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A Comparative Study on South Korea's Response to the UN Climate Change Convention and the Biodiversity Convention

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ABSTRACT

Climate change and biodiversity loss are intricately linked, and as the severity of these challenges intensifies, the need for a cohesive international response has become increasingly evident. Since 1992, South Korea has developed relevant legal and institutional frameworks; however, its initiatives addressing biodiversity loss have received less recognition and prioritization compared to its efforts concerning climate change. In this context, this study aims to analyze the disparities in South Korea's policy responses to the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), while proposing an integrated policy direction. To achieve this, the study compares key policies related to both conventions by utilizing the OECD's Policy Coherence for Sustainable Development (PCSD) indicators and evaluation criteria derived from previous research. Furthermore, the analysis incorporates variables identified in earlier studies, including legal enforceability, economic incentives, financial support, and industry participation, to enhance the depth of the analysis. Additionally, a review of international best practices was conducted to extract actionable insights for policy enhancement. The analysis reveals several challenges in biodiversity policies, including fragmented governance systems, low policy prioritization, weakened policy momentum, imbalanced financial support, and limited corporate awareness. Moreover, difficulties in quantitative evaluation hinder the verification of policy effectiveness due to the complex nature of biodiversity goals. This research aims to assess South Korea's responsiveness in accordance with the integrated approach promoted by the international community.

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1. Introduction

Climate change and biodiversity loss are among the most critical environmental threats facing humanity, significantly impacting global ecosystems and human societies. Climate change threatens the foundations of human survival through increasing extreme weather events, rising sea levels, and ecosystem disruptions. Meanwhile, biodiversity loss leads to the degradation of ecosystem services, food security threats, and the spread of diseases, among other socio-economic issues[1]. In response to these crises, the international community adopted the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) at the Rio Earth Summit in 1992. The UNFCCC focuses on protecting the climate system by regulating greenhouse gas emissions, requiring countries to set and implement reduction targets. On the other hand, the CBD aims to conserve biodiversity, promote its sustainable use, and ensure the fair and equitable sharing of benefits arising from genetic resources.

Although these two conventions were introduced in the same era, they have exhibited significant differences in status and policy implementation. The UNFCCC has received greater attention in terms of policy execution, financial support, and capacity-building efforts[2]. In contrast, biodiversity has increasingly been considered a national issue due to the intrinsic differences between the two conventions. Biodiversity conservation requires tailored approaches that consider each country's unique ecological and geographical characteristics, as well as the complex interactions within ecosystems, making it difficult to establish quantitative targets and measure outcomes. In comparison, climate change offers a clear metric in greenhouse gas emissions, enabling global collaboration toward common goals with relatively straightforward economic mechanisms. These distinctions have contributed to the CBD receiving less international attention and support than the UNFCCC[3].

Recently, however, The international community has increasingly acknowledged the intricate relationship between climate change and biodiversity loss, both of which have intensified in severity. The decline in biodiversity diminishes the capacity of natural ecosystems to sequester and absorb carbon, while deforestation and the degradation of marine biodiversity contribute to elevated levels of atmospheric greenhouse gases, thereby exacerbating climate change. Furthermore, the diminished resilience of ecosystems impedes their capacity to adapt to or mitigate the effects of climate change, ultimately leading to the degradation of these natural systems. The reciprocal relationship between climate change and biodiversity loss serves to amplify and exacerbate these challenges. For example, the destruction of tropical rainforests results in heightened greenhouse gas emissions, which accelerates climate change and subsequently adversely affects biodiversity. This dynamic illustrates the interconnectedness of these crises and underscores the pressing necessity for concurrent and integrated strategies to effectively address both issues[4]. Against this backdrop, nature-based solutions (NbS) have emerged as a key strategy to enhance climate resilience and biodiversity conservation simultaneously through nature-based climate adaptation and carbon sequestration management[5]. NbS initiatives, such as wetland restoration, urban green space expansion, and forest conservation, are evaluated as effective methods for achieving both carbon absorption and biodiversity preservation[6].

Since 1992, South Korea has developed legal and institutional frameworks to address both the Convention on Biological Diversity and the UN Framework Convention on Climate Change. However, consistent with global trends, public awareness and prioritization of biodiversity issues remain significantly lower than those associated with climate change. According to South Korea's 5th National Biodiversity Strategy (2024–2028), public awareness of the Convention on Biological Diversity stands at 46.7%, which is considerably lower than the 75.2% awareness of the UN Framework Convention on Climate Change. This disparity contributes to imbalances in policy formulation, implementation, budget allocation, and stakeholder engagement. From the perspective of the integrated approach advocated by the international community, South Korea's current response framework is evaluated as underutilizing the potential syner-

gies between the two conventions[7].

Moreover, the Fourth National Biodiversity Strategy (2019–2023) underscores the ongoing lack of collaboration among central and local governments as well as the private sector. The policies and systems for biodiversity conservation in South Korea remain disjointed, lacking comprehensive cooperative frameworks for ecosystem services, sustainable agriculture, forestry, and fisheries. For example, various governmental bodies, including the Ministry of Environment, the Ministry of Oceans and Fisheries, the Korea Forest Service, and the Rural Development Administration, conduct independent assessments of ecosystem services and develop related technologies, complicating the possibility of integrated national or regional evaluations.

In light of these challenges, this study seeks to assess South Korea's level of response through the lens of the integrated approach advocated by the international community and to propose an effective governance framework aimed at optimizing synergies between the two conventions.

