

The Applicability of the Precautionary Principle in International Investment Disputes: Science, Law, and Human Rights

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Abstract: Against the backdrop of deepening globalization, international investment activities have surged, and environmental issues and disputes have become increasingly complex. Discussing the applicability of the precautionary principle will provide new ideas for the resolution of future disputes. This paper adopts a multidimensional analysis method, comprehensively exploring the applicability of the precautionary principle in international investment disputes from the perspectives of science, law, human rights protection, and sustainable development. The advancement of technology has laid a solid foundation for the application of this principle. From the legal perspective, the precautionary principle has been widely adopted by international treaties and domestic legislation. Moreover, it is linked to the obligation to protect human rights and aligns with the goals of achieving sustainable development and maintaining global environmental security. Therefore, the application of the precautionary principle in international investment disputes is necessary.

Keywords: Precautionary Principle; International Law; International Investment; Scientific Uncertainty; International Environment

1. Introduction of the Issue

In recent years, the number of international investment disputes increases rapidly, not only in traditional energy and mining sectors but also in modern technology, service industries, and infrastructure construction. Transnational investment activities in these fields have become increasingly frequent, leading to a rise in cross-border environmental damage incidents. Global environmental crises have become significant issues affecting human life safety and quality of life. As countries place

greater emphasis on protecting their environmental interests, finding a balance between safeguarding investors' rights and ensuring environmental sustainability has become an urgent issue to address.

Everyone may live in a risk society due to the transformation of conflicts. The purification of technological rationality has given rise to the socialization of ecological risks, and the precautionary principle, which is inherent in this context, has value and utility in breaking through the traditional mindset of "no harm, no relief" in environmental protection. It has gained ample application in environmental justice. Amidst the context of a risk society, the precautionary principle's status as customary international law within the realm of international environmental law has progressively become distinct and solidified. As a key tenet of environmental jurisprudence, the precautionary principle is designed to implement preventative actions to prevent or reduce potential harm to the environment when there is a lack of scientific certainty. Despite this, its implementation has encountered numerous obstacles. This paper seeks to scrutinize the viability of applying the precautionary principle within the context of international investment disputes, employing a multifaceted examination that encompasses scientific, legal, and human rights viewpoints.

2. Analysis of the Scientific Basis

2.1 The Increasing Prominence of Environmental Issues in International Investment Disputes

Environmental issues have become increasingly complex in recent international investment arbitration disputes, primarily due to the ecological damage caused by resource development activities. On a physical level, large-scale mining, oil, and natural gas development often lead to extensive land occupation and significant changes in the

landscape. Heavy metals accumulated in the soil from mining operations may pose a threat to agricultural production and food safety; untreated industrial wastewater discharged into water systems weakens the ecological functions of water quality; and air pollution continues to exacerbate the negative impacts of global climate change. The integrity of ecosystems is compromised by the encroachment and destruction of habitats for wildlife and plants due to resource development, leading to a loss of biodiversity; excessive logging and the transformation of wetlands significantly reshape the original ecological structure, weakening the mechanisms for ecological resilience and the maintenance of biodiversity. The trend of global warming may be further worsened by resource development activities.

Beyond the environmental harm inflicted during the operational phase of investments, the ecological damage resulting from resource exploitation activities, along with the residual environmental issues that persist after project shutdowns or exits, can exert adverse effects on the local ecological conditions. This includes improper disposal of waste, excessive emission of pollutants, or leaving behind unaddressed environmental pollution and ecological scars during the withdrawal process after the termination of investment projects, such as abandoned mines and factory ruins. All these can affect the environmental sustainability and overall ecological health of the host country, creating diverse environmental challenges in the area. Most of these hazards stem from investors' disregard for the host country's environmental regulations and standards, and their impact extends to the ecological environment and welfare of citizens of the host country, potentially triggering a chain reaction at the global environmental level.

