Research Handbook on International Environmental Law

Edited by

Malgosia Fitzmaurice

Professor of Public International Law, Queen Mary, University of London, UK

David M. Ong

University of Essex, UK

Panos Merkouris

Queen Mary, University of London, UK

RESEARCH HANDBOOKS IN INTERNATIONAL LAW

Edward Elgar
Cheltenham, UK • Northampton, MA, USA

Published by
Edward Elgar Publishing Limited
The Lypiatts
15 Lansdown Road
Cheltenham
Glos GL50 2JA
UK

Edward Elgar Publishing, Inc.
William Pratt House
9 Dewey Court
Northampton
Massachusetts 01060
USA

A catalogue record for this book is available from the British Library

Library of Congress Control Number: 2009938382

ISBN 978 1 84720 124 9 (cased)

Typeset by Cambrian Typesetters, Camberley, Surrey
Printed and bound by MPG Books Group, UK

10 The precautionary principle

Minna Pyhälä, Anne Christine Brusendorff and Hanna Paulomäki

Introduction

The application of the precautionary principle is defined by the taking of measures to prevent potential harm to humans or the environment resulting from potentially damaging policies and actions in the face of scientific uncertainty. The concept embraces risk prevention, cost effectiveness, ethical responsibilities towards maintaining the integrity of natural systems, and the shortcomings of human understanding.

The precautionary principle has since the mid-1980s been included in numerous international agreements regulating various environmental media. In addition to various hard and soft law instruments, there is widespread support for the precautionary principle in state practice and judicial opinion. The lack of rulings in favour of the precautionary principle in international courts, however, suggests that the principle is still only emerging as part of customary international law.

This chapter gives an overview of the historical development of the precautionary principle from the preventative principle. An analysis of the various components of the principle is carried out, including the relationships between science, economics, ethics and politics. Emphasis is given to the lack of a clear definition, or guidelines for the interpretation of the principle's components, which present a challenge to scientists and policy-makers in its application. Later in the chapter, examples are given of ways in which the precautionary principle has been and can be implemented.

From repairing damage to acting with precaution: the evolution of the precautionary principle

For a long time, the duty to prevent pollution of, and to protect, the environment has restricted states in exercising their sovereign rights, both within and outside their territory. The global environmental concerns which have given rise to environmental law also inform the legal principles which underlie environmental law as we know it. These include three guiding principles which have emerged during the past decades: the polluter pays principle, the preventive principle and the precautionary principle. Although, in many respects, these are 'soft law' rules, they have become formally recognized and incorporated into the binding provisions of many international treaties and conventions, as well as the domestic law of numerous countries.

1. Polluter pays principle – remedial action

This chapter focuses on the precautionary principle, and a whole separate chapter in this book has been dedicated to the 'polluter pays principle'. Nevertheless, the polluter pays principle merits mention here because in many ways it has served as the backbone of environmental

law and thus contributed to the development of the preventative and precautionary principles. The polluter pays principle emerged fairly early in the development of environmental law and favours a curative approach which is concerned with repairing ecological damage. In 1972, the intergovernmental organization for economic cooperation (OECD) recognized it as a means of establishing new cost charge-back rules for pollution prevention measures. It is by virtue of the polluter pays principle that present and potential polluters are now required to: cover the cost of technical studies undertaken to assess the pollution they produce and the cost of the technology required to monitor and control this pollution; compensate third parties whose property, person or quality of life has been compromised by pollution; and cover the costs of any legal penalties arising from their failure to observe the normative rules laid down by the state (Birnie and Boyle, 2002). Although, when practically interpreted, the polluter pays principle is primarily economical and aimed at covering the expenses of cleaning up, or compensating for, pollution, the mere fact that potential polluters are expected to take responsibility for their actions can be viewed as encouraging a forward-looking approach that includes a degree of precaution.

2. Preventive principle – preventing the foreseeable

The preventive principle may well be the oldest of the guiding principles, with reference to it being made in an arbitration award granted on 11 March 1941 in the *Trail Smelter* case.[1] For several decades, states have been requested to ensure that the activities they undertake have minimal environmental damage by incorporating the principle of preventive action in a body of applicable environmental measures. This pollution prevention obligation has been taken up in numerous international declarations and in many binding international conventions established during the past 30 years, for example, the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, and more explicitly in the 1982 United Nations Convention on the Law of the Sea (UNCLOS, 1982: Art. 194(1)) and the 1974 Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention, 1974: Art. 3(1)).

Within the comprehensive body of environmental measures requesting the application of the principle of preventive action, some measures are very specific, allowing or prohibiting certain actions, while others merely request a *bonus pater* conduct, that is, behaviour to be expected of a 'good government'.

The principle of preventive action is broader than the traditional principle requesting states to ensure that activities they undertake do not damage the environment of other states or that of areas beyond their national jurisdiction[2] as it requests states, despite their sovereign rights, to also prevent damage to the environment within their own jurisdiction.

In domestic law, the preventive principle translates into prior authorization procedures that enable competent authorities to intervene before a project is undertaken, either to prevent it from going forward or to impose technical or other requirements designed to ensure that the project will adhere to standards, restrictions and other factors which are intended to limit harm to the environment. Examples of the application of the preventive principle include environmental impact assessments (EIAs) and scientific tests on products prior to their release on the market.

With the emergence of the preventive principle, it was no longer considered acceptable to 'fill up' the environment to a certain level. Rather, it was considered that known risks should be avoided at source. The application of the principle, therefore, requires states to be able to

foresee that an activity they are about to undertake will cause environmental damage. This, in turn, requires the availability of scientific data and evidence pointing to the potentially/proven damaging effect of a proposed activity. As is often the case, however, a clear cause-effect relationship (dose-response relationship) is difficult to establish due to scientific uncertainty (for example, lack of information on long-term, cumulative and combined effects), a lack of reliable monitoring data, and the tendency of political and scientific communities to be responsive to already identified problems rather than to the prediction of upcoming problems. It is this general lack of certainty in the face of potential harm to the environment caused by policies and activities that led to the development of the precautionary principle.

3. Precautionary principle – anticipating damage

Policy measures to counter environmental damage have undergone radical changes. From an early phase of remedial actions, followed by a preventive approach, environmental legislation is now marked with anticipation. Whereas the polluter pays and preventive principles were conceived to address known situations and risks, the precautionary principle relates to the realm of the uncertain. Before the precautionary principle was born, waste disposal and the ability of the environment to absorb the effects of human activities without negative consequences on biological systems were viewed in the light of the environment's assimilative capacity. The precautionary principle, however, expressly rejects this approach, where scientists are expected to predict the carrying capacity of, and damages to, the environment, taking into account society's technological capabilities to address such threats once recognized (Burns, 2005: 1–9).

Conversely, the precautionary principle emphasizes the vulnerability of the environment, the limitations of science to accurately predict threats, the availability of methods for termination or minimization of inputs to the environment, and the need for long-term economic considerations. And, as it does not rest on certainties, the precautionary principle is the most controversial of the three guiding principles discussed. Precaution is also contentious because it calls for changes to established legal principles and practices such as liability, compensation, and burden of proof and challenges politicians to think within longer time frames and to cut across disciplinary boundaries (O'Riordan and Jordan, 1995: 95–102).

Precautionary principle – from political manifest to legal principle

The precautionary principle developed as a reaction to scientific uncertainty, in order to ensure there was a tool for decision-making also in these instances. In simple terms, the principle was to be invoked by states to prevent potential risks of a certain magnitude resulting from policies and activities.

1. Birth of the precautionary principle

The legal history of the precautionary principle traces back to the 1960s when the early concept of *vorsorge* (foresight, taking care) was included in the former West Germany's environmental management, with the belief that environmental damage could be prevented or minimized through careful, forward-looking planning. The *vorsorgeprinzip* (precautionary or foresight principle) was used by the German government, as well as other European countries, to address many pressing issues in the 1970s and 1980s.

The principle emerged at the international level in the 1980s when it was incorporated into

the World Charter for Nature (World Charter for Nature, 1982: Part II, Section 12).[3] The earliest use of the principle in international law was marked by explicit reference to it in the 1984 Bremen Ministerial Declaration (Art. D3)[4] and the 1987 London Declaration (Art. 7)[5] of the First and Second International Conferences on the Protection of the North Sea, respectively. In 1987, the 1985 Vienna Convention for the Protection of the Ozone Layer endorsed the principle by adopting the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer (Protocol on Substances that Deplete the Ozone Layer, 1987: Preamble).[6] Since then, the principle has been reflected in numerous international treaties and declarations. Another example of early adoption of the principle is the 1988 Ministerial Declaration under the 1974 Convention for the Protection of the Marine Environment of the Baltic Sea (Preamble).[7]

The incorporation of the precautionary principle in Principle 15 of the 1992 Rio Declaration on Environment and Development (Stockholm Declaration, 1972: Principle 21; Rio Declaration, 1992: Principles 2 and 15) has been seen as a crystallization of the principle in international environmental law. During 1992, the principle was also included in various other international environmental instruments, for example, the UN Framework Convention on Climate Change (UNFCCC, 1992: Art. 3(3)), the Convention on Biological Diversity (CBD, 1992: Preamble), and regional marine conventions such as the Helsinki Convention (Convention for the Protection of the Marine Environment of the Baltic Sea Area, 1992: Art. 3(29)) and the Convention on the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention, 1992: Art. 2(2)(a)).

