Economics, Law and Policy
ISSN 2576-2060 (Print) ISSN 2576-2052 (Online)
Vol. 8, No. 2, 2025
www.scholink.org/ojs/index.php/elp

Original Paper

The Response of the Codification of the Eco-Environmental Code to the "Mainstreaming of Biodiversity" Objective in the GBF

Xilai Li[1]

[1] Xiangtan University, XiangTan, China

Received: September 12, 2025 Accepted: September 19, 2025 Online Published: October 2, 2025

doi:10.22158/elp.v8n2p178 URL: http://dx.doi.org/10.22158/elp.v8n2p178

Abstract

The subsequent international negotiations of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework are approaching. China's ecological civilization construction is advancing vigorously, and the draft of the Ecological Environment Code has been formulated for public consultation. Against the backdrop of these critical historical milestones, both domestic and international processes resonate with the priority area of "biodiversity mainstreaming" outlined in the National Biodiversity Strategy and Action Plan (2023-2030). The content of this priority area mainly involves two major directions: establishing a legal and regulatory system related to biodiversity, and drafting regulations on access and benefit-sharing of biological genetic resources. To meet the localized objective of "biodiversity mainstreaming," the Ecological Environment Code, which is philosophically grounded in "harmonious coexistence between humans and nature," must also respond to issues related to this priority area. This includes formulating rules on benefit-sharing of digital sequence information on genetic resources and establishing a "biodiversity credit market mechanism." Such measures will not only promote the integrated development of ecological civilization construction and biodiversity conservation in China but also help shape the international discourse on China's concept of "ecological civilization."

Keywords

ecological civilization construction, Kunming-Montreal Global Biodiversity Framework, digital sequence information on genetic resources, Ecological Environment Code

1. Introduction

Originating from the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, the Convention on Biological Diversity (CBD) has, over more than 30 years of development, progressively established key objectives including "the conservation of biological diversity," "the sustainable use of its components," and "the fair and equitable sharing of the benefits arising out of the utilization of genetic resources." At the fifteenth meeting of the Conference of the Parties (COP15), China put forward consensus-building concepts such as "ecological civilization," "exploring a path of harmonious coexistence between humans and nature," "working together to build a community of all life on Earth," and "a community with a shared future for humanity." China also announced the establishment of the Kunming Biodiversity Fund to address funding challenges faced by developing countries in implementing the Convention and played a leading role in the successful adoption of the "Kunming-Montreal Global Biodiversity Framework" (GBF) and a package of associated decisions. This has resulted in a combined and diversified system of international biodiversity law characterized by "convention-protocol-framework" interactions and a blend of "hard law and soft law." The Kunming-Montreal Global Biodiversity Framework (GBF) also supports the revision and update of China's "National Biodiversity Strategy and Action Plan" (hereinafter referred to as the "Strategy and Action Plan"), the implementation of concrete action targets, and the normative preparation on specific issues to enable localized regulatory responses. In particular, Priority Area (Mainstreaming Biodiversity) under Chapter 4 of the "Strategy and Action Plan" proposes the establishment of a policy and regulatory system for biodiversity, especially through the research and drafting of regulations on access to and benefit-sharing of biological genetic resources. Currently, a draft of the "Ecological Environment Code" has been prepared for public consultation. Within this draft, the sections on ecological conservation and legal responsibilities are expected to respond to the content related to the "mainstreaming biodiversity" priority area outlined in the "Strategy and Action Plan," which is aligned with the CBD-GBF structure. Particular attention should be given to issues such as digital sequence information on genetic resources.

2. Issues Related to the "Mainstreaming of Biodiversity" Objective: Core Controversies Over Benefit-Sharing

Prior to the adoption of the Kunming-Montreal Global Biodiversity Framework, developing countries insisted on suspending negotiations until progress was made on financial issues. These financial issues include matters related to digital sequence information (DSI) on genetic resources. This indicates that the issue of DSI cannot be overlooked in the process of achieving the "mainstreaming of biodiversity" objective. Furthermore, China's National Biodiversity Strategy and Action Plan (NBSAP) lists benefit-sharing of traditional genetic resources as Priority Area 3 (Action 19). However, this does not fully encompass the scope of the issue. Therefore, the NBSAP also incorporates this matter into Priority Area 1 (Priority Action 1: Policy and Legal Framework for Biodiversity). Thus, it is essential

to clarify the issue of benefit-sharing related to DSI on genetic resources in the context of the "mainstreaming of biodiversity" objective.

2.1 Controversies over Benefit-Sharing Mechanisms for Traditional Genetic Resources

At the COP6 meeting in The Hague in April 2002, the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of Their Utilization were adopted, establishing the Prior Informed Consent (PIC) system. However, developing countries argued that the objectives of the Convention on Biological Diversity (CBD) could not be effectively implemented, particularly in preventing the unjust appropriation of benefits from genetic resources. The CBD lacked appropriate mechanisms to curb illegal transnational bioprospecting activities. Moreover, as a soft law instrument, the Bonn Guidelines are not legally binding on Contracting Parties. Subsequently, at COP10 in 2010, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity (hereinafter referred to as the "Nagoya Protocol") was adopted, introducing "The Aichi biodiversity Targets."