The legal complexity of environmental issues in international investment arbitration disputes often manifests as the superposition of multiple legal relationships. These include the contractual and legal obligations between investors and host countries, the legal procedural relationships between investors and international arbitration tribunals, and the obligations of host countries to commit to and implement environmental protection within the framework of international law. Since

environmental damage typically has a long-term cumulative nature, it is often difficult for people to easily identify the chain of causal relationships and quantify the extent of damage, and it is also challenging to collect and assess evidence of environmental damage. In practice, these factors also increase the difficulty of the tribunal's judgment. Moreover, as environmental issues are public concerns that affect the welfare of all citizens and ecosystems, they often conflict with investors' goals of maximizing economic benefits. This inherent conflict between public interest and private rights is particularly evident in international investment arbitration disputes, where the arbitration tribunal needs to protect the legitimate rights and interests of investors while also taking into account and safeguarding the environmental public interests of the host country and the world to maintain a fair and reasonable balance.

2.2 The Response of the Precautionary Principle to Environmental Issues

In the face of complex environmental issues triggered by investments, international investment arbitration tribunals and governments of various countries need to fully consider the scientific connotations of the precautionary principle when making decisions and formulating policies, striving to achieve a balance between pursuing economic benefits and maintaining global environmental interests. The scientific basis for the precautionary principle in the resolution of international investment disputes primarily stems from a deepened understanding of the potential environmental and social risks associated with investment activities, as well as an in-depth comprehension of scientific uncertainty in the context of technological progress. Faced with imminent and increasingly complex ecological crises, the public and nations cannot wait for scientific development to ultimately eliminate this *de facto* uncertainty. Therefore, it is necessary to make decisions quickly, "deciding in the face of unknown dilemmas." [1] Tracing the inception and evolution of the precautionary principle, the risk regulatory activities that it covers are primarily divided into two components: the evaluation of risks and the governance of those risks. [2] Among these, the environmental risk assessment triggered by investment activities is the main

practical form of the precautionary principle. The implementation and operation of investment projects, especially transnational investments, may have profound impacts on the environment of the host country and even the global environment, which has attracted much attention. Thus, the environmental risk assessment of investment activities is also an obligation that investing countries and investors should undertake in international investment agreements and international environmental law. Risk assessment is usually a prerequisite procedure that investing countries and investors must fulfill before initiating a project to identify and assess the potential environmental impacts of the investment project, especially those with cross-border characteristics and potential significant environmental damage. Specifically, the environmental risk assessment of investment activities covers the potential environmental impacts throughout the entire life cycle of the investment project, including but not limited to air, water, soil pollution, loss of biodiversity, and exacerbation of climate change, among various environmental dimensions. As an important concept under the precautionary principle, scientific uncertainty plays a particularly crucial role in this process—even the most advanced technology and scientific knowledge cannot provide absolutely certain predictions for all environmental risks. Therefore, based on the precautionary principle, decision-makers can take precautionary measures even when scientific evidence is insufficient, as long as there are sufficient reasons to believe that there are potential significant environmental risks.

The development of scientific prediction technology also meets the needs of the precautionary principle in international investment practice. The rise of emerging technological methods such as big data, artificial intelligence, and remote sensing monitoring allows people to more accurately simulate and estimate the environmental impacts caused by investment activities. International investment arbitration institutions, when dealing with cases involving environmental risks, have also begun to refer to and rely on the data and analysis provided by these scientific prediction technologies to judge the rationality of environmental regulation measures in individual cases,

whether they constitute indirect expropriation, and other issues.