The embodiment of precaution in the 1995 UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (Arts 5 and 6)[8] signified a major shift in the traditional approach to fisheries management which has tended to react to management problems once they reach crisis levels (Freestone, 1999: 30). Recognizing the risks posed by persistent organic pollutants to human health and the environment, the precautionary principle has been identified as the main objective of the 2000 Stockholm Convention on Persistent Organic Pollutants (POPs) (Art. 1). The 2000 Cartagena Protocol on Biosafety has been considered the most advanced expression of the precautionary principle in any international agreement with its numerous references to precaution (de Sadeleer, 2002; de Sadeleer, 2007). Not only is precaution referred to as an objective in the Protocol (Cartagena Protocol, 2000: Art. 1), but it also gives authorization to take a decision on a precautionary basis (Cartagena Protocol, 2000: Arts 10(6) and 11(8); see also de Sadeleer, 2002: 98–9).

At a European level the precautionary principle is one of the most important principles of European Community (EC) environmental policy and was adopted into community law in the 1992 Maastricht Amendments to the European Treaty (Treaty of Rome) (Art. 130R(2)). The EC position with regard to the precautionary principle (Commission of the European Communities, 2000)[9] is evident also in that the EC has evoked the principle in several World Trade Organization (WTO) disputes (see below for a more detailed discussion).

2. *The precautionary principle in international case law*

In addition to the above-mentioned hard and soft law instruments, there has been widespread reference to the precautionary principle in state practice and international case law. Although states do take action when the extent of ecological problems is unknown, uncertainty about the transboundary consequences of alleged problems often hinders international policy (Dimitrov, 2005: 96–113). At a global level, international courts of law have been reluctant to pronounce about the status of the precautionary principle. The following sections summa-

rize some cases where the precautionary principle has been evoked, namely: the 1995 *Nuclear Tests Case* and the 1997 *Gabčíkovo-Nagymaros Case* in the International Court of Justice (ICJ); the 1999 *Southern Bluefin Tuna Case* and the 2001 *MOX Plant Case* in the International Tribunal for the Law of the Seas (ITLOS); as well as transatlantic disputes regarding beef hormones and genetically modified organisms which have been dealt with by World Trade Organization (WTO) dispute settlement bodies.

2.1. INTERNATIONAL COURT OF JUSTICE (ICJ)

In the following two cases, where the precautionary principle was invoked, the ICJ avoided taking a position about the principle. The first case was the 1995 *Nuclear Test Case* (*New Zealand v. France*), which had to do with underground nuclear tests that France intended to conduct in the territory of French Polynesia in the South Pacific. New Zealand argued that France was bound by customary international law to respect the precautionary principle and therefore to prove the safety of such nuclear tests and to assess their environmental impact before conducting them. The order of the ICJ of 22 September 1995, which dismissed New Zealand's claim on procedural grounds, did not rule upon the nature of the precautionary principle (*Nuclear Tests Case,* 1995: 288). Nevertheless, it is interesting to note that two of the dissenting judges mentioned the precautionary principle as an emerging feature of international environmental law.[10]

In the second case, the 1997 *Gabčíkovo-Nagymaros Case* (*Hungary v. Slovakia*), Hungary invoked the precautionary principle and the notion of sustainable development to repudiate the Treaty with Slovakia aimed at the construction of the Gabčíkovo-Nagymaros system of locks on the Danube River. Hungary argued that the precautionary principle imposed 'an *erga omnes* obligation of prevention of damage …' and invoked Article 33 of the International Law Commission Draft Articles on the International Responsibility of States, which permits countries to avoid an international duty if necessary to 'safeguard an essential interest of the State against a grave and imminent peril' (*Gabčíkovo-Nagymaros Project*, 1997: para. 52). Hungary argued that Slovakia should provide proof that no harm to the environment would be derived from the diversion of the Danube River. The ICJ agreed that Article 33 incorporated concepts of precaution, but interpreted this narrowly by ruling that a country could invoke the principle as a basis for terminating a treaty only if it could demonstrate by credible scientific evidence that a real risk will materialize in the near future and is thus more than a possibility (*Gabčíkovo-Nagymaros Project*, 1997: para. 57; see also Van Dyke, 2004). The Court then ruled that Hungary's evidence of potential environmental damage had failed to meet this standard and therefore that Hungary remained bound by the Treaty (de Sadeleer, 2002: 100–2).

2.2. INTERNATIONAL TRIBUNAL FOR THE LAW OF THE SEAS (ITLOS)

In the 1999 *Southern Bluefin Tuna Case* (*Australia and New Zealand v. Japan*), there was a disagreement between Australia and New Zealand on one hand, and Japan on the other, with regard to experimental fishing being carried out by Japan on southern bluefin tuna. Australia and New Zealand argued that Japan, by unilaterally undertaking experimental fishing, was not complying with its obligation to cooperate in conserving the southern bluefin tuna stock. The provisional measures requested by New Zealand included that the parties' fishing practices be consistent with the precautionary principle until a final settlement of the dispute is achieved.

Despite a promising beginning, with the ITLOS issuing strong provisional measures designed to protect the over-fished species, the end result was unfortunate, when an ad hoc arbitral tribunal declared that both it and ITLOS lacked jurisdiction over the case. Regardless of the inconclusive ending of this case, the provisional measures issued by ITLOS acknowledged the precautionary principle.[11] The tribunal prescribed a limitation to Japanese 'experimental fishing' in order to give the bluefin tuna a chance to recover while the countries developed new management plans. Although the tribunal was reluctant to take a position as to whether the precautionary approach is a binding principle of customary international law, several judges gave separate opinions of the precautionary approach being inherent in the notions of the provisional measures issued (*Southern Bluefin Tuna Case* (Separate Opinion of Judge Treves), 1999: para. 9).[12]

The 2001 *MOX Plant Case* (*Ireland v. United Kingdom*) stemmed from the authorization by the United Kingdom of a new MOX facility (Mixed-Oxide Fuel, a nuclear power reactor fuel made from plutonium mixed with uranium) near Sellafield. Ireland accused the United Kingdom of failing to properly examine the consequences of commissioning a MOX plant on the marine environment in the Irish Sea and sought provisional measures to shut down the MOX plant in order to prevent the entry of radioactive materials into Irish waters.

Ireland quoted in its Memorial (*MOX Plant Case*, Memorial of Ireland, 2002: paras 6.22–6.23) Article 2(2)a of the 1992 OSPAR Convention as defining the duties of countries under the precautionary principle and as reflecting 'a rule of general international law amongst European states'. Ireland further submitted that '[t]he precautionary principle has been recognised as being inherent in the approach adopted by UNCLOS' (*MOX Plant Case*, Memorial of Ireland, 2002: para. 6.25). According to Ireland, the precautionary principle required the United Kingdom to demonstrate that no harm would arise from the operation of the MOX plant.

The ITLOS issued an Order in response to Ireland's request for the prescription of provisional measures in accordance with Article 290 of the UNCLOS. The United Kingdom responded in its Rejoinder by saying that 'the United Kingdom was, and is today, guided by the precautionary principle as elaborated in European Community law in the context of its Strategy 2001–2020', and that 'the United Kingdom's practice in respect of the MOX Plant was entirely consistent with a precautionary approach' (*MOX Plant Case*, Rejoinder of the United Kingdom, 2003: para. 8.34; also see de Sadeleer, 2002: 109; Van Dyke, 2004: 372–3). The UK also stated that there was no trigger for precaution since the risk of pollution was, in its view, infinitesimally small (*MOX Plant Case*, Rejoinder of the United Kingdom, 2003: para. 3.3).

Although the tribunal did not pronounce on precaution nor grant the provisional measures requested by Ireland, it did, however, underline the duty to cooperate as a fundamental principle in the prevention of pollution of the marine environment under UNCLOS and general international law. The parties were also ordered to cooperate further and share information on the potential risks of the plant, as required by 'prudence and caution'. It also ordered the parties to consult in order to 'devise, as appropriate, measures to prevent pollution of the marine environment which might result from the operation of the MOX plant' (*MOX Plant Case* (Order No. 3), 2003: para. 37).

2.3. WORLD TRADE ORGANIZATION (WTO) DISPUTE SETTLEMENT BODIES

The WTO has also been the scene of international disputes on the precautionary principle, of

which two cases will be summarized here.[13] In 1988, the EC banned the use of six hormones for growth promotion and thus also imports of meat and meat products unless the exporter could prove that these had not been treated with the banned hormones. The United States and Canada both requested the establishment of a panel under the WTO, arguing that the EC's ban on imports violated trade agreements (WTO Hormones Dispute).[14]

In January 1998 the WTO Appellate Body held that the EC was not entitled under the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) to maintain its ban on the importation of meat from cattle treated with growth hormones. The EC invoked the precautionary principle as a customary rule of international law or, at least, a general principle of law and argued that Articles 5.1 and 5.2[15] of the SPS Agreement on risk assessment did not prevent Members from being cautious when setting health standards in the face of conflicting scientific evidence and uncertainty. The United States and Canada maintained that the precautionary principle is just an 'approach', and argued that the EC ban was not based on scientific principles, because there was no evidence that hormones pose a risk to human health.[16]

Although the WTO Appellate Body recognized that the precautionary principle had been incorporated into the Preamble,[17] Article 3.3[18] and Article 5.7[19] of the SPS Agreement, it decided that the precautionary principle did not apply to the case because it could not override the explicit wording of Articles 5.1 and 5.2 of the SPS Agreement, which provide that SPS measures must be based on risk assessment and scientific evidence (*WTO Appellate Body Report, EC Measures Affecting Meat and Meat Products* (*Hormones*), Complaint by the United States and Canada, 13 February 1998).