2. Theoretical Background and Literature Review

The crises of climate change and biodiversity loss are not isolated issues but interact in a complex manner. Biodiversity loss weakens the resilience of natural ecosystems, threatening food production and increasing climate risks[8, 9]. These interconnected crises can exacerbate one another, highlighting the need for stronger international agreements and policy reforms to address them[10, 11]. Notably, longitudinal analyses of agreements among European countries have shown that legally binding agreements lead to more significant emission reduction outcomes[10].

In response, policy portfolios have been proposed that include measures such as reducing fossil fuel consumption, adopting sustainable diets, improving food productivity, reducing waste, promoting good governance, and implementing nature-based solutions[12]. Additionally, the integration of fiscal policies and private financial decisions through frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD) and the Taskforce on Nature-related Financial Disclosures (TNFD) has been suggested[13].

Nevertheless, the comparatively lower emphasis on biodiversity relative to climate change can be attributed to the influence exerted by non-governmental organizations (NGOs) and industry stakeholders, which underscores the inadequate roles of corporations and civil society[14].

Meanwhile, some studies suggest that differences in media exposure may lead to disparities in public interest[15, 16]. To address these challenges, it is imperative to enhance the responsibilities and roles of corporations, civil society, and academic institutions, supported by the establishment of new international legal frameworks[17]. At the national level, it is crucial to maximize synergies between climate change and biodiversity objectives[18]. This can be accomplished by ensuring coherence in budget allocations and policy goals to optimize resource utilization effectively. The evolution of policy goals and instruments has been significantly shaped by international consensus and political contexts, making it essential for policy design and responses to be tailored to these factors[19].

Existing studies[18, 20–25] consistently suggest that policies combining policy coherence, legal enforcement, and economic incentives for the industrial sector are effective in achieving the objectives of both conventions. However, key factors hindering the integration of the two conventions include insufficient policy tools such as monitoring systems, difficulties in securing financial resources, and low levels of industry participation.

3. Materials and Methods

This study utilizes the OECD's Policy Coherence for Sustainable Development (PCSD) indicators to analyze South Korea's policy responses to the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), with the aim of assessing their sustainability and coherence. To this end, the study identifies essential factors for policy effectiveness through a review of previous research and compares case studies of countries that have successfully implemented an integrated approach to highlight differences with South Korea's policies and propose improvement measures.

The analysis focuses on key factors such as policy coherence, legal enforcement, economic incentives, monitoring systems, financial support, and industry participation. Based on these factors, the study conducts a comprehensive review of South Korea's climate change and biodiversity policies.

Specifically, the PCSD indicators are applied to evaluate policy goals, implementation processes, and outcomes, with the aim of comparing South Korea's policies against international standards and suggesting effective and coherent policy directions.

The reason for employing PCSD indicators is that climate change (SDG 13) and biodiversity (SDGs 14 and 15) are core components of the Sustainable Development Goals (SDGs). The PCSD framework provides a tool for assessing both vertical and horizontal policy coherence and ensuring harmony across various policies. PCSD is particularly useful for evaluating cooperation between central and local governments, as well as consistency between legislation, such as the Framework Act on Carbon Neutrality and laws related to biodiversity conservation and sustainable use. Additionally, PCSD incorporates a long-term perspective and intergenerational equity, reflecting the long-term impacts of climate change and biodiversity issues. The framework also emphasizes the participation and collaboration of diverse stakeholders, recognizing that these complex challenges cannot be addressed solely through government efforts. Furthermore, PCSD facilitates an analysis of the interactions between domestic and international policies, making it highly valuable for evaluating comprehensive and coherent responses to global issues.

The scope of the study covers South Korea's policy changes and key achievements from 1992, when the two conventions were adopted, to the present (2024). However, the indicator-based analysis focuses on current policies to identify ongoing challenges. By reflecting the complexity of climate change and biodiversity issues, the study evaluates South Korea's policy responses comprehensively, focusing on policy coherence, legal enforcement, economic incentives, monitoring systems, financial support, and industry participation.

The literature review primarily focused on studies that examined policy trends and legal changes using keywords related to Korea's climate change and biodiversity policies. Due to the limited availability of research materials on the desired topic, government-issued policy documents and articles were also referenced as supplementary sources.

The study is structured as follows: First, the theoretical background and literature review analyze the definitions, development processes, and research trends related to the two conventions. Second, analytical variables and indicators are established, and data collection and analysis methods are explained. Third, the analysis results compare policy responses to the two conventions and present key findings. Finally, the conclusion and implications summarize the research findings, provide policy recommendations, and discuss the study's limitations and future research directions.

4. Results

4.1. Policy Sustainability Assessment

4.1.1. High-Level Political Response

In the PCSD framework, high-level political commitment is a crucial element. The OECD provides a clear explanation of the definition and impact of this indicator to evaluate institutional mechanisms for policy coherence. The highest level of political will begins with strong leadership, clear authority, and the support of a well-defined and time-bound implementation plan. Political commitment is essential for fostering ownership across institutions and driving whole-of-government actions[26].

