An Analysis of China's Biodiversity Mainstreaming Implementation Pathway Under the Kunming-Montreal Global Biodiversity Framework (Postprint)

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Abstract

The Kunming-Montreal Global Biodiversity Framework has established important actions for biodiversity conservation worldwide in the coming period, including mainstreaming biodiversity and its multiple values into economic and social activities. As a Party to the United Nations Convention on Biological Diversity, China has made unremitting efforts and achieved remarkable results in continuously promoting biodiversity mainstreaming. This paper explores and analyzes the conceptual connotation of biodiversity mainstreaming, systematically summarizes the specific practices and phased achievements of biodiversity mainstreaming in China, benchmarks against the targets of the Kunming-Montreal Global Biodiversity Framework, and proposes implementation pathways for comprehensively advancing biodiversity mainstreaming in China in the new era, focusing on different actors including government, enterprises, and the public. These pathways include: 1) introducing a unified action framework; 2) leveraging the leading role of government governance; 3) coordinating enterprises to take joint actions; and 4) enhancing public awareness to promote broad participation, with the aim of integrating biodiversity into policy mechanisms at all levels of government departments and into social production and living practices, thereby providing references for improving biodiversity governance decision-making.

Full Text

Analysis on the Implementation Path of Biodiversity Mainstreaming in China Under the Guidance of the Kunming-Montreal Global Biodiversity Framework

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Abstract: The Kunming-Montreal Global Biodiversity Framework establishes critical actions for biodiversity conservation worldwide, including integrating biodiversity and its multiple values into economic and social activities. As a party to the United Nations Convention on Biological Diversity, China has made unremitting efforts to promote biodiversity mainstreaming with remarkable results. This paper examines the conceptual connotation of biodiversity mainstreaming, summarizes China's specific practices and phased achievements, and proposes implementation pathways for comprehensively advancing biodiversity mainstreaming in the new era, focusing on different actors including governments, enterprises, and the public. The recommendations include: (1) introducing a consistent action framework; (2) leveraging the leading role of government governance; (3) coordinating joint corporate actions; and (4) raising public awareness to promote broad participation. These efforts aim to integrate biodiversity into policy mechanisms at all levels of government and into social production and life practices, providing references for improving biodiversity governance decisions.

Keywords: biodiversity, value, mainstreaming, Kunming-Montreal Global Biodiversity Framework, ecosystem services

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The United Nations' 2019 Global Assessment Report on Biodiversity and Ecosystem Services reveals that the global decline in biodiversity remains fundamentally unchecked. Coupled with intensifying climate crises, humanity's capacity to supply ecological products and ecosystem services continues to face threats. Reversing the trend of biodiversity loss requires concerted global action and coordinated policy solutions across spatial scales (Leclère et al., 2020; Droste et al., 2022). All actors, including governments, businesses, and land users, must participate in unified efforts to reduce ecological damage and maintain biodiversity (Damiens et al., 2020).

The second phase of the 15th Conference of the Parties (COP15) to the Con-

vention on Biological Diversity (CBD) adopted the historic Kunming-Montreal Global Biodiversity Framework (hereafter "Kunming-Montreal Framework"), providing strategic objectives and solutions for addressing global biodiversity loss and ecosystem service degradation. The framework sets targets for 2030 and 2050, reaffirming biodiversity mainstreaming as a critical action for 2030. As a CBD party, China has made continuous efforts over the past decade, implementing measures including national strategic action plans, establishing the China National Committee for Biodiversity Conservation, improving biodiversity protection policies and standards, creating the ecological conservation red line system, and conducting joint law enforcement inspections on national species. However, constrained by factors such as insufficient biodiversity baseline data, low public awareness, and the complexity of mechanisms addressing biodiversity loss, China, like other countries, fell short of ideal expectations in achieving the Aichi Targets. Under the guidance of the Kunming-Montreal Framework, how to comprehensively advance biodiversity mainstreaming remains a key challenge for China. Using literature review, experience summarization, and inductive-deductive methods, this paper draws on relevant research findings to analyze the connotation of biodiversity mainstreaming, summarize China's practices and achievements, and propose recommendations for comprehensively advancing biodiversity mainstreaming in the new era to inform decision-making.

