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The Precautionary Principle in International Environmental Law (die): Foundations, Legal Scope, and Conditions for Implementation

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ABSTRACT

The precautionary principle is an important component of international environmental law because it guides public decision-making when scientific evidence indicates a risk of serious or irreversible harm, even though the available evidence does not establish that risk with certainty. This article revisits the principle's historical and legal foundations, its distinction from prevention, its main international formulations, and the conditions for its practical implementation. The study employs doctrinal and documentary analysis of international instruments and institutional materials, including the 1992 Rio Declaration, the Convention on Biological Diversity, the Cartagena Protocol on Biosafety, and the European Commission's 2000 Communication. The analysis finds that precaution is neither a blanket prohibition on risky activities nor a demand for absolute scientific proof of harmlessness. Rather, it calls for structured risk assessment, proportionate, non-discriminatory, transparent, and reviewable measures, and monitoring as scientific knowledge evolves. Its legal effect depends on the applicable instrument, its wording, the institutional context, and domestic

implementation. The article concludes that effective precaution requires sound expertise, public participation, traceable decisions, and stronger scientific and regulatory capacity, particularly in countries with limited resources.

Keywords: precautionary principle; international environmental law; scientific uncertainty; risk assessment; sustainable development; future generations.

1. INTRODUCTION

Earth-destroying and human-destroying productivism continues its march; and, a priori, it is not a principle of God that will stop it. It can, however, help to slow it down.

Optimism of the will is not forbidden; as the saying goes, it is better to light a candle than to curse the darkness.

Advances in scientific knowledge go hand in hand with increasing uncertainties regarding environmental protection: the pessimism of reason is plain to see—provided one opens one's eyes.

A principle of law is a general norm of primary importance, generally unwritten, accepted by the collective legal consciousness at a specific time and place as the foundation of the statutory provisions in force. It applies even in the absence of statutory texts. It is not created by the judge during the adjudication of a dispute. It is discovered through experience in the wake of environmental disasters.

In the field of environmental protection, the wording of each article of a convention constitutes a principle. Environmental law has gradually developed through its own major principles, ensuring its autonomy and enabling it to rise to the level of other branches of law. The precautionary principle is one such principle and serves as a mechanism for better managing uncertainties.

Decisions regarding the environment are often made in situations where the consequences of an activity are not fully known.

The effects of human activities can be delayed, cumulative, transboundary, or difficult to reverse: water contamination, damage to biodiversity, disruption of ecosystems, risks associated with certain technologies, or changes to the climate system.

In these circumstances, waiting for complete scientific certainty can lead to taking action too late. The precautionary principle addresses this dilemma by allowing action to be taken based on sufficiently plausible scientific evidence, even when uncertainty remains.

The existing literature emphasizes foresight, responsibility toward future generations, and the need to avoid using the lack of certainty as an excuse for inaction. These ideas are consistent with Principle 15 of the Rio Declaration on Environment and Development, which states that States should apply the precautionary approach widely, in accordance with their capabilities, and should not use the lack of complete scientific certainty as a reason to delay economically effective measures in the face of threats of serious or irreversible damage (United Nations, 1992).

The principle is not, however, limited to a moral exhortation. Its wording and effects must be assessed in light of the applicable texts.

The Rio Declaration is a declaration of principles and not a treaty as such; nevertheless, certain formulations of the precautionary principle appear in conventions or protocols that create obligations for the parties.

The Convention on Biological Diversity recognizes, in its preamble, that a threat of significant reduction or loss of biological diversity must not be dismissed solely on the grounds that science does not provide complete certainty (United Nations, 1992a).

The Cartagena Protocol stipulates, with regard to certain decisions concerning living modified organisms, that a lack of scientific knowledge should not prevent a decision aimed at avoiding or reducing potential adverse effects (CBD Secretariat, 2000).

The main question is therefore: How can the precautionary principle guide a legally sound, scientifically responsible, and proportionate decision in the face of environmental uncertainty? The overall objective of this article is to clarify the principle's foundations, scope, and conditions for implementation. More specifically, the aim is to: (i) trace its international recognition; (ii) clarify its content and how it differs from the principle of prevention; (iii) examine its main areas of application and its effects; and finally (iv) identify its limitations and the safeguards necessary to prevent arbitrary application.