A comparison of high-level political responses in South Korea reveals a more proactive stance in the climate change domain. In May 2021, the 2050 Carbon Neutrality Committee, a public-private joint committee under the direct authority of the President, was launched. Since his inauguration, President Yoon Suk-yeol has expressed strong commitment to climate action, including key pledges such as achieving the 2030 Nationally Determined Contributions (NDC), realizing carbon neutrality by 2050, establishing a balanced energy mix with nuclear and renewable energy, and continuing the Green New Deal policies. Additionally, at the 27th UN Climate Change Conference (COP27), the Prime Minister represented South Korea and pledged to strengthen international cooperation and expand support for developing countries. On the local government level, the "Carbon Neutral Local Government Alliance" was launched in 2020, with 243 local governments participating to establish an institutional framework for implementing the agreements. In contrast, despite the establishment of the first National Biodiversity Strategy in 1997, policy progress related to the Convention on Biological Diversity (CBD) has been limited. Although the 5th National Biodiversity Strategy was recently

announced, it lacks an independent financial management system and a clear implementation plan. While individual projects, such as the successful restoration of the Asiatic black bear, have shown positive outcomes, these efforts are not closely linked to a comprehensive national strategy and are managed in a fragmented manner by different government agencies. Despite the ratification of the Nagoya Protocol and the introduction of an Access and Benefit-Sharing (ABS) system for genetic resources, practical implementation has been limited due to a lack of awareness among domestic companies and stakeholders.

4.1.2. Policy Integration

Policy integration refers to whether a government possesses mechanisms that enable strategic decision-making authority across ministries and multi-stakeholder groups to coordinate and align plans, budgets, laws, sectoral programs, and policies [26].

In terms of policy integration, the "Framework Act on Carbon Neutrality and Green Growth for Coping with the Climate Crisis" enacted in March 2022 includes Article 37, which mandates the assessment of the impact and vulnerabilities of climate crises on ecosystems and biodiversity at the national level, laying a legal foundation for establishing an integrated information management system. To centralize and analyze previously fragmented climate-ecosystem monitoring data, the Ministry of Environment developed an Information Strategy Plan (ISP) to create an Integrated Ecosystem Climate Response Information Management System. Since 2023, the National Institute of Ecology has been working on system development [27]. However, there is still no formal guideline for integrating policies and sectoral plans related to both conventions. Climate change policies have different goals, implementation frameworks, and timelines, which hinder overall policy integration.

4.1.3. Strategic Long-Term Vision

A long-term perspective refers to the presence of a strategic framework that considers the long-term impacts of policies. It also relates to whether PCSD considerations are incorporated into future government plans and programs [28].

Korea's climate change response policies appear to meet many of the requirements for the PCSD strategic long-term vision indicator. Korea has developed clear implementation roadmaps and systems to account for the long-term effects of its policies. For instance, the 2030 Roadmap for the climate change sector sets a specific target of reducing greenhouse gas emissions by 37% compared to the Business-as-Usual (BAU) level by 2030. Detailed plans to achieve this target have been devised, utilizing technologies and policies across diverse sectors such as energy transition, industry, transportation, buildings, agriculture, forestry, and fisheries, as well as waste management. Furthermore, these policies have been continuously refined by incorporating stakeholder feedback and adapting to changes in domestic and international conditions. To ensure policy continuity beyond election cycles, Korea has established robust systems, including periodic performance assessments of climate change responses by central administrative agencies, local governments, and public institutions under the Framework Act on Government Performance Evaluation. Additionally, the implementation and monitoring framework for Nationally Determined Contributions (NDC) allows Korea to transparently share progress with the international community, ensuring the sustainability and accountability of its policies.

In contrast, the biodiversity sector falls short of meeting the PCSD strategic long-term vision indicator. While there are department-led projects, a comprehensive national strategy and long-term vision are relatively lacking. For example, the Asiatic black bear restoration project is a notable success in preserving endangered species, achieving increased populations in natural habitats. However, such projects are managed in a fragmented manner by individual departments without integration into a national strategy, resulting in limited policy continuity and efficiency. Additionally, limitations are evident in international cooperation on biodiversity. Korea ratified the Nagoya Protocol in 2010, introducing an Access and Benefit-Sharing (ABS) system for biological genetic resources. However, implementation remains insufficient due to a lack of awareness among domestic businesses and stakeholders. Consequently, the biodiversity sector lacks adequate systems to ensure policy continuity or implement a long-term vision beyond electoral cycles.

4.1.4. Whole-of-Government Coordination

Policy coordination pertains to the establishment of mechanisms that facilitate inter-ministerial collaboration. This concept extends beyond mere cooperation among ministries, encompassing systems that enable the effective sharing of information and the allocation of responsibilities and

resources among public institutions. The indicators of policy coordination are delineated by two principal components:

1. The availability of coordination mechanisms that permit ministries and public institutions to exchange information and distribute responsibilities and resources in support of sustainable development.

2. The presence of mechanisms endowed with clear authority and sufficient resources to anticipate and address policy inconsistencies.

An examination of South Korea's climate change and biodiversity policies through the framework of policy coordination reveals notable disparities. Climate change policies predominantly satisfy the aforementioned indicators, as evidenced by the presence of inter-ministerial coordination mechanisms, which were previously highlighted in the analysis of policy integration and long-term vision.

Conversely, biodiversity policies exhibit certain deficiencies. The National Biodiversity Strategy incorporates inter-ministerial coordination mechanisms designed to promote collaboration through seminars, expert consultations, and working group meetings. These initiatives also integrate feedback from a diverse array of stakeholders, including local governments, civil society, and industry representatives