1.1 Conceptual Development and Evolution

The term "mainstreaming" typically functions as a verb, referring to the process by which something becomes accepted by the majority or the integration of multiple objectives into a single target, and is widely applied in international contexts. The concept of "biodiversity mainstreaming" originated in the Convention on Biological Diversity, whose Article 6 calls for: (1) developing national strategies, plans, or programs for biodiversity conservation and sustainable use; and (2) integrating biodiversity conservation and sustainable use into relevant sectoral or cross-sectoral plans, programs, and policies as far as possible and as appropriate. This aims to promote biodiversity conservation and sustainable use through government governance by incorporating them into national strategic and departmental planning systems.

In 2010, the Aichi Targets—the world's first decade-long biodiversity conservation action plan—were formally adopted, establishing biodiversity mainstreaming as a strategic goal for global biodiversity governance. The targets set specific action objectives across four areas: raising public awareness, mainstreaming biodiversity values, reforming incentive measures, and promoting sustainable production and consumption. By integrating biodiversity into government decision-making and mainstream economic and social activities, the Aichi Targets sought to address biodiversity loss (CBD, 2010). The targets further expanded mainstreaming pathways, emphasizing quantifying and evaluating biodiversity values and benefits for integration into national and local development

and poverty reduction strategies, national accounting systems, and reporting frameworks. They also called for considering human impacts on biodiversity and integrating biodiversity into production and living practices. However, the UN's Global Biodiversity Outlook 5 shows that none of the 20 Aichi Targets were fully achieved, including the biodiversity mainstreaming target. The primary reasons were weak linkages between strategic actions and national policy mechanisms, lack of robust implementation pathways, insufficient mainstreaming efforts, inadequate capacity building in resource mobilization and regulation, and poor implementation effectiveness that prevented incorporating the financial costs of biodiversity loss and environmental degradation into other sectors' financial plans. Consequently, biodiversity mainstreaming has become a major global challenge (Karlsson-Vinkhuyzen et al., 2018).

In 2016, COP13 adopted the Cancun Declaration, reaffirming the importance of biodiversity mainstreaming and emphasizing that biodiversity conservation must be integrated into all levels of government and economic sectors (CBD, 2016). Over 190 CBD parties committed to intensifying efforts to mainstream biodiversity into forestry, agriculture, fisheries, tourism, and other sectors. COP14 in 2018 adopted the Sharm El-Sheikh Declaration (CBD, 2018b), further expanding the scope of mainstreaming to include energy, infrastructure, manufacturing, and processing sectors. The Kunming-Montreal Framework further integrates and refines tools for mainstreaming and framework implementation. Among its 23 action targets, 10 (Targets 14-23) address mainstreaming and implementation tools, covering biodiversity integration into government decision-making, promoting sustainable production and consumption, enhancing biosafety measures, reforming incentive mechanisms, innovating financing mechanisms, advancing technological innovation and capacity building, promoting public participation, respecting indigenous and local community rights, and ensuring gender equality (CBD, 2022). Additionally, Target 12 calls for improving urban ecosystem functions and protecting biodiversity to increase human well-being through mainstreaming biodiversity conservation and sustainable use. The framework's targets are both ambitious and pragmatic, helping mobilize resources across government and society to guide consistent global action toward building a community of life in harmony between humanity and nature.

CBD parties have made extensive efforts to explore mainstreaming pathways and tools, accumulating rich experiences. Vietnam established facilitation mechanisms for mainstreaming, implementing co-management policies for mangroves that mobilized local fishermen and government resources while building trust and reciprocity in palm oil certification and marine fisheries development. South Africa and Costa Rica, benefiting from high biodiversity levels, attracted investor attention and support through active mainstreaming and democratic, transparent governance systems, securing long-term funding (Huntley, 2014). This demonstrates that mainstreaming strategies must combine conservation policies with strong political will to be effective (Karlsson-Vinkhuyzen et al., 2018). The global fisheries sector has strengthened integration with biodiversity conservation, seeking common ground and promoting cross-sectoral institutional

cooperation in policy and action, achieving significant results in biodiversity mainstreaming and development cooperation. Consequently, enhanced communication and cross-sectoral collaboration are considered key success factors for biodiversity mainstreaming.