The *Hormones Case* continues to be open, with parties not being able to reach an agreement about the scientific basis of the EC risk assessment and the implementation by the EC of the recommendations and rulings of the WTO dispute settlement body.[20] As such, the US and Canada are continuing to apply sanctions to the EU by raising tariffs on a list of goods from the EC.

The precautionary principle was once again the subject of a trade dispute when in May 2003, the United States, Canada and Argentina launched a WTO case against the EC concerning the EU authorization regime for genetically modified organisms (GMOs). The complainants asserted that the de facto moratorium applied by the EC since October 1998 on the approval of biotech products, has restricted imports of agricultural and food products and thus violated international trade agreements. The *EC – Approval and Marketing of Biotech Products Case* was addressed by the WTO dispute settlement body and, as in the *Hormones Case*, was founded on differing perceptions about what constitutes legitimate precaution versus its invocation as trade protectionism in disguise. The panel spent several years evaluating the complex topic and gathered the views of independent and highly reputable scientists from different parts of the world.

The panel found that the EC had acted inconsistently with various obligations under the SPS Agreement, and as in the *Hormones Case*, found that the measures applied by the EC were not based on risk assessments satisfying the definition of the SPS Agreement and hence could be presumed to be maintained without sufficient scientific evidence.[21]

At a dispute settlement body meeting in December 2006, the EC announced its intention to implement the recommendations and rulings in a manner consistent with its WTO obligations. However, due to the complexity and sensitivity of the issues involved, the EC requested a reasonable period of time for implementation.[22]

The increasing number of international cases invoking the precautionary principle and the fact that international courts have avoided ruling in favour of the principle suggest that the status of the principle as custom is still 'emerging'. Furthermore, especially in the case of the WTO, changes may need to be made to existing obligations, especially with regard to risk assessment in the SPS Agreement, before the principle can be accepted (Shaw and Schwartz, 2005; Petitpierre et al., 2006).

3. The legal status of the precautionary principle

In its rather recent emergence in international environment law, precaution has produced much controversy over its legal status and effects, with many disputes arising over whether it should be labelled an 'approach' which is not legally binding, or a 'principle' which is clearly embedded in a legal system (de Sadeleer, 2007: 3). The very nature of the precautionary principle, in that it supports uncertainty, places a challenge on traditional legal systems which generally rely on certainty.[23] Perhaps this explains the hesitance of courts to rule in favour of the precautionary principle. Nevertheless, individual countries have on several occasions invoked the precautionary principle, illustrating that the principle has developed from a merely political manifestation to a principle with legal value. With increasing uncertainty arising from new technologies, the precautionary principle also challenges science and is expected to intensify discussions of the status and role of the principle, especially in relation to WTO trade issues (de Sadeleer, 2007: 4; Shaw and Schwartz, 2005).

Much has been written about whether the principle is a legally binding principle of international customary law.[24] Despite the abstractness of the precautionary principle, many environmental lawyers argue that it is already a principle of customary international law (McIntyre and Mosedale, 1997: 221–41; Trouwborst, 2002). Others, however, argue that although the principle is an underlying objective of many multilateral environmental agreements, it is only likely to be transformed into customary law if it is repeatedly applied in international tribunals and courts, as well as in state practice and *opinio juris* (Sands, 1995). Although the court rulings and the opinions of the judges mentioned in this chapter suggest that the principle is only emerging, an analysis of state practices and doctrinal debates in the Nordic countries suggests that, at least from a regional perspective, the precautionary principle can be considered a principle of customary international law (de Sadeleer, 2007: 383).

3.1. PRINCIPLE VERSUS RULE

Before discussing the nature of the precautionary principle in more detail, a few words should be said about principles in general. In jurisprudential terms, the difference between a principle and a rule is the very level of generality in which it is phrased. While a rule is formulated with a degree of precision which will allow for its equal application in similar cases, a principle is formulated on a more general level, allowing for a broader application (Freestone, 1999: 26). The contrast between principles and rules is, therefore, functional. Both principles and rules point to particular decisions about legal obligations in particular circumstances, but they differ in the character of the direction they give. Principles, which may also be understood as public standards of morality, are the standards for deciding which rule applies, although they do not necessitate a particular decision. Rules, on the other hand, are applicable in an all-or-nothing fashion; if their conditions are met, the legal consequence follows automatically (see Dworkin, 1978). Principles, in contrast to rules, have a dimension of weight; so they can guide moral decisions but cannot prescribe the decision made.

Bearing in mind the nature of principles, it should be accepted, therefore, that it is a characteristic of the precautionary principle that uncertainties about its application and content remain (Freestone, 1999: 27). The precautionary principle should be seen as giving reasons that argue in the direction of precaution but do not necessitate particular decisions that would guarantee total protection. An absolutist approach to the precautionary principle could be seen as counter-productive to its purpose (for example, in case of cross-media effects and the lack of a cross-sectoral approach); however, there is also a need to specify a uniform interpretation of the principle and an understanding among states on how to apply the principle (Nollkaemper, 1996: 73–94).

Examining the precautionary principle

Despite its seemingly widespread political support, the precautionary principle has generated endless controversy. One of the greatest problems of the precautionary principle as a policy tool is its extreme variability in interpretation. One legal analysis identified 14 different formulations of the principle in treaties and non-treaty declarations (Foster et al., 2000: 979–81).

The precautionary principle has been referred to in a wide variety of ways, with different degrees of stringency, under the numerous international environmental instruments that use it as a guiding principle. In its strongest formulations, the principle can be interpreted as calling for absolute proof of safety before allowing new technologies to be adopted.[25] If interpreted literally, no new technology could meet this requirement. Other formulations open the door to cost-benefit analysis and discretionary judgment, with Principle 15 of the Rio Declaration urging the application of the precautionary approach only if damage is likely to be 'serious or irreversible' and if the taking of precautionary measures is 'cost effective'.[26]

This section will shed some light on the characteristics of the precautionary principle, highlighting some of its main elements, which, when expressed in a multitude of fashions, leave room for diverse interpretations of the principle. The aim here is not to come up with a universal definition of the precautionary principle, but rather to define some of the criteria/conditions to be taken into account when deciding if and how to apply the principle. Such criteria/conditions are of importance for those interested in, or affected by, a decision; for the efficiency and authority of the decision-making institutions; and for acceptability by the society.

1. Elements of the precautionary principle

Despite the numerous, and varying expressions of the precautionary principle, some common assumptions exist; namely, there is a credible or known threat of harm, the situation lacks scientific certainty or evidence, cause-effect relationships have not yet been proven, and there is a necessity, or duty, to act (Burns, 2005: 2).

As an example, the use of the precautionary principle in the 1992 Helsinki Convention (Helsinki Convention, 1992: Art. 3(29)) clearly embodies these four aspects. Article 3(2) of the Helsinki Convention states:

> The Contracting Parties shall apply the precautionary principle, i.e., to *take preventive measures* when *there is reason to assume* that substances or energy introduced, directly or indirectly, into the marine environment *may create hazards* to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea *even when there is no conclusive evidence of a causal relationship* between inputs and their alleged effects. (Emphasis added)

In addition to the aforementioned assumptions, several other commonly occurring themes have been identified in the complex debate on the meaning and applicability of the precautionary principle. These are, amongst others: preparedness to provide ecological space and margins for error; recognition of the importance of the well-being of non-human entities; a shift in the burden of proof onto those who propose change; a greater concern for impacts on future generations; and recognition of the need to address ecological 'debts' (Jordan and O'Riordan, 1998).[27] Some of these common elements in the use of the precautionary principle are discussed further here.

1.1. THREAT OF HARM

The assumption that action should be taken when there is a credible or known threat of harm raises a number of questions. What kind of damage should be avoided? What degree of damage is acceptable? Should action only be taken when irreversible damage is suspected? Or is there a threshold or a *de minimis* damage which is acceptable?

Threshold levels for potentially harmful activities need to be in place in order to be able to apply preventative action as part of the implementation of the precautionary principle. Treaties use different terminology in order to define thresholds; for example, preventative action is required when there are 'reasonable grounds for concern' (OSPAR Convention, 1992: Art. 2(2)(a)) or there is 'reason to assume' (Helsinki Convention, 1974: Art. 3(2)) that pollution will result in harm to humans and/or the environment caused by pollution, or when 'there are threats of serious or irreversible damage' (UNFCCC, 1992: Art. 3(3)). A broader definition, for example, referring to a lower degree of potential harm and being more open to scientific uncertainties, can be seen as setting a lower threshold for the application of the precautionary principle (Pyhälä et al., 2007: 147). These thresholds play a critical role in determining the degree to which the balancing of interests is allowed when implementing the precautionary principle.