From a phased perspective, the Nagoya Protocol incorporated relevant experience from the Bonn Guidelines, particularly regarding the scope of protected subjects. In addition to genetic resources, it also extends to traditional knowledge associated with genetic resources. As a hard law instrument, it explicitly establishes the obligation for user countries to ensure that utilization within their jurisdiction complies with the requirements of the Protocol. It is elevated to the status of hard law, explicitly establishing that resource-user states are also obligated to ensure that resource use within their jurisdiction complies with the provisions of the protocol. However, the fulfillment of these obligations—specifically, how compliance is ensured—still requires the development and operation of a subsequent, fully elaborated compliance mechanism. The significance of the Nagoya Protocol lies in several aspects. First, it clarifies the transnational nature of genetic resources. Second, it imposes more detailed obligations on both provider and user countries, aiming to strike a balance. Additionally, the interests of non-governmental organizations and groups, particularly academic and research institutions, are given greater attention, and they are to be treated differently from commercial users. Unfortunately, the disclosure requirement strongly advocated by provider countries was not incorporated into the final text.

In summary, the fundamental point of contention regarding access to genetic resources and benefit-sharing is that genetic resources have increasingly become the material basis for developed industrialized countries to obtain patents or new plant and animal varieties, while developing countries have derived minimal benefits from this process. Consequently, developing countries have begun to emphasize national sovereignty over biological genetic resources. Since the inception of the CBD, after nearly two decades of intense negotiations and compromises, a fragile international framework for access to genetic resources and benefit-sharing—the Access and Benefit-Sharing (ABS) mechanism—has ultimately been established.

2.2 Controversies over Establishing a Benefit-Sharing Mechanism for Digital Sequence Information on Genetic Resources

The information and communication technology revolution in the digital age has fundamentally transformed how people connect and interact, bringing about radical changes in production and lifestyle, and leading to profound social shifts. Data itself, as a new factor of production, now directly participates in the production process, altering the traditional way value is created. Digital Sequence Information on Genetic Resources is a product of this data era. It also directly engages in production processes and has changed conventional value-creation methods, thereby impacting the fragile international regime on access to genetic resources and benefit-sharing. Of particular concern is the issue of "Digital-mediated Bio-piracy of Biological Resources."

DSI, as an operational entity of genetic information in digital space, possesses the characteristics of accountability, specificity, and transfer-ability. The rapid growth in the volume of DSI has directly spurred the emergence of a new data-driven research paradigm for scientific discovery in the life sciences. The application of DSI has expanded the boundaries of understanding life sciences and given rise to numerous emerging bio-industries, such as drug design, vaccine development, and genetic testing. From the perspective of biodiversity conservation, access to and utilization of DSI can provide new research avenues and more technological options for the protection and sustainable use of genetic resources, as well as for bio-security management and risk prevention. Specifically, DSI holds significant application value in areas such as the description and identification of biodiversity, biological classification, monitoring habitat changes, invasive species monitoring and early control, tracking illegal trade, determining product origin, planning conservation management, mitigating risks to threatened species, crop breeding and improvement, maintaining crop genetic diversity, pest control, and understanding pollination patterns.

The impact of DSI on the international regime for access to genetic resources and benefit-sharing is manifested in several ways: First, there is the challenge of identifying the source of sequences and defining the original providers. Genetic digital sequence information often cannot be traced back to a specific biological source, and this issue becomes more complex as sequences are modified. Second, monitoring digital sequence information is far more difficult than monitoring traditional genetic resources, as the origin of sequences can be obscured over time through modifications. Third, valuing DSI is problematic—the value derived from individual sequences is difficult to quantify. Digital sequences can be regularly modified and reused indefinitely, raising questions about benefit-sharing for each transaction they generate.

Although a subsequent decision adopted at COP16 formally established a multilateral mechanism for benefit-sharing from DSI, including the creation of the "Cali Fund" to ensure the equitable distribution of benefits arising from the utilization of DSI, challenges remain. The mechanism stipulates that users of digital sequence information on genetic resources should contribute 1% of their profits or 0.1% of their revenue, as an indicative scale, to the global fund, based on their size. This model also includes

provisions for non-monetary benefit-sharing and terms for entities operating databases, tools, and models that rely on DSI. However, developed countries advocate for open access, while developing countries emphasize national sovereignty and benefit-sharing, leading to ongoing conflicts in negotiations. Moreover, the current DSI benefit-sharing mechanism lacks legal enforce-ability, relying instead on voluntary implementation by contracting parties. Its effectiveness, including the scale of the fund and the distribution of benefits, will require periodic evaluation in the future.

3. Prerequisites for Achieving the "Mainstreaming of Biodiversity" Objective in the Kunming-Montreal Framework

3.1 Ideological Foundation: Shaping International Discourse on "Harmonious Coexistence between Humans and Nature"

As the president of COP15, China centered the conference around the theme "Ecological Civilization: Building a Shared Future for All Life on Earth." This philosophy, which prioritizes the common interests of all humanity, holds the moral high ground and helps counteract narrow national interests, compelling all parties to collaborate on addressing global issues.