The study is of both theoretical and practical interest. Theoretically, it helps distinguish the precautionary principle from related concepts such as prudence, prevention, and liability. Practically, it offers a useful analytical framework for public authorities, courts, businesses, civil society

organizations, and communities exposed to environmental risks.

It highlights the fact that the present generation serves merely as a stepping stone for the responsible and honest transmission of a legacy a healthy environment, unencumbered, clear, and free from any burdens that would make its enjoyment difficult for the heirs, future generations and, consequently, to avoid fatally jeopardizing the survival of humanity.

Rather than scrambling to keep up with environmental disasters, this principle commits to anticipating the unfortunate and uncertain events looming on the horizon, so as to address them and resolve them upstream if not to prevent them altogether.

2. METHODOLOGY

This analysis is part of a doctrinal legal study based on the qualitative analysis of documents. It does not involve field research or an original statistical methodology. Its findings are therefore the result of legal interpretation and a synthesis of the literature, rather than empirical measurements.

2.1 Document Corpus

The main corpus includes the Rio Declaration on Environment and Development (1992), the Convention on Biological Diversity (1992), the Cartagena Protocol on Biosafety (2000), and the African Charter on Human and Peoples' Rights (1981); the European Commission's communication on the precautionary principle (European Commission, 2000); the Montego Bay Convention (MBC) on the Law of the Sea; the Convention on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (New York, 1995); the Danube Convention (Sofia, 1994); Convention on Transboundary Watercourses (Helsinki, 1992); Conventions on the North-East Atlantic (Paris, 1992); Framework Directive No. 2008/98/EC (on waste, November 19, 2005). These sources were selected because of their relevance to the definition of the principle, its inclusion in international instruments, and the procedural safeguards for its implementation.

The secondary literature includes scholarly works, notably those by Beck (2001), Brown and Weiss (1993); Michel PRIEUR (2001); Treich (1997), Beurrier J-P (2010); Charbonneau (1992); Eckard RAHBINDER (1996); WINTER, G. (2001); KOURILSKY, Ph. (1999); LAVIEILLE, Jean-Marc (2010); and Remond GOULOUD (1992).

2.2 Method of Analysis

The analysis consisted of four steps: first, the identification of relevant legal provisions; second, a comparison between declaratory texts and treaty instruments; third, an examination of decision-making logic in situations of uncertainty; and, finally, an assessment of the limitations related to evidence, proportionality, institutional capacities, and the risk of abuse.

The provisions were interpreted within their context, distinguishing between their legal value and their political scope.

2.3 Methodological Limitations

The research is limited by the documentary nature of the corpus and by the heterogeneity of the principle's formulations across the various instruments.

3. RESULTS

3.1 Origins and International Recognition

The origins of the precautionary principle can be traced to three distinct periods: - the age of certainty, the 15th century, on the night of April 14–15, 1912 (–1945), when the giant ship Titanic deemed perfect by humanity sank to the bottom of the ocean; - the era of doubt, August 6–9, 1945 (–1986), with the effects of the bombings of Hiroshima and Nagasaki; - the era of precaution, April 26, 1986 (–to the present day), during the Chernobyl nuclear disaster.

The precautionary principle developed in response to the limitations of a risk management approach that would wait for harm to be demonstrated before authorizing public action. Its history is often associated with the German tradition of Vorsorge, and subsequently with its adoption in European and international environmental policies.

While dangers are generally prohibited, the same does not apply to risks. Risks cannot be ruled out because there will always be a probability of at least some harm. Risks can be mitigated. While legislation prohibits dangerous actions but does not prohibit risk mitigation, the precautionary principle is applied, which requires reducing the extent, frequency, or uncertainty of harm (Gerd WINTER, 2001).

Risks are simultaneously real and unreal. On the one hand, we observe threats and destruction that are already very real: water pollution or depletion, deforestation, the emergence of new diseases, etc.; on the other hand, the true social power of the risk argument lies precisely in the danger we project into the future.

In the risk society, the precautionary principle is worth its weight in gold, for the past loses its decisive role in shaping the present. The future takes its place, and thus something "non-existent"—something constructed—becomes the "cause" of experience and action in the present (Ulrich BECK, 2001).

