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# DEFENDING THE PRECAUTIONARY PRINCIPLE AGAINST THREE CRITICISMS

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**Abstract.** The precautionary principle that calls for early measures to avoid and mitigate uncertain environmental damages (and health hazards) in the future has come to the fore in risk debates. This paper evaluates three criticisms which have been presented in academic discourses, in political arenas, and also in public discussions in order to reject the principle altogether. In particular, the criticisms are labelled as the argument from vagueness, the argument from incoherence, and the argument from adverse effects. It is argued that these objections do not result in the abandonment of the precautionary principle on the whole, but only of its particular implausible interpretations. The conclusion drawn is that the burden of proof remains with the ones who reject the principle.

**Keywords:** environmental law and policy, risk governance, environmental risks, precautionary principle, vagueness, incoherence, adverse effects, health hazards, uncertainty, ambiguity, burden of proof

## 1. Introduction

The so-called precautionary principle (PP) that calls for early measures to avoid and mitigate uncertain environmental damages (and health hazards) in the future has come to the fore in risk discourses. A standard formulation of the principle, which was introduced at a conference organised by the Science and Environment Health Network (SEHN) in 1998, states that "[w]hen an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (*Wingspread Statement on the Precautionary Principle* 1998, see also UNCED 1992, Ahteensuu *forthcoming*).

The PP has been invoked in various fields of academic risk and policy debates as well as in actual policymaking. It is included in a number of official documents – for example, in national laws (e.g. GTA 2004/847) and international agreements (CPB 2000) – within different regulatory contexts. Its relevance touches upon, for

example, marine and fisheries protection, the conservation of our natural environment, climate change and global warming regulation and debate, the protection of the ozone layer, the nuclear power risk, the risks of radio frequency electromagnetic fields, the risk debate of nanotechnology, and the risk governance of modern biotechnology.

At the same time, the PP has evoked much controversy. As phrased by Jenneth Parker (1998:635), in addition to jurisprudence, "the PP is developing a life of its own within the range of professional, general environmentalist, and lay discourses". The principle has been heavily criticised by several noted scholars (e.g. Holm and Harris 1999, Morris 2000, Starr 2003, Wildavsky 1996). Particularly, it has been claimed that the PP is too vague to guide actual decision-making (e.g. Turner and Hartzell 2004), that the principle is inherently incoherent (Sunstein 2005), and that its implementation would result in adverse effects (Goklany 2001). Moreover, to argue that the PP blurs the boundary between science and policy in an unacceptable way (e.g. Morris, Wildavsky, see also Gray and Bewers 1996:768) is not uncommon. However, the last-mentioned objection is explained away elsewhere (Sandin et al. 2002: esp. 295–296, see also Ahteensuu 2004, Resnik 2003, Stirling et al. 2001), and because I find the counterarguments convincing, I do not restate them here.

Interestingly, in policymaking, the United States (US) has not explicitly accepted the PP as the official basis for its risk regulation, and the US has reproached the European Union (EU) for imposing illicit trade barriers in the name of precaution. A common but oversimplified transatlantic antithesis states that, whilst the EU endorses the PP, the US opposes it (see Wiener and Rogers 2002).

Although a few academic papers address charges against the PP (e.g. Sandin et al. 2002, Gardiner 2006), a clear need for further discussion and for more systematic analysis can be recognised. Accordingly, the aim of this paper is to offer a critical overview of three particular criticisms which have been presented in the discourses of various academic disciplines, in political arenas, and also in public discussions. The criticisms are labelled as the argument from vagueness, the argument from incoherence, and the argument from adverse effects. As noted by Per Sandin, these objections have often been presented as 'knock-down' arguments. More specifically, by explicating and assessing elaborated versions of each objection, I try to demonstrate that they do not lead to the abandonment of the PP on the whole, but only of its particular implausible interpretations. This is followed by a brief review of the reasons for taking precautionary actions, and by a conclusion that the burden of proof seems to remain with the ones who reject the principle.

## 2. Analysis of three general arguments against the precautionary principle

In theory, three kinds of arguments against the implementation of the PP in a regulatory context can be presented. First, it may be – and indeed has been – claimed that the PP *per se* is flawed, and cannot, thus, be invoked as a basis for

societal decisions. The second type of arguments does not imply a commitment to the general (un)acceptability of the PP, but simply states that the principle should not be employed in a certain regulatory context or in a specific risk decision. Third, somebody might acknowledge the PP as a valid basis for certain risk decisions (or more generally for specific regulatory frameworks), and at the same time hold that the principle should not be applied in some other regulatory context(s), such as in the context of modern agri-biotechnology (for a further discussion see Ahteensuu *forthcoming*). Below, I consider three arguments of the first kind, that is, general arguments introduced to dismiss the PP altogether.

