Original Research Article

Collaborative pathways for ecological environment and economic development under the background of low-carbon transition

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Abstract: In the context of the global push for low-carbon transformation, the synergistic advancement of ecological environment and economic development has become an inevitable trend. This article delves into the significant importance of the synergy between ecological environment and economic development in the context of low-carbon transformation, sorts out the current challenges faced, and elaborates on the effective paths to achieve the synergistic development of both, hoping to provide a useful reference for promoting green economic growth and protecting the ecological environment.

Keywords: Low-carbon transition; Ecological environment; Economic development; Synergistic pathways

1. Introduction

Under the global wave of low-carbon transformation, the synergistic progress of ecological environment and economic development has become increasingly critical. The threat of climate change is growing, ecosystems urgently need protection, and the economic development model also needs innovation. However, at present, the synergy between the two faces numerous obstacles, with frequent issues in technology, policy, funding, and other aspects. A thorough exploration of the synergistic paths and resolution of existing problems have become an urgent task for promoting sustainable development, holding profound significance for the long-term development of human society.

2. The Importance of Synergy Between Ecological Environment and Economic Development Under the Background of Low-carbon Transition

2.1. The inevitable choice for addressing climate change

Climate change is deeply affected by greenhouse gas emissions, bringing extensive and profound impacts on ecosystems and human societies. The coordinated advancement of ecological environment and economy in low-carbon transformation is crucial for effectively suppressing emissions of carbon dioxide and other greenhouse gases, and alleviating the risks of climate change. For instance, in terms of energy consumption structure,increasing the proportion of renewable energy can significantly reduce dependence on fossil fuels and lower carbon emissions. Vigorously developing clean energy sources such as solar and wind power to replace fossil fuels can not only mitigate the risks of extreme weather caused by the greenhouse effect but also foster new industries like new energy equipment manufacturing and smart grid development, opening up new spaces for economic growth.

2.2. Enhance the function of ecosystem services

The health and stability of ecosystems are the foundation for the sustained development of the economy

and society. Ecosystems provide humans with a rich variety of ecological services, such as water conservation, soil protection, and climate regulation [1]. A synergistic approach that promotes environmental protection and low-carbon development can effectively enhance the ecological carrying capacity. By implementing measures such as forest tending and wetland restoration, the capacity for carbon sequestration and water conservation can be significantly improved. At the same time, fostering green industries like ecological tourism and carbon trading can create a virtuous cycle of ecological protection and economic development.

2.3. Promote the optimization and upgrading of the economic structure

Low-carbon transformation forces technological innovation and industrial change, promoting traditional industries to transform and upgrade from high energy consumption and heavy pollution to low energy consumption and high value-added directions. In the process of coordinated development of the ecological environment and the economy, enterprises will increase investment in research and development of energy-saving and emission reduction technologies, green product manufacturing, and other fields to meet environmental protection requirements, thereby promoting the adjustment and upgrading of the industrial structure. Taking the electric vehicle industry as an example, its rapid development not only reduces carbon emissions in the transportation sector but also drives the prosperity of supporting industrial chains such as power batteries and intelligent charging piles.

2.4. Achieving sustainable development goals

The sustainable development of human civilization is inseparable from the dynamic balance between economy and ecology. By coordinating the efficiency of resource utilization and environmental protection standards, the coordinated development model can not only guarantee the needs of contemporary development, but also retain ecological capital for future generations. This comprehensive path of giving consideration to social equity, economic efficiency and ecological security is the only way to solve the development dilemma and achieve intergenerational equity.

3. The current ecological environment and economic development are coordinated challenges

3.1. Lack of technological innovation capacity

The key to realizing ecological and economic coordination lies in low-carbon technological innovation breakthroughs. However, at present, China still has technological bottlenecks in frontier fields such as carbon capture and utilization and new energy conversion, and there are intergenerational differences with the international advanced level. Weak research and development capabilities lead to the dependence on imports of core technologies, which not only restricts the pace of industrial upgrading, but also weakens the initiative in ecological and environmental governance.

3.2. Imperfect policy system

The current policy system in China has not yet formed an organic whole, and there is a logical conflict between the industrial guidance policies formulated by different departments and the environmental protection constraint provisions. In the process of promoting industrialization, some regions are faced with the dual pressure of environmental protection red line and economic growth. In the process of policy implementation, there are often regulatory blind spots or dislocation of standards, which makes it difficult for enterprises to form a stable

green development expectation [2] in the actual development process.