Since its inception in the third iteration, South Korea's National Biodiversity Strategy has been a statutory plan aligned with global biodiversity objectives. To synchronize its timeline with the Post-2020 Global Biodiversity Framework (GBF), the implementation period for the fifth National Biodiversity Strategy was extended from five years to ten years. The strategy's development process encompasses information-sharing seminars and expert consultations to evaluate outcomes from the Convention on Biological Diversity (CBD), as well as working group meetings to assess action targets, specific action goals, indicators, and tasks assigned to each ministry. The draft strategy is subjected to further scrutiny through explanatory sessions, public hearings, and discussions involving local governments, civil society, industry stakeholders, youth, and women prior to its final endorsement by the National Biodiversity Committee. This governance framework aligns with the Policy Coherence for Sustainable Development (PCSD) recommendation advocating for "inclusive institutions and governance to address policy interactions," and is regarded as well-developed in terms of stakeholder engagement.Nevertheless, the strategy encounters challenges in maintaining policy coherence and sustainability. Specifically, its alignment with global biodiversity objectives, such as those outlined in the Post-2020 Global Biodiversity Framework (GBF), is inadequate. Furthermore, inconsistencies between the objectives and indicators of other environmental plans impede its efficacy. The presence of overlapping or fragmented responsibilities among ministries further diminishes operational efficiency.While the National Biodiversity Strategy partially meets the indicators of policy coordination, substantial enhancements are imperative. For instance, South Korea currently lacks integrated management systems and dedicated operational entities to monitor implementation through indicator-based methodologies, particularly in relation to the Post-2020 GBF. The establishment of a comprehensive evaluation framework—including methodologies, procedures, and operational structures—coupled with robust inter-ministerial collaboration and evaluation systems, is urgently needed.

4.1.5. Monitoring Systems

From a monitoring standpoint, it is essential to ascertain the existence of a framework and indicators that facilitate the systematic monitoring and reporting of implementation outcomes aimed at enhancing Policy Coherence for Sustainable Development (PCSD). This involves assessing whether relevant data is being collected and whether adequate resources and capacities are available to analyze the progress of PCSD implementation [29].

Specifically, the following detailed indicators can be utilized for PCSD monitoring and reporting:

1. Regular Reporting on PCSD Progress: This involves using national, regional, and local data to monitor policy and financial impacts, culminating in the publication of regular progress reports on PCSD. These reports should comprehensively analyze the impacts on domestic and international sustainable development and propose improved approaches based on the findings.
2. Inclusion of Policy Coherence Elements in Evaluation Systems: Evaluation systems should incorporate elements of policy coherence to assess the linkages and potential conflicts between sectoral policies. Furthermore, they should consider transboundary impacts to provide critical information necessary for informed policy-making.

The study examined the monitoring reports associated with the policies for both conventions. The analysis covered the publication frequency, usage, feedback systems, and the existence of independent external audit agencies. Key reports related to climate change policies include the National Climate Change Adaptation Implementation Report, the IPCC Assessment Reports, the Biennial Transparency Reports (BTR), the Annual Implementation Performance Report, and the Mid-Term Comprehensive Evaluation Report. Reports related to biodiversity policies include the National Report (NR), the National Biodiversity Strategy Implementation Monitoring Report, and the Korea Biodiversity Observation Network (K-BON) Report.

Climate change policies undergo annual evaluations of adaptation measures, with mid-term comprehensive evaluations conducted to review progress and identify areas for improvement. For example, the 2nd National Climate Change Adaptation Plan conducted a mid-term evaluation in its third year to assess and refine policy performance. Additionally, the implementation status is evaluated using internationally established assessment frameworks such as the IPCC and BTR, providing objective and clear standards.

Biodiversity response policies actively incorporate monitoring results into policy implementation; however, the system and its level of utilization are considered relatively insufficient. Implementation progress is reviewed based on data collected through the Clearing-House Mechanism (CHM) for biodiversity, but the extent to which this data is utilized and analyzed to inform policy improvements remains low. Additionally, National Reports (NR) are submitted to the international community to enhance policy transparency, yet their evaluation criteria are largely confined to the national level, resulting in insufficient alignment with international standards.

Both policy domains are characterized by a lack of independent external audit agencies, which constrains objective feedback mechanisms. While climate change policies benefit from established international evaluation systems (e.g., IPCC and BTR), which enhance transparency, biodiversity policies are heavily reliant on domestic evaluations and necessitate a more systematic internal feedback mechanism.

4.1.6. Stakeholder Participation

This indicator evaluates the extent to which the government has established mechanisms to facilitate the involvement of stakeholders, including civil society, businesses, industries, the scientific community, and academia, in the policymaking and planning processes[30]. To assess this indicator, we performed a comparative analysis of the legislative frameworks and national implementation strategies pertaining to climate change and biodiversity. The analysis specifically examined public awareness and the degree of stakeholder engagement within each policy domain to discern their respective strengths and weaknesses.

- Comparison of Public Awareness

  Public awareness and engagement regarding climate change in South Korea have shown a consistent upward trend. The rise of fine dust as a significant national concern has prompted substantial initiatives across various sectors, including energy, transportation, and daily life, thereby increasing public interest in environmental matters.

  Citizens have transitioned from a passive reliance on government policies to becoming proactive "policy prosumers," actively seeking knowledge and addressing issues through online platforms focused on fine dust, specialized climate change blogs, and a growing cohort of young environmental activists. This transformation is also reflected in the business sector, where companies are beginning to recognize the importance of managing environmental risks and are capitalizing on environmental challenges as opportunities to enhance their corporate reputation and develop new markets.

  However, despite these advancements, a public awareness survey conducted in 2018 indicated that while 98% of participants acknowledged the seriousness of climate change, a majority identified the government (52.3%) and industry (13.2%) as the primary entities responsible for tackling the issue[31]. This finding highlights the need for further development in promoting active public engagement and individual responsibility[32].

  In contrast, public awareness of biodiversity policies remains relatively low. The 5th National Biodiversity Strategy indicates that while 90% of the population recognizes the significance of biodiversity conservation, only 10% possess a comprehensive understanding of the concept. Although there is considerable in-

terest in biodiversity conservation policies, awareness regarding the sustainable use of biodiversity resources is inadequate. Furthermore, 52% of the population views central and local governments as the main actors responsible for biodiversity conservation, with only 7.4% and 4% attributing this responsibility to the public and businesses, respectively. This suggests that biodiversity is not perceived by the public as an urgent or pressing issue comparable to climate change [33].