### *2.1. Argument from vagueness*

In their article on the PP in contemporary environmental policy, Andrew Jordan and Timothy O'Riordan (1999:32) conclude that "[t]he precautionary principle is vague enough to be acknowledged by all governments regardless of how well they protect the environment". Even opposite courses of action may be described as acts of precaution. Indeed, the argument from vagueness is one of the most often presented arguments against the PP. It says that the principle is ill-defined, and thus too vacuous to offer any useful guidance for decision-making. Consequently, the PP should be abandoned. Daniel Bodansky (1991:5), for example, has argued that the PP cannot serve as a regulatory standard because it does not specify how much (pre)caution should be taken. Yet he concludes that the principle may play a role in environmental policy as a general goal and stresses the use of discretion in its implementation (43). A more pessimistic conclusion is drawn by Derek Turner and Lauren Hartzell when they claim that "the precautionary principle, in all of its forms, is fraught with vagueness and ambiguity", that "there is no way of gaining precision and conceptual clarity without sacrificing plausibility", and that the PP principle can serve us neither as a moral principle nor as a decision-making principle (449, 451, 459, see also Sunstein: 54–55).

If the above claims are well-grounded, then a strong reason to reject the PP exists. Accordingly, in order to find out whether the argument from vagueness is valid, the following two questions need to be considered. First, is the PP (currently) ill-defined, ambiguous and/or vacuous? Second, if so, does it follow that the principle should be abandoned? I explore these issues in order.

A number of facts support an affirmative answer to the first question. The claim that the PP is ill-defined (in different senses) can be argued for as follows. Originally, the first references to the principle in official environmental policy documents were short and without a definition. In addition to the phrase 'pre-cautionary principle', terms such as 'precautionary measure', 'precautionary approach', 'precautionary action', 'principle of precaution', and 'precaution' have been employed. Still, whilst most of the authors speak about one definite principle (e.g. Rogers 2001), others use the indefinite plural form (e.g. Löfstedt et al. 2002). Furthermore, whether there is a difference in meaning between 'precautionary

principle' and 'precautionary approach' is not commonly agreed upon (see e.g. Conco 2003:642–643, Trouwborst 2002:3–5, VanderZwaag 2002:166–167).

Even if we sidestep the terminological issues, a positive answer to the first question is also supported by, at least, two further facts. Following David VanderZwaag's (167–168) use of terms, these may be called as *definitional variations* and *definitional generalities*. The former refers to the fact that, not only one right (or commonly accepted) definition of the PP exists, but rather that there are several formulations of it. This is true of judicial texts and other official documents and also holds in regard to the commentary literature of the principle. In his article on the dimensions of the PP, Sandin (1999) presents 19 different formulations of the principle. Neil A. Manson states that "[v]ersions of the precautionary principle are many, both in terms of wording and in terms of surface syntactic structure" (2002:263, see also Adams 2002:302). In addition to the surface structure and wording differences, the formulations differ significantly in regard to their content (see e.g. Ahteensuu 2007). Given the multiple and differing formulations of the PP, it seems strange that the Commission of European Communities did not define the principle in their Communication (CEC), which was aimed to clarify the principle and its use.

Definitional generalities, in their turn, refer to the fact that different formulations of the PP are "loaded with generalities" (VanderZwaag: 167). Most of the particular formulations (or definitions) of the principle do not provide specific guidance as to what exactly must be shown to justify precautionary measures, for instance. Thus, they leave much space for discretion. In their analysis, Turner and Hartzell use the *Wingspread Statement* to illuminate definitional generalities. According to them, the statement "fails to indicate who must bear the cost of precaution; what constitutes a threat of harm; how much precaution is too much; and what should be done when environmental concerns and concern for human health pull in different directions" (449). It should, however, be noted that even if the official formulations of the PP include definitional generalities, attempts to clarify and specify the principle have been made in the academic literature (e.g. Sandin 1999, 2004). Admittedly, these analyses have illuminated various aspects of the PP – yet much of the work seems to be undone. VanderZwaag (167), for instance, contends that "[a]cademic efforts to clarify the meaning of the precautionary approach have also left considerable fuzziness".

On the basis of above, I conclude that the PP is currently vague in a number of senses (and also a matter of ongoing disputes). It would, indeed, be hard to assure the opposite. This brings us to the second question, namely that of whether – and if so, to what extent – this matters. On the one hand, it has been argued that the (problem of) vagueness should be taken seriously. Kenneth Foster and his colleagues (2000) consider the extreme variability of interpretations of the PP as its greatest problem as a policy tool. Turner and Hartzell (459) argue that the ambiguity of the PP can only be seen as a good thing from a rhetorical perspective, not from those of moral philosophy and practical decision-making. On the other hand, some proponents of the principle do not seem to be concerned

about the vagueness at all. According to Jordan and O'Riordan (18), it is not problematic that the PP only offers broad guidelines (or a frame) to policymakers. They even think that the vagueness is, in fact, desirable and a precondition for the functionality of the principle. "Paradoxically, we conclude that the application of precaution will remain politically potent so long as it continues to be tantalizingly ill-defined and imperfectly translatable into codes of conduct, while capturing the emotions of misgiving and guilt" (15). In their view, the precise meaning of precaution will only emerge when stakeholders come together to make a decision in a particular context, trading costs against benefits and determining the (un)acceptable levels of damage (18).