However, some countries and regions face challenges with imperfect mechanisms and tools in advancing mainstreaming. The UK has gradually mainstreamed biodiversity into spatial planning policies, emphasizing nature as an irreplaceable asset and implementing traditional hierarchical differentiated management for protected areas while applying policy tools based on net gain, mitigation, offsetting, ecosystem services, and green infrastructure in broader rural and urban areas (Wilson, 2023). However, this differentiated control policy places primary responsibility for biodiversity conservation on local policy tools, which may lead to tensions over nature's "substitutability" if effective oversight is lacking. In the Democratic Republic of Congo, a biodiversity-rich developing country where populations heavily depend on natural resources for livelihoods, efforts to effectively combine biodiversity with environmental impact assessment tools face challenges such as insufficient biodiversity baseline data in mitigation measures and inconsistent data classification standards (Hugé et al., 2020). India has integrated biodiversity into traditional agricultural production landscapes to promote agricultural biodiversity conservation and sustainable use, but results show that top-down decision-making systems have limited positive effects on sustainable development in India's traditional agriculture, while farmers' experiential knowledge in biodiversity management, maintenance, and sustainable utilization is crucial (Bisht et al., 2020). Overall, global mainstreaming still faces numerous obstacles, primarily severe shortages of financial resources and knowledge, which directly hinder and affect conservation plans in developing countries and transition economies.

In 2007, GEF, UNEP, and CBD (2007) first jointly defined biodiversity mainstreaming as the process of integrating biodiversity considerations and conservation actions into different economic sectors and development plans. Following the Aichi Targets' 2010 call to promote biodiversity mainstreaming, research on the topic increased significantly. Researchers and policymakers gradually recognized that mitigating direct pressures and drivers affecting biodiversity at their source is crucial to halting biodiversity loss, as these pressures often originate from economic activities highly dependent on biological resources such as agriculture, forestry, and fisheries. Huntley and Redford (2014) further expanded the scope of mainstreaming with greater focus on sustainable use, defining biodiversity mainstreaming as "the process of integrating biodiversity into the strategies, policies, and practices of major public and private actors that affect or depend on biodiversity to promote its conservation and sustainable use." Zhang Fengchun et al. (2015) synthesized previous research and defined it in the Chinese context as "the process of integrating biodiversity into the political, economic, social, military, cultural, and environmental protection mainstream of national or local economic and social development, as well as into the production and life of enterprises, communities, and the public." They argued that mainstream-

ing pathways include integrating biodiversity into government decision-making, corporate planning, construction and production processes, and community development and public daily life.

The Kunming-Montreal Framework's action targets comprehensively cover different actors—government, enterprises, and the public—emphasizing institutional regulation as the dominant approach to transform high-level objectives into inclusive, multi-scale concrete actions. Creating enabling conditions is an important prerequisite for effective biodiversity conservation, including establishing functional institutions, adequate financial guarantees, and necessary knowledge to guide effective biodiversity conservation actions (Milner, 2021). Additionally, general principles for biodiversity governance have gradually become global mainstream, such as the no-net-loss principle, mitigation hierarchy, pooled funds or banking approaches allowing third-party compensation, and focusing on damage compensation for protected areas (Droste et al., 2022).

Overall, biodiversity mainstreaming can be understood as the process of integrating biodiversity into national and regional economic and social development mainstream and broad production and living practices. The essential problem it seeks to address remains the conflict between conservation and development, avoiding the pattern of "destroy first, protect later" and enabling biodiversity conservation to resonate with economic development. Its core lies in government-led integration of biodiversity into national governance systems, building a biodiversity conservation action framework with whole-of-society participation, and promoting the implementation of biodiversity conservation across all industries and production and living practices.