Environmental economics further establishes a scientific foundation for employing the precautionary principle in the realm of international investment. In the context of environmental concerns, even in the absence of definitive scientific proof that certain investor actions pose specific risks, the irreversible nature of potential harm and the substantial expenses associated with damage rectification suggest that the benefits of proactive measures often outweigh the costs of reactive management. The costs here include but are not limited to the direct costs incurred by investors taking preventive measures, the additional costs brought by alternative technologies or operational models, the loss of economic benefits from abandoning behaviors that may pose environmental risks, and the potential costs of environmental restoration and payment of claims. The benefits are understood as the positive effects generated by avoiding environmental damage, such as the protection of ecosystems, the sustainable use of natural resources, and the avoidance of economic losses and social costs caused by environmental issues. Scholar Gollier also links the precautionary principle with decision-making in the face of uncertainty through the concept of option value, arguing that under conditions of environmental risk uncertainty, new information about the future will to some extent force decision-makers to adopt more cautious strategies in the short term. In other words, in the face of scientific uncertainty, decision-makers should adopt flexible means to deal with potential future risks, such as postponing project development to delay decision-making until sufficient scientific information is obtained [3]. Cost-benefit analysis can not only assist investors and host countries in strategy selection but also serve as an important tool for decision-makers to judge the legitimacy of actions in international judicial practice. For example, in some cases, arbitration tribunals will assess whether the financial burden imposed on investors by the host country's implementation of environmental protection policies exceeds the actual prevention effect of environmental risks, or whether it complies with the cost-effective principle.

In summary, the scientific basis for the

application of the precautionary principle in international investment disputes includes not only the adaptation to the current state of technological development but also an objective recognition and assessment of the environmental risks of investment behaviors, as well as the recognition of the necessity of forward-looking decision-making under conditions of scientific uncertainty. Scientific methods and economic cost-benefit analysis have provided strong support for the scientific nature of the precautionary principle in the resolution of international investment disputes and have also laid a scientific foundation for the prevention and control of environmental risks in investment.

3. Analysis of the Legal Basis

3.1 Gradual Acceptance at the International Law Level

The precautionary principle, as a legal concept (Vorsorgeprinzip), originated in Germany and was initially used as a criterion for judging the fairness of political decisions. With its integration into German legal frameworks and subsequent refinement through legal proceedings, the principle progressively matured, becoming a cornerstone of Germany's environmental legal and policy landscape. [4] Later on, during the inaugural North Sea Conference for Marine Environmental Protection in 1984, the German administration put forth the precautionary principle as a key objective for negotiation. From that point forward, this principle has become a recurring theme in a multitude of international agreements, forums discussing unresolved scientific environmental concerns, and within the sustainability strategies as well as national legislations across various countries. [5]

In 1992, the principle was formally recognized in the United Nations' Rio Declaration on Environment and Development, henceforth known as the "Rio Declaration," signifying a pivotal moment in the global acknowledgment of the precautionary principle within international environmental law. Article 15 of the Rio Declaration mandates: "To safeguard the environment, nations are encouraged to widely implement precautionary actions aligned with their capabilities. The absence of complete scientific certainty should not serve as a justification for deferring necessary

actions to avert environmental deterioration, especially when faced with the prospect of severe or irreversible harm." Moreover, agreements including the Convention on the Conservation and Utilization of Transboundary Watercourses and International Lakes, the United Nations Framework Convention on Climate Change, and the Stockholm Convention on Persistent Organic Pollutants have all embraced the precautionary principle. Within the sphere of trade, while the WTO pacts have not overtly integrated the precautionary principle, its essence has emerged as a significant element in the discourse on trade and environmental concerns, with certain clauses in specific agreements reflecting its influence. In the European Union, the precautionary principle holds an even higher legal status. In 1992, the Maastricht Treaty established the precautionary principle as one of the foundations of the EC's environmental policy, stating in Article 174(2) under the environmental heading. This move is considered the codification of the precautionary principle in the EU, elevating the principle to the level of a constitutional objective of the Union. Currently, the precautionary principle is reflected in numerous international environmental legislative documents, both comprehensive and specialized. Their commonalities mainly focus on the following three points: (1) highlighting the importance of the precautionary principle for environmental protection and enhancing awareness of environmental pollution prevention; (2) requiring the active adoption of appropriate preventive measures to prevent environmental pollution; (3) not delaying the implementation of preventive measures due to a lack of sufficient scientific evidence. The differences mainly lie in: (1) the focus on different environmental risks depending on the field of environmental issues; (2) the preventive measures to be taken vary according to different environmental issues [6,7].