The irreversibility of certain damages to the natural environment and to animal and plant species necessarily affects future generations. Therefore, public or private decision-making must systematically take into account its direct and indirect long-term effects (M. Remond Gouloud, 1992; E. Brown Weiss, 1993).

This is justified by the legal consequence of assuming long-term responsibility and the recognition of the rights of future generations, which can be interpreted as a duty for present generations to protect the environment over the long term by preserving the assets of the common heritage.

This is because environmental policy is not limited to the elimination or reduction of existing or imminent pollution (protection against danger), but rather aims to combat pollution from the outset (protection against mere risk) and ensures that natural resources are utilized on the basis of sustainable yield (Eckard Rahbinder, 1996). The precautionary principle is currently an indispensable reference point in all approaches to risk (Michel PRIEUR, 2001).

It would, however, be simplistic to attribute its origins to a single event: rather, it is the result of legal, scientific, and political developments in response to technological risks, persistent pollution, and potentially irreversible damage.

The 1992 Rio Declaration represents a key milestone. Its Principle 15 combines four elements: - the threat of serious or irreversible harm; complete scientific uncertainty; - the possibility of taking action before certainty is achieved; and - the adaptation of action to the capacities of States.

The reference to "economically efficient" measures emphasizes that precaution must be part of a reasoned decision, not an automatic reaction to any hypothetical danger (United Nations, 1992).

The precautionary principle also appears in sector-specific instruments. The preamble to the Convention on Biological Diversity addresses the threats of significant reduction or loss of biodiversity.

The Cartagena Protocol makes this approach more operational in the context of transboundary movements of living modified organisms, particularly through its provisions on import decisions and risk assessment (CBD Secretariat, 2000).

In Europe, the European Commission proposes a decision-making framework that emphasizes scientific assessment, proportionality, non-discrimination, consistency, consideration of the benefits and costs of action or inaction, and the review of measures in light of new data (European Commission, 2000).

At the African regional level, Article 24 of the African Charter on Human and Peoples' Rights recognizes the right of peoples to a satisfactory and comprehensive environment conducive to their development (OAU, 1981). This provision does not, on its own, establish a detailed precautionary regime, but it strengthens the normative framework within which States must protect the environment

In the DRC, Article 11 of Law No. 11/009 of July 9, 2011, on the fundamental principles relating to environmental protection, explicitly includes the precautionary principle among the fundamental guidelines binding on public authorities and human activities.

In Gabon, Article 3 of Law No. 2014 on Environmental Protection stipulates that the absence of scientific or technical certainty must not hinder public action in the face of a risk of serious and irreversible harm;

In Côte d'Ivoire, Framework Law No. 96-766 establishing the Environmental Code places the precautionary principle at the heart of the obligations to take proactive measures for the preservation of the natural environment and biological diversity.

3.2 Constituent Elements of the Principle

An analysis of the body of literature highlights five elements that underpin a precautionary decision.

- First, there must be a plausible threat, not merely a speculative fear.

- Second, the anticipated harm must be sufficiently serious or irreversible under the applicable law.

- Third, the available knowledge does not allow for a complete characterization of the risk or its causal link.

- Fourth, uncertainty does not necessarily preclude action: it may justify provisional or adaptive measures.

- Fifth, the measures must be justified, proportionate, and reviewed as knowledge evolves.

The precautionary principle therefore does not require proof of the absolute absence of any risk before any activity is undertaken. Such a requirement would make many public or private decisions nearly impossible. Conversely, it does not allow for justifying any restriction by vaguely invoking uncertainty. The authority must clearly explain the feared danger, the available scientific evidence, the gaps in knowledge, the options considered, and the reasons why the chosen measure is appropriate.

3.3 Distinction Between Prevention and Precaution

Unlike the principle of prevention, with which it is often closely conflated, the precautionary principle does not require that the risk be established. It is sufficient that the risk be suspected. In other words, while certainty of ecological harm implies adopting a preventive approach, uncertainty calls for precaution. Precaution is, therefore, a more stringent form of prevention, adopted in a context of uncertainty.