- Comparison of Stakeholder Engagement

  The Climate Change Response Framework Act establishes a legal foundation for stakeholder engagement in the formulation of climate change policies. A notable initiative under this framework is the 2050 Carbon Neutral Vision Forum, which convenes a variety of stakeholders to collaboratively shape national objectives and greenhouse gas reduction targets. This participatory approach encompasses public hearings, roundtable discussions, and voting mechanisms aimed at enhancing public involvement. Nevertheless, these engagement processes frequently function as mere formalities, lacking a binding obligation to integrate public input into policy outcomes. Moreover, the monitoring and evaluation of policies predominantly depend on internal assessments conducted by relevant governmental ministries, thereby restricting the active participation of external stakeholders [34].

  In a similar vein, biodiversity policies are also underpinned by a legal framework designed to facilitate stakeholder involvement. During the development of the National Biodiversity Strategy, the government solicited feedback from civil society, academic institutions, and industry representatives through public hearings and roundtable discussions. The 5th National Biodiversity Strategy is aligned with the objectives of the Global Biodiversity Framework (GBF) and explicitly incorporates stakeholder participation as a target for implementation. For instance, Action Goal 21 underscores the necessity of stakeholder engagement throughout the strategy's development, execution, and reporting phases, mandating local governments to incorporate the national strategy into their regional biodiversity plans. While this marks an advancement compared to the 4th National Biodiversity Strategy, which did not explicitly prioritize stakeholder participation, several challenges persist.

  The assessment of stakeholder engagement is limited by three primary indicators:

  1. The number of provincial-level local governments involved in the strategy's development,

  2. The number of citizen scientists engaged in relevant research, and

  3. The representation of women, youth, and individuals with disabilities in the planning process.

  These indicators do not adequately promote active participation from a diverse array of civil society and stakeholders. Although the 5th National Biodiversity Strategy references international citizen science initiatives as a framework for enhancing participation, it has yet to implement specific measures or establish actionable targets. Furthermore, the absence of regular reporting on the implementation and evaluation of the strategy further constrains the capacity to assess the effectiveness of the policies.

  In conclusion, climate change policies exhibit a higher degree of public awareness and engagement in comparison to biodiversity policies. Climate change is often perceived as an urgent and concrete environmental challenge, which has successfully garnered public interest and stimulated both governmental support and individual behavioral modifications. In contrast, biodiversity policies do not enjoy similar levels of public recognition, with a notable deficiency in the promotion of sustainable practices and involvement from non-governmental entities.

  Although both policy frameworks provide legal avenues for stakeholder participation, such opportunities are frequently restricted to the collection of feedback through brief public hearings or roundtable discussions, lacking robust implementation and evaluation mechanisms. To improve the efficacy of both policy areas, it is imperative to prioritize the enhancement of meaningful stakeholder engagement throughout the stages of policy implementation and monitoring. Strengthening these participatory processes is crucial for achieving comprehensive and sustainable policy outcomes.

4.2. Legal Enforcement and Economic Incentives

Previous research, including studies by [23, 24], has demonstrated that climate policies in the Netherlands, Aus-

tralia, Germany, and the United Kingdom that integrate legally binding mechanisms with economic incentives have resulted in more significant reductions in greenhouse gas emissions. In South Korea, both economic incentives and legally binding mechanisms are implemented through the Emissions Trading System (ETS), which operates under the Act on the Allocation and Trading of Greenhouse Gas Emission Permits (2012). Companies participating in the ETS are subject to penalties, including fines, for non-compliance with reporting obligations or emission reduction targets [35].

The ETS was established in South Korea in 2015, with approximately 5.8 million tons of emission allowances traded in its inaugural year. The trading volume has shown a consistent upward trend, reaching 58.93 million tons in 2022. In comparison, the European Union's trading volume was approximately 1.6 billion tons, while China's volume was 4.5 billion tons in the same year [36].

Conversely, biodiversity conservation efforts in South Korea reveal deficiencies in both legally binding mechanisms and economic incentives. Although the Act on Biodiversity Conservation and Sustainable Use (2013) was enacted, it primarily underscores the importance of conservation without establishing enforceable provisions. In terms of economic incentives, South Korea has adopted a genetic resource benefit-sharing system in accordance with the Nagoya Protocol. However, this system, unlike the ETS, offers indirect incentives that exert minimal direct influence on corporate practices.

Moreover, while the Ministry of Environment and the National Institute of Biological Resources are in the process of developing frameworks to manage the utilization of genetic resources and facilitate benefit-sharing agreements, these initiatives remain incomplete. Unlike the ETS, this framework does not serve as a direct incentive mechanism for corporations. Consequently, it can be posited that economic incentives aimed at mitigating biodiversity loss are largely absent in South Korea.

4.3. Government Budget Support for Each Convention

A comparison of South Korea's budget allocation for policies responding to the UNFCCC and CBD reveals that climate change response funding benefits from a more stable and continuous funding structure, such as revenue from the Emissions Trading System (ETS). In contrast, biodiversity conservation funding tends to rely heavily on individual project budgets managed by various ministries. Climate and biodiversity-related budgets are dispersed across multiple ministries, and the scope and definition of policy-related budgets remain unclear, making it difficult to accurately calculate the overall budget size. For instance, the budget for greenhouse gas reduction initiatives is managed by several ministries, including the Ministry of Environment, the Ministry of SMEs and Startups, and the Ministry of Science and ICT. Since these ministries operate their projects independently, issues such as budget duplication and inefficiency arise. The financial investment plan included in the Carbon Neutrality Master Plan also lacks sufficient linkage to the existing budget framework, making it difficult to assess the actual policy effectiveness.