The implementation mechanism of Precautionary Principle has guided environmental law from preventive regulation towards risk prevention regulation, acting as a driving force for change in international environmental regulation policies. The principle has gradually been accepted by international tribunals and courts in practice

and serves as a key principle in handling environmental dispute cases. It requires countries to adopt a cautious attitude and preventive measures when there is a clear risk of environmental damage and scientific uncertainty, in order to avoid potential serious environmental harm. Although some international courts have debated whether the Precautionary Principle can be an absolute legal obligation during case trials, this also reflects that in the absence of definitive scientific evidence, the principle can be considered as one of the standards for measuring the reasonableness of environmental protection measures taken by countries. In international investment dispute cases, arbitration tribunals also discuss the application of the Precautionary Principle when adjudicating the allocation of environmental responsibilities between investors and host countries, to determine whether the preventive measures taken by the host country violate investment agreements in the absence of sufficient scientific evidence.

The Precautionary Principle, as a guiding principle for risk regulation in environmental law, not only provides a basis for value judgment in risk decision-making but also serves as a source of legitimacy for risk measures. This makes it clear that the type, applicable conditions, and key points of the Precautionary Principle are prerequisites for decision-makers to determine when to apply the principle and to determine the extent of risk regulation measures to be taken. The principle is applicable when the degree of risk is serious or irreversible damage. It is one of the important aspects that distinguishes the Precautionary Principle from the prevention principle, that is, when there is uncertainty, measures should still be taken to prevent the occurrence of risks to avoid irreversible and irreparable damage. Therefore, when risks that may cause serious harm or irreversible damage to human health arise, risk regulation measures should be taken under the guidance of the Precautionary Principle to prevent environmental pollution or hazardous substances from causing irreparable damage to human health. On the contrary, when the degree of risk is low, corresponding preventive measures can be taken to regulate based on risk assessment and other research results. The Precautionary Principle is applicable when

there is a reasonable determination of the degree of risk. Before applying the Precautionary Principle, a relatively complete risk standard system should be established to clarify what standards can be identified as significant risks. It is important to clarify that risk standards should be formulated on the basis of reasonable doubt, rather than relying solely on scientific evidence. At the same time, risk standards are different from environmental protection standards and health standards, but are regulations that clearly define risk levels by comprehensively measuring multiple factors such as the level of technological development, social needs, and economic development status. Lastly, when integrating the Precautionary Principle into environmental health law regulation, a comprehensive analysis of environmental health information obtained in risk management and risk communication should be made based on risk assessment and environmental health surveys. Moreover, based on scientific evidence and research results, risk-benefit analysis should be carried out to take risk regulation measures within a reasonable range, rather than regulating potential hazards regardless of cost. The goal of environmental health risk regulation is to effectively reduce the damage or harm caused by environmental pollution to public health through the formulation and implementation of risk regulation measures, to avoid serious and irreparable public health damage, rather than eliminating all potential risks.

The Precautionary Principle has emerged as a leading legal doctrine within the domain of environmental health law, and indeed, it is garnering equal or even heightened interest and endorsement in other sectors characterized by substantial scientific ambiguity and elevated risk levels, including the arena of climate change mitigation. The theoretical basis of the Precautionary Principle in the field of environmental health law regulation is evident in the introduction of the weak risk prevention concept, and it is also reflected in the clear applicable conditions, scientific value judgment standards, and operational considerations based on this. Ensuring that risk decisions and regulatory measures form a dynamic balance between legality and rationality is an important goal of environmental health risk regulation. Therefore, the application of the Precautionary Principle