However, Western countries, leveraging their inherent influence in international institutions, continue to dominate the global discourse on systemic environmental solutions and green governance. Influenced by counter currents such as anti-globalization, populism, and trade protectionism, some Western nations exhibit skepticism, resistance, and exclusion toward China's concept of ecological civilization governance. This is particularly evident in divergent understandings of "ecocentrism" within ecological civilization construction. Western "ecocentrism" emphasizes placing the overall interests of ecosystems above human interests, representing a critical reconstruction based on "rights-based" thinking. In contrast, China's interpretation of ecological relations leans toward a political philosophy of "harmonious coexistence between humans and nature," reflecting a relational approach focused on "balanced symbiosis."

Therefore, China's theory of socialist ecological civilization is structured around the organic unity of historical materialism's political economy and philosophical research paradigms. Through COP15 and the Kunming-Montreal Framework, China has attempted to reshape the international discourse on global environmental solutions and green governance. Specifically, it aligns with the green theories of ecological justice advocated by other developing countries while offering "Chinese wisdom" as an option to bridge the "North-South divide" and establish a more just and equitable global environmental governance order. Under the guidance of China's international discourse system of "ecological civilization" as "harmonious coexistence between humans and nature," the mainstreaming of biodiversity is expected to achieve further substantive progress. More importantly, this provides the ideological prerequisite for realizing China's goal of "mainstreaming biodiversity."

3.2 Policy Framework Prerequisite: Constructing a Legal and Regulatory System for Biodiversity

The Kunming-Montreal Framework builds on the provisions of the CBD and also touches upon the Cartage Protocol on Bio-safety and the Nagoya Protocol. Its innovations lie in its concepts, form, logic, and content, which collectively advance the mainstreaming of biodiversity conservation and sustainable use to varying degrees. Among its action targets, Target 13 explicitly calls on countries to establish or strengthen legal and regulatory frameworks related to biodiversity as appropriate. In response to Target 13 of the Kunming-Montreal Framework, China has revised its National Biodiversity Strategy and Action Plan (NBSAP). Chapter 4, Priority Area one (Priority Action 1), explicitly emphasizes the need to develop a policy and legal system for biodiversity. Priority Action outlines a three-pronged approach: improving coordinated mechanisms for biodiversity conservation, establishing joint promotion mechanisms for biodiversity conservation and governance in key strategic regions, and constructing a "1+N" policy system for biodiversity governance. Under this national policy layout, it is essential to first examine China's existing legal system and stay updated on legislative and scientific developments to address current challenges effectively.

China has already enacted laws such as the Yangtze River Protection Law, the Yellow River Protection Law, the Qinghai-Xizang Plateau Ecological Protection Law, and the Wetland Protection Law. These laws have improved the administrative supervision and management system for biodiversity, initially establishing a "multi-stakeholder co-governance and collaborative protection" mechanism for key ecological regions. Currently, a draft of the National Parks Law has been formulated. This law adopts a systematic approach to legislation for protected areas, designing its framework and arranging relevant institutions rationally. The legislative design authorizes national park management agencies to exercise centralized and unified resource management and environmental enforcement powers within park boundaries. This indicates that China is building a "protected area system with national parks as the core" to achieve biodiversity conservation. In summary, legislation on protected areas and laws for special regions form a "general-specific" relationship, providing an integrated direction and framework for improving the legal system of "mainstreaming biodiversity."

However, there are still gaps. China's reforms on ecological and environmental damage compensation have not addressed compensation for damages caused by biodiversity loss and degradation. The valuation and accounting of biodiversity have not been integrated into administrative decision-making, and a bio safety risk prevention and control system remains to be established, with no categorized institutional arrangements in place. The main reason for this omission is the ongoing controversy over the conceptual and legal nature of "ecological restoration." Additionally, the Civil Code, confined to private law theory, exhibits limitations in addressing "biodiversity loss" within ecological and environmental damage compensation, as seen in Articles 1234 and 1235 and their interpretations. Only "permanent loss of ecological environmental functions" is eligible for relief, which does not fully encompass the concept of "biodiversity loss." Finally, assessing such losses in practice faces numerous difficulties.

3.3 Legal Tools for Achieving the "Mainstreaming of Biodiversity" Objective in the Kunming-Montreal Framework

3.3.1 Optimization of the Draft Regulations on Access to and Benefit-Sharing of Biological Genetic Resources

In accordance with Target 13 of the Kunming-Montreal Framework, Priority Action 2 under Priority Area 1 in Chapter 4 of the NBSAP explicitly calls for in-depth research and drafting of regulations on access to and benefit-sharing of biological genetic resources. As early as 2017, China released a draft of the Regulations on Access to and Benefit-Sharing of Biological Genetic Resources for public comment. However, it was not promulgated due to various reasons.