Prevention relates to proven risks, whereas precaution relates to potential risks. In the case of precaution, as a principle, the focus is on the probability that the hypothesis is correct, whereas in the case of prevention, the danger is established and the focus is on the probability of an environmental accident.

In short, prevention generally concerns risks that are sufficiently well-established that their causes, effects, or probability are known with a reasonable degree of confidence. Precaution comes into play when there remains relevant scientific uncertainty regarding the nature, extent, or probability of harm, but the possible consequences justify taking action in advance.

The two principles are complementary: prevention reduces known risks; precaution ensures that uncertainty is not used as a pretext to indefinitely postpone any action.

This distinction is functional rather than absolute. Knowledge may evolve, and a risk that was initially uncertain may become sufficiently well-established to fall primarily under the realm of prevention. Similarly, a precautionary measure may involve monitoring requirements and generate new data that can then be used to adjust regulations.

The adaptive approach thus links science, decision-making, and reassessment.

3.4 Implementation Procedure

Violation of the principle is subject to penalties, both criminal and even civil, including the award of damages. This is a correct application a logical expression of the polluter pays principle through which the precautionary principle is applied and enforced with authority.

The rigorous implementation of the principle can be organized into the following seven complementary steps:

- Identify the activity, the exposed environment, the affected populations, and the possible routes of exposure.
- Describe the potential harm, considering its severity, extent, duration, reversibility, and cumulative effects.
- Conduct an accessible and independent scientific assessment, explicitly indicating missing data, assumptions, and disagreements among experts.
- Compare the options: conditional authorization, reduction of the activity, containment, enhanced monitoring, a limited moratorium, or a ban when the legal framework and the evidence justify it.
- Select a measure that is proportionate, consistent with measures applied in comparable situations, and non-discriminatory.
- Justify the decision and ensure its transparency, with public participation where applicable laws so provide, and establish oversight mechanisms.
- Monitor the effects, set a deadline for review, and adapt or lift the measure in light of new knowledge.

This procedure reflects the spirit of the European Commission's communication (2000), which holds that the precautionary principle must be integrated into a structured decision-making process.

Scientific expertise must not be confused with political decision-making: scientists characterize the data, uncertainties, and scenarios, while the competent authority assumes responsibility for selecting and justifying the measure taken.

3.5 Areas of Application and Legal Scope

The principle applies in a world where there are doubts and questions; where scientific knowledge is called into question.

In this world of precaution, there is a dual source of uncertainty: the hazard itself and the lack of definitive scientific knowledge about it.

Precaution, then, aims to manage the wait for information. It arises from the gap between the immediate need for action and the point at which our scientific knowledge will change (Nicolas TREICH and GREMAQ, 1997).

The principle applies to everything related to life. Its scope has far exceeded the realm of the environment; it has even become a guide for action regarding genetically modified organisms, consumer health, and food safety. The principle is applied in several areas, notably biodiversity conservation, chemical management, risks associated with living modified organisms, climate change, and the protection of marine environments.

In the Cartagena Protocol, for example, the precautionary principle is linked to specific procedures for the assessment and decision-making regarding living modified organisms; it does not constitute a general authorization to disregard any evidence or procedure.

It is also important to distinguish the legal authority of different texts. A treaty binds the States that are parties to it in accordance with its provisions and the applicable rules of treaty law. A declaration, such as the Rio Declaration, does not have the same legal status as a treaty, even though it may guide interpretation, influence national legislation, and contribute to the development of international law.

With its general nature—inherent in environmental protection principles—it attempts, to some extent, to anticipate and prepare for the occurrence of events. The principle has targeted the uncertainty stemming from the short- or long-term consequences of the earth-destroying and human-destroying productivism of human activities, making uncertainty its primary focus and main cause. To achieve this, it draws on the imperfection that underlies scientific knowledge—especially that of scientists inflated with pride: "Science has made us experts in God before we deserved to be human beings."