Biodiversity mainstreaming has attracted international attention and emphasis because it provides a strong policy environment for biodiversity conservation and sustainable use, serves as an important cornerstone for achieving other action targets of the Kunming-Montreal Framework, offers institutional guarantees for mobilizing resources across sectors and stakeholders, and provides necessary means to drive joint participation of enterprises, institutions, social organizations, and the public in biodiversity conservation.

2. China's Practice and Effectiveness in Biodiversity Mainstreaming

Since signing the Convention on Biological Diversity, China has conducted extensive exploration and efforts to promote biodiversity mainstreaming, characterized by government leadership and limited participation from other actors. These efforts cover integrating biodiversity into national strategic decision-making and planning, departmental policy mechanisms, and scientific research reports, effectively promoting coordinated development between biodiversity conservation and economic society.

2.1 Integrating Biodiversity Conservation into National Top-Level Decision-Making and Major Strategic Planning

Since the 18th National Congress of the Communist Party of China, ecological civilization construction has accelerated, with biodiversity conservation as an important component incorporated into Party Congress reports and resolutions. The 18th Party Congress report explicitly stated the need to "implement major ecological restoration projects and protect biodiversity," marking the first time biodiversity conservation tasks were included in a Party Congress report. The Third Plenary Session of the 18th Central Committee established the strategic task of innovating and establishing a national park system. The 19th Party Congress report explicitly called for "strengthening ecosystem protection," requiring implementation of major projects for important ecosystem protection and restoration, optimizing ecological security barrier systems, building ecological corridors and biodiversity conservation networks, and improving ecosystem quality and stability. The Sixth Plenary Session of the 19th Central Committee resolution again emphasized establishing a nature protected area system with national parks as the main body, strengthening ecosystem protection and restoration, and enhancing biodiversity conservation. The 20th Party Congress report identified harmonious coexistence between humanity and nature as one of the fundamental characteristics of Chinese modernization, requiring "enhancing ecosystem diversity, stability, and sustainability, accelerating implementation of major projects for important ecosystem protection and restoration, and implementing major biodiversity conservation projects," providing an action guide for biodiversity conservation in the new era.

Over the past decade, China has promulgated and revised more than 20 laws and regulations, including the Environmental Protection Law, Grassland Law, Environmental Impact Assessment Law, and Wildlife Protection Law, all involving biodiversity conservation and sustainable use, initially establishing a biodiversity legal and regulatory system focused on ecological environment and natural resources protection and management. The 2014 revised Environmental Protection Law added requirements to "protect biodiversity" and "prevent damage to biodiversity." The 2022 newly revised Wildlife Protection Law further strengthened protection of wildlife habitats and refined wildlife population regulation measures. China has also promulgated and implemented relevant regulations including the Nature Reserve Regulations, Wild Plant Protection Regulations, Regulations on Import and Export of Endangered Wild Fauna and Flora, Regulations on Agricultural GMO Biosafety Management, and Regulations on Planning Environmental Impact Assessment. In 2021, China released the white paper "Biodiversity Conservation in China," comprehensively summarizing biodiversity governance measures and achievements, and issued the "Opinions on Further Strengthening Biodiversity Conservation," becoming a programmatic document for comprehensively advancing biodiversity conservation in China.

Since signing the Convention, China has gradually elevated biodiversity conservation to a national strategy, incorporating it into the 12th, 13th, and 14th

Five-Year Plans for National Economic and Social Development and long-range objective outlines, requiring implementation of major biodiversity conservation projects and building biodiversity conservation networks. In 2011, China established the National Committee for Biodiversity Conservation to coordinate national biodiversity conservation work, guide "China's Actions for the UN Decade on Biodiversity," and release and implement the first decade-long "China Biodiversity Conservation Strategy and Action Plan (2011–2030)," marking the formal establishment of China's biodiversity strategy. Under the unified territorial spatial planning system, protecting biodiversity is both a core objective for optimizing ecological protection space and a key action for implementing integrated protection and restoration of mountains, rivers, forests, farmlands, lakes, grasslands, and deserts, incorporated into territorial spatial plans and ecological protection and restoration plans at all levels.