A comparative analysis of the budgets for climate change and biodiversity response policies in South Korea highlights significant differences in priority and financial investment between the two areas. The climate change response budget increased steadily from approximately KRW 4.217 trillion in 2005 to KRW 14.131 trillion in 2024, indicating that climate change has become a top policy priority. The introduction of new policies, such as the climate-related budget tagging system for greenhouse gas reduction, has been a key factor driving the budget increase. Additionally, domestic legislation, such as the Framework Act on Carbon Neutrality, has strengthened policy obligations, further supporting increased financial investment. This reflects the growing international recognition of the severity of climate change and the necessity for countries to fulfill their international commitments.

In contrast, the biodiversity response budget increased from KRW 16.8 billion in 2007 to KRW 1.5937 trillion in 2024, but it remains significantly lower than the climate change budget. The increase in biodiversity-related funding is often influenced by the formulation of specific strategies or international events, resulting in short-term budget spikes. For example, following the announcement of the 5th National Biodiversity Strategy in 2020, the budget increased significantly. However, due to the absence of an independent financial management system and continued reliance on ministry-specific budgets, the biodiversity response lacks a stable and long-term support system. This structural issue

has been identified as a key factor limiting the effectiveness of biodiversity conservation policies.

The most notable differences between the two policy budgets are the size and structural coherence. As of 2024, the climate change response budget is more than nine times larger than the biodiversity response budget, clearly reflecting differences in policy priorities and the obligations imposed by international agreements. Since biodiversity conservation plays a crucial role in both climate change mitigation and adaptation, establishing an independent financial institution to secure stable and sustainable funding for both conventions is necessary to enable an integrated approach. Additionally, before establishing such a financial institution, it is essential to address issues of budget overlap and inefficiency by strengthening inter-ministerial cooperation and implementing an integrated budget management system.

4.4. Participation of Domestic Industries in Each Convention

The participation rate of South Korean industries in the UNFCCC and CBD-related initiatives has been gradually increasing due to the introduction of various systems and mandatory disclosure regulations. However, several challenges remain. For instance, while the Task Force on Climate-related Financial Disclosures (TCFD) has been voluntarily adopted by major domestic corporations, its implementation rate was only 28% as of 2022 [37]. Although discussions on the mandatory adoption of the Taskforce on Nature-related Financial Disclosures (TNFD) are ongoing, concerns have been raised that enforcing TNFD obligations could place a significant burden on companies, especially when TCFD implementation is still at a low level. Additionally, with existing frameworks such as RE100 and CF100 not yet fully implemented, there is a risk that the introduction of new regulations could lead to increased corporate burdens and confusion [38].

Therefore, a phased approach that considers companies' preparedness and potential burdens is necessary.

In January 2021, South Korea announced plans to mandate sustainability disclosures starting in 2025. However, in October 2022, the government decided to postpone this requirement to 2026 or later. Nevertheless, considering the policies and current trends of major global economies, as well as the reliance of South Korean companies on overseas markets, sustainability disclosures are seen as an inevitable requirement rather than an option.

RE100 (Renewable Electricity 100%) is a global initiative in which companies commit to sourcing 100% of their electricity from renewable energy. In 2021, South Korea introduced a localized version of this initiative, the K-RE100 system, enabling domestic electricity consumers to use renewable energy and receive a "Renewable Energy Use Certificate." As of 2024, 724 companies are participating in K-RE100, with the number of member companies increasing annually since its introduction [39].

CF100 (Carbon-Free Energy 100%) is a complementary alternative to RE100, proposed by the South Korean government. Unlike RE100, CF100 includes not only renewable energy but also other carbon-free energy sources such as nuclear power, hydrogen, and carbon capture and storage (CCS). Its international designation is "24/7 Carbon-Free Energy (CFE)," signifying the use of carbon-free energy around the clock, seven days a week [40].

The South Korean government has highlighted several reasons for the necessity of CF100:

- Electricity generated from nuclear power is cost-effective.
- Renewable energy alone cannot supply sufficient power for industrial demands.
- There is a global trend of returning to nuclear energy [41].

In 2024, the number of listed companies in South Korea that disclosed TCFD-related information through sustainability management reports increased by 17% compared to the previous year, reaching 188 companies [42]. Notably, 90% of listed companies with assets exceeding KRW 2 trillion published reports, demonstrating active compliance with mandatory ESG disclosure requirements focusing on climate-related disclosures. The Korea Sustainability Standards Board (KSSB) has released a draft ESG disclosure framework and is considering prioritizing mandatory climate-

related disclosures. However, key issues such as the timeline for mandatory disclosure, the scope of disclosure, reporting channels, and whether greenhouse gas emissions must be disclosed have not yet been clarified.

Globally, 502 companies and financial institutions have adopted TNFD recommendations for the fiscal year 2024 or 2025, while only five South Korean companies have pledged to align their corporate reporting with TNFD recommendations by the 2025 fiscal year[39]. Although this number may not seem low compared to global figures, it remains significantly behind Japan, where 135 companies have adopted TNFD[43].