in environmental health law regulation needs to be based on prudent reasonable doubt to prevent "over-prevention" or "ineffective prevention." The institutionalization of the Precautionary Principle in the field of environmental health law regulation should be carried out based on four aspects: policy basis, technical basis, project management, and judicial relief. Among them, environmental health planning, which often appears in the form of policy, is an overall protective measure for environmental health risk regulation, providing a framework for the effective application and connection of other systems; the risk assessment system is the technical guarantee for environmental health risk regulation, providing a basis for the formulation, decision-making, and application of standards; environmental health impact assessment is a beneficial means to reduce and prevent project risks, and it is also the most implementable necessary measure; preventive environmental public interest litigation constructs an institutional bridge between environmental health risks and their transformation into actual damage and the Precautionary Principle, achieving effective and beneficial communication and cooperation between prevention and remedy.

3.2 Adoption and Practice at the Domestic Law Level

Within the realms of national legislation and the judiciary's domestic application, the Precautionary Principle has been progressively embraced and operationalized within legal proceedings. For instance, Belgium's "Marine Environmental Protection Act" explicitly requires consideration of the Precautionary Principle in marine environmental activities. The domestic legislation of Australia and Canada also emphasizes the importance of the Precautionary Principle in guiding the formulation and implementation of environmental protection policies against the backdrop of ecological sustainable development. Costa Rica has gone further to incorporate the Precautionary Principle into its "Basic Environmental Law." Several domestic courts in different countries have cited the Precautionary Principle in adjudicating environmental tort cases. The Precautionary Principle serves as the cornerstone of all provisions in the "Swedish Environmental

Code," with extensive use of terminology related to precautionary measures, and the entire law reflects the spirit of this principle [8]. It is evident that, despite variations in the legal status and specific implementation standards of the Precautionary Principle across different countries and regions, it has already established a considerable foundation in legal practice, both internationally and domestically. Looking ahead, with the growing salience of environmental concerns and the ongoing quest for sustainable development by the global community, the Precautionary Principle is poised to evolve into a pivotal component in shaping the legal frameworks for environmental governance both internationally and domestically, thereby offering robust legal safeguards for the protection of the environment.

In terms of the Precautionary Principle's position within the framework of international law, there exist viewpoints that regard it as an emerging norm of customary international law, whereas other academics see it as a core principle of international environmental law [9]. The "Statute of the International Court of Justice" under Article 38 delineates customary international law, characterizing it as a general practice that is accepted as such [10]. Despite the Precautionary Principle's presence in numerous treaties, it currently does not have a definition that is universally acknowledged, nor does it have a set of guidelines for its application. Practically, even though the 2010 decision in the Pulp Mills on the River Uruguay case indicated that the principle of preventing harm is a customary international law rule, originating from the obligation of diligence, such instances are relatively few, and the principle is not yet backed by extensive state practice or widespread acceptance, which complicates the assertion that the Precautionary Principle is a customary international law principle [11]. Consequently, a more prevalent scholarly perspective is that "this principle has not yet attained the status of customary international law and is in the process of developing into one."

4. Application of the Precautionary Principle in Human Rights and Sustainable Development

4.1 Fulfillment of Human Rights Protection

Obligations

The legal justification for employing the Precautionary Principle encompasses the host nation's duty to safeguard human rights. The menace of climate change extends widely and deeply across human society, impacting not just the present populace but also the prospects for subsequent generations. The Human Rights Committee has acknowledged that climate change represents "an imminent and severe risk to the capacity of both current and future generations to realize their right to life." This underscores that climate change has evolved beyond a simple environmental issue, now entwining with the imperative to preserve basic human rights.