Whether using ambiguous principles in societal decision-making is desirable or not remains debatable. There are reasons as to why the latter view might be too optimistic, however. That this understanding of the PP undermines the principle's status as a legal principle has been argued (e.g. Gardiner). The principles of environmental law should be consistent with values shared in a society, not be based upon mere hunches, gut feelings or emotions. Nonetheless, certain (moral) emotions play a significant role in morality, and legislation has strong connections to morals as ethical analyses can serve as a basis for changes in legislation and for new laws.

Should the vagueness of the PP result in its abandonment? As correctly pointed out by Sandin and his colleagues (2002:289), the lack of precision in the definition is not unique to the PP, but also holds in regard to several other decision rules. (Writing general policy objectives in legislation is, in fact, a common practice.) Consequently, the same objection could be raised in these other cases as well. This implies two options for the critics of the PP. One option is to argue that principles (such as the PP) in general are vague, and thus cannot provide useful guidance for decision-making. This might be based upon the fact that (decision-making) principles do not imply context specific guidance, and thus their application to concrete situations presupposes interpretation (see e.g. Beauchamp and Childress 1983:5, Gardiner, Nollkaemper 1996:80–81). Following Ronald Dworkin's description of legal principles,

> *[a] principle […] states a reason that argues in one direction, but does not necessitate a particular decision. […] There may be other principles or policies arguing in the other direction […] If so, our principle may not prevail, but that does not mean that it is not a principle of our legal system, because in the next case, when these contravening considerations are absent or less weighty, the principle may be decisive. All that is meant, when we say that a particular principle is a principle of our law, is that the principle is one which officials must take into account, if it is relevant, as a consideration inclining in one direction or another* (1978:26).

Dworkin makes here two important observations, specifically that *principles* (of law) have to be considered in the realm of other principles and that they (usually) leave room for discretion. Given the vague nature of principles in this sense, the argument from ambiguity has consequences which are not satisfactory. It follows

that if the PP should be abandoned because its nature as a principle, then – in the name of consistency – other principles should go with the same strain. Provided that we are not willing to abandon most of our (conduct-guiding) principles – as a kind of a *reductio ad absurdum* – this way of argumentation is not plausible.

The other, and more plausible, option would be to try to show that even if principles in general are vague and in need of interpretation when applied to concrete cases, the PP is ill-defined in a special way, and that this makes the principle flawed. Again, two sub-options for an argument emerge. First, that there is an essential difference between the PP and (most of the) other decision-making principles might be argued for. Yet what that difference could be in practice is hard to imagine. It is not the case that the PP offers us no guidance for action. The principle offers a rationale to act in the case of uncertain risks before the scientific proof of the causal relationship between an action and the assumed damage is achieved. Moreover, the existence of several definitions is not unique to the PP. The principle of sustainable development, for instance, has several definitions (and interpretations). Lastly, other legal principles and terms also require interpretation and deliberation when applied to particular cases. Thus, the burden of proof seems to remain with the proponents of this view.

Second, following the argument presented by Sandin and his colleagues,

> *even if other decision rules are not* in principle *more well-defined than the precautionary principle, they might* in fact *be, in the sense that due to their long period of use there has emerged a substantial body of interpretations and practices that partly compensate for the lack of exact definitions. There are, for instance, governmental guidance documents and court cases that can be of help in interpreting these principles* (2002:289).

I do not deny this because the history of the PP in official texts and court decisions is still a brief one. Nonetheless, when considering the weight of this argument, the following facts should be taken seriously. Why the PP could not be defined more precisely in principle is hard to imagine. Several governmental documents (such as the CEC) have been established in order to clarify the principle and its use. In addition, academic efforts have been dedicated to define the principle more precisely (e.g. Ahteensuu *forthcoming*, 2007, Sandin 1999). Lastly, a number of court decisions already exist, and they can be used as precedents in the future.

In sum, the PP is currently vague in several senses, but so are various other decision-making principles which we use. In order to demonstrate that the PP should be abandoned on this basis, one would have to show why the case of the PP is different from, and more problematic than, other principles with respect to its vagueness, and that this reason is strong enough for the rejection of the principle.

### *2.2. Argument from incoherence*

Besides the argument from vagueness, the PP has also been objected to on the basis of other alleged problems. More specifically, the principle has been argued

to be inherently incoherent (e.g. Morris). The basic logic of the argument from incoherence is as follows: incoherent principles should not be used as a basis for societal risk decision-making; the PP is incoherent; thus, it should be abandoned. Gary Comstock (2000), for example, has argued that "[t]he precautionary principle commits us to each of the following propositions: (1) We must not develop GM crops. (2) We must develop GM crops." In their paper "Extending Human Lifespan and the Precautionary Paradox", John Harris and Søren Holm (2002, see also 1999) similarly claim that the PP is incoherent and consequently does not provide the kind of justification (for a precautionary 'pause' from proceeding with new technologies) that it is often presumed to offer. Their main argument is that the principle cannot coherently be employed as a decision rule, an epistemic rule, or a moral principle. The argument from incoherence is also found in Cass R. Sunstein's recent book on the PP.