A comparison of South Korea's participation rates in TCFD and TNFD shows that while TCFD-related disclosures are relatively active, TNFD-related disclosures are still in their early stages. This suggests that awareness and responses to biodiversity and natural capital issues remain underdeveloped. Although TCFD adoption is relatively widespread, South Korean companies still lag behind their counterparts in neighboring countries like Japan. The low disclosure rate is attributed to a lack of understanding of the recommendations and insufficient experience and technical capacity for climate-related disclosures. Furthermore, there is a lack of systems to identify and respond to the specific impacts of climate change and natural capital issues on corporate activities.

Most companies that have adopted disclosure frameworks in South Korea are large corporations, while small and medium-sized enterprises (SMEs) face difficulties participating in the disclosure system for similar reasons. Large corporations generally have sufficient resources to meet disclosure requirements, but SMEs often require additional support. To alleviate the burden on companies, the government has implemented measures such as revising quarterly reporting formats to focus on key information and expanding exemptions for target companies and omitted items. However, while these measures may lower the barrier to participation, they highlight the need for substantial support to enhance companies' understanding of the recommendations and strengthen their reporting capabilities.

In February 2023, the "1st Natural Capital Disclosure Forum" was held to share global trends and case studies on biodiversity disclosure with South Korean companies. However, a survey conducted during the forum targeting 300 domestic companies revealed that only 1.3% identified biodiversity as a major ESG issue[44]. This result underscores the low level of recognition among South Korean companies regarding biodiversity as a key ESG management issue. This contrasts sharply with the recent trends among global corporations, which are increasingly prioritizing biodiversity-related natural capital disclosures as part of their ESG strategies.

With biodiversity-related disclosure regulations becoming stricter, particularly within the European Union (EU), the low interest among domestic companies may pose challenges in meeting global supply chain requirements and adapting to changes in the international regulatory environment.

4.5. International Case Studies on Integrated Responses to the Conventions

Efforts to address climate change and biodiversity loss simultaneously through the integration of nature conservation, restoration, and climate policies have become a crucial strategic approach in the international community. The European Union (EU), Japan, and Germany have adopted nature-based solutions (NbS) that reflect their unique social, ecological, and economic contexts. The EU demonstrates strengths in international governance and policy coherence, Japan excels in regional-specific strategies and community participation models, and Germany stands out for its balance between legal enforcement and financial support systems. Analyzing the integrated response strategies of these countries can provide valuable insights for South Korea's policy development.

The EU actively implements NbS to address climate change and biodiversity loss and has systematically incorporated these solutions into its policies. The *European Green Deal* and the *Biodiversity Strategy 2030* prioritize ecosystem restoration and climate change mitigation and adaptation, making the EU a leading model for achieving multiple policy goals.

Announced in 2019, the European Green Deal sets key strategies for achieving carbon neutrality by 2050, including expanding renewable energy, restoring biodiversity, and adopting a circular economy. A central pillar of the Green Deal, the *EU Biodiversity Strategy 2030*, presents a comprehensive plan for adapting to and mitigating the impacts of climate change through habitat restoration and ecosystem

recovery. This strategy outlines specific targets for integrating climate change mitigation and biodiversity conservation across various sectors, such as agriculture, fisheries, and forest management, and enhances policy coherence and integration through cooperation among member states.

Germany has been at the forefront of developing and implementing comprehensive plans for climate change response and biodiversity protection within the EU. The *Climate Action Plan 2050 (CAP 2050)*, announced in 2016, serves as Germany's long-term climate policy roadmap and aims to reduce net greenhouse gas emissions by 80–95% by 2050 compared to 1990 levels. The plan integrates climate change mitigation and biodiversity conservation by setting sector-specific reduction targets and action plans across energy, construction, transportation, industry, agriculture, and forestry.

NbS, such as ecosystem restoration and forest and wetland management, are key strategies for enhancing carbon sequestration, alongside sustainable agricultural practices to expand carbon sinks.

Germany also continuously monitors ecosystem services to minimize the impacts of climate change on biodiversity [45].

Additionally, Germany actively participates in global climate partnerships, supporting coal phase-out initiatives in emerging economies and advocating for carbon pricing reforms within the EU. Its policy approach incorporates the concept of *Inclusive Wealth*, which considers economic, environmental, and social values to achieve climate change mitigation, biodiversity conservation, and improved human well-being simultaneously. Universities in Germany also promote transdisciplinary research to strengthen the integration of climate and biodiversity policies, emphasizing continuous research and evaluation for effective policy implementation.

Japan's policies reflect its environmental characteristics, including frequent natural disasters, focusing on disaster risk reduction and climate change adaptation through ecological restoration. The *Satoyama Initiative* exemplifies Japan's unique model that combines traditional ecosystem management practices with modern restoration strategies, aiming for harmonious coexistence between nature and humans.

The Satoyama Initiative is implemented across diverse environments, including agriculture, forests, and marine ecosystems, and features restoration activities centered on community participation. The Japanese government has also strengthened forest restoration activities through its national forest management system, enhancing carbon absorption and improving climate resilience.

Japan's efforts are based on collaboration with local governments and community participation. In addition to central government funding, sustainable financial resources are secured through contributions from the private sector and NGOs. For example, community-led restoration projects have created ancillary benefits, such as revitalizing the local economy and tourism industry, providing incentives for local communities to participate in ecological restoration.

Japan's approach, which integrates traditional values with modern technology, is recognized as an important model for addressing climate change and biodiversity issues. It demonstrates that ecosystem restoration can simultaneously achieve environmental sustainability and economic stability.