Considering the critical and pressing nature of climate change, nations are duty-bound to embrace a precautionary stance, implementing essential regulatory steps to mitigate additional threats of climate-related harm. The Committee on Economic, Social and Cultural Rights' admonition underscores this imperative—In 2018, this Committee alerted nations that the omission of preemptive actions to guard against climate change-induced human rights violations might be seen as a breach of the duty to shield human rights from climate change repercussions, encompassing measures to preserve the right to life from "encroachments by individuals or entities." As a result, it is imperative for countries to implement suitable legal and regulatory measures, in line with the Precautionary Principle, to guarantee that all operations within their territories and under their governance—encompassing the commercial endeavors of corporations registered or overseen by them—adhere to the stipulations of Article 6 of the International Covenant on Civil and Political Rights. In this regard, countries bear the onus, in light of their international legal commitments, to oversee investor conduct to avert or minimize the role or intensification of climate change and its anticipated detrimental effects on human rights.

4.2 Integration with the Principles of Sustainable Development and the Common Interest of Humanity

The application of the Precautionary Principle reflects its synergistic mechanism with the core concepts of international environmental policy—the principle of sustainable

development and the principle of the common interest of humanity.

The principle of sustainable development pursues an intergenerational balance of development across temporal dimensions, requiring humans to meet current socio-economic needs while treating the long-term maintenance of the environment and the carrying capacity of ecosystems with comprehensive and prudent attention. It is essential to ensure that the present-day actions of humanity do not inflict enduring, severe harm on the environment that future generations will inhabit. Within the sphere of global investment, this tenet urges both investors and policy architects to transcend a myopic focus on immediate financial gains when evaluating the fiscal advantages of investment ventures. Instead, they must thoroughly contemplate the enduring consequences for the ecological setting and the communities affected throughout the entire duration of the project. In this context, the Precautionary Principle acts as a conduit and link, translating the enduring perspective of sustainable development into tangible environmental conservation efforts. It directs the trajectory of international investment to account for ecological durability and societal obligations alongside the quest for economic profitability. In essence, the Precautionary Principle's advocacy for preemptive actions in the face of scientific uncertainty to preempt potential ecological harm is a tangible execution of sustainable development's ethos.

The principle of the common interest of humanity focuses on the integrity and interdependence of the Earth's ecosystems, emphasizing that in the face of global environmental issues, countries should go beyond their territorial and sovereign boundaries to view and address environmental challenges from a global perspective. In the process of pursuing economic prosperity and social progress, they should jointly bear the responsibility of maintaining global environmental security and ecological balance. In the field of international investment, the principle of the common interest of humanity requires countries to not only protect and promote the legitimate rights and interests of domestic and foreign investors when exercising their sovereign rights but also to incorporate the maintenance of the common

welfare of the global environment into their decision-making and actions. The application of the Precautionary Principle helps countries make legal and policy decisions that reflect their commitment to global environmental protection, achieving a coordinated unity of the exercise of sovereignty, the protection of investors' rights and interests, and environmental protection. This, in turn, promotes the development of international investment activities towards a more sustainable and environmentally friendly direction, providing strong support for building a fairer, more harmonious, and sustainable international investment environment.

Sustainable development and the principle of the common interest of humanity form the foundation for the realization of the Precautionary Principle, and the close integration of the Precautionary Principle with these principles is not only a specific manifestation of the deep interweaving of international law and environmental policy but also a strong guarantee for promoting the continuous improvement of the global environmental governance system and achieving a trinity balance of economic, social, and environmental sustainable development. By integrating these principles into the decision-making and implementation process of investment activities, the international community is committed to building a new model of global environmental governance that can meet the development needs of the present while ensuring the quality of life for future generations.

5. Conclusion

This paper has delivered a thorough examination of the foundational underpinnings for applying the Precautionary Principle within the context of settling disputes arising from international investments. It has highlighted the principle's critical importance across various dimensions, including scientific understanding, legal frameworks, the safeguarding of human rights, and the pursuit of sustainable development goals. Propelled by the forces of globalization, there has been a steady rise in international investment endeavors, coupled with a growing complexity in environmental challenges and associated disputes. This trend significantly underscores the pressing need for, and the time-sensitive

relevance of, the Precautionary Principle in international legal discourse.

