

Exploration and Practice of Biodiversity Investment and Financing in Jilin Province and Policy Optimization

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Abstract Biodiversity is closely related to human well-being and is an important foundation for human survival and development. Currently, there is a significant funding gap in biodiversity conservation in various regions. How to leverage financial resources in key areas such as financial support for biodiversity conservation, value conversion of ecological products, and green inclusive finance has become an increasingly concerned field and an actively explored direction. This article reviews the relevant policies that have been issued in Jilin Province regarding biodiversity conservation, providing guidance for the formulation of investment and financing policies. In practice, Jilin Province has explored investment and financing models through multiple channels. In terms of finance, it has strengthened the coordination of financial resources at all levels in accordance with the principle of matching fiscal powers and expenditure responsibilities, and increased support for biodiversity conservation through existing funding channels. At the same time, it has actively studied the establishment of market-oriented and socialized investment and financing mechanisms and encouraged the participation of social capital. Through the research on the investment and financing policies and practices for biodiversity in Jilin Province, this article analyzes the existing bottlenecks in green finance support for biodiversity, aiming to provide reference for further improving relevant policies, optimizing the allocation and use of funds, and enhancing the level of biodiversity conservation.

Key words Biodiversity; Green finance; Investment and financing; Practice; Jilin Province

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Biodiversity is the foundation of human survival and development, playing an irreplaceable role in maintaining ecological balance, providing ecological services, and promoting economic development^[1]. Jilin Province is located at the geographical center of Northeast Asia, with abundant biodiversity resources, covering various ecosystems such as forests, grasslands, wetlands, *etc.* It is a habitat for numerous wild animals and plants. However, with the rapid development of the economy and society, biodiversity is facing many threats, such as habitat loss, species invasion, and overexploitation. Biodiversity protection is urgent, and sufficient capital investment is one of the key factors to achieve effective conservation^[2]. Therefore, it has important practical significance by studying the investment and financing policies and practices of biodiversity in Jilin Province.

1 Basic overview of Jilin Province

Jilin Province is located in the central part of Northeast China, with an area of 187 400 km². It has the Changbai Mountain forest ecosystem, the Songnen Plain grassland ecosystem, and numerous wetland ecosystems. The Changbai Mountain region is rich in forest resources and has a clear vertical distribution of vegetation, making it one of the important natural forest areas in China. The grasslands of the Songnen Plain provide living space for numerous herbivorous animals. Wetlands such as Xianghai and

Momoge are resting and breeding grounds for numerous migratory birds, and play an important role in global biodiversity conservation^[3]. At present, the forest coverage rate in Jilin Province has reached 45.28%, the comprehensive vegetation coverage of grasslands is 72.15%, and the wetland protection rate is 45.22%. For 19 consecutive years, the ecological environment in Jilin Province has maintained a good level.

Jilin Province has a wide variety of wild animals and plants, including rare and endangered wild animals such as *Panthera tigris*, *Panthera pardus orientalis*, *Grus japonensis*, and *Mergus squamatus*, as well as national key protected wild plants such as *Taxus cuspidata* and *Pinus sylvestris*. In recent years, with the increasing protection efforts, the number of some species has shown an increasing trend, such as the number of *P. tigris* and *P. pardus orientalis* in the Northeast China Tiger and Leopard National Park area, which has grown from 27 and 42 before the pilot to 70 and 80 at present. At the same time, new species are constantly being discovered, demonstrating the richness and effectiveness of biodiversity conservation in Jilin Province. There are currently over 4 900 species of wild animals, including 36 species of national first-class protected wild animals and 100 species of national second-class protected wild animals. There are currently over 4 000 species of wild plants, including 1 species of national first-class protected wild plant and 39 species of national second-class protected wild plants. An ecological chain corridor is formed from east to west, with tigers and leopards in the east, spotted deer in the middle, and white cranes in the west.