China has continuously optimized its territorial spatial development and protection pattern, innovated ecological space protection models, designated areas of extremely important ecological functions and environmentally sensitive areas as ecological conservation red lines for strict protection, and gradually established a nature protected area system with national parks as the main body to strengthen the integrity of natural ecosystem structure and function and biodiversity conservation in key areas, providing innovative solutions for global biodiversity conservation. In 2021, the "Overall Plan for Major National Ecosystem Protection and Restoration Projects (2021–2035)" was issued, establishing the long-term goal that "by 2035, nature protected areas with national parks as the main body will account for more than 18% of land territory, and endangered wild fauna and flora and their habitats will be comprehensively protected," and issuing nine special plans including major project construction plans for nature protected areas and wildlife conservation, comprehensively laying out objectives and tasks for important ecosystem and species conservation in the coming period. All provinces, municipalities, and autonomous regions have actively promoted biodiversity mainstreaming at the local level, incorporating biodiversity into development plans and spatial plans at different levels and issuing provincial and municipal biodiversity conservation strategic action plans to clarify action directions for local biodiversity conservation work.

2.2 Integrating Biodiversity into Sectoral Policies, Norms, and Assessment Mechanisms

The Ministry of Ecology and Environment has continuously improved standards and norms for biodiversity survey and monitoring, supervision and law enforcement, and evaluation and assessment, successively issuing technical specifications such as the Regional Biodiversity Evaluation Standards, County-Level Biodiversity Survey and Assessment Technical Regulations, and Biodiversity Observation Technical Guidelines. The ministry issued and implemented the Regional Ecological Quality Evaluation Measures (Trial), incorporating biodiversity into regional ecological quality comprehensive evaluation systems for the

first time. It also released policy documents including the 14th Five-Year Plan for Ecological Protection Supervision, Interim Measures for Ecological Environment Supervision of Nature Protected Areas, and Measures for Ecological Environment Supervision of Ecological Conservation Red Lines to strengthen protection and supervision of important ecosystems and biodiversity nationwide. Biodiversity impact has been incorporated into the national strategic and project environmental impact assessment system, with standards such as the Technical Guidelines for Environmental Impact Assessment—Ecological Impact issued to include biodiversity impact as an important component of planning and project EIA, preventing biodiversity loss and ecosystem service degradation from the source.

Under the overall situation of vigorously promoting ecological civilization construction, indicators related to natural ecosystem and biodiversity conservation have been gradually incorporated into assessment systems for local governments and departments. In 2016, the National Development and Reform Commission issued the Green Development Indicator System and Ecological Civilization Construction Assessment Target Responsibility System, listing forest and grassland coverage, wetland protection, and nature reserves as ecological protection assessment indicators. In connection with ecological civilization demonstration creation, many demonstration areas have incorporated indicators such as important species protection, ecological conservation red lines, and nature protected areas into construction targets and government performance assessments. In 2022, Jiangsu Province deployed the construction of a biodiversity conservation effectiveness assessment indicator system, using biodiversity conservation effectiveness as an important reference for comprehensive assessment and accountability of Party and government leadership teams and officials, as well as for departure audits, implementing lifelong accountability for those causing serious ecological and resource damage.

China has explored integrating biodiversity into industrial green transformation mechanisms, practicing the concept that "lucid waters and lush mountains are invaluable assets" and establishing a green, low-carbon, circular development economic system to reduce negative impacts on biodiversity. By developing ecological industries such as ecological planting and breeding, China has coordinated biodiversity conservation with rural revitalization strategies, promoted sustainable management of biological germplasm resources in forestry, agriculture, animal husbandry, and aquaculture, advanced systems for natural resource asset registration and paid use, and promoted green product certification for green food, organic agricultural products, forest ecological 标志 products, and sustainable aquatic products. China has implemented management systems for key wildlife and plant utilization such as special hunting permits, collection permits, and breeding licenses to promote biodiversity conservation and sustainable use (State Council Information Office, 2021). The country has adopted ecosystem-based integrated ocean management, implemented a series of resource conservation policies and measures, strengthened aquatic organism protection, and sustainably utilized existing fishery resources. Additionally, China

