the SMS rule as a uniform rule and as a control over CBA is flawed. While it is possible that the SMS rule invokes considerations of intergenerational equity as envisaged by Bishop (1978) (1979), there is no guarantee that it will do so. The relaxation point of 'unbearable costs' ranges from threats to human subsistence down to simple economic comparisons of costs and benefits. One of the important roles for economists and decision makers to play will be to determine appropriate formats for the SMS rule, and to distinguish between various applications.

These complexities are not a death knell for the SMS rule. Its use still offers advantages. The rule is clear and simple, it reverses the burden of proof away from the environment, and it is risk adverse. The major advantage to the rule comes from its role as a 'flagging' mechanism rather than as an independent decision criteria. In the latter role the choices of philosophical framework, the lack of clear ecological thresholds, and the

inability of the rule to clearly weigh options cast doubt on its effectiveness.

Finally, the role of the SMS rule as a constraint in the field of ecological economics seems suspect. An ecological formulation for the rule as envisaged by Bishop (1978) is possible. Yet this paper has shown how closely related the operation of the SMS rule is to CBA. Justifying the SMS rule in terms of costs and benefits removes doubt altogether. In summary, the role of the SMS rule will vary according to its justification, and most roles do not allow the SMS rule to act as an independent constraint to the use of CBA.

### References

- Bennett, J. W. and Carter, M. (1993), 'Prospects for Contingent Valuation', *Australian Journal of Agricultural Economics*, 37 (2):79-93.
- Bishop, R. C. (1978), 'Endangered Species and Uncertainty: The Economics of a Safe Minimum Standard', *American Journal of Agricultural Economics*, 60:10-18.
- Bishop, R. C. (1979), 'Endangered Species, Irreversibilities, and Uncertainty: A Reply', *American Journal of Agricultural Economics*, 61 (2):376-379.
- Bishop, R. C. (1980), 'Endangered Species: An Economic Perspective', Transactions of the 45th North American Wildlife and Natural Resources Conference, pp.208-218.
- Bishop, R. C. and Woodward, R. T. (1994), 'Efficiency and Sustainability in Imperfect Market Systems', unpublished paper, Department of Agricultural Economics, University of Wisconsin.
- Ciriacy-Wantrup, S. V. (1952), *Resource Conservation: Economics and Policies*, University of California Press, Berkeley.
- Costanza, R. (1989), 'What is Ecological Economics' *Ecological Economics*, 1:1-7.
- Cropper, M. and Oates, W. (1992), 'Environmental Economics: A Survey', *Journal of Economic Literature*, 30:675-740.
- Ehrenfeld, D. (1988), 'Why Put a Value on Biodiversity', in Wilson, E. O. (ed) *Biodiversity*, National Academy Press, Washington, pp. 200-205.
- Ehrlich, P. and Ehrlich, A. (1981), *Extinction: The Causes and Consequences of the Disappearance of Species*, Random House, New York.
- Elster, J. (1977), 'Ulysses and the Sirens: A Theory of Imperfect Rationality', *Social Sciences Information*, 16 (5):469-526.
- Hoehn, J. P. and Randall, A. (1989), 'Too Many Proposals Pass the Benefit Cost Test', *American Economic Review*, 79:544-571.
- Hohl, A. and Tisdell, C. (1993), 'How Useful Are Environmental Safety Standards in Economics? - The Example of Safe Minimum Standards for Protection of Species', *Biodiversity and Conservation*, 2:168-181.
- Krutilla, J. V. (1967), 'Conservation Reconsidered', *American Economic Review*, 57:787-796.
- Mitchell, R. C. and Carson, R. T. (1989), *Using Surveys to Measure Public Goods: The Contingent Valuation Method*, Resources for the Future, Washington.
- Nelson, M. P. (1993), 'A Defense of Environmental Ethics: A Reply to Janna Thompson', *Environmental Ethics*, 15 (3):245-57.
- Norton, B. G. (1989), 'Intergenerational Equity and Environmental Decisions: A Model Using Rawls' Veil of Ignorance', *Ecological Economics*, 1:137-159.
- Norton, B. G. (1991), *Towards Unity Among Environmentalists*, Oxford University Press, New York.
- Pearce, D. W. and Turner, R. K. (1990), *Economics of Natural Resources and the Environment*, Harvester Wheatsheaf, New York.



- Randall, A. (1988), 'What Mainstream Economists Have to Say About the Value of Biodiversity', in Wilson, E. (ed), *Biodiversity*, National Academy Press, Washington.
- Randall, A. (1991), 'The Value of Biodiversity', *Ambio*, 20:64-68.
- Randall, A. and Thomas M. (1991), *The Role and Limits of Economics in Decision Making Regarding Non-Indigenous Species*, Report to Congress of the United States, The Ohio State University, Columbus.
- Randall, A. and Farmer, M. (1993), 'Benefits, Costs, and the Safe Minimum Standard of Conservation', unpublished paper, Department of Agricultural Economics and Rural Sociology, Ohio State University, Columbus.
- Ready, R. C. and Bishop R. C. (1991), 'Endangered Species and the Safe Minimum Standard', *American Journal of Agricultural Economics*, 72 (2):309-312.
- Schulze, P. C. (1994), 'Cost Benefit Analysis and Environmental Policy' *Ecological Economics*, 9:197-199.
- Sen, A. (1987), *On Ethics and Economics*, Blackwell, Oxford.
- Smith, V. K. and Krutilla J. V. (1979), 'Endangered Species, Irreversibilities and Uncertainty: A Comment', *American Journal of Agricultural Economics*, 61 (2):371-375.
- Tacconi, L. and Bennett, J. W. (1993), 'Implications of Intergenerational Equity for Biodiversity Conservation', *Vanuatu Forest Conservation Research Report No 2*, University College, University of New South Wales, Canberra.
- Taylor, P. (1986), *Respect for Nature*, Princeton University Press, Princeton, NJ.
- Tisdell C. (1990), 'Economics and the Debate about Preservation of Species, Crop Varieties and Genetic Diversity', *Ecological Economics*, 2:77-90.
- Thompson, J. (1990), 'A Refutation of Environmental Ethics', *Environmental Ethics*, 12 (2):147-60.