Currently, China's system for access to and benefit-sharing of biological genetic resources is not fully established and faces challenges posed by DSI-related issues. There is significant room for optimizing the draft regulations.

First, the legislative purpose and basic principles need expansion. The draft was formulated to implement the Nagoya Protocol. Based on current international developments and the realities of DSI, it should incorporate relevant requirements of the Kunming-Montreal Framework, particularly methodologies, rights fields, and values such as the "whole-of-government and whole-of-society approach," "cooperation and synergy," "human rights-based approach," and "One Health approach." Second, the content of investigation and protection planning requires optimization. The draft stipulates the establishment and updating of a national database for biological genetic resources. Currently, China's National Center for Bio-information has certain infrastructure capabilities aligned with international standards. However, challenges remain, such as fragmented data storage, insufficient data sharing and utilization, and the lack of a scientific evaluation system for data value. Third, regarding benefit-sharing of biological genetic resources, the draft should include a multilateral mechanism for benefit-sharing from the use of DSI, as well as alternative measures for revenue generation at different stages of the value chain and the feasibility of implementing these measures. Specifically, it is necessary to classify and categorize DSI data and, based on these classifications, simulate revenue generation measures at different value chain stages to establish a benefit-sharing mechanism for DSI under various scenarios.

3.3.2 Strengthening the Response of the "Ecological Environment Code" to the "Mainstreaming of Biodiversity" Objective

As a "sector-specific" code, the Ecological Environment Code must consider the appropriate extent and the central logical of "mainstreaming biodiversity"—that is, how and to what degree "mainstreaming biodiversity" should be integrated into the code. The code constructs a broad concept of "ecological environment" under the concept of "comprehensive environmental protection," encompassing the three narrower concepts of "environment," "ecology," and "resources," The concept of "mainstreaming biodiversity" is broad. From the perspective of the code's responsive purpose and based on rational reasoning, it is more reliable to integrate the connotations of "mainstreaming biodiversity" through the

two narrower concepts of "ecology" and "resources."

This is because the concept of "environment" in the code's context is linked to "pollution prevention and control" and is the core concept of the pollution control section. The two concepts of "ecology" and "resources" are increasingly converging. Under the premise of downplaying "resources," limiting "ecology," strengthening ecological protection, and organizing by elements and spaces (regions), the ecological protection section is structured with general provisions (element protection) followed by special provisions (regional protection), balancing utilization control, protection and improvement, and restoration and governance. It makes unified arrangements from the perspective of holistic ecosystem protection, constructing the ecological protection section. The ecological protection section uses "natural ecology" as its foundational concept, "ecological priority" as its value orientation, and "coordinated governance" as its governance principal, building a normative and institutional system suited to holistic ecological protection. This aligns with the NBSAP (2023-2030), which establishes 4 principles, 3 strategic positioning, 2 objectives, 4 priority areas, and 27 priority actions ("432427") to promote "mainstreaming biodiversity." Both are remarkable achievements in China's ecological civilization construction.

Therefore, the ecological protection section is the main pathway for integrating "mainstreaming biodiversity" into the code and the primary domain for expressing its core content. As for the legal liability section, it provides safeguards for legal accountability after the main content of "mainstreaming biodiversity" is expressed in the code. Particularly, it is essential to address the specialized nature of ecological environment responsibilities to counter the current "fragmented" state of ecological environment legal liability and offer solutions for addressing liability issues related to "biodiversity loss."

4. Codification Response: Specific Approaches to Implementing the "Mainstreaming Biodiversity" Objective

4.1 Ecological Conservation Section: Establishing a DSI Benefit-Sharing Mechanism

Currently, the draft "Ecological Environment Code" has been formulated. The ecological protection section of the code addresses biodiversity conservation through two types of norms: "ecological element protection" and "ecological region protection." It incorporates achievements from the reform of the ecological civilization system and adopts a "moderate codification" approach through coordinated legislation and watershed legislation. Based on Articles 39 and 40 of the General Principles section, it governs the specific provisions related to biodiversity in the ecological protection section. Although the general principles of the ecological protection section stipulate the state's responsibility for protecting and monitoring important ecosystems, biological species, and genetic resources, as well as a national benefit-sharing scheme for biological genetic resources, and further implement the "mainstreaming biodiversity" strategic deployment of the NBSAP (2023-2030) through ecosystem protection, key geographical units, national parks as the main focus, and nature reserves as

carriers, thereby providing "Chinese wisdom" and constructing China's discourse system for post-Kunming-Montreal Framework international negotiations under the Convention, the ecological protection section still has deficiencies in protecting DSI.

First, As China is building a protected area system with national parks as the core, DSI, as an indispensable part of systematic biodiversity conservation, also needs to be incorporated into this management system. Article 687 of the code still regulates DSI from the perspective of the ABS system, which cannot address the issue of "digital bio piracy." Specifically, DSI technology may give rise to unknown types or variations of genetic information. Therefore, protecting such genetic information has cutting-edge value. In particular, the economic, ecological, and social value of DSI bio synthetic products and recombined DSI information units is immense. Excluding DSI bio synthetic products and information units from the species and genetic diversity protection system may put China at a disadvantage in international competition and negotiations.