The Rio de Janeiro Declaration appears less demanding than the World Charter for Nature, which originated in United Nations General Assembly Resolution 37/7 of 1982, according to an environmental law specialist. Tullio SCOVAZZI argues that "in the face of human activities, two approaches are taken: either we prioritize risk prevention—if I don't know what might happen, I must not act; or we prioritize, in a frankly excessive manner, risk and the acquisition of knowledge at any cost—if I don't know what might happen, I can act and, in the end, know what I've done." This renowned thinker continues: "A very interesting development in modern thought is embodied in the precautionary principle. This principle is not merely a generic call for caution aimed at protecting the environment. On the contrary, it has a more specific meaning, intended to provide guidance on the decisions to be made in cases where the environmental effects of a given activity are not yet fully understood from a scientific standpoint" ("On the Precautionary Principle in International Environmental Law," Rivista di Diritto Internazionale LXXV/699–705, fasc. 3, Milan: Giuffre Editore, 1992, cited by Brazilian Professor Paulo Affonso Leme Machado, 2017, Environmental Law, Master's 2 Course, University of Limoges / France, Option 2: Comparative International Environmental Law, p. 12).

Uncertainty often lies in the future, which greatly broadens the scope of the principle. It primarily concerns technological risks. It also covers natural risks, such as monitoring a dormant volcano or the emergence of a new pathogen.

There are two variations in the application of the principle:

- The first version is moderate and makes certain concessions to proponents of economic growth, in the name of economic development.
- The second, more stringent and more extreme version, permits an activity only if absolute certainty unshakable proof of the absence of harmful effects has been established by internationally renowned scientists.

It applies in both criminal and civil law, through the payment of damages.

3.6 Key Contributions

The first contribution is temporal: the principle allows for action to be taken before the harm is fully established, which is essential when the damage may be irreversible. Certain texts that provide for this principle state that:

- "To protect the environment, precautionary measures must be widely applied by States in accordance with their capabilities. Where there is a risk of serious or irreversible damage, the lack of full scientific certainty should not be used as a reason for postponing effective measures to prevent environmental degradation" (Principle 15 of the Convention on Biological Diversity, 1992).
- "… (…) when the potential harmful effects of such activities are not fully understood, they should not be undertaken" (Article 11(b) of the World Charter for Nature, October 28, 1982).

- "Signatory governments must apply the precautionary principle, that is, take measures to prevent the potentially harmful impacts of substances, even when there is no scientific evidence of a causal link between emissions and their effects" (Interministerial Declaration, 2nd Conference on the Protection of the North Sea, 1987).
- A declaration adopted by 137 states following the Second World Climate Conference (November 17, 1990) states: We cannot wait for scientific certainty before taking immediate measures to reduce greenhouse gas emissions.
- Article 4, paragraph 3(f), of the Bamako Convention (January 29, 1991), which prohibits the importation of hazardous waste into Africa, adopts the precautionary principle by stipulating: "without waiting for scientific proof" of the risks involved.

The second is epistemic: it requires that the limits of knowledge be made explicit rather than concealed.

The process of applying this principle begins with a risk analysis, a highly delicate and costly undertaking.

The procedure requires that we not settle for vague assumptions which a passive, noncommittal attitude would generally accept but instead calls for expert assessments that are often lengthy and costly.

In applying the precautionary principle, economic and social analysis offers additional value by providing a set of data and perspectives that can be integrated into benefit/risk and cost/benefit analyses.

Here, costs and benefits are understood in a broad sense and not merely in financial terms. Such an analysis has the merit of encouraging serious and in-depth reflection that situates risk within a broader context, which should promote a comprehensive management of certain risks.

Some authors believe that activities and substances capable of seriously damaging the environment must be regulated, even if no evidence of such a risk exists a priori. Others believe it is necessary to place the burden of proof on the organization (NGO) or the government considering a hazardous activity, requiring them to demonstrate that the proposed activities would not cause harm to the environment.

The third approach is institutional: it promotes coordination among experts, regulatory authorities, operators, and the public.