Thresholds and degrees of damage are, however, extremely difficult to establish, especially when taking into account the complex nature of ecological systems and the interactive effects, and often long-term impacts, of multiple pressures. Quite often, there is no evidence of a threshold concentration, for example as in the carcinogenic and mutagenic effects of pollutants such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and dioxins, which may manifest themselves after several generations. Current limitations in scientific understanding can make it difficult to ascertain causal links between specific actions and their effects in the environment. Furthermore, it is not always possible to place a price tag on the environment, which could help to justify the need for precautionary actions.

Nevertheless, there is a need to set criteria for identifying thresholds which take into account the amount of scientific evidence available about a potential risk, and the seriousness of the probable consequences. Where a given risk is deemed to be above the threshold, environmental measures may be justified. To ensure that serious harm and irreversible damage do not occur, precautionary levels need to be applied.

1.2. SCIENTIFIC UNCERTAINTY

The 'absence of evidence' should not be accepted as 'evidence of absence' of environmental risk (Ervin et al., 2001). Some issues which fall into the category of risks whose characteristics are uncertain or unknown include GMOs, global warming, species extinctions and intro-

duction of exotic species, etc. Precaution points to the inherent limitation and incompleteness of scientific knowledge in representing indeterminate and complex ecosystems. Consequently, by evoking the precautionary principle, action should be taken in advance of scientific certainty.

The acceptance of uncertainty is linked to the allocation of the burden of proof. Whereas mitigating actions have historically been taken once an activity has proven to be hazardous, the precautionary principle embodies reversal of the burden of proof. In pointing to the modest extent of scientific understanding of nature and the function of ecosystems, and of the effects of human activities upon them, the principle suggests that the burden of uncertainty should not necessarily fall on the environment or on human populations (Ellis and FitzGerald, 2004: 779–800). In other words, it allocates the burden of proof to those proposing to undertake a potentially risk-generating activity. This is typically incorporated in the environmental risk assessments required of activities likely to have environmental impacts.

Traditionally, the law has tended to privilege parties accused of degrading the environment rather than the victims of pollution. 'Acts of god' and 'accidents' tend to disallow claims for compensation, and in this sense the law offers little incentive to developers or operators of industrial processes to take adequate precautions regarding the environmental impact of their actions (Jordan and O'Riordan, 1998). The introduction of a strict liability regime which places the burden of proof upon the polluter to prove that emissions are 'harmless' before the activity is allowed (as is the case in the licensing of new medicines, for example) would entice developers to act with greater precaution.

The challenge here, however, lies in defining 'harmlessness' – which may be equally difficult to prove as 'harmfulness'. In many cases of high uncertainty, it is not possible to meet the burden of proof, and this may result in activities not being able to proceed, despite the many potential benefits to be expected. To this end, it must be recalled that reversing the burden of proof is only one part of a much more complex decision-making process and that it may be desirable to mitigate the consequences of failing to meet the burden of proof (Nollkaemper, 1996: 84–6).

In a situation of uncertainty, the parameters of the system and adverse outcomes may be known, but there is lack of knowledge on how to quantify probabilities. In this situation, traditional risk assessment is too narrow in scope to adequately manage uncertainty. Techniques such as scenario analysis, forecasting and computer simulations can assist; but ultimately judgements have to be balanced in regulatory actions, which are inevitably fraught with subjective values and assumptions (Bäckstrand, 2002).

2. *From scientific uncertainty to policy actions – a value judgement*

One of the most important contributions of the precautionary principle is that it implies a new division of labour between scientists and political decision-makers. The precautionary principle acknowledges that the identification of the threshold at which action becomes necessary is a matter of policy, informed by science, rather than decision-makers waiting for scientific proof of causal links between activities and harm before placing restrictions on the activities; the latter having been the case with the assimilative capacity approach (Ellis and FitzGerald, 2004). It has even been argued that the application of the precautionary principle is inherently non-scientific, due to the psychological, economic and aesthetic evaluations of 'harm', 'adverse effects', and 'thresholds', and that it is not the role of science to decide whether a risk is serious or substantial enough to warrant precautionary action. Instead, scientific uncertainty,

and the value judgements required to apply the precautionary principle, place the burden of responsibility on society (Walker, 2003: 197–228).

It is, however, important to note that the lack of conclusive scientific evidence does not negate science, and that scientists have an essential role in contributing to the application of the precautionary principle, as they often hold information that is necessary for decision-making. The value of science should not be diminished, as the precautionary principle gives it an added responsibility for reducing management uncertainties by recognizing and quantifying environmental problems, providing key evidence for prioritizing management actions and providing alternatives to the actions themselves (Mee, 1996: 109–31).

Although science and policy can nurture each other, many have recognized the gap between them, emphasizing that managers and legislators have failed to use science appropriately. On the one hand, 'early warnings' have often been ignored, but on the other, the precautionary principle has been criticized for its acceptance of 'suspicion of effects', rather than scientific evidence, as sufficient to introduce for example discharge measures to address a small discharge of limited persistence and toxicity being released into a large environment, thus sometimes being overprotective and diverting resources from other more important measures (Gray, 1996: 133–46; Nollkaemper, 1996).

Scientific uncertainty challenges decision-making because it complicates risk assessments and risk communication procedures. Quite often there are contradictory scientific theories around the same issue – making it difficult for decision-makers to understand the problem at hand. Here it is useful to bear in mind that some experts are driven by self-interest and their theories may be sensitive to funding sources, thus biasing their policy recommendations. Likewise, policy-makers, faced by confusing and differing scientific information, may rely more on the scientific theory that best matches their own objectives.

Precautionary actions imply a commitment of current resources to investments for the future, the benefits of which may be uncertain or even non-existent. Since conclusive scientific evidence of harm in the future may not always be available to justify such commitments, other grounds for legitimization may need to be taken on board, for example moral, political, ethical and legal (Jordan and O'Riordan, 1998). It is also important to develop mechanisms for applying the precautionary principle by increasing the liability of actors as a safeguard against opportunistic behaviour in the light of imperfect knowledge (Gollier and Triech, 2003: 77–103). Needless to say, however, the political biases of democracy, which favour immediate gratification and gain today rather than tomorrow, are not well matched by the time-scale involved in the precautionary approach.

3. Towards a policy-nurturing science

There has also been a fair amount of debate about the quality of research and monitoring activities as well as their adequacy to support the implementation of the precautionary principle. It has been recognized that there is a need for 'responsive assessment' where management options and political decisions are based on scientifically valid feasibility studies and cost-benefit analyses (Mee, 1996: 110–11). Monitoring plays a fundamental role in such work, as it examines trends and the effectiveness of actions taken. Challenges in implementing such monitoring do exist however, with difficulties in financing large-scale international programmes and securing long-term commitments from governments and researchers.

Monitoring generally does not identify new problems, but rather is designed to address already identified problems. If the precautionary principle is to be applied, it is necessary to

consider research methods that help to foresee potential harm. The value of environmental impact assessments (EIAs) and their predictions of possible harmful consequences of activities have been recognized as a useful tool in implementing the precautionary principle. In addition, feedback monitoring designed to test EIA predictions is necessary in order to ensure that remedial actions are taken in the case of damage resulting from an approved activity (Gray, 1996: 140–3).

The value of biological effects monitoring, such as the use of bio-marker techniques, has also been highlighted as a valuable tool for predicting hazards to the environment and as feeding into the decision-making process, thus encouraging the adoption of precaution measures (Gray, 1996: 146). The monitoring of effects, and the identification of cause-effect relationships, is particularly important for addressing long-term impacts to the environment.

Many environmental conventions have developed lists of harmful substances (for example, London, OSPAR and Helsinki Conventions). Although valuable in their own right, such lists do have weaknesses; especially because they address already identified harmful substances, are based on dose-response relationships, may result in a sense of false security and may not be responsive enough to new scientific findings because it can take years to add new substances to the list – a long delay, considering that hundreds of new chemicals are introduced into the environment every year (Mee, 1996: 113–19).

Despite the existence of useful tools, which to some extent support the application of the precautionary principle, there remains room for improvement. For starters, the scientific community and managers should be challenged to re-examine current approaches to pollution management and question whether the information being currently generated is sufficient to protect the environment from irreversible damage.

4. Cost-benefit analysis – an economic perspective

When it comes to setting legal limits for acceptable impacts of anthropogenic activities on the environment, a value judgement has to be made on the amount of damage which is acceptable and on the costs that society is willing to pay to reduce or lower the risk of such damage. The implementation of the precautionary principle, thus, invariably entails the balancing of interests between the prevention of environmental risks and the socio-economic interests related to the activities that generate such risks.

4.1. GIVING THE ENVIRONMENT 'VALUE'

The precautionary principle can be said to legitimize the status of the intrinsic value of ecological systems, with strong formulations being consistent with a 'bioethic' and implying a moral obligation to protect vulnerable or critical natural systems (O'Riordan and Jordan, 1995: 5). In doing so, the precautionary principle challenges some of the implicit assumptions of 'modern' (in particular 'western') societies: namely, material growth, the power and efficacy of scientific reason, and the pre-eminence of human interests over those of other entities (O'Riordan and Jordan, 1995: 5). Although the precautionary principle does not define how respect for nature should be incorporated into decision-making, it does offer a strong presumption in favour of high environmental protection.