To avoid these issues, it is possible to consider adding fallback provisions to Articles 682 and 683 of the code, such as the DSI database information coordination and monitoring mechanism proposed in the aforementioned draft "Regulations on Access to and Benefit-Sharing of Biological Genetic Resources." Incorporating this mechanism could provide a higher-level legal basis for the "inter-ministerial coordination mechanism for biological genetic resources" in the draft regulations. Simultaneously, it would enhance the coordination and transparency of benefit-sharing related to DSI. It is important to note that the DSI database information coordination and monitoring mechanism, as stipulated in these articles, need only clarify its responsibilities for DSI coordination and monitoring, while more detailed behavioral norms should not be included in the code for now.

Under the Digital Sequence Information database information coordination and monitoring mechanism, it is also necessary to clarify the content of biodiversity baseline investigations. This is because biodiversity baseline investigations serve as an important means for tracing the origin of DSI, defining information units, and evaluating the value of bio-synthesized compounds. At the same time, biodiversity baseline investigations provide essential data and materials for the construction of DSI databases and information systems. Furthermore, these investigations supply critical information for the development of subsequent biodiversity conservation policies, thus promoting the sustainable utilization of resources.

Therefore, incorporating DSI-related content into biodiversity baseline investigations aligns with the strategic requirements of "mainstreaming biodiversity." Building DSI databases and information systems on the basis of these biodiversity baseline investigations is technically feasible and can be effectively supported. It is particularly important to note that confidential DSI of domestic origin must be subject to a classified management system. This involves maintaining both public and localized versions to safeguard China's sovereignty over genetic resources and its associated interests. For instance, DSI data from giant pandas and endemic plants must be stored locally. Furthermore, attempts to infiltrate localized databases and information systems containing confidential DSI must be penalized

and incorporated into a "blacklist" mechanism. On this basis, it is also necessary to establish a "comprehensive" DSI classification and grading catalogue at the genetic level (encompassing DNA, RNA, information units, cells, and tissues). This catalogue is distinct from the species management list and system based on DSI risk grading and classification. Moreover, the fundamental requirements for the safety management of biotechnology research and development primarily interface with the main responsibilities of the DSI database information coordination and monitoring mechanism. Considering the construction of basic safety management requirements for biotechnology based on the main duties of this mechanism involves several aspects: adherence to a classified management system, implementation of primary responsibility and organizational structure requirements, compliance approval and contingency planning, risk management and emergency response, as well as record keeping and credit-based penalties. Subsequently, it is essential to link these requirements with the provisions of the "Administrative Measures for the Safety of Biotechnology Research and Development" issued by the Ministry of Science and Technology of China, making referential provisions. This means that under the premise of following the basic safety management requirements for biotechnology, and based on the "comprehensive" DSI classification and grading catalogue, a classified management system should be established. This includes clarifying risk categories and matching them with appropriate laboratory bio safety levels. The classification of risk levels and their matching with laboratory levels can refer to the relevant content of the aforementioned "Administrative Measures." It is important to note that the safety traceability management and tracking assessment of DSI-related biotechnology must be dynamic, allowing for timely adjustments to risk levels and corresponding response measures.

In summary, the establishment of utilization rules for Digital Sequence Information (DSI) that differ from the traditional Access and Benefit-Sharing (ABS) framework must be grounded in a comprehensive process. This begins with biodiversity baseline surveys of DSI, followed by the coordination and monitoring mechanisms of DSI databases, leading to the development of integrated information systems and periodically updated classified inventories. Additionally, it requires the implementation of traceability management and tracking assessments for bio safety. Only then can such a framework be effectively formed, one that better aligns with the interests of developing countries like China in safeguarding sovereignty over their biological genetic resources.

Furthermore, the provision in Article 687 of the Code, which encourages the "transmission, promotion, and innovation of related practices to conserve biodiversity," is intrinsically linked to access and benefit-sharing of biodiversity. Within this framework, explicit support should be provided for the utilization of digital sequence information (DSI)—on the condition that intellectual property rights are respected—with priority given to initiatives addressing ecological poverty alleviation, environmental crisis response, and the advancement of social equity. Specific applications may include promoting organic agriculture, incorporating DSI into ecological compensation mechanisms, supporting the breeding of endangered wildlife, and increasing income opportunities for low-income populations.

Should conditions permit, efforts may further advance the establishment of a unified national socialized compensation mechanism for DSI. Building on this foundation, it is essential to strengthen preferential protection and participation mechanisms for indigenous peoples in matters involving DSI. Clarifying the legal status of DSI as biological genetic resources will effectively safeguard the rights and interests of indigenous peoples arising from traditional knowledge associated with DSI. This approach aligns not only with the principles of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework, but also reflects the traditional ethos of "living in harmony with nature, sustaining livelihoods through ecological reciprocity." Moreover, such a mechanism will substantively protect the interests of China's indigenous peoples in subsequent international negotiations, consistent with the nation's identity as a developing country, while upholding sovereignty over its biological genetic resources.