has vigorously promoted the establishment of ecological product value realization mechanisms, exploring government-led, enterprise and social participation, market-based operation, and sustainable ecological product value realization pathways, and improving horizontal and vertical ecological compensation mechanisms to promote balanced development among regions and industries (Xue Dayuan, 2020).

2.3 Multi-Sector Support for Biodiversity Scientific Research

Biodiversity conservation relies on scientific research and technical support. China has released two editions of the China Biodiversity Country Study Report. The second edition assessed the value of China's ecosystem diversity, showing that the total annual value of national ecosystem diversity is approximately 87 trillion yuan (Gao Jixi et al., 2018). Various functional departments, scientific research institutions, enterprises, and social organizations have conducted extensive and in-depth research on multiple aspects of biodiversity conservation management, advancing biodiversity science and application. In December 2022, the Supreme People's Court released the China Biodiversity Judicial Protection Report, revealing that since 2013, people's courts at all levels have concluded 182,000 first-instance cases involving biodiversity protection, covering China's endemic species such as Chinese sturgeon, Tibetan antelope, and yew, as well as globally rare and endangered species such as pangolins, great white sharks, and corals. Some organizations have conducted specialized research on corporate biodiversity protection to support mainstreaming, releasing reports such as Research on Corporate Biodiversity Information Disclosure and Corporate Biodiversity Pressure Assessment Report 2021, exploring solutions for investment and financing to support biodiversity protection. An increasing number of enterprises and social organizations have initiated collaborative actions to promote biodiversity conservation and development.

3. Recommendations for Comprehensively Advancing Biodiversity Mainstreaming in the New Era

3.1 Introducing a Consistent Action Framework

The greatest obstacle to advancing biodiversity mainstreaming is the lack of a systematic, feasible, and consistent framework usable by all scales and actors. Milner-Gulland et al. (2021) proposed the Mitigation and Conservation Hierarchy (MCH) conceptual framework, which includes specific biodiversity impact mitigation measures and broader actions needed to achieve net biodiversity gains, comprising four sequential steps: (1) avoid, (2) minimize, (3) restore, and (4) offset biodiversity impacts. The MCH framework aims to establish a robust mitigation hierarchy structure to achieve overall "no net loss" or "net gain" of biodiversity, emphasizing enhanced conservation levels through established mitigation hierarchies to iteratively address biodiversity loss caused by human development activities. In this four-step hierarchy, options with lower biodiver-

sity risks are prioritized to minimize direct development impacts on biodiversity as much as possible. The framework can support actions to mainstream biodiversity, including accounting elements (biodiversity loss and benefits to achieve net outcomes) and accountability elements (responsibility allocation) for mainstreaming.

In this framework, mitigation refers to minimizing harmful biodiversity impacts, while offsetting refers to compensating for or replacing destroyed habitats. The argument for biodiversity mitigation and offsetting is based on the polluter-pays principle (Defra, 2014). Net gain means that the "stock" of biodiversity replaced after development is higher than before development (Sullivan & Hannis, 2015; Apostolopoulou & Adams, 2019). Offsetting and net gain are described as a comprehensive "full-coverage" approach to managing development impacts on nature conservation and landscapes in broader rural and urban areas (Albrecht et al., 2014), representing an extremely challenging action target. The MCH framework provides government departments with relatively flexible action guidance, helping formulate and identify actions that can simultaneously achieve multiple policy objectives and trade-offs when policy objectives may conflict, such as linking with other convention objectives. It also provides intuitive comparisons of economic costs, allowing priority selection of the lowest-cost management strategies to achieve desired conservation benefits across the four steps. Simultaneously, the MCH framework helps enterprises understand their operations' impacts on nature and explore ways to mitigate these impacts, supports individuals in understanding their lifestyle impacts to guide potential low-impact alternatives, and enables contributions to biodiversity conservation.