It has been argued that the rather strong formulations of the precautionary principle in most environmental treaties suggest an absolutist approach which is cost-oblivious; implying that once risk thresholds have been crossed, concerned activities need to be stopped no matter the costs (O'Riordan and Jordan, 1995: 5). As such, the precautionary principle is seen as

limiting the scope of balancing costs and benefits, and may even block the consideration of tradeoffs (Ervin et al., 2001: 10).

The danger in applying the precautionary principle according to such absolutist terms may result in the opportunity cost (the revenue forgone by cancelling/preventing an activity) being much higher that the costs of inaction. 'What is one person's "unacceptable consequence" is another's "regrettable necessity"' (Fleming, 1996: 147–67). The existence of opportunity cost therefore weighs heavily against the application of the precautionary principle. Nevertheless, recent attempts to analyse the economics of precaution have highlighted that the precautionary principle may be economically justified on grounds of irreversibility (physical and socio-economic) where uncertainty, risk aversion and stock externalities exist (Gollier and Triech, 2003). This is because in the face of irreversible consequences of activities, precautionary measures which result in the preservation of the environment, leave more flexibility for future decisions and choices.

Cost-benefit analysis has been advocated as a tool to justify the use of precaution, that is, the long-term economic costs and hazards to man can be used to 'convince' decision-makers of the need for mitigating measures against an activity that causes harm. Irreversibility and the uncertainty inherent in the future benefits of development decisions play key roles in cost-benefit analyses. From an ecological point of view, however, accurate economic analyses are difficult to carry out, in particular, because, although pressures on the environment may increase in a linear manner, the responses in nature are often non-linear or even discontinuous (Ervin et al., 2001: 7). The magnitude and significance of changes in ecosystem functions are therefore often beyond scientific understanding and it is not possible to give them the economic value necessary for an accurate cost-benefit assessment. Ervin et al. (2001) identify several challenges for cost-benefit analyses:

- environmental processes take longer periods to reveal the degree, scope and variability of impacts than production and market effects;
- while some environmental outcomes and payoffs are known, they cannot yet be described with probability distributions;
- the environmental effects that lack markets are difficult to accurately value, and the costs may therefore be incurred in large measure by future generations. These intergenerational effects are not part of benefit-cost efficiency analyses;
- some potential environmental effects exhibit non-linear response functions and critical zones beyond which threshold effects (for example, irreversibility) may occur, such as biodiversity losses that can induce species extinctions; and
- all potential environmental effects cannot be accounted for, that is, 'surprises' may occur.

Due to these limitations in understanding, traditional cost-benefit analyses are insufficient when attempting to apply the precautionary principle. Instead, there is a need for a more fully developed 'economics of precaution' (Ervin et al., 2001: 3).

4.2. SETTING PRIORITIES

Given the complex nature of the environment, and the variety of impacts caused by anthropogenic activities, there is a need to set priorities. In other words, some risks have to be accepted in order to erase others and this has to be done on a case-by-case basis. It should not be presumed that all risks need to be phased out once a threshold has been crossed. It is

important to evaluate the seriousness of risks, and the costs needed to regulate them, in order to ensure that smaller, and less urgent, risks do not consume resources that would be better spent mitigating the greatest risks. With a lack of prioritization, projects are easily selected on the basis of whether they are easy to implement, rather than on the basis of environmental need. This is where cost-benefit and cost-effectiveness analyses play important roles as they help to identify where actions are most urgently needed.[28]

The setting of priorities is no easy task, especially in the light of uncertainty regarding risks and cause-effect relationships, but also due to the lack of a price tag on non-marketed environmental resources. Furthermore, environmental protection tends to be under-funded and there is tremendous competition to address different problems with the limited resources available. Historically, damages and hazards have often been grossly underestimated, partly due to cultural efforts to endorse and confirm current values and practices and thus to understate the risks. Risk has also been underestimated because society's willingness to acknowledge hazard is governed by its belief in the existence of solutions and due to a time-lag problem, for example before the effects on the environment are noticeable, and because of the political delay from perception of the problem to policy development, and finally to policy implementation and commitment (Fleming, 1996: 150–8).

When prioritizing, it is important to remain realistic regarding the costs of mitigation efforts. Several environmental agreements advocate the use of best available technology (BAT) in order to prevent negative impacts of activities on the environment. The formulations of many global treaties for the application of BAT leave room for states to use the best means at their disposal and apply these in accordance with their economical and technological capabilities (Gray, 1996: 136; Nollkaemper, 1996: 89–91; O'Riordan, 1992: 13–17). This may, in cases of high costs and limited resources, mean that prevention of pollution is not mandatory – a situation which is more frequently applicable to developing countries.

Burden-sharing is also an important aspect of prioritizing, and is mentioned in various international environmental agreements; for example, the notion of 'common but differentiated responsibilities'.[29] Here it is useful to recall also some of the international financial mechanisms in place under several treaties and the value of supporting less capable states in applying preventative measures. Due to the transboundary nature of many pollutants, more efficient pollution reduction results may be achieved by supporting resource-poor states in cleaning up their pollution hot-spots, rather than further reducing discharges from sources that are already applying cleaner technology.

Implementing the precautionary principle

The challenge of the 21st century is to operationalize the principles that emerged in the late 20th century by developing methodologies for giving effect to abstract concepts such as the precautionary principle. Several aspects of the precautionary principle have been discussed, and it is clear that in applying the precautionary principle, 'one size does not fit all'. Different ecological, cultural, political and economic interests and conditions need to be balanced before decisions on measures can be taken. The resulting range of precautionary actions, therefore, also varies from weak (intensive studying of a problem before acting) to strong (prohibiting or phasing out a specific activity). In order to ensure the greatest impact, preventative actions should be taken, when possible, at the design stage of potentially hazardous activities. And, of course, the precautionary principle cannot fulfil its purpose unless preventative measures are implemented.

The following sections illustrate with examples some of the methods that can be used in applying the precautionary principle. These methods have been identified by Tickner et al. in their Handbook on the precautionary principle in action (Tickner et al., 1999).

1. Bans and phase-outs

A ban or phase-out could be considered as the strongest expression of precautionary action. There are many cases where precautionary action has been taken in order to stop the production and use of hazardous substances. For instance, in many countries the use of PCBs and DDT was banned without conclusive scientific evidence about the harmfulness of the substances. In many cases a total ban has been seen as the only way to eliminate the risk of injury or disease from a very toxic chemical or hazardous activity. However, there are still some constraints on implementing a total ban as a precautionary action, namely, a global ban on DDT simultaneously results in potential benefits in developed countries but creates another set of uncertain hazards to public health and/or the environment in countries where malaria is still an ongoing threat (Sunstein, 2003: 24). As discussed earlier, the minimization of environmental risks should be balanced against socio-economic risks. A comparative risk assessment is therefore needed, especially in the context of sustainable development, where countries may face urgent problems with poverty alleviation measures if their limited resources are spent on banning certain polluting activities.

2. Clean production and pollution prevention

The clean production approach addresses the whole production system of products in order to reduce pollution at source (in the production process or product development stage). The activities include, for instance, introducing sustainable product design, bio-based technologies, and consideration of raw material and energy consumed in product creation. Pollution prevention and the reversal of the burden of proof are at the core of clean production. Some international and regional agreements, such as the Helsinki and OSPAR Conventions, have agreed to phase out discharges of hazardous substances into the environment within a stipulated time-frame and within the Baltic Sea region, HELCOM has adopted several 'soft law' recommendations regarding, for example, the application of best available technology in the industrial and maritime sectors.

3. Alternatives assessment

Precautionary approaches are often goal and alternatives oriented, lending themselves to technology innovation, pollution prevention, and impact assessments. Alternatives assessment is a commonly used methodology as well as an underlying component of precaution. The alternatives assessment process seeks to examine a full range of alternatives for achieving a specific purpose and selects the alternative with the least potential impact on human health and ecological systems, including the alternative of doing nothing. An important component of alternatives assessments is the continuous updating of knowledge to avoid harm. Other tools, such as risk assessment and cost-benefit analysis, are used to inform decision-making. In comparison to these techniques, which quantify an 'acceptable' risk, alternatives assessments are used to compare alternatives to an activity (or to establish priorities) – an approach which is much less complex and often more clear cut, requiring less rigorous quantitative analysis and being less uncertain.

Many countries have initiated programmes to investigate alternatives to actions deter-

mined to have potential environmental impacts. Ashford et al. (1993) have developed a structure for chemical accident prevention using a Technology Options Assessment. This scheme requires companies to undertake comprehensive assessments of alternative primary prevention technologies and justify their decision if safer alternatives have not been chosen. The alternatives assessment also requires democratic decision-making processes that are transparent, and structures for involving citizens in decisions regarding science and technology.