Finally, to address DSI-related issues in a systematic manner, consideration should be given to adding a dedicated chapter on the protection of genetic resources in the ecological conservation section. This would primarily involve general provisions on the protection of genetic resources and the establishment of a fund for the protection and benefit-sharing of genetic resources. The general provisions on genetic resource protection should incorporate the legal definition and concept of DSI. The legal definition and concept of DSI is as follows: "information derived from valuable biological materials containing genetic functions, expressed in digital form, representing specific arrangement code that encompass genetic and other multidimensional information attributes." Regarding the fund for the protection and benefit-sharing of genetic resources, it is essential to balance the dual needs of data security management and open sharing of biological resources. This will help promote the development of an industrial system for the submission, management, research, application, and benefit-sharing of biological resource data, thereby fostering mutual benefits of DSI data across the country. Additionally, attention should be paid to ensuring alignment with the optimized content of the sixth point on benefit-sharing in the above-mentioned Regulations on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization (Draft). For instance, the draft stipulates that users must contribute 0.5% to 10% of their profits to a national fund for resource conservation and the development of regions of origin. A specific proposal could involve leveraging the Kunming Biodiversity Fund to share benefits generated from DSI-based technologies at different stages according to varying proportions. Alternatively, direct linkage could be established with Articles 49 and 50 of the National Parks Law (Draft).

4.2 Legal Liability Section: Establishing a Biodiversity Credit Market Mechanism

The current concept for the legal liability section is to form a systematic ecological environment legal liability framework structured as "basic provisions + environmental administrative liability + environmental civil liability + ecological environment damage liability + ecological environment dispute resolution," following an "independent main body with supplementary dispersed provisions" approach. Within this, the legal liability section assumes an "ecologically rational economic actor" and

adjusts legal norms governing the relationships between "humans–nature–humans," divided into "liability to humans" and "liability to the environment." Under this division, an "environmental liability" system based on the "theory of ecological restoration" is being attempted. "Liability to humans" is reflected in relevant criminal, civil, and administrative legislation, as well as in specialized environmental legislation.

From the perspective of the aforementioned theory, "biodiversity loss liability" should fall under the "special liability" category of "environmental law liability." If categorized as "special liability," it would overlap with the concept of "permanent loss of ecological environment functions" under Article 1235 of the Civil Code, creating conceptual intersection and rule conflicts. This would hinder the "communication and coordination" between ecological environment legal liability and traditional departmental law liabilities. Moreover, given the current progress of reforms on ecological environment damage compensation mechanisms, "biodiversity loss liability" is unlikely to be recognized. After all, it faces numerous challenges, including an undefined legal concept, rejection by theories and liability mechanisms of traditional departmental laws (e.g., cases involving illegal electrocution of wild earthworms), and the exclusion of biodiversity value assessment and accounting from administrative decision-making.

From the legal philosophy perspective of "harmonious coexistence between humans and nature," "biodiversity loss" can be affirmed as damage to "ecology" or "resources." However, the current theory of traditional departmental laws based on "anthropocentrism" is an established fact. Furthermore, the draft "Ecological Environment Code" adopts an indirect expression of ecological environment liability, without directly clarifying its composite and specialized nature. The specialized nature of "biodiversity loss liability" lacks sufficient support in the code. However, if "biodiversity loss" is completely ignored, the realization of the "2030 Agenda for Sustainable Development" under the Kunming-Montreal Framework and the vision of "living in harmony with nature by 2050" would be jeopardized. Even the implementation effectiveness of the "mainstreaming biodiversity" objective in the NBSAP (2023-2030) would be compromised.

According to Marxist dialectical materialism, "biodiversity loss liability," under the universal expression of contradictions and based on the above analysis, does not qualify for integration into China's legal theory and system. However, if "biodiversity loss liability" is specialized, it may yield surprising "roundabout solutions." Admittedly, the term "biodiversity," as a scientific concept, is not fully standardized. But at least a basic understanding can be established: biodiversity emphasizes a state. Only diverse genes, species, and ecosystems constitute a stable, balanced, and secure state. If maintaining this state is taken as the legislative purpose, the issue of defining the legal concept of "biodiversity" can be temporarily set aside.

The specialized solution for "biodiversity loss liability" is to transform it into "biodiversity credit liability." Then, based on the theoretical presuppositions of environmental liability in the legal liability section, it could be confirmed and implemented as a "special form of environmental credit liability."

For example, establishing a mechanism similar to the "carbon mechanism" for "biodiversity loss" would internalize externalize and transform it into a special environmental administrative liability mechanism, ultimately accepted by traditional departmental law theories and systems. Here, the concept of "biodiversity credit liability" should be broadly understood, divided into two types: "biodiversity credits liability" and "biodiversity offsets liability." "Biodiversity credits liability" leans toward positive incentives, serving as a measurement unit in biodiversity offset projects. "Biodiversity offsets liability" leans toward "command-and-control" type negative impact management liability. Therefore, this specialized solution for "biodiversity loss liability" requires institutional design based on these two different understandings. Similarly, the necessity and feasibility of this specialized solution are worth discussing.