> *The real problem with the Precautionary Principle in its strongest forms is that it is incoherent; it purports to give guidance, but it fails to do so, because it condemns the very steps that it requires. The regulation that the principle requires always gives rise to risks of its own – and hence the principle bans what it simultaneously mandates (…) The principle threatens to be paralysing, forbidding regulation, inaction, and every step in between* (2005:14–15).

If Comstock, Harris and Holm, and Sunstein are right, the PP should be abandoned. In order to evaluate the argument from incoherence, distinguishing its different forms is necessary. First, the definition of the PP may be incoherent. Second, the PP (or precautionary decision-making in general) may be based upon false presumptions about risk-imposition, particularly that of risk governance as a risk-free enterprise, and thus – when applied symmetrically to different risks (taking also into account the risks induced by regulatory actions) – implies contradictory conduct-guidance. If so, the application of the PP results in demands, i.e. precautionary actions, which are impossible to implement in practice. In short, the policy implications of the PP may be incoherent. Third, the PP may be employed in argumentation and policymaking in inconsistent, and thus unacceptable, ways. Next, I assess the three forms of this argument one by one.

First, if one takes a look at the formulations of the PP found in official documents and in the academic commentary literature, it becomes obvious that the definitions of the principle *per se* are not contradictory (see e.g. *Wingspread Statement*). The PP – as commonly defined – does not simultaneously state that precautionary measures should be taken and should not be taken. Thus, the principle is not incoherent in this sense, and the possible incoherent formulations can be easily revised. How, then, to explain Comstock's position? What he is most probably thinking is not the inherent incoherence in a particular definition of the PP, but that it is impossible to exclude the very possibility of invoked precautionary actions (or measures) resulting in a severe environmental damage or in health hazards, and thus that the PP should also be applied to the precautionary actions prescribed by the very same principle. Accordingly, the (kind

of a first-order) precautionary action prescribed by the PP should be taken and should not be taken at the same time.

In other words, the reasoning behind precautionary decision-making can be employed to generate a prescription for the contrary course of precautionary (in)action. We cannot know for certain that an action will not lead to a catastrophe, and thus it may be required to prohibit that action. But in the same way, that we do not know for certain that the corresponding inaction (owing to an imposed prohibition) will not result in a catastrophe also holds, and thus we may be required to proceed with that very action. Consequently, we should prevent the activity and proceed with it. It should be noted, however, that the resulted 'incoherence' may be unavoidable in nature or it might only be specific to precautionary measures in certain contexts in which there are trade-offs between two unacceptable risks. The former option is of our interest here, and it brings us to the second form of the argument from incoherence.

Second, it is not clear as to whether some formulations of the PP are based upon false presuppositions about risk-imposition. As quoted above, Sunstein contends that every precautionary measure in itself imposes a new risk. This may be interpreted as an ontological claim about 'the structure of the world'. So let us assume for the sake of the argument that, because of the world's structure, every action imposes harmful consequences with some probability. It follows, then, that if an action and its counterpart (i.e. an 'act' of inaction) result in unacceptable risks, the PP will prohibit both options, and thus the principle leads to contradictory conduct-guidance. However, the critics of the PP are not (usually) concerned about this possibility. What they are worried about is that extreme possibilities that cannot be ruled out because of our imperfect knowledge about environmental threats and health hazards are used in 'precautionary argumentation' in an unacceptable way (see e.g. Holm and Harris 1999, Manson 2002, 1999, Wildavsky: 24). In fact, what Sunstein might have in mind is (an epistemological claim) that, from our point of view, there are no risk-free alternatives. Given our imperfect knowledge about the world, it is impossible to rule out the very possibility of harmful effects of any activity. The best that can be done is to (try to) show that a regulatory action does not have the harmful consequences identified in scientific risk assessment. However, it is not possible to test 'risks' that nobody knows about. A precautionary action may always have direct or indirect consequences which risk analysts are not able to specify on the basis of their current state of knowledge; consequently, to subject these possibilities to scientific risk analysis is impossible. Generally speaking, we cannot rule out the possibility of harm because we do not know what we do not know, i.e. the exact scope of our ignorance. In sum, because of our imperfect knowledge, there are no risk-free alternatives. Even if there were risk-free alternatives, we would not know about them because we are not usually able to rule out the possibility of a risk (i.e. of harmful effects).

The fact that the very possibility of a risk cannot be ruled out does not result in the rejection of the PP, but implies restrictions for its plausible formation. On the one hand, it follows that if the PP presupposes that a regulatory action (i.e. a

precautionary measure) cannot in itself induce a risk, the formation of the principle is flawed. Some authors have argued this. According to Aaron Wildavsky,

> *the rhetoric [of the PP] works in part because it assumes what actually should be proved, namely, that the health effects of the actions in view will be superior to the alternative. And this comparison is made favourable in the only possible way – by assuming also that there are no health detriments from the proposed regulation. (…) Something (health) is gained with nothing lost (no adverse health effects from the bans or regulations)* (428–429).