3.2 Leveraging the Leading Role of Government Governance

According to the CBD definition, biodiversity mainstreaming is government-led. Promoting strategic mainstreaming of biodiversity and issuing and implementing the National Biodiversity Strategy and Action Plan (NBSAP) for the next decade are currently the most important and urgent actions. Based on national conditions, scientifically establishing governance objectives to avoid, minimize, or restore biodiversity, comprehensively laying out major biodiversity conservation projects for the new era, and aligning national action objectives with global targets will form truly meaningful global collaborative action.

Biodiversity should be integrated into development plans and territorial spatial plans at all levels of government and departments. Referencing the MCH conceptual framework, sustainable management of important ecological spaces such as ecological conservation red lines and nature protected areas should be promoted to avoid biodiversity loss through strict protection. For areas outside protected areas, low-impact biodiversity solutions such as Nature-based Solutions (NbS) and effective area-based conservation measures (OECMs) should be adopted to restore and maintain biodiversity in urban and agricultural spaces.

Biodiversity should be mainstreamed into economic sector policies including

agriculture, forestry, fisheries, and energy (Whitehorn, 2019). Emphasis should be placed on biodiversity value assessment and transformation, promoting natural capital accounting and research, and developing tools, guidelines, and methods to support government decision-making. Existing policy implementation should be improved, and biodiversity assessments should be conducted and reported to guide decision-making. Biodiversity conservation supervision capacity should be enhanced, biotechnology environmental safety management mechanisms improved, and fair and equitable sharing of benefits from utilizing genetic resources and related traditional knowledge promoted.

Synergies should be enhanced between biodiversity governance and strategies addressing climate change, food security, and rural revitalization to comprehensively tackle multiple challenges including biodiversity loss, climate change, and environmental pollution. Closely integrating policy tools such as strategic environmental assessment and project environmental impact assessment, standards and mechanisms for evaluating biodiversity impacts caused by strategic planning and project implementation should be improved to prevent biodiversity loss and ecosystem service degradation from the source. Valuation technical standards that fully reflect market supply and demand and resource scarcity should be continuously improved, and comprehensive benefit and damage assessment standards for biodiversity and ecosystem services should be established to provide scientific basis and technical support for government decision-making and implementation.

Biodiversity administrative law enforcement and supervision should be improved to ensure the sustainability, safety, and legality of wild species use, harvesting, and trade, preventing biosafety risks from overexploitation and illegal market transactions. A national biodiversity information database should be established to break information barriers and build a convenient and efficient information sharing platform. Investment funds reflecting natural resource values should be established, biodiversity governance funds properly utilized, and biodiversity conservation effectiveness used as an important basis for financial support in ecological protection and restoration, government performance assessment, natural resource asset departure audits, and accountability. Biodiversity compensation mechanisms should be explored.

3.3 Coordinating Joint Corporate Actions

Statistics show that half of global GDP moderately or highly depends on nature (WEF, 2020). Many business activities create value through direct or indirect use of ecosystem services or their supply chains, but unscientific production and business activities also cause biodiversity destruction. Integrating biodiversity into business decision-making mainstream is an important foundation for promoting sustainable economic and social development. Developing unified action framework assessment tools aimed at mitigating biodiversity risks or impacts associated with business activities and creating systematic and lasting economic incentives for adopting sustainable management will play an important role in

biodiversity conservation by internalizing ecological and environmental hazards into business operations (Herity et al., 2018).

Enterprises should develop internal biodiversity conservation action plans, integrate biodiversity conservation into corporate decision-making, assess and measure potential biodiversity impacts including risks and dependencies in procurement, production, and operation links, set time-bound, quantifiable, and actionable objectives, take mitigation and positive conservation actions, and disclose assessment results in their social responsibility reports or through information disclosure to demonstrate support for and contributions to biodiversity conservation targets. Internal coordination and management mechanisms directly relate to the execution capacity to safeguard biodiversity, minimizing action risks associated with biodiversity and biosafety to achieve sustainability across the entire chain from raw material extraction, production, product supply, to use and disposal.

