Implementing the Precautionary Principle/Approach

John Shepherd
School of Ocean & Earth Science, University of Southampton, SO14 3ZH, UK
Draft: October 2023

1) Introduction

When there is substantial uncertainty about the outcome of some action, the Precautionary Principle (or Approach) asserts that one should proceed cautiously, i.e. err on the side of caution, and certainly not just assume that all will be well. At this level of generality, this just seems like common-sense, coupled with some level of risk aversion, and is in principle unexceptionable. However, scientific (and other) evidence almost never provides certainty, and there can be room for massive disagreement about what this means in practice, especially concerning the level of caution to be applied. Indeed, taken to its logical conclusion, the principle could lead to inaction even in the face of a serious and imminent threat, or never attempting anything new[1]. There is therefore a real need to operationalise the principle, and elaborate what its implementation could (or should) mean in practice.

2) Dealing with high uncertainty

Any course of action is likely to have both risks[2] and potential benefits, and both of these will almost always be somewhat uncertain. However, if it is possible to undertake any sort of quantitative assessment, it may be possible to estimate the magnitude of both risks and benefits, together with some estimate of the uncertainty in these, even if the latter is very large and maybe very approximate (for example, something like "within a factor of about three either way"). In this case I suggest that a cautious and risk-averse approach would be ***to refrain from action unless a pessimistic (i.e. high) estimate of the risks***

a) is tolerable, should it materialise, and

b) ***is less than a similarly pessimistic (i.e. low) estimate of the benefits*** that may accrue.

These conditions should be met for all sectors of the population (or components of the ecosystem) concerned. If it were possible to estimate the full probability distributions of both benefits and risks, one could use appropriate fractiles for these pessimistic estimates, for example the lower and upper quartiles respectively. However, in most situations of great uncertainty this will not be feasible. Instead, it may be adequate simply to use those multiplicative factors[3] of two, three or more that roughly express the uncertainties of the central "best" estimates.

Thus if the benefits are estimated within a factor of A either way, and the risks to be within a factor of B, one would require the estimated benefits to exceed the estimated risks by a factor of A*B before contemplating the action concerned. Such an approach is of course commonplace in engineering, where A*B can be recognised as a simple safety factor. Here however this factor is not just conventional or arbitrary, but is deliberately constructed to reflect the levels of uncertainty in any estimates made, and may become very large if those estimates are extremely uncertain.

3) Other issues: Catastrophe, Irreversibility, Accumulation, Multiplicity and Equity

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[1] For a good review, see Bourguignon (2015) "The precautionary principle: Definitions, applications and governance", European Parliamentary Research Service, EPRS_IDA(2015)573876_EN, https://policycommons.net/artifacts/1334548/the-precautionary-principle/1940163/

[2] The term "risk" is here used in its conventional sense, i.e. as the product of both the magnitude of some potential (but uncertain) harm or detriment, and the probability of its occurrence.

[3] If these factors represent the geometric standard deviations of a log-normal distribution, which is a plausible approximation when the uncertainties are very large, this would correspond to using the upper and lower 16th percentiles of the distributions.

Adopting a cautious approach is not only about allowing for uncertainty. One is in any case likely to wish to avoid any significant chance of ***catastrophic*** harm, whatever the possible benefits, and also to avoid significant risk of harm that may be ***irreversible***. Where benefits and harms are long-lived, it would be appropriate to ***cumulate*** them over time, probably with some small discount rate, substantially less than 1% per year if one wishes to take account of the needs of future generations.

Since there will usually be ***multiple*** benefits and risks, some overall summation of these usually needs to be considered. Expressing them in a sufficiently similar way to enable this summation may be a major problem, and of course the benefits and risks themselves may be difficult to define in a commensurable way. In addition, one often needs to consider ***multiple options*** for action. In this case a useful way to reduce these problems is to compare (pessimistic) estimates of the various options that are designed to achieve the same (uncertain) benefit: for example limiting global warming to some defined level (with all the associated benefits - or absence of risks - that that is expected to bring).

Finally, it is commonplace for benefits and risks to accrue unequally to different sectors of the population (or components of the ecosystem). In this case it may well be appropriate to concentrate attention on those that affect the most vulnerable sectors. Among people, that will often mean prioritising the implications for the poorest and most disadvantaged, so as to ensure that the expected benefits outweigh the risks that are relevant to them by a sufficient margin, even if the balance is less favourable for those who are less vulnerable.