- Applying this principle means either refraining from action that is, fulfilling a contractual obligation to abstain and forgo any uncontrolled action or taking legal and other measures to limit future adverse effects on the environment and on human and animal health.
- It must be strongly emphasized that the longer we wait to legislate on a risk, the more difficult it becomes to do so. The longer we wait to resist, the less capable we are of saying no or challenging the status quo. Are not our paths of good intentions sometimes paved with successive acts of surrender?
    - The fourth principle is intergenerational: it encourages us to take long-term consequences into account and not to make future generations bear the costs of a present decision that was insufficiently informed (Brown & Weiss, 1993).
- In the text of Agenda 21, Chapters 17 and 18, on the protection of oceans and seas, including coastal zones, this principle is set forth in point (d) of Chapter 17, which states: "…take preventive measures and appropriate precautions in the planning and implementation of projects, including prior assessment and systematic monitoring of incidents related to major projects."
- Furthermore, Chapter 17-29 continues, "With regard to the physical destruction of coastal and marine areas leading to degradation of the marine environment, priority should be given to controlling and preventing erosion and siltation caused by human activities, particularly by land-use practices and construction methods. Effective watershed management practices should be promoted to prevent, contain, and reduce the degradation of the marine environment. Preventive action and measures to combat marine environmental degradation caused by offshore activities."

This principle can also encourage research, environmental monitoring, and data collection. It does not replace impact assessments or liability regimes, but can complement them by justifying precautionary measures and more careful monitoring. In this sense, it is less a substitute for science than a framework for making honest decisions when science cannot yet provide definitive answers.

4. DISCUSSION

4.1 A Decision-Making Standard Rather Than a Principle of Absolute Abstention

The Rio formula addresses threats of serious or irreversible harm and provides for implementation in accordance with the capabilities of States. The European Commission's communication (2000) also emphasizes proportionate measures and the consideration of the consequences of both action and inaction.

The precautionary principle therefore entails an obligation to exercise sound judgment and due diligence, but the specific content of this obligation varies depending on the applicable text and the circumstances. In some cases, it may lead to the suspension of an activity; in others, to authorizing it under certain conditions, imposing monitoring, limiting discharges, or requesting additional information. The decision must be able to explain why the chosen option addresses the identified risk.

The binding nature of the principle cannot, therefore, be asserted uniformly across all contexts without examining the relevant legal source. However, it should not be understood as a recommendation to refrain from action, but rather as an obligation to refrain, as is evident from the case law of the European Court of Human Rights in the Zender v. Sweden judgment.

4.2 Scientific Uncertainty and the Quality of Expertise

The principle is not a miracle cure for productivism, nor is it a futility to be dismissed as a useless trifle. It represents the appropriate approach to take when faced with a poorly understood or unknown risk—a kind of political and ethical guide. It is a legal principle with legal effects that must be subject to legal oversight and enforcement.

Uncertainty is not synonymous with a total lack of knowledge. It may concern the probability of harm, the causal relationship, the magnitude of the effects, their geographic distribution, or the time it takes for them to manifest.

Best practice involves characterizing these uncertainties and presenting several scenarios rather than reducing the discussion to a dichotomy between certainty and ignorance.

Independent expertise, transparency in methods, and the disclosure of conflicts of interest strengthen the legitimacy of the decision.

The precautionary principle must not be misused to impose a conclusion without a scientific basis, nor should it be paralyzed by a demand for certainty that is impossible to achieve. It requires a documented threshold of plausibility and an explicit assessment of potential severity. The scientific debate can remain open while still allowing for temporary and revisable measures.

4.3 Proportionality, Transparency, and Participation

A precautionary measure can have significant economic and social effects. It must include certain safeguards, including proportionality, non-discrimination, transparency, and public participation in the authority's decision-making process.

Proportionality requires weighing the protection objectives, the severity of the feared harm, the expected effectiveness of the measure, less restrictive alternatives, and the consequences of delay.

Non-discrimination requires that comparable situations be treated consistently, unless there is an objective justification.

Transparency requires that the reasons, data, and uncertainties be made available to the extent compatible with applicable rules.

Public participation is particularly important when risks affect livelihoods, health, or the shared resources of communities.

The Rio Declaration, Principle 10, links environmental management to access to information, participation, and access to justice (United Nations, 1992).

These safeguards are not incidental: they can reveal overlooked exposures, relevant local knowledge, or distributional consequences that technical expertise alone does not uncover.

4.4 Limitations and Risks of Abuse

The principle is not a miracle cure for productivism, nor is it a futility to be dismissed as a useless formality. It represents the appropriate approach to take when faced with a poorly understood or unknown risk—a kind of political and ethical guide.