4. Reverse-onus chemical listing

Around the world, there is compelling evidence that humans, wildlife, and the environment are suffering the detrimental effects of man-made chemicals. Recognizing that regulatory initiatives are needed to try to prevent harm before it occurs in the future, the precautionary principle has become the focus of attention on both sides of the Atlantic. Proposals in the EU and the US have been put forward to drive the development of information on chemicals and their effects. In Denmark, one proposal would require a chemical to be considered the most toxic in its class if full information on its toxicity was not available – an example of a strict application of precaution. A US proposal would require that all chemicals produced in high volume, for which basic toxicity information does not exist, would be added to the toxics-release inventory for emissions and waste reporting (Tickner et al., 1999: 5–6).

The aims of the new EU Regulation Framework for the Registration, Evaluation and Authorisation of Chemicals (REACH)[30] are to improve the protection of human health and the environment while maintaining competitiveness and enhancing the innovative capability of the EU chemicals industry. Furthermore, REACH will give greater responsibility to industry to manage the risks from chemicals and to provide safety information on the substances – an example of the shifting of the burden of proof concerning risk assessments from the regulator to the producer.[31]

5. Pre-market or pre-activity testing requirements

Nowadays, there are several pre-activity testing requirements for new pharmaceuticals, chemicals, etc. prior to their release onto the market. The large-scale introduction of GMOs during the past decade represents an unprecedented change in the world's food and agricultural systems and has provoked calls, especially in Europe, to develop precautionary actions. To a large extent, debates have surrounded the differing opinions as to the quality of pre-market testing of GM crops. The Cartagena Protocol on Biosafety has been in the forefront when applying precautionary legislation to trade in living modified organisms. Also EU legislation, with regard to GMOs, has been developed largely with a precautionary attitude (see above for a discussion about transatlantic trade disputes resulting from the EC's precautionary approach to GMOs) (Myhr, 2007: 185–96; Christoforou, 2007: 197–228).

6. Ecosystem management

The complexity, and the limited understanding humans have, of natural systems suggests that their management should include a substantial degree of precaution. In many cases, risk assessments and other tools have been unable to predict and/or prevent ecological disasters resulting from human activities, such as unsustainable logging and fisheries. Global biodiversity is declining at an alarming rate, not only due to irresponsible resource management, but also due to the introduction of non-native species, habitat destruction and climate change.

Several treaties are working on the protection of biodiversity with a precautionary attitude

(for example, CBD, 1992; UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, 1995), and resource management as well the development of protected area networks are being addressed at national, regional and global levels. A positive example of cross-sectoral cooperation to reduce threats of alien species invasions can be seen in the development of the Ballast Water Convention under the International Maritime Organization.

6.1. ADAPTIVE MANAGEMENT

Adaptive management is a management tool expressly developed to deal with uncertainty. Adaptive management involves management actions that emphasize reversible management interventions, careful monitoring of impacts, and continual assessment and refinement of management practice as information increases. Some see the precautionary principle and adaptive management as competing approaches, with precaution weighing in favour of 'doing nothing' until an action can be shown to be harmless, and adaptive management favouring controlled interventions which increase understanding of the system in question. However, others view adaptive management as an inherently precautionary strategy as it recognizes that in complex systems the certainty of outcome is impossible and it seeks to create a dynamic regime, capable of responding to unpredictable changes (Benidickson et al., 2005).[32]

Proponents view adaptive management as a primary means by which precaution should be implemented at national and regional levels in conservation and natural resource management. Adaptive management has been adopted by many countries in an attempt to integrate the precautionary approach into their national fisheries policies (Restrepo et al., 1998) and Art. 6(3)a of the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks on the application of the precautionary principle suggests an adaptive management approach.[33]

Ecosystem approach – a revitalization of the precautionary principle?

An ecosystem approach to the management of human activities has cemented a more ecocentric stance when it comes to conserving the environment. While the preventive principle only addresses reductions in pollution loads, the ecosystem approach takes a more holistic view by aiming for a desired status of the environment.

The term 'ecosystem approach' has been defined within the CBD as 'a strategy for integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way' (CBD: Decision V/6). This approach considers the environment as a whole, including the interactive effects from multiple pressures.

Adaptive management is often seen as a key management tool within the broader framework of the ecosystem approach. And, as discussed above, adaptive management can be said to embrace precaution as it is accepting of scientific uncertainty. In expressly tackling the uncertainty and dynamics of complex systems, adaptive management also allows managers to take into account possible regime shifts. As natural ecosystems function independently of human activities, the ecosystem approach and adaptive management aim at managing the human activities that are interconnected with ecosystems and their functioning.

One of the cornerstones of implementing the ecosystem approach is the defining of commonly agreed-upon ecological objectives. Activities to develop ecological objectives that define good ecological status are being carried out by the EU[34] and HELCOM[35] among others. Within HELCOM, the ambitious objectives include: concentrations of nutrients and hazardous substances in the marine environment close to natural levels and natural distribu-

tion and occurrence of marine life. Such objectives, referring to 'natural' conditions, embody an appreciation for the intrinsic value of nature, and as such can also be said to reflect a precautionary attitude.

Concluding remarks

Despite much criticsm around the practical application of the precautionary principle, it is clear that the debates surrounding the issue have also highlighted its value. Whereas criticism has focused on the vagueness of the principle and on the lack of clear guidance on how to implement it in the face of uncertainties and limited scientific understanding, it has also been recognized that rather than requiring a set of rules for its implementation, the application needs to be carried out on a case-by-case basis where value judgements based on moral, cultural, economic and political interests need to be weighed up.

As the perception of joint interdependence on global resources, and the transboundary effects of many human activities, have increased, so to has the realization of the need for joint policies. On this positive note, the precautionary principle has contributed to increasing policy coordination among states. Concerns remain, however, with some actors arguing that the ambiguity associated with the precautionary principle is leading to 'arbitrariness' in policy-making, while others are concerned that unwarranted recourse to the precautionary principle is a disguised form of protectionism and that its overall bias toward safety violates individual rights to have different attitudes towards risk and uncertainty (Maguire and Ellis, 2002: 256–65). Extending this to the international arena, there are likewise differences in preferences and attitudes among negotiating states towards various environmental risks, depending on political, societal, economic and cultural context.

The GMO debate, discussed above, clearly reflects how different preferences and attitudes dictate the use of precaution. In this sense, the precautionary principle can be seen as a barometer for a society's risk aversion (a tolerance threshold of a group or society to risk) to a particular product, process or practice (Ellis and Fitzgerald, 2004). In the United States there has not been public worry about genetically modified food, while in Europe the same issue has stirred public fear and outcry. These societal norms, or cultural preferences, which have been reflected at national and regional levels through the establishment of institutional legal frameworks and commercial adoption of less formal technical product and safety standards, have increasingly come into conflict at the level of international trade (Kogan, 2004: 78). From this perspective, the use of the precautionary principle as a unifying decision rule for environmental policy-making areas is problematic.

Finally, the power of the global economy cannot be ignored when working with the precautionary principle. In many ways, one can view the global market and democracy as challengers of the principle while at the same time seeing the principle as a constraint on economic development. In the business world, high profits are often promised to firms with new and innovative solutions and developments. In pursuit of these benefits, and in the midst of stiff competition, businesses may introduce products/innovations in a great hurry before appropriate risk assessments have been carried out (Gollier and Triech, 2003: 98). Despite recent incentives for industries to come up with 'ecologically competitive products', there is a necessity to further develop economic incentives in order to bring a wider range of sectors and businesses on board when it comes to a precautionary and sustainable approach to development. The precautionary principle cannot be ignored if we are to ensure a quality of life for present and future generations.

Notes

1. In the *Trail Smelter Case,* 1938/1941, Canada was held responsible for damages caused by air pollution produced by a smelter located on its territory. The award recognized that states have an obligation to prevent cross-border pollution.
2. Principle 21 of the 1972 Stockholm Declaration of the United Nations Conference on the Human Environment (Stockholm, Sweden, 5–16 June 1972) and Principle 2 of the 1992 Rio Declaration on Environment and Development of the United Nations Conference on Environment and Development (UNCED) (Rio de Janeiro, 14 June 1992) state that: 'States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction'.
3. It states that 'Discharge of pollutants into natural systems shall be avoided and … special *precautions* shall be taken to prevent discharge of radioactive or toxic wastes' (emphasis added).
4. It states: 'Precautionary measures for air quality control by reduction of emissions at source should also be determined for the protection of the North Sea, based on the best available technology'.
5. It states that 'in order to protect the North Sea from possibly damaging effects of the most dangerous substances, a precautionary approach is necessary which may require action to control inputs of such substances even before a causal link has been established by absolutely clear scientific evidence'.
6. It states that parties are mindful that adverse effects result, or are likely to result, from human activities 'which modify or are likely to modify the ozone layer'. Thus, the parties to the Protocol declared themselves 'determined to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations'.
7. It states:

   > being convinced that damage to the marine environment can be irreversible or remediable only in a long term perspective and at considerable expense and that therefore, Contracting Parties to the Convention must adopt a precautionary approach and not wait for the full and undisputed scientific proof of harmful effects before taking action to prevent and abate pollution.