In recent years, the biodiversity conservation work in Jilin Province has achieved positive results. Jilin Province has a total of 39 nature reserves at or above the provincial level, including 22 at the national level and 17 at the provincial level. Changbai Mountain and Longwan Group, two protected areas, have been selected for the green list of IUCN. A natural protected area system has been established, with Northeast China Tiger and Leopard National Park as the main body, nature reserves as the foundation, and various natural parks as supplements. Various endangered wildlife and plants have been protected and restored, and the quality and stability of the ecosystem have been effectively improved. It has successively issued and implemented the *Biodiversity Conservation Strategy Action Plan in Jilin Province*, the *Aquatic Biodiversity Conservation Plan in the Songhua River and the Liaohe River Basin of Jilin Province*, and the *Implementation Opinions on Further Strengthening Biodiversity Conservation*, systematically promoting biodiversity conservation work. The protection rate of national key protected wild animal and plant species has reached 95%, and the effective protection rate of terrestrial ecosystem types has reached 92%.

2 Biodiversity investment and financing policies in Jilin Province

Jilin Province actively builds a policy system for biodiversity investment and financing. In terms of financial support, it strengthens the coordination of financial resources at all levels and continues to provide financial support for biodiversity conservation. At the same time, it is committed to leveraging more social capital and building diversified investment and financing mechanisms. For example, through policy guidance, financial institutions are encouraged to innovate green financial products and services, such as "ecological loans", to support industrial development through financial innovation and indirectly promote biodiversity conservation. In addition, it actively seeks various central funds to provide financial support for biodiversity conservation related projects. It promotes the integration of biodiversity conservation work with economic development, laying a strong financial foundation for achieving the 2025 and 2035 biodiversity conservation goals. It promotes sustainable development of biodiversity by raising conservation funds through multiple channels and fields.

2.1 Financial support policies According to the principle of matching fiscal powers with expenditure responsibilities, Jilin Province strengthens the overall coordination of financial resources at all levels. Through existing funding channels such as ecological protection special funds, forestry development funds, etc., it increases support for biodiversity conservation work. These funds are mainly used for the construction and management of nature reserves, the protection of wildlife and plants, ecological restoration, and other aspects. From 2021 to 2023, Jilin provincial finance raised and allocated 27.983 billion yuan for ecological pro-

tection and restoration. It comprehensively strengthens the protection of natural forests and deeply promotes large-scale land greening actions. The first batch of forest, grass and wetland ecological connectivity demonstration projects in Jilin Province is implemented to promote the consolidation and improvement of carbon sequestration capacity^[4]. A special biodiversity conservation fund is established for supporting biodiversity surveys and assessments, monitoring network construction, and other related work. In August 2023, Jilin provincial government issued the *Pilot Plan for Compensation Insurance for Personal and Property Damage Caused by Key Protected Terrestrial Wildlife in Jilin Province*, launching the pilot work of wildlife damage compensation insurance. By fully utilizing market mechanisms and commercial insurance methods, it strengthens compensation responsibilities of local governments, promotes the transformation of compensation methods to commercial insurance claims, and ensures the stable and orderly progress of ecological damage compensation work.

2.2 Market oriented investment and financing policies It studies and establishes market-oriented and socialized investment and financing mechanisms, and encourages social capital to participate in biodiversity conservation in various forms^[5]. For example, through the public-private partnership (PPP) model, it attracts social capital to participate in the construction of ecotourism facilities and ecological restoration projects in nature reserves. On the premise of reasonable development, a positive interaction between biodiversity conservation and economic development could be achieved. Drawing on the experience of establishing industry equity investment funds in the development of new energy industries, it explores the establishment of a biodiversity conservation industry guidance fund. It guides funds to invest in biodiversity related industries such as biomedicine and biological agriculture, not only promoting industry development, but also raising funds for biodiversity conservation, and achieving synergy between industry development and biodiversity conservation.