From a scientific perspective, the Precautionary Principle offers a pragmatic framework for dealing with scientific uncertainty, allowing for the adoption of preventive measures in the face of incomplete information to prevent or mitigate potential environmental harm. The rapid advancement of technology has laid a solid scientific foundation for the implementation of the Precautionary Principle. Within the legal framework, the Precautionary Principle has been extensively recognized and integrated into both international environmental agreements and national laws, solidifying its role as a fundamental element of global environmental jurisprudence. During the adjudication of disputes in international investment, arbitral panels are more frequently considering this principle to guarantee that investment practices uphold environmental integrity and avoid causing lasting harm, thus maintaining ecological balance and sustainability. In terms of human rights, the Precautionary Principle is intricately connected with the state's duty to safeguard human rights. Considering the challenges that environmental concerns, including climate change, present to the safeguarding of human rights, there is an onus on nations to implement essential precautionary actions. This is to shield the rights of current and future populations from potential violations. Through the lens of sustainable development and the collective well-being of humanity, the Precautionary Principle emerges as a crucial instrument for realizing objectives of sustainability and upholding the security of the global environment. It calls for a comprehensive approach by investors and policymakers that prioritizes ecological conservation and societal duties, alongside the quest for economic prosperity, to ensure the enduring and equitable stewardship of our planet's environmental resources.

To conclude, the implementation of the Precautionary Principle within the realm of international investment disputes is essential and of immediate importance. It necessitates that the global community, along with investors and host nations, embrace a more cautious and proactive stance in decision-making. This approach is aimed at fostering a

symbiotic relationship between economic progress and the preservation of the environment. As we look to the future, with environmental concerns gaining greater visibility and the pursuit of sustainable development objectives by the international community, the Precautionary Principle is poised to assume a more pivotal function in the governance of the global environment. It is anticipated to lay a robust legal and ethical groundwork for the establishment of an international investment milieu that is equitable, cohesive, and enduringly sustainable.

References

- [1] Xiaodong Dou. The Dual Logic of the Compilation of the Ecological Environment Code and Its Development. *Chinese Social Sciences*, 2024, 3: 146-165.
- [2] Peng Zhao. The Administrative Law Response to the Risk Society: Centered on the Regulation of Health and Environmental Risks. China University of Political Science and Law Press, 2018: 145-148.
- [3] Gollier C., N. Treich. Decision-Making Under Scientific Uncertainty: The Economics of the Precautionary Principle. *Journal of Risk and Uncertainty*, 2003, 27(1):99.
- [4] WHITESIDE K H. Precautionary politics. Principle and practice in confronting environmental risk. MIT Press, 2006:145-153.
- [5] Ting Yu. The Precautionary Principle and Its Application in the Prevention and Control of Air Pollution in China. *Environmental Ecology*, 2023(5):108.
- [6] Jiangeng Zhu. A Study on the Precautionary Principle in Marine Environmental Protection. Doctoral Dissertation, China University of Political Science and Law, 2005:11.
- [7] Hui Jia, "A Study on the State Responsibility for Environmental Protection in International Investment," Doctoral Dissertation, China University of Political Science and Law, 2021: 55.
- [8] Rubenson S. The Swedish Environmental Code . *European Environmental Law Review*, 1999 (12) : 328-332.
- [9] Xi Wang. *International Environmental Law*. Law Press, 1998:116.
- [10] Ian Brownlie. *Principle of Public International Law*. Cambridge University Press, 2003:5.
- [11] Catherine Tinker, "State responsibility and the Precautionary Principle", in David Freestone and Ellen Hey (eds), *The Precautionary Principle and International Law: the Challenge of implementation*, Kluwer Law International, 1996:53.