8. Hereinafter Implementation Agreement, 1995; for a discussion on the precaution and fisheries, see Henriksen (2007: 153–84).
9. Text available at: http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf (last visited on 15 March 2008).
10. Judge Palmer was of the opinion that 'the norm involved in the precautionary principle has developed rapidly and may now be considered a principle of customary international law relating to the environment', see ICJ Reports (1995: 412); and Judge Weeramantry wrote that the precautionary principle is gaining 'increasing support as part of the international law of the environment' (ICJ Reports, 1995: 342).
11. The provisional measures stated that:

    > parties should in the circumstances act with prudence and caution to ensure that effective conservation measures are taken to prevent serious harm to the stock of southern bluefin tuna…. [Although there is] scientific uncertainty regarding measures to be taken to conserve the stock of southern bluefin tuna and… although the Tribunal cannot conclusively assess the scientific evidence presented by the parties, it finds that measures should be taken as a matter of urgency to preserve the rights of the parties and to avert further deterioration.

12. Here Judge Treves states that '… a precautionary approach seems to me inherent in the very notion of provisional measures', and Separate Opinion of Judge Shearer: 'the measures ordered by the Tribunal are rightly based upon considerations deriving from a precautionary approach'. See also: de Sadeleer (2002: 108–9); Freestone (1999: 29–30); Van Dyke (2004: 371–2).
13. For a detailed discussion of the precautionary principle in WTO law, see Kogan (2004: 77–123).
14. *EC Measures Concerning Meat and Meat Products (Hormones), Dispute WT/DS26 and Dispute WT/DS48,* 1996. For more information about the Hormone Dispute, see: http://www.wto.org/English/tratop_e/sps_e/sps_agreement_cbt_e/c5s3p1_e.htm (last visited on 15 March 2008).
15. Article 5.1 on Assessment of Risk and Determination of the Appropriate Level of Sanitary or Phytosanitary Protection states:

    > Members shall ensure that their sanitary or phytosanitary measures are based on an assessment, as appropri-

ate to the circumstances, of the risks to human, animal or plant life or health, taking into account risk assessment techniques developed by the relevant international organizations.

Article 5.2 states that:

In the assessment of risks, Members shall take into account available scientific evidence; relevant processes and production methods; relevant inspection, sampling and testing methods; prevalence of specific diseases or pests; existence of pest- or disease-free areas; relevant ecological and environmental conditions; and quarantine or other treatment.

16. For further information, see de Sadeleer (2002: 103–5); Bridges and Bridges (2002: 167–8).
17. Paragraph 6 of the SPS Agreement Preamble embraces precaution by encouraging harmonization of national SPS measures with international standards without requiring Members to change their sovereignly determined appropriate levels of health protection.
18. Article 3.3 of the SPS Agreement entails a precautionary approach because it explicitly permits Members to adopt SPS measures which are more stringent than measures based on the relevant international standards.
19. Article 5.7 allows Members to take provisional measures when sufficient scientific evidence does not exist to permit a final decision on the safety of a product or process. The provisional measure must take into consideration available pertinent information. The Member adopting the measure must seek to obtain the additional information necessary for a more objective assessment of risk, and must review the SPS measure within a reasonable period of time.
20. For more information, see: http://www.wto.org/English/tratop_e/dispu_e/cases_e/ds48_e.htm (last visited on 15 March 2008).
21. For a summary of the *Biotech Case* and access to the panel report, see: http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds291_e.htm (last visited on 29 March 2007).
22. *EC – Measures Affecting the Approval and Marketing of Biotech Products* – Notification of an Agreement With Respect to Article 21.3(c) of the DSU.
23. For example, the requirement for Members of the WTO to prove that their regulatory decisions are based on scientific evidence resulting from a risk assessment (de Sadeleer, 2007: 4).
24. For a detailed discussion of the legal aspects of the precautionary principle, see Trouwborst (2006).
25. For example, the World Charter for Nature (see *supra* note 8) states that 'where potential adverse effects are not fully understood, the activities should not proceed'.
26. Principle 15 states: 'In order to protect the environment, the *precautionary approach* shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation' (emphasis added).
27. Accessible at http://www.johnsonfdn.org/conferences/precautionary/jord.html (last visited on 30 November 2008).
28. An appropriate example is the work currently being carried out under the HELCOM Baltic Sea Action Plan to identify cost-effective measures to reduce nutrient and hazardous substance inputs to the Baltic Sea from its catchment area.
29. As an example, the UNFCCC states in its Preamble that 'the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions'.
30. Regulation (EC) No. 1907/2006 of the European Parliament and of the Council, of 18 December 2006, concerning the Registration, Evaluation, and Authorisation of Chemicals (REACH), establishing a European Chemicals Agency, in force 1 June 2007.
31. For a discussion on REACH, see Winter (2007: 313–29).
32. Accessible at http://www.ie.uottawa.ca/English/Reports/JBPP_Final_Report.pdf (last visited on 30 November 2008).
33. Article 6(3)a, UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks states that states shall 'improve decision-making for fishery resource conservation and management by obtaining and sharing the best scientific information available and implementing improved techniques for dealing with risk and uncertainty'.
34. For example, EU Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy, adopted 23 October 2000) and the EU Marine Strategy Framework Directive (Directive 2008/56/EC EC of the European Parliament and of the Council establishing a framework for community action in the field of marine environmental policy, adopted 17 June 2008).
35. HELCOM Baltic Sea Action Plan (see: http://www.helcom.fi).

References

Ashford, N.A. et al. (1993), *The Encouragement of Technological Change for Preventing Chemical Accidents: Moving Firms from Secondary Prevention and Mitigation to Primary Prevention*, Cambridge, MA: MIT Press.

Bäckstrand, K. (2002), 'Precaution, Scientisation or Deliberation? Greening Environmental Decision Making', Paper presented at the ECPR Joint Sessions of Workshops, Turin, 22–7 March.

Benidickson, J. et al. (2005), 'Practicing Precaution and Adaptive Management: Legal, Institutional and Procedural Dimensions of Science Uncertainty. Final Report, June 2005', accessible online at www.ie.uottawa.ca/English/Reports/JBPP_Final_Report.pdf.

Birnie, P. and Boyle, A. (2002), *International Law and the Environment*, 2nd edition, Oxford: OUP.

Bridges, J.W. and Bridges, O. (2002), 'Hormones as Growth Promoters: the Precautionary Principle or a Political Risk Assessment', in P. Harremoës et al., *The Precautionary Principle in the 20th Century: Late lessons from Early Warnings*, London: Earthscan, 161–9.

Burns, W.C.G. (2005), 'Introduction', *International Journal of Global Environmental Issues* **5**(1/2), 1–9.

Christoforou, T. (2007), 'Genetically Modified Organisms in European Union Law', in N. de Sadeleer (ed.), *Implementing the Precautionary Principle: Approaches from Nordic Countries, EU and the USA*, London: Earthscan, 197–228.

de Sadeleer, N. (2002), *Environmental Principles: From Political Slogans to Legal Rules*, Oxford: OUP.

de Sadeleer, N. (ed.) (2007), *Implementing the Precautionary Principle: Approaches from Nordic Countries, EU and the USA*, London: Earthscan.

Dimitrov, R.S. (2005), 'Precaution in Global Environmental Politics', *International Journal of Global Environmental Issues* **5**, 96–113.

Dworkin, R. (1978), *Taking Rights Seriously*, Cambridge, MA: Harvard University Press.

Ellis, J. and FitzGerald, A. (2004). The Precautionary Principle in International Law: Lessons from Fuller's Internal Morality, *McGill Law Journal* **49**(3), 779–800.

Ervin, D.E. et al. (2001), 'Transgenic Crops and the Environment: The Economics of Precaution', University Invited Paper, Western Agricultural Economics Association, 10 July, Logan, Utah.

Fleming, D. (1996), 'The Economics of Taking Care: An Evaluation of the Precautionary Principle', in D. Freestone and E. Hey (eds), *The Precautionary Principle and International Law: The Challenge of Implementation*, The Hague: Kluwer Law International, 147–67.

Foster, K.R. et al. (2000), 'Science and the Precautionary Principle', *Science*, 12 May, 979–81.

Freestone, D. (1999), 'Caution or Precaution: "A Rose by any other Name..."?', *Yearbook of International Environmental Law* **10**, 25–32.

Freestone, D. and Hey, E. (eds) (1996), *The Precautionary Principle and International Law: The Challenge of Implementation*, The Hague: Kluwer Law International.

Gollier, C. and Triech, N. (2003), 'Decision-making under Scientific Uncertainty: The Economics of the Precautionary Principle', *Journal of Risk and Uncertainty* **27**(1), 77–103.

Gray, J.S. (1996), 'Integrating Precautionary Scientific Methods into Decision-making', in D. Freestone and E. Hey (eds), *The Precautionary Principle and International Law: The Challenge of Implementation*, The Hague: Kluwer Law International, 133–46.

Harremoës, P. et al. (2002), *The Precautionary Principle in the 20th Century: Late Lessons from Early Warnings*, London: Earthscan.

Henriksen, T. (2007), 'The Precautionary Approach and Fisheries: A Nordic Approach', in N. de Sadeleer (ed.), *Implementing the Precautionary Principle: Approaches from Nordic Countries, EU and the USA*, London: Earthscan, 153–84.

Jordan, A. and O'Riordan, T. (1998), 'The Precautionary Principle in Contemporary Environmental Policy and Politics', Paper prepared for the Wingspread Conference on 'Implementing the Precautionary Principle', 23–5 January 1998, Racine, Wisconsin, accessible at: http://www.johnsonfdn.org/conferences/precautionary/ jord.html.

