



# Safe Minimum Standard (SMS)

*The safe minimum standard is a guide for managing catastrophic risk. Originally designed for the conservation of natural resources, the rule can be applied to any area when management decisions entail a probability of catastrophic outcome and when actions to be taken can be categorized as risky or non-risky. The rule specifies that decisions should be chosen from the non-risky set of possible actions.*

The safe minimum standard (SMS) is a policy that attempts to eliminate risk of catastrophic outcomes in the management of natural resources. SMS has been advocated as an applicable rule when the probabilities associated with different actions that can be taken are difficult or impossible to quantify and standard economic calculations of costs and benefits are unreliable. The SMS was originally proposed by the German natural resource economist Sigfried von Ciriacy-Wantrup (1906–1980) as a policy that could be applied to conservation issues. Proponents argue that the SMS is a rational way of responding to the risk of catastrophes; others argue that the SMS is too blunt an instrument to be applied as a general rule.

## The Concept of SMS

The SMS is an intuitively obvious and simple way of dealing with catastrophic risk: if there is a possibility that an action will trigger unacceptable consequences, do not take that action. The concept does, however, demand a few prerequisites for practical implementation. First of all, it must be possible to specify which actions imply the potential for catastrophic risk and which actions do not. For example, in managing greenhouse gas emissions it is unclear to many what the threshold is for emissions that

will cause irreversible climate change; this makes setting a SMS very difficult. Second, the term *unacceptable consequences* must be properly defined. For example, is the loss of a species of fish an unacceptable consequence if a fish of greater economic value is able to thrive in its place? Third, even if risky actions are deemed unacceptable, it may very well be that the cost of restricting the choice of actions to the ones without risk may also be “unacceptably” high, in which case a cost-benefit calculation of some sort becomes unavoidable. SMSs specify allowable actions only for a specific risk, so if another risk is to be considered, there can be contradictory signals for what action is acceptable. The term *unacceptable consequences* is subjective, so SMS is not an objective policy tool that can be mechanically applied on a case-by-case basis.

An alternative way of thinking about SMSs is that they may function as temporary policy rules until a better understanding of risks, costs, and benefits of available actions are available. This “stop sign” interpretation of SMS makes the concept similar to the concept of the precautionary principle, which is widely accepted as a sensible and more flexible policy rule when managing potentially catastrophic risk. (The precautionary principle posits that until a risk—such as the potential ramification of a new technology—has been studied, it is best to avoid that risk.)

## Resource Management Problems and SMSs

There are many situations for which SMSs may be an appropriate policy guide. In ecology, for example, there are minimum viable populations (MVPs): if a population of organisms declines below a certain level, population growth becomes negative, and the population becomes

extinct. If the MVP is known, then that value is a candidate for a SMS. If the MVP is unknown, a SMS may then be prescribed as the maximum value of the range of possible MVPs. Eutrophication provides another example. If accumulated nutrient deposition in a lake from agriculture crosses a certain threshold, this may trigger algae blooms, with associated deterioration of water quality and species composition. This process may be irreversible, so that even if nutrient depositions are stopped, the lake will not revert to its original state. This threshold is also a candidate for a SMS. A tipping point with consequences on a larger scale includes the possibility of greenhouse gas emissions inducing runaway climate change that causes irreversible sea level rise and temperature change.

In all these examples, it is possible to deduce the existence of critical boundaries that, if they exist and are in fact crossed, lead to a fundamental change in the system dynamics. They thus satisfy the criterion for implementation of a SMS. Nonetheless, defining an unacceptable consequence is arguably a subjective choice and in some—but not all—cases is debatable. For example, intensive agriculture practices can deplete soil to irreparable levels, causing desertification; some might argue, however, that intensive agricultural practices are necessary to provide food for starving people. While a SMS might be put in place to prevent desertification, those who seek to combat current food challenges might argue that the SMS limits their ability to manage another unacceptable risk—starvation.

## Criticisms of SMSs

SMSs have been criticized on many grounds, but mostly because the economic rationale for SMSs is considered poor. The criticism may be summarized as follows (Randall 2011, 174): even if a particular ecosystem collapses, there are substitutes. If one lake eutrophies, that is not such a big disaster as long as other lakes are preserved. Imposing an SMS may thus imply a decision to avoid risky outcomes that are not truly catastrophic. The revenue from harvesting trees may, for example, be determined a greater benefit than leaving the forest ecosystem intact even though it will be a long time before the forest is regenerated. Finally, economic resource management

tends to be incremental in nature and rarely prescribes that a resource should not be used at all. SMSs implicitly assign a value that reduces the risk to zero, which most economic management practices find arbitrary. Economists have been reluctant to accept SMSs as a policy tool because of the contrast with traditional economic methods of cost-benefit calculations and improved economic techniques for evaluating catastrophic risk. When there are suspected tipping points, however, they often prescribe SMSs as the optimal policy from an economic perspective, since tipping points indicate the possibility of irreversible change that can have indeterminate economic costs (Margolis and Nævdal 2008).

Proponents of economic cost-benefit analysis often cite the inherent subjectivity in defining “unacceptable costs” when deciding on the adoption of a SMS as an argument against its use. Advocates of SMS, however, counter that economic cost-benefit analysis is founded on a theory of what is valuable (utilitarianism), which is also a subjective moral philosophy. Therefore, advocates of SMSs claim that cost-benefit analysis is not in any sense a more objective policy tool than SMSs.

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*See also* Adaptive Resource Management; Administrative Law; Best Management Practices (BMP); Carrying Capacity; Complexity Theory; Community Ecology; Ecological Forecasting; Forest Management; Keystone Species; Mutualism; Population Dynamics; Regime Shifts; Resilience

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