A similar view is also held by Bodansky (43) who claims that the PP wrongly suggests that there is a choice to be made between risk and precaution, not between one risk and another as typically is the case.

I agree with Sunstein, Wildavsky and Bodansky that precautionary actions may result in unacceptable risks in particular cases. However, what I want to point out here is that the false presupposition of risk-free regulation alternatives is not inherent in the PP. In fact, it can only be predicated to particular understandings of the principle – the ones that Sunstein calls the strongest forms of the PP. In contrast, a number of formulations of the PP in official documents include a paragraph "cost-effective measures" (e.g. UNCED) which may well be interpreted to contain a wider range of (possible) losses than only economic ones. Some of the formulations state that an application of the PP "must also involve an examination of the range of alternatives, including no action" (e.g. *Wingspread Statement*, see also CEC). Obviously, the false presumption of risk-free alternatives cannot correctly be predicated to these formulations. Furthermore, even if some formulations of the PP leave room for this false presumption, they can be easily reformulated. This reformulation may take, for example, the following form: "precautionary measures should be of such kind that it is not plausible that they impose an unacceptable risk to the environment and/or to human (or animal) health".

Marc A. Saner (2002) proposes a "second order risk evaluation methodology" – as he calls it – as an answer to avoid the problems when both a precautionary action and inaction lead to the conditions which trigger the PP. According to him, it is meaningful to apply the PP to the question as to whether to incorporate the PP into a regulatory system. This enables decision-makers to find "the location of risk neutrality where more stringent precaution becomes counter-productive" (91–92). As Sandin and his colleagues (2002:294) put it, we should apply the PP in a reasonable and reflected manner. This is taken to mean that the principle should also be applied to the precautionary actions which are prescribed by the PP.

On the other hand, the fact that the very possibility of a risk cannot be ruled out has also implications for the trigger condition of the PP, not just for the precautionary response. (I have explicated the structure of the PP elsewhere, see Ahteensuu *forthcoming*.) Particularly, if the proof of safety is required by the PP (in order not to invoke precautionary measures, i.e. to ban the activity in question, for example), the formation of the principle is implausible. No doubt, some shift

in the burden of proof follows from the very basic idea of the PP. As Parker points out, often "the principle is viewed as a shifting of the burden of proof: instead of environmentalists having to demonstrate damage after the fact, the PP is viewed as shifting the onus onto the potential polluter to demonstrate that what they propose will not cause damage" (635, see also Manson 1999:12, Wiener and Rogers: 321, Hohmann 1994:334). A concrete example of this can be found in Austrian gene technology policies. Helge Torgensen and Franz Seifert state that

> *[w]hile administrators in other countries are satisfied if there is no evidence of risk, Austrian administrators demand more evidence of safety and consideration of all possible uncertainties, which are not tolerated (…) The Austrian objections to marketing applications depend less on demonstrating 'risk' than on reversing the burden of evidence (…) in a television interview (…) the Minister in charge even demanded exclusion of any risk"* (2000:212).

What should be noticed here, however, is a theoretical problem in the requirement for a total reversal of the burden of proof. Namely, the requirement includes a commitment to the following kind of negative existential claim: there exists no possible environmental state of affairs which arises out of the particular activity (under risk assessment), and which has the properties of being harmful and highly undesirable. As noted above, it is impossible to demonstrate that an action has no harmful consequences. Calls for zero risk are not reasonable. The best that can be done is to show that an action does not have the harmful consequences which are identified in risk assessment, particularly in hazard identification.

Third, that the PP can be used in argumentation and actual policymaking in inconsistent ways is a fact. But this – as being external to the PP – does not provide a sufficient reason to abandon the principle altogether. Not only the PP but also the other decision-making principles can be employed in inconsistent ways. Although they should not be used in such ways, the prescription not to do so is not inherent in the principles themselves, but a kind of a meta-rule (or general guideline) on how to use principles in the first place. For example, in their Communication on the PP, the Commission (CEC) urges that precautionary measures which will be taken should be consistent with similar measures implemented earlier, that is, comparable in scope and nature to those already taken in equivalent areas in which relevant and adequate scientific data is available.

In sum, the argument from incoherence put forward by the critics of the PP is not convincing. The principle *per se* is not incoherent, and – given certain specifications to the trigger condition and to the prescribed action in the formation of the principle – it does not imply contradictory conduct-guidance. The critics seem to derive from a common source, namely from the consequences of our imperfect knowledge about the nature and its causal relationships and (sometimes stochastic) interactions.

### *2.3. Argument from adverse effects*

In addition to the alleged problems of vagueness and incoherence, it has been argued that the implementation of the PP would lead to serious and commonly unwanted consequences, and thus that the principle should be abandoned as a policymaking tool. The argument from adverse effects says that, instead of decreasing it, the PP increases our risk-imposition in total. This argument also takes several forms.