3.3. shortage of capital investment

Ecological protection and low-carbon transformation require long-term, large and continuous capital investment, but the existing capital channels are highly dependent on financial allocation, and the participation of social capital is not high and the participation channels are relatively narrow. In addition, the innovative application of market financing tools lags behind, and the supply of green financial products is insufficient, which leads to the high financing cost of ecological environment projects, which seriously restricts the feasibility of large-scale implementation.

4. The coordinated path of ecological environment and economic development under the background of low-carbon transformation

4.1. Strengthen technological innovation to provide support for coordinated development

To promote the innovative development of low-carbon technologies, we need to build a systematic support system. First of all, it is necessary to build a diversified capital investment system, guide government finance and social capital to participate in key technology breakthroughs, and focus on cultivating core technologies in areas such as carbon capture, clean energy development and efficient utilization of resources. Secondly, a regular cooperation mechanism should be established to promote the rapid transformation of laboratory research results to industrial application, enhance the exchange and cooperation between scientific research institutions, universities and enterprises, and encourage enterprises to participate in technology research and development through policies such as tax incentives and joint laboratory construction, so as to form an innovation ecology of deep integration of industry, university and research. Finally, active in international low carbon technology cooperation, deepen international science and technology exchanges and cooperation, actively participate in the global climate governance system construction, pay attention to digestion in the process of technology introduction of the absorption and innovation, by building demonstration projects and joint research and development center improve technology transformation efficiency, comprehensive improve domestic low carbon technology level, and promote the ecological environment protection and economic development to achieve depth fusion, towards synergy to a new height.

4.2. Improve the policy system and strengthen policy coordination

To improve the institutional framework of the coordinated development of ecological environment and economy, we need to optimize the policy supply system from multiple dimensions. First of all, the government should start to optimize industrial policies, focusing on the development needs of low-carbon and green industries, and guide capital to renewable energy, energy saving technology and other fields through differentiated tax rates, special subsidies and green finance, so as to help their vigorous development. Secondly, it is necessary to strengthen the implementation efficiency of environmental laws and regulations, build a dynamic monitoring network covering the whole chain, use big data technology to implement precise supervision, and take stepped punishment measures for excessive emission behaviors, so as to force enterprises to establish a long-term mechanism of environmental responsibility mechanism. On this basis, also need to pay attention to the policy system of system integration, coordination, establish cross-departmental joint meeting mechanism, in developing energy strategy overall ecological considering the red line and the comprehensive demand of

industrial upgrading, through carbon trading market cohesion carbon emissions trading mechanism and green technology innovation incentive policy, with scientific planning to promote energy structure optimization, form the compound system advantage to promote the development of high quality.

4.3. Expand capital channels and increase capital input

To improve the fund guarantee mechanism of ecological environment protection and low-carbon development, it is necessary to build a diversified investment system led by the government and social participation. The government should take the initiative to significantly increase the scale of financial investment in ecological and environmental protection and the development of low-carbon industries, set up special development funds to focus on supporting ecological restoration projects and clean energy infrastructure, and optimize the efficiency of fund allocation through scientific planning of the flow of financial funds. At the same time, it is necessary to improve market-oriented incentive policies, encourage private capital to participate in ecological governance projects through public-private cooperation, issue green bonds and other financial instruments, attract social capital to actively participate in ecological protection, low-carbon infrastructure construction and other projects, and expand the funding sources[3]. On this basis, promote financial institutions to deepen green financial innovation, encourage financial institutions to actively carry out green financial business, continuous innovation form of green financial products and services, such as green credit, green insurance diversified products, for the coordinated development of ecological environment and economic project to build all-round, multi-level financing channels, help to achieve sustainable development goals.