From the perspective of necessity, transforming "biodiversity loss liability" into "biodiversity credit liability" is driven by legislative purpose needs, which is one aspect of its necessity. In fact, there are several considerations for the necessity of establishing "biodiversity credit liability" in the code: First, based on economic theory as the underlying logic, constructing a "biodiversity credit market mechanism" as a financing tool can be included in green finance, providing positive incentives. It can generate substantial funds for the "Biodiversity Fund" and enterprise development. Simultaneously, it offers an important metric for corporate ESG development, standardizes corporate behavior, and enhances market competitiveness. Second, establishing a "biodiversity credit blacklist mechanism," biodiversity offsets liability, can integrate with administrative "credit-based penalties" liability mechanisms, meeting the requirements of the "no net loss" principle related to the mitigation hierarchy ("avoid-reduce-compensate," ARC). It can also rely on public interest litigation mechanisms for judicial safeguards. Third, differing from the relief model for "permanent loss of ecological environment functions" under Article 1235 of the Civil Code, it avoids the drawbacks of private law tools while fulfilling the ecological environment damage liability rules of the legal liability section.

From the perspective of feasibility: First, the global biodiversity credit market is emerging, and international experiences in constructing such markets are available for China's reference. Examples include the biodiversity banking models in the United States, Australia, and Colombia. Among these, there are practical projects for reference, such as Australia's South Pole biodiversity and carbon credit project, Colombia's Climate Trade and Terasos habitat banking project, and the Wallacea Trust global biodiversity credit project. Second, some scholars have proposed: "It is recommended that China use national parks as biodiversity credit providers, engage in 'horizontal' value exchange with enterprises, innovate by using indicator trading models to offset the ecological impacts of development projects to net zero, support credit pledge loans and enhance corporate ESG ratings through green finance incentives, supplemented by mandatory information disclosure and market access permits as hard constraints, to jointly accelerate the formation of a biodiversity credit investment and financing mechanism that benefits national parks and surrounding communities." This "national park model" has a certain legal foundation. Firstly, the ecological protection section of the code already presupposes

management systems for natural ecological protection, ecological element protection, protected areas, and biodiversity conservation, along with supporting measures such as natural ecological protection planning, natural ecological protection information, ecological element utilization control and protection improvement, species and genetic diversity protection, protected area conservation and management, and ecological protection compensation. Then, according to Articles 49 and 50 of China's draft "National Parks Law," corresponding action basis and legal support can be provided for this model. Third, as observed from China's relevant regulations such as the "Ecological and Environmental Damage Compensation Management Regulations," "Cultivated Land Requisition-Compensation Balance Assessment Measures," "Wetland Protection and Restoration System Scheme," and the "Interim Measures for the Collection and Use of Forest Vegetation Restoration Fees," it is evident that the country demonstrates an initial inclination to require enterprises and individuals to "offset negative impacts to achieve net-zero." The government's demand to "offset negative impacts to achieve net-zero" essentially represents an approach to holding enterprises accountable for biodiversity credit obligations.

Fourth, although providing sound legal safeguards for "diversity accounting methods and measurement indicators" is currently challenging, China still has a foundation in rule of law soil for nurturing such mechanisms. The concept of "biodiversity credits liability" leans more toward an economic legal tool within the code. The concept of "biodiversity offsets liability" leans more toward a fallback mechanism for legal liability consequences. The two can form a logical chain of "risk prevention-process control-liability for damage" within the code. The "biodiversity credits liability" mechanism can serve as a financial tool for "preventing irreversible biodiversity damage risks." Here, international mechanisms such as "Payment for Ecosystem Services" (PES) can be referenced to design a "credit prepayment for preventing irreversible biodiversity damage risks," requiring enterprises to pay this security deposit during the environmental impact assessment phase based on biodiversity impact assessments.

Fifth, although methodologies and metrics for biodiversity accounting are still under development, they do not present fundamentally insurmountable challenges. Internationally, assessing the "net change" in biodiversity requires primary consideration of the following elements: (1) Spatiality: it must be linked to specific geographical areas. (2) Temporality: as biodiversity changes over time, the validity period of credit allowances needs to be considered. (3) Additionally: this refers to the "additional" increase in biodiversity resulting from the implementation of a specific project. (4) Baseline: this refers to a reference point used to compare the current state with future changes. (5) Leakage: this occurs when improvements or maintenance of biodiversity within a project area lead to biodiversity loss in adjacent areas. Based on these indicators, it is feasible to develop a methodology for biodiversity accounting. The construction of such a biodiversity accounting methodology could be designed around approaches such as negative list management, dynamically adjusted thresholds, and credit unit accounting. For negative list management, statutory law could authorize the State Council to issue an "Applicable List

of Biodiversity Credit Obligations" to clarify the types and contents of biodiversity credit responsibilities. Subsequently, the Ministry of Ecology and Environment could further refine the "Technical Guidelines for Environmental Impact Assessment—Ecological Impact" (HJ19-2022). Specifically, building on the HJ710 Technical Guidelines for Biodiversity Monitoring, dynamically adjusted thresholds and coefficients for the "Habitat Fragmentation Index" and "Endangered Species Decline Rate" could be introduced following research. Exceeding these thresholds and coefficients would trigger biodiversity credit obligations. Finally, the Ministry of Ecology and Environment could lead the development of a "Biodiversity Credit Equivalent Accounting Guide." One approach could be to introduce a coefficient based on the "endangered species coefficient × habitat restoration cost" to quantify responsibilities. Alternatively, a "Biodiversity Proxy Indicator Assessment Method" could be piloted initially, with the main assessment approach formalized in the "Biodiversity Credit Equivalent Accounting Guide" once matured.