Kogan, L. (2004), 'The Precautionary Principle and WTO Law: Divergent Views Toward the Role of Science in Assessing and Managing Risk', *Seton Hall Journal of Diplomacy and International Relations* **5**(1), 77–123.

Maguire, S. and Ellis, J. (2002), 'Uncertainty, Precaution and Global Interdependence: Implications of the Precautionary Principle for State and Non-state Actors', in F. Biermann et al. (eds), *Proceedings of the 2001 Berlin Conference on the Human Dimensions of Global Environmental Change 'Global Environmental Change and the Nation State'*, Potsdam: Potsdam Institute for Climate Impact Research, 256–65.

McIntyre, O. and Mosedale, T. (1997), 'The Precautionary Principle as a Norm of Customary International Law', *Journal of Environmental Law* **9**, 221–41.

Mee, L.D. (1996), 'Scientific Methods and the Precautionary Principle', in D. Freestone and E. Hey (eds), *The Precautionary Principle and International Law: The Challenge of Implementation*, The Hague: Kluwer Law International, 109–31.

Myhr, A.I. (2007), 'Uncertainty and Precaution: Challenges and Implications for Science and the Policy of Genetically Modified Organisms', in N. de Sadeleer (ed.), *Implementing the Precautionary Principle: Approaches from Nordic Countries, EU and the USA*, London: Earthscan, 185–96.

Nollkaemper, A. (1996), 'What you Risk Reveals what you Value and Other Dilemmas Encountered in the Legal Assaults on Risks', in D. Freestone and E. Hey (eds), *The Precautionary Principle and International Law: The Challenge of Implementation*, The Hague: Kluwer Law International, 73–94.
O'Riordan, T. (1992), 'The Precautionary Principle in Environmental Management', CSERGE Working Paper PA 92-03.
O'Riordan, T. and Jordan, A. (1995), 'The Precautionary Principle, Science, Politics and Ethics', CSERGE Working Paper PA 95-02.
Petitpierre, A. et al. (2006), 'Trade, the Environment, and the International Regulation of Biotechnology', *Economic Policy and Law, Journal of Trade and Environment Studies* **1**(8), 41 *et seq.*
Pyhälä, M. et al. (2007), 'The Precautionary Principle and the Helsinki Commission', in N. de Sadeleer (ed.), *Implementing the Precautionary Principle: Approaches from Nordic Countries, EU and the USA*, London: Earthscan, 143–52.
Restrepo, V.R. et al. (1998), 'The Precautionary Approach: A New Paradigm, or Business as Usual?', *Our Living Oceans*, 61–80.
Sands, P. (1995), *Principles of International Environmental Law, volume 1: Frameworks, Standards and Implementation*, Manchester: MUP.
Shaw, S. and Schwartz, R. (2005), 'Trading Precaution: The Precautionary Principle and the WTO', *UNU-IAS Report*.
Sunstein, C.S. (2003), 'Beyond the Precautionary Principle', *John M. Olin Law and Economics*, Working Paper No. 149 (2nd series), University of Chicago Law School.
Tickner, J. et al. (1999), 'The Precautionary Principle in Action: A Handbook', accessible at: http://www.biotech-info.net/handbook.pdf.
Trouwborst, A. (2002), *Evolution and Status of the Precautionary Principle in International Law*, The Hague: Kluwer Law International.
Trouwborst, A. (2006), *Precautionary Rights and Duties of States*, Leiden: Martinus Nijhoff Publishers.
Van Dyke, J.M. (2004), 'The Evolution and International Acceptance of the Precautionary Principle', in D.D. Caron and H.N. Scheiber (eds), *Bringing New Law to Ocean Waters*, Leiden: Martinus Nijhoff Publishers, 357–79.
Walker, V.R. (2003), 'The Myth of Science as a "Neutral Arbiter" for Triggering Precautions', *Boston College International and Comparative Law Review* **26**(2), 197–28.
Winter, G. (2007), 'Risks, Costs and Alternatives in European Community Environmental Legislation: The Case of Registration, Evaluation and Authorization of Chemicals (REACH)', in N. de Sadeleer (ed.), *Implementing the Precautionary Principle: Approaches from Nordic Countries, EU and the USA*, London: Earthscan, 313–29.

Cases

Case Concerning the Gabčíkovo-Nagymaros Project (Hungary v. Slovakia), 1997 *ICJ Rep.*, 7.
European Communities – Measures Affecting Meat and Meat Products (Hormones) (WT/DS26, WT/DS48), reports of the Appellate Body and the panels adopted on 13 February 1998.
European Communities – Measures Affecting the Approval and Marketing of Biotech Products (WT/DS291, WT/DS292, WT/DS293), report of the panel adopted on 21 November 2006.
MOX Plant Case (Ireland v. United Kingdom), PCA, Memorial of Ireland of 26 July 2002.
MOX Plant Case (Ireland v. United Kingdom), PCA, Order No. 3 of 24 June 2003.
MOX Plant Case (Ireland v. United Kingdom), PCA, Rejoinder of the United Kingdom of 24 April 2003.
Nuclear Tests Case (New Zealand v. France), 1974 *ICJ Rep.*, 457.
Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court's Judgment of 20 December 1974 in the Nuclear Tests Case (New Zealand v. France), 1995 *ICJ Rep.*, 288.
Southern Bluefin Tuna Cases (New Zealand v. Japan) and (Australia v. Japan), ITLOS, Award on Jurisdiction and Admissibility of 4 August 2000.
Southern Bluefin Tuna Cases (New Zealand v. Japan) and (Australia v. Japan), ITLOS, Order for Provisional Measures of 27 August 1999.
The MOX Plant Case (Ireland v. United Kingdom) (2001), ITLOS, Order for Provisional Measures of 3 December 2001.
Trail Smelter Case (United States of America v. Canada), 1941, *RIAA* **III**, 1905.

Treaties and documents

Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2000), *ILM* **39**, 1027.
Commission of the European Communities (2000), 'Communication from the Commission on the Precautionary Principle, Brussels, 2 February 2000', COM(2000)1, accessible at: http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf.
Convention for the Protection of the Marine Environment of the Baltic Sea Area, Helsinki (1974), *ILM* **13**, 546.
Convention for the Protection of the Marine Environment of the Baltic Sea Area (1992), reprinted in R. Wallace

(1994), *The Marine Mammal Commission Compendium*, Washington, DC: United States Government Printing Office, 1493.
Convention for the Protection of the Marine Environment of the North-East Atlantic (1992), *ILM* **32**, 1072.
Convention on Biological Diversity (1992), *ILM* **31**, 818.
Declaration of the International Conference on the Protection of the North Sea, Bremen (1984), accessible at: http://www.seas-at-risk.org/1mages/1984%20Bremen%20Declaration.pdf.
Declaration of the Second International Conference on the Protection of the North Sea, London (1987), accessible at: http://www.seas-at-risk.org/1mages/1987%20London%20Declaration.pdf.
Declaration on the Protection of the Marine Environment of the Baltic Sea Area (1988), accessible at: http://www.helcom.fi/stc/files/MinisterialDeclarations/MinDecl1988.pdf.
European Parliament and Council, EU Water Framework Directive – Framework 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (2000), EC Framework Directive 2000/60/EC.
European Parliament and Council (2006), EC Regulation No. 1907/2006 of the European Parliament and of the Council, of 18 December 2006, concerning the Registration, Evaluation, and Authorisation of Chemicals (REACH), establishing a European Chemicals Agency, EC Regulation No. 1907/2006.
European Parliament and Council, EU Marine Strategy Framework Directive – Directive 2008/56/EC of the European Parliament and of the Council establishing a framework for community action in the field of marine environmental policy, of 17 June 2008, accessible at: http://eur-lex.europa.eu/LexUnServ/LexUnServ.do?uri=CELEX: 32008L0056:EN:NOT.
International Convention for the Control and Management of Ships Ballast Water and Sediments (2004), accessible at: http://www.imo.org/home.asp?flash=false.
International Convention for the Control and Management of Ships Ballast Water and Sediments (2004), accessible at: http://www.imo.org/TCD/mainframe.asp?topic_id=867.
Ministerial Declaration on the Protection of the Marine Environment of the Baltic Sea area, Helsinki (1988), accessible at: http://www.helcom.fi/stc/files/MinisterialDeclarations/MinDecl1988.pdf.
Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) (1987), *UNTS* **15**, 3; *ILM* **26,** 1550.
Rio Declaration on Environment and Development (1992), *ILM* **31**, 874.
Stockholm Convention on Persistent Organic Pollutants (2001), *ILM* **40**, 532.
Stockholm Declaration of the United Nations Conference on the Human Environment (1972), UN Doc. A/Conf.48/14.
Treaty Establishing the European Community as Amended by Subsequent Treaties (Treaty of Rome) (1957), *UNTS* **298**, 11.
United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (1995), *ILM* **34**, 1542.
United Nations Convention on the Law of the Sea (UNCLOS) (1982), *ILM* **21**, 1261.
United Nations Framework Convention on Climate Change (1992), *ILM* **31**, 849.
World Charter for Nature (1982), *ILM* **22**, 455.
World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (1994), *UNTS* **1867**, 493.