4.4. Strengthen ecological protection and restoration, and improve the quality of ecosystems

Improve the ecological protection system to implement systematic engineering measures, first strengthen the planning and construction of nature reserve (**Figure 1**), through scientific delimit ecological red line, optimize the spatial layout gradually expand the scope of protection, synchronous perfect hierarchical management system and supervision mechanism, to build a biodiversity conservation barrier, to maintain the integrity and stability of the ecological system. Second promote the whole domain ecological management, in view of the soil erosion area implement slope vegetation restoration project, desertification land ban protection and grass square sand-fixing operations, push forward lakes wetland ecological hydrating and returning farmland to wet work, effectively improve the ecological environment, improve the ecosystem service function, create a good ecological environment for economic sustainable development. Finally to build intelligent monitoring and evaluation system, using satellite remote sensing, Internet sensor technology to establish empty integration monitoring network, regularly carry out ecological bearing capacity assessment and ecological benefit accounting, through dynamic data tracking for ecological red line adjustment, restoration scheme optimization to provide decision support, form a closed loop management mode, realize the coordinated development of ecology and economy.

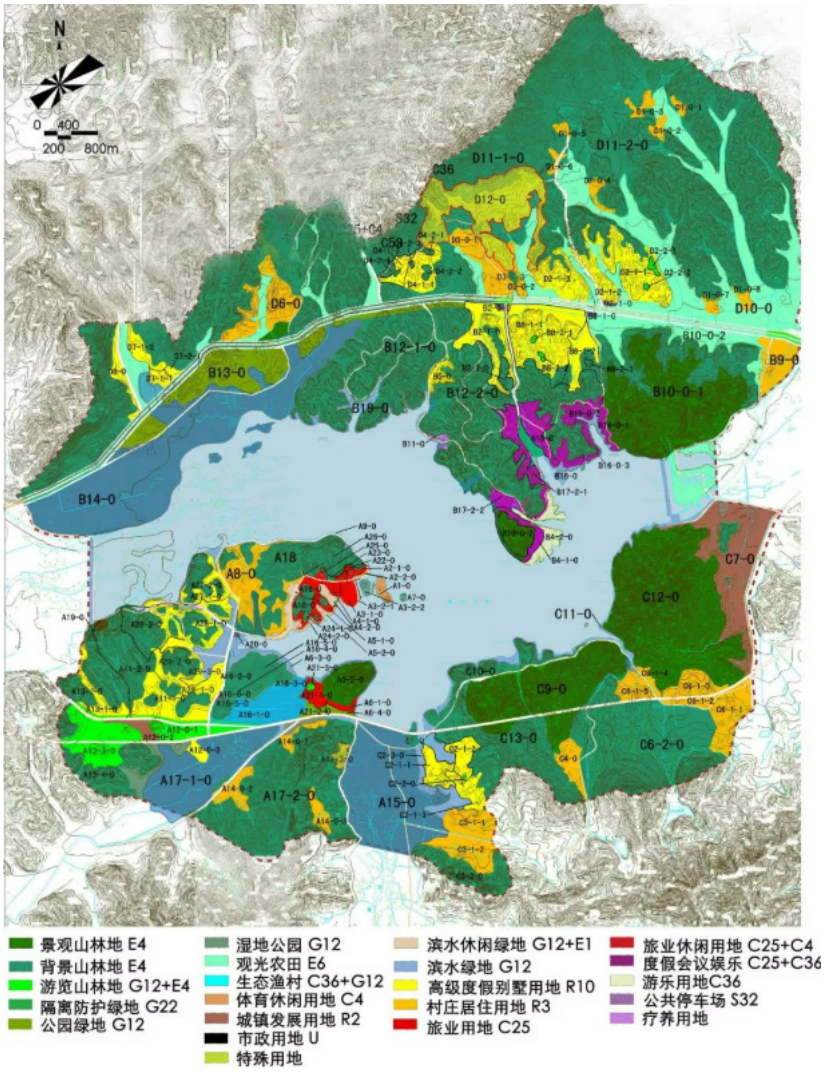

Figure 1. Layout diagram of nature reserves.

5. Epilogue

In the context of low-carbon transformation, the coordination of ecological environment and economic development is the only way to achieve sustainable development. Although there are multiple challenges, including technology, policy and capital, the benign interaction between ecological environment and economic development can be effectively promoted through the transformation of the concept of development, technological innovation, the improvement of the policy system, broadening the capital channels and the strengthening of ecological protection and restoration. In the future development, in the future, we should pool the strength of all parties, unswervingly take the road of ecological priority and green development, constantly explore and improve the coordinated development model, achieve a win-win situation between ecology and economy, and create a new situation of harmonious coexistence of human society prosperity and ecology.

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