The MCH framework provides enterprises with a means to comprehensively consider overall impacts and supports analysis of return on investment from actions at different impact levels. The possible impacts of biodiversity and ecosystem services across the entire industrial chain and product life cycle should be considered in systems such as environmental impact assessment, product environmental certification, and environmental damage compensation, reducing the environmental externalities of corporate economic activities while ensuring compensation for damaged biodiversity and ecosystem services (Xu Jing et al., 2022).

The financial sector should play a key role in promoting biodiversity-friendly financing mainstreaming and reducing capital flows that damage biodiversity, channeling funds into biodiversity investments that generate economic and ecological benefits. The biodiversity fiscal and tax system should be continuously improved, and market-based financial transaction mechanisms such as biodiversity credit, bonds, and sector funds should be developed to broaden channels and pathways for broad societal participation in biodiversity conservation and sustainable use.

3.4 Raising Public Awareness to Promote Broad Participation

Biodiversity mainstreaming cannot succeed without public support and participation. Target 21 of the Kunming-Montreal Framework explicitly requires ensuring public access to biodiversity-related data, information, and knowledge, and calls for strengthening communication, raising awareness, education, monitoring, research, and knowledge management to establish clear linkages between individual choices and ambitious biodiversity governance targets, enhancing public understanding of the vision of harmonious coexistence between humanity and nature, and motivating and enhancing whole-of-society participation.

Raising public awareness is a prerequisite for public participation, and government or corporate biodiversity information communication and disclosure are

necessary conditions for public participation. Publicity and education on biodiversity conservation laws, regulations, scientific knowledge, typical cases, and major project achievements should be carried out, biodiversity status bulletins should be regularly released, and the public's right to know and supervisory role should be guaranteed. Biodiversity conservation publicity channels and approaches should be broadened to bring biodiversity conservation into public life through technology, internet, art, and other life-relevant means, conveying new concepts and knowledge to awaken public participation. A system for public participation in biodiversity conservation should be established, enabling the public and social organizations to contribute to major biodiversity conservation and sustainable use decisions through standardized procedures.

Translating awareness into action and practicing green and low-carbon lifestyles is the core of public participation. The MCH framework provides the public with intuitive choices for establishing biodiversity-friendly lifestyles, avoiding high-impact consumption behaviors and reliance on recycling, as recycling does not fully close product life cycles (Sandin & Peters, 2018). Positive public support actions for biodiversity conservation should drive corporate transformation in production and operation, and promote the translation of public green and low-carbon lifestyles into actual benefits for biodiversity and climate mitigation improvement.

The global COVID-19 pandemic serves as a warning that ecological and biosafety relate to human well-being, and correctly handling the relationship between humanity and nature by integrating biodiversity into decision-making mainstream at all levels of government and departments is of great significance. The establishment of the Kunming-Montreal Framework provides an ambitious and pragmatic action framework for biodiversity mainstreaming, while the MCH framework provides a systematic action framework usable by all types of actors to support biodiversity mainstreaming. China has taken many actions to advance mainstreaming around the four levels of avoiding, minimizing, restoring, and offsetting biodiversity impacts, but still faces challenges including insufficient awareness, financial resource shortages, and limited technical methods. Biodiversity mainstreaming is key to achieving the 2030 and 2050 vision targets of the Kunming-Montreal Framework, but comprehensive participation of governments, departments, enterprises, and the public in biodiversity governance still faces many limiting factors. Effective safeguard mechanisms are urgently needed to provide a strong policy environment for framework implementation, improve biodiversity laws, policies, planning, and technical systems, break through obstacles in financial resources, knowledge, and decentralized decision-making, mobilize resources across the whole government and society, and work together to put China's biodiversity on the path to recovery toward a harmonious future between humanity and nature.

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Note: Figure translations are in progress. See original paper for figures.