Four main limitations emerge from this analysis.

- First, legal formulations vary and do not create the same obligations everywhere.

- Second, the quality of the assessment depends on the available scientific resources, data, and institutional independence.

- Third, measures can be exploited to favor certain economic interests or arbitrarily restrict activities.

- Fourth, uncertainty may persist for a long time, making it necessary to establish a schedule for review and criteria for adjusting decisions.

Resolutions, recommendations, declarations, action plans, and the like—the fact remains that some of these non-binding texts, or "soft law," can be of great importance. They can become established within the international community as rules of conduct; they can be incorporated into other texts as customary rules of international law. They can also be transformed, in whole or in part, into treaty rules, with the principles they set forth being incorporated into treaties.

As an example, one need only consider certain principles proclaimed in the Stockholm and Rio de Janeiro declarations, or even certain chapters of the Stockholm Action Plan and Agenda 21 adopted in Rio de Janeiro. These consist of principles, and principles are the laws of the parties.

From this perspective, the precautionary principle has a promising future, for in the event of conflicts between competing overriding interests, the environment need not systematically take a back seat; rather, being on equal footing depending on the circumstances, it must compel these other overriding interests to yield. It can naturally apply to both public entities and private companies, and is, from now on and forever, an indispensable reference point in discussions regarding environmental risks.

The principle alone does not determine the burden of proof in each legal dispute. This issue depends on the relevant legal framework, procedural rules, and applicable legislation. Similarly, a violation of the principle does not automatically trigger civil or criminal penalties: liability requires a legal basis, conditions for enforcement, and, where applicable, proof of the elements required by applicable national or international law.

4.5 Challenges for States with Limited Capacities

The requirement to apply the precautionary principle "in accordance with the capabilities" of States, as set forth in Rio Principle 15, underscores the fact that available resources are unequal.

This disparity should not be used to justify inaction, but it calls for technical and financial cooperation, access to data, the strengthening of laboratories, training for government agencies, and the networking of scientific institutions.

In contexts where monitoring resources are limited, simple measures—such as inventories of risk sources, supervised community monitoring, transparency in permitting, and publication of results—can help improve early detection.

Resolutions, recommendations, declarations, action plans… the fact remains that some of these non-binding texts—so-called "soft law"—can nonetheless be of great importance. They can become established within the international community as rules of conduct; they can be incorporated into other texts as customary rules of international law. They can also be transformed, in whole or in part, into treaty rules, with the principles they set forth being incorporated into treaties.

For example, one need only consider certain principles proclaimed in the Stockholm and Rio de Janeiro declarations, or even certain chapters of the Stockholm Action Plan and Agenda 21 adopted in Rio de Janeiro. These consist of principles, and these principles are the laws of the parties.

For the Democratic Republic of the Congo and other biodiversity-rich countries, the challenge is to integrate the precautionary principle with environmental assessment, permitting systems, pollution control, the protection of natural areas, and community rights. This integration requires a fact-based foundation specific to each project and cannot be replaced by a mechanical transposition of foreign models.

CONCLUSION

The analysis and interpretation presented here confirm that the precautionary principle is a key tool of international environmental law for managing serious or irreversible risks when scientific knowledge remains incomplete.

The enshrinement of the principle in the Rio Declaration and its incorporation into sector-specific instruments demonstrate its influence, while also underscoring that its legal force and implementation procedures must be established on the basis of each relevant text.

The principle differs from prevention in the role it assigns to uncertainty, but the two approaches are complementary. Precaution does not mean that every uncertain activity must be prohibited, nor that authorities can act without justification. It calls for a rigorous assessment, a proportionate measure, a transparent decision, the participation of affected parties when required, and a mechanism for monitoring and review.

To enhance the effectiveness of this principle, authorities should: (1) clearly explain the risk and uncertainties; (2) draw on independent and diverse expertise; (3) compare several options and their consequences; (4) publicly justify the chosen measure; (5) establish monitoring indicators and a timeline for review; and (6) strengthen scientific cooperation and regulatory capacity.

Understood in this way, the precautionary principle is not a general obstacle to development, but a responsible decision-making method aimed at preventing the absence of certainty from leading to harm that could have been limited or avoided.

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