In summary, the "biodiversity credit market mechanism" is primarily based on the "national park model," supplemented by the "biodiversity banking model." It draws on the accounting methods and metrics of carbon trading markets, with biodiversity impact assessment deposits and dynamic corporate credit ratings serving as safeguards. If implemented, this framework would provide a systematic approach to jointly addressing climate change and the biodiversity crisis. It would not only advance the "ecological civilization" goals of "Chinese-style modernization" but also help secure a leading position in post GBF" international negotiations.

References

Feng, H., & Zhang, Y. (2023). Problems in the practice of our country's administrative law enforcement "blacklist" system and the approach to rule of law. *Nanjing Journal of Social Sciences*, (02), 76-84, 95.

Gong, G. (2022). The Concept of the Cornerstone of the Environmental Code Starts from the Change of the Concepts of Resource, Environment and Ecology. *Peking University Law Journal*, *34*(06), 1523-1542.

Li, B., & X D. (2019). Application of digital sequence information of genetic resources in biodiversity conservation and its impact on benefit-sharing system. *Biodiversity Science*, *27*(12), 1379-1385. https://doi.org/10.17520/biods.2019242

Li, J., Zhang, H., & Wang, N. (2023). The path and institutional arrangement of biodiversity product value realization: Lessons and enlightenment from the experience of foreign biodiversity banks. *Acta Ecologica Sinica*, *43*(01), 198-207.

Li, X. (2019). International Dissemination of Xi Jinping Thought on Ecological Civilization and Its Path Optimization. *Issues of Contemporary World Socialism*, (04), 3-14.

Li, Y. (2023). Kunming-Montreal Global Biodiversity Framework: Essentials, Focuses and Local Normative Responses. *Pacific Journal*, *31*(08), 88-100.

Liu, J. (2019). Credit Liability: The Emerging Fourth Major Category of Legal Responsibility. *Legal Forum*, *34*(06), 5-17.

Lv, Z. (2023). Theoretical Framework for Environmental Code Compilation. *China Legal Science*, (02), 25-47.

Lv, Z., & Liu, J. (2024). Legislative Framework for the Protected Area System. *World Social Sciences*, (01), 63-80, 243-244.

Ni, G. (2012). Review and prospect of the Convention on Biological Diversity. *Journal of Shanghai University (Social Sciences Edition)*, *29*(06), 1-12.

Ni, G. (2012). Review and prospect of the Convention on Biological Diversity. *Journal of Shanghai University (Social Sciences Edition)*, *29*(06), 1-12.

Pan, C. (2007). Reconciling Tensions between Genetic Resource Conservation and Intellectual Property Rights. *Intellectual Property*, (03), 42-46. https://doi.org/10.1093/acprof:oso/9780198765011.003.0001

Peng, Y., Jin, T., & Zhang, X. (2024). Biodiversity Credits: Concept, Principles, Trading, and Challenges. *Biodiversity Science*, *32*(02), 154-164.

Victor Meyer-Schoenberg, Kenneth Cooker. (2013). *The Era of Big Data: The Great Change of Life, Work and Thinking* (Sheng, Y., &Zhou, T., Trans., pp. 123-126). Hangzhou: Zhejiang People's Publishing House.

Wan, X., & Zou, Y. (2020). Wang Qianlu. The 15th Conference of the Parties to the Convention on Biological Diversity and the International Dissemination of the Concept of Ecological Civilization. *Environmental Protection*, *48*(22), 55-58.

Wang, Q. (2023). Implementation dilemmas and reform paths of the Convention on Biological Diversity. *Local Legislation Journal*, *8*(01), 78-91.

Wang, T. (2021). Social Transformations and Research in the Digital Era. *Social Sciences in China*, (12), 73-88, 200-201.

Xun, Q. (2017). A Critical Overview of the Theory of Transcending Development in Latin America. *Marxism & Reality*, (06), 115-123.

Zhang, L., Song, Z., & Xu, N. (2025). Operation Mechanism and Practical Experience of Costa Rica's Forest Ecosystem Service Payment System. *National Park*, *38*(01), 118-125.

Zhao, Y., Liu, Y., & Wan, X. (2024). A New Path for the Marketization of National Park Ecological Products: A Case Study of Biodiversity Offset and Credit Mechanism. *National Park*, *2*(05), 296-307.