The use of the PP may result in different kinds of adverse effects – directly or indirectly. First, precautionary measures taken may, in themselves, impose a new environmental threat or a health hazard. In his book entitled *The Precautionary Principle: A Critical Appraisal of Environment Risk Assessment*, Indur Goklany (2001, see also 2000) provides us with a detailed analysis as to why the application of the PP to various contentious environmental issues may lead to undesirable effects and to increased risk-taking. In particular, he considers three specific case examples: the use of DDT (Dichloro-Diphenyl-Trichloroethane) in the developing countries; the effects of greenhouse gases emissions and, more generally, the effects of global warming; and possible benefits and risks of the cultivation of genetically engineered crops. In all of these cases, the PP has been invoked to justify bans and tightened controls. It should be noted, however, that although Goklany (2000:221) argues that the implementation of the proposed precautionary bans and controls "would, in fact, increase overall risks to public health and the environment", he does not conclude that the PP should be abandoned altogether. In his view, the increased risk-taking follows from the current misapplication of the PP "on a limited set of consequences of the policies themselves" (221). In particular, the problems, i.e. public health and environmental consequences, are framed too narrowly.

A similar kind of an argument is put forward by Henry I. Miller and Gregory Conco who argue that "[i]f the precautionary principle had been applied decades ago to innovations like polio vaccines, and antibiotics, regulators might have prevented occasionally serious, and sometimes fatal, side effects by delaying or denying approval of those products, but that precaution would have come at the expense of millions of lives lost to infectious diseases" (Conco: 2000:100, see also Sandin et al. 2002:292–293).

What might be taken to weaken the above arguments is that they are hypothetical in nature, that is, they appeal to adverse consequences which are claimed to take place if the PP were (to be) applied in specific regulatory contexts. Admittedly still, they are hypothetical with varying degrees of plausibility. An empirical claim that the implementation of the principle has already resulted in severe adverse effects would, nevertheless, provide a stronger support for the argument from adverse effects. A concrete example of taken precautions with observable consequences is provided by Sunstein,

> *[i]n 2002, the United States government donated thousands of tons of corn to the Zambian government, which refused the corn on the ground that it likely contained some GM kernels. The Precautionary Principle lay at the foundation*

> *of the refusal (…) a "conservative scenario" from the World Health Organization predicted that at least 35,000 Zambians would die of starvation if more corn could not be found* (2005:31–32).

No doubt, these highly detrimental consequences may still be hard or even impossible to estimate precisely because of several influencing factors present.

It should also be noted that taking precautionary actions may impose risks through economic mechanism owing to the limited resources of risk governance and to the allocation of these resources. If much precaution is taken in one regulatory context, it may lead to lesser attention in another regulatory contexts (Nollkaemper 1996: 91, see also Sandin et al. 2002:292–293).

Second, in addition to the possible imposition of environmental threats or health hazards, precautionary decisions may also result in other kinds of adverse effects. Namely, they impose economic burdens (owing to time-consuming and expensive monitoring programs, labelling, and/or extra scientific studies on the issue, for example), and may also violate people's rights and liberties (see Wildavsky 1996:446). Furthermore, a plausible scenario might be that precautionary measures taken stifle technological progress, resulting in the loss of benefits and in the absence of risk-reducing technologies that would otherwise be available. Taking precautions may prevent technological development that would, in the end, have substantial beneficial health and environmental effects (in the form of healthier food from genetically modified plants, for example).

Third, besides the alleged direct and indirect risk-imposition and other adverse effects, sometimes the critics of the PP question whether the use of the principle has any effect on the risk-imposition at all. This view is presented by Bodansky who argues that

> *[m]any of today's most serious problems were unanticipated and would probably not have been prevented even if regulators had chosen the cautious approach. CFCs and DDT, for example, were viewed as environmentally benign when first developed. The problem was not that state regulators permitted their use in the face of uncertainties, but that scientists did not test for the right types of environmental impacts* (1991:43).

In some of the more elaborated and detailed analyses, this kind of a claim is coupled with empirical evidence. In his book *But is it True?*, Wildavsky (1996: 428–429) questions the widely held belief that 'precautionary regulation' is, in fact, in favour of the public health. His argument in a nutshell is that "overall there are no health benefits from regulation of small, intermittent exposures to chemicals" (ibid.).

When the PP is objected on the grounds of adverse (or no) effects, the following facts should be borne in mind. First, most often, the argument from adverse effects is put forward in the form of a conditional without a reference to empirical observations or studies on the issue. Second, even when there have been cases in which taken precautions have *de facto* resulted in detrimental effects, an understanding of the PP in which the consequences of the precautionary measures are not taken into

consideration has been employed. As is seen above (in the Section 2.2.), these particular formulations (or interpretations) of the PP should be abandoned. If a precautionary response to a threat imposed another risk (or an actual loss with the probability of which being one) that is regarded as unacceptable, both risks should be considered symmetrically. It is also important to notice that pre-emptive measures prescribed by the PP may take the form of outright bans, phase-outs and moratoria, but also that of pre-market testing, labelling and requests for extra scientific information before proceeding. Still another kind of a precautionary response would be the establishment and implementation of new precautionary risk assessment methodologies (see e.g. Tickner 2003).