The integration of Nature-based Solutions (NbS) within South Korea's policy framework remains relatively underdeveloped. Recent initiatives, such as the inclusion of biodiversity management strategies in the 1st National Carbon Neutrality and Green Growth Master Plan (April 2023) and the 3rd National Climate Crisis Adaptation Plan (June 2023), have been undertaken to combat climate change. Nonetheless, these efforts are still nascent, revealing a significant gap in the establishment of a comprehensive and systematic integration strategy. For example, there is a conspicuous lack of specific and measurable approaches aimed at enhancing carbon sequestration through wetland restoration or bolstering climate resilience [46].

Moreover, South Korea currently lacks institutional frameworks, including legislation that supports NbS methodologies such as wetland and blue carbon initiatives [47].

The 5th National Biodiversity Strategy outlines plans to augment carbon sinks by ecosystem type and to develop technologies for carbon sequestration to improve carbon absorption via NbS. In a manner akin to European models, South Korea aspires to implement an inter-ministerial integrated management system for ecosystem-based climate responses by 2026 [33].

However, the successful execution of these strategies necessitates sustainable funding and research, as evidenced by the experiences of countries such as Japan and Germany. Additionally, the incorporation of ecosystem restoration ac-

tivities into regional regeneration projects, including urban revitalization efforts, may prove to be an effective approach. Learning from Japan's practices, it is also advisable to consider the expansion of community-participatory ecosystem restoration initiatives throughout South Korea.

5. Conclusions

This study analyzes South Korea's policy responses to the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) and diagnoses the causes of the imbalance in responses to these two conventions. The primary objective of this research is to identify the policy differences between the two conventions and their underlying causes to propose an integrated policy approach that considers the interconnections between climate change and biodiversity.

To achieve this, the study conducted a comparative review of South Korea's major policies and legal frameworks related to climate change and biodiversity through literature analysis and case studies. The OECD's Policy Coherence for Sustainable Development (PCSD) indicators were used to evaluate policy coherence, supplemented by additional indicators—legal enforceability, economic incentives, financial support, and industry engagement—identified as essential policy elements in previous research. Moreover, exemplary cases of integrated policy responses from other countries were analyzed to seek improvements for South Korea's policy responses.

The findings reveal that South Korea, compared to other nations, generally lacks policy specificity and sufficient financial support, although efforts are being made to reflect the risks of climate change and biodiversity loss in policies. The comparative analysis of domestic climate change and biodiversity loss response policies shows that biodiversity policies face greater limitations in terms of policy continuity, legal enforceability, financial support, and stakeholder engagement. Climate change policies demonstrate policy coherence based on clear quantitative targets and legal obligations, whereas biodiversity policies suffer from fragmented management and a lower policy priority, limiting their effectiveness.

In terms of climate change responses, a collaborative system involving central and local governments has been established, supported by a solid legal foundation and clear economic incentives. In contrast, biodiversity policies face challenges due to insufficient inter-ministerial coordination, limited stakeholder participation, and inadequate financial support. Notably, climate change policies benefit from a single evaluation metric—greenhouse gas (GHG) reduction—making them easier to assess quantitatively. In contrast, biodiversity policies must consider regional characteristics and multidimensional goals, making quantitative evaluation more complex. These differences contribute to the policy gap between the two conventions.

The study identifies three main reasons for the relatively weaker response to biodiversity compared to climate change in South Korea.

Firstly, there is a lack of public awareness regarding biodiversity conservation, which serves as a significant constraint. The public and private sectors have a limited understanding of the necessity of biodiversity conservation, negatively affecting the prioritization of related policies. In contrast, climate change, centered around the clear metric of GHG reduction, enjoys robust international discourse, public interest, and political support, making policy implementation more feasible. Furthermore, raising awareness that biodiversity conservation is essential for achieving GHG reduction and adaptation would strengthen the perception of their complementary relationship.

Secondly, the legal enforceability and financial support system for biodiversity policies are weak. Although significant budgets have been allocated to both types of policies, transparency in budget allocation and spending has been limited. Additionally, due to differences in public attention, the budget for biodiversity loss and conservation has been significantly lower than that for climate change. Biodiversity-related projects are often managed in a decentralized manner, weakening policy coherence and sustainability.

Lastly, stakeholder engagement is limited. While both policies have institutional processes to ensure the participation of central and local governments, the private sector, and civil society in strategy formulation, there are insufficient channels for these stakeholders to continuously influence policy implementation, evaluation, and feedback.

In conclusion, the following policy recommendations are proposed to address these challenges:

1. **Establish an integrated governance system:** that

promotes cooperation among central and local governments and the private sector. This would enhance policy coherence and resolve inter-ministerial coordination issues. Climate change and biodiversity are interconnected issues that cannot be addressed solely by individual ministries. Therefore, an integrated governance approach is necessary. Treating the two issues as separate could result in fragmented projects and dualized budgets, reducing overall policy effectiveness.

2. **Strengthen economic incentives:** to encourage active participation from businesses and local communities. Offering tax benefits to companies involved in biodiversity conservation activities, as well as providing education and budget support to address participation constraints, can expand private sector engagement. In leading countries with proactive climate and biodiversity policies, governments use enforceable regulations and incentives to draw corporate attention to these issues. In South Korea, however, legal enforcement and incentive policies remain insufficient.

As a limitation, this study relied on literature analysis and case studies to derive policy implications, which may not fully reflect the complex and dynamic factors involved in the actual policy implementation process. For example, regional characteristics and socio-cultural factors affecting biodiversity conservation were not thoroughly analyzed. Additionally, the quantitative analysis of the interlinkages between climate change and biodiversity policies was limited, making it difficult to present concrete evidence of the effectiveness of an integrated approach. Therefore, future research should include additional field studies and stakeholder interviews to provide more practical policy recommendations.

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The authors declare no conflict of interest.

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