## 3. Discussion

What is the rationale behind taking precautions? In other words, if one accepts the counter-arguments introduced above, what are the reasons pointing to the direction of precaution? Indeed, several general grounds for the importance of the PP in environmental and health risk decision-making exist.

First, owing to a number of factors (such as the growth in the world's population; the increasing change, complexity and interdependencies of societies; and the new possibilities provided by the rapid technological development), the stakes have become higher than before. Human action can lead – and has already contributed – to serious and irreversible environmental damage. Second, a growing recognition of ecosystems' sensitivity as well as of their intra- and interdependencies is not without significance. Our limited understanding of several natural processes and related risks has increasingly been admitted and emphasised. Furthermore, the prevailing institutionalised risk governance methodology (especially quantitative risk assessment) has been subjected to substantial criticism. In this methodological approach, it is presumed that the strict boundary between scientific knowledge and unscientific beliefs (i.e. mere opinions or speculative guesses) is appropriate to the governance of environmental risks. Conclusive scientific proof has been employed as a prerequisite for taking preventative measures. Notwithstanding this, there have often been weak indicators (or early 'warnings') of damage before its materialisation. Because the available evidence for the threats has not fulfilled the strict criteria of scientific knowledge, real risks have been ignored with highly detrimental consequences. European Environment Agency's report *Late Lessons from Early Warnings: The Precautionary Principle 1896–2000* (EEA 2001) examines fourteen case studies on taking no precaution in the state of uncertainty, and the serious consequences of this omission (see also *Wingspread Statement*). Moreover, that the popularity and highlighted nature of the PP may reflect a change in people's fundamental values and world-views and/or a changed situation with regard to the inducement and management of environmental threats and health hazards is also worth noticing. Lastly, taking absolutely no precaution would be immoral from the ethical point of view and irrational from the decision theory's point of view.

Provided the general reasons to take precautions as well as the justifications which are specific to a regulatory context for which I have argued elsewhere (see Ahteensuu *forthcoming*), I conclude that the burden of proof still lies with the opponents of the PP. Yet it is necessary to borne in mind that even if the three objections fail to put down the PP as a whole, they are decisive in the case of particular formulations and interpretations of the principle.

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## References

Adams, M. D. (2002) "The precautionary principle and the rhetoric behind it". *Journal of Risk Research* 5, 301–316.

Ahteensuu, M. (2004) "The precautionary principle in the risk management of modern biotechnology". *Science Studies* 17, 1, 57–65.

Ahteensuu, M. (2007) "Rationale for taking precautions: normative choices and commitments in the implementation of the precautionary principle". *Risk & Rationalities* (Conference Proceedings), Queens' College, Cambridge, UK. In <http://www.kent.ac.uk/scarr/events/ahteensuu.pdf>.

Ahteensuu, M. (forthcoming) "The precautionary principle and the risks of modern agri-biotechnology". In *Genetic democracy: philosophical perspectives*. V. Launis and J. Räikkä, eds. Dordrecht: Springer.

Beauchamp, T. L. and J. F. Childress (1983) *Principles of biomedical ethics.* New York: Oxford University Press.

Bodansky, D. (1991) "Scientific uncertainty and the precautionary principle", *Environment* 33, 7, 4–5, 43–44.

CEC=Commission of European Communities (2000) *Communication on the precautionary principle.*

Comstock, G. (2000) "Are the policy implications of the precautionary principle coherent?". In <http://www.lifesciencesnetwork.com/repository/defining_pp.pdf>.

Conco, G. (2003) "Safety, risk and the precautionary principle: rethinking precautionary approaches to the regulation of transgenic plants". *Transgenic Research* 12, 639–647.

CPB=*Cartagena protocol on biosafety to the convention on biological diversity* (2000).

Dworkin, R. (1978) *Taking rights seriously*. Cambridge: Harvard University Press.

EEA=European Environment Agency (2001) *Late lessons from early warnings: the precautionary principle 1896–2000.* In <http://reports.eea.eu.int/environmental_issue_report_2001_22/en/Issue_Report_No_22.pdf>.

Foster, K., P. Vecchia, and M. H. Repacholi (2000) "Science and the precautionary principle". *Science* (May 12th), 979-981.

Gardiner, S. M. (2006) "A core precautionary principle". *The Journal of Political Philosophy* 14, 1, 33–60.

Goklany, I. M. (2000) "Applying the precautionary principle in a broader context". In *Rethinking risk and the precautionary principle*, 189–228. J. Morris, ed. Oxford: Butterworth-Heinemann.

Goklany, I. M. (2001) *The precautionary principle: a critical appraisal of environment risk assessment*. Washington, DC: Cato Institute.

Gray, J. S. and M. Bewers (1996) "Towards a scientific definition of the precautionary principle". *Marine Pollution Bulletin* 32, 11, 768–771.

GTA=*Finnish gene technology act (Geenitekniikkalaki)* (2004/847 [1995/377]).

Harris, J. and S. Holm (2002) "Extending human lifespan and the precautionary paradox". *Journal of Medicine and Philosophy* 27, 3, 355–368.

Hohmann, H. (1994) *Precautionary legal duties and principles of modern international environmental law: the precautionary principle: international environmental law between exploitation and protection*. (International Environmental Law and Policy Series.) London: Graham & Trotman; The Hague: Martinus Nijhoff.

Holm, S. & J. Harris (1999) "Precautionary principle stifles discovery". *Nature* 400 (July 29th), 398.

Jordan, A. and T. O'Riordan (1999) "The precautionary principle in contemporary environmental policy and politics". In *Protecting public health and the environment: implementing the precautionary principle*, 15–35. C. Raffensberger and J. Tickner, eds. Washington, DC: Island Press.

Löfstedt, R. E. & B. Fischhoff & I. R. Fischhoff (2002) "Precautionary principles: general definitions and specific applications to genetically modified organisms". *Journal of Policy Analysis and Management* 21, 3, 381–407.

Manson, N. A. (1999) "The precautionary principle, the catastrophe argument, and Pascal's Wager". *Journal of Ends and Means* 4, 12–16.

Manson, N.A. (2002) "Formulating the precautionary principle". *Environmental Ethics* 24, 263–274.

Miller, H. I. and G. Conco (2000) "Genetically modified fear and the international regulation of biotechnology". In *Rethinking risk and the precautionary principle*, 84-104. J. Morris, ed. Oxford: Butterworth-Heinemann.

Morris, J. (2000) "Defining the precautionary principle". In *Rethinking risk and the precautionary principle*, 1–21. J. Morris, ed. Oxford: Butterworth-Heinemann.

Nollkaemper, A. (1996), "'What you risk reveals what you value' and other dilemmas encountered in the legal assaults on risks". In *The precautionary principle and international law: the challenge of implementation*, 73–94. D. Freestone and E. Hey, eds. The Hague: Kluwer Law International.

Parker, J. (1998) "Precautionary principle". In *Encyclopedia of applied ethics.* Vol. 3, 633–641. R. Chadwick, ed. San Diego: Academic Press.

Resnik, D. B. (2003) "Is the precautionary principle unscientific?". *Studies in History and Philosophy of Biological and Biomedical Sciences* 34, 329–344.

Rogers, M. D. (2001) "Scientific and technological uncertainty, the precautionary principle, scenarios and risk management" *Journal of Risk Research* 4, 1, 1–15.

Sandin, P. (1999) "Dimensions of the precautionary principle". *Human and Ecological Risk Assessment* 5, 889–907.

Sandin, P. (2004) "The precautionary principle and the concept of precaution". *Environmental Values* 13, 461–475.

Sandin, P., M. Peterson, S. O. Hansson, C. Rudén, and A. Juthe (2002) "Five charges against the precautionary principle". *Journal of Risk Research* 5, 287–299.

Saner, M. (2002) "An ethical analysis of the precautionary principle". *International Journal of Biotechnology* 4, 1, 81–95.

Starr, C. (2003) "The precautionary principle versus risk analysis". *Risk Analysis* 23, 1, 1–3.

Stirling, A., ed. (2001) *On science and precaution in the management of technological risk.* (An ESTO Project Report.) In <ftp://ftp.jrc.es/pub/EURdoc/eur19056en.pdf>.

Sunstein, C. (2005) *Laws of fear: beyond the precautionary principle*. Cambridge: Cambridge University Press.

Tickner, J. (2003) "Precautionary assessment: a framework for integrating science, uncertainty, and preventative policy". In *Precaution, environmental science, and preventive public policy*, 265–304. J. Tickner, ed. Washington, DC: Island Press.

Torgersen, H. and F. Seifert (2000) "Austria: precautionary blockage of agricultural biotechnology". *Journal of Risk Research* 3, 209–217.

Trouwborst, A. (2002) *Evolution and status of the precautionary principle in international law*. London: Kluwer Law International.

Turner, D. and L. Hartzell (2004) "The lack of clarity in the precautionary principle". *Environmental Values* 13, 449–460.

UNCED=*Rio declaration on environment and development* (United Nations Conference on Environment and Development, Rio de Janeiro, 3rd–14th June 1992).

VanderZwaag, D. (2002) "The precautionary principle and marine environmental protection: slippery shores, rough seas, and rising normative tides". *Ocean Development & International Law* 33, 165–188.

Wiener, J. and M. Rogers (2002) "Comparing precaution in the united states and Europe", *Journal of Risk Research* 5, 317–349.

Wildavsky, A. (1996) *But is it true? A citizen's guide to environmental health and safety issues*. Cambridge: Harvard University Press.

*Wingspread statement on the precautionary principle* (1998).