2.3 Policy guarantees and incentive measures It should establish a sound system for biodiversity conservation and supervision. Based on the revision of relevant national laws and regulations, it should timely formulate and revise local regulations and government rules and regulations in the fields of forest, grassland, wetland, wildlife and plant protection in Jilin Province. It provides legal protection for biodiversity investment and financing activities, regulates the behavior of all parties, and reduces investment risks^[6]. Preferential tax policy should be provided to enterprises and social organizations involved in biodiversity conservation, such as reducing or exempting corporate income tax and value-added tax. At the same time, subsidies should be provided to entities carrying out projects related to biodiversity conservation to increase their participation enthusiasm. For example, it should provide certain financial subsidies to enterprises engaged in ecological restoration to encourage them to adopt advanced ecological restoration technologies.

3 Exploration and practice of biodiversity investment and financing in Jilin Province

3.1 Deepening the promotion of "ecological insurance"

3.1.1 Comprehensively promoting forest insurance, which effectively maintains the stability of forest ecosystems. Jilin Province launched forest insurance in 2012. Currently, there are 7 underwriting institutions that offer forest insurance services in Jilin Province, with an insurance amount of 800 yuan per mu and an insurance premium rate of 0.25%, that is, an annual premium of 2 yuan per mu is required. In 2023, Jilin Province was affected by floods, fires, harmful organisms and other disasters, resulting in a total of 94 forest disasters. 94 cases were surveyed, assessed and compensated, with a compensation area of 1 368.13 km² and a total compensation of 27.374 2 million yuan. Forest insurance promotes financial institutions to increase effective credit investment in forestry development, effectively maintaining the stability of forest ecosystems^[7].

3.1.2 Improving and refining agricultural insurance, steadily promoting mandatory liability insurance for environmental pollution. In the field of biological agriculture, policies such as fiscal subsidies and tax incentives are used to attract social capital to invest in biological agriculture projects, such as organic agriculture planting and the application of biological control technology^[8]. The implementation of these projects has reduced the use of chemical pesticides and fertilizers, protected the biodiversity of agricultural ecosystems, and improved the quality and economic benefits of agricultural products.

In 2007, Jilin Province became one of the first pilot provinces for policy based agricultural insurance in China. In 2008, the number of pilot counties (districts) for planting insurance increased from 27 to 45. At the end of 2019, Jilin Province launched the work of environmental pollution liability insurance. In 2021, the *Environmental Pollution Liability Insurance Implementation Plan in Jilin Province* and the *Implementation Rules* were issued. Through unified design at the provincial level, the municipal ecological environment department, brokerage companies, and insured enterprises (1 + 3) worked together to promote the healthy and orderly operation of environmental liability insurance. In 2023, Jilin provincial government issued the *Implementation Plan for Agricultural Insurance Work in Jilin Province* in 2023, further regulating the order of the agricultural insurance market, accelerating the high-quality development of agricultural insurance, and fully leveraging the role of agricultural insurance in supporting stable production and supply of grain and important agricultural products.

3.2 Taking multiple measures to promote "ecological loans" and "green bonds" One is to build a platform to promote precise matching of financing supply and demand in the field of ecological environment. Jilin Provincial Department of Ecology and Environment has signed strategic framework agreements with provincial branches of the People's Bank of China, China Development Bank, Agricultural Development Bank, and China Construc-

tion Bank, and has established contacts with more than 10 financial institutions including Jilin branches of Industrial and Commercial Bank of China and Bank of China, comprehensively establishing a "government – bank – enterprise" strategic cooperation relationship, and providing strong support for the development of green finance. In recent years, multiple online and offline match-making meetings for financing needs have been held, and a total of 371 financing projects in the field of ecological and environmental protection have been pushed to financial institutions, with a total financing demand of 100.96 billion yuan. As of the end of 2023, the balance of green loans in Jilin Province was 270.55 billion yuan, a year-on-year increase of 32.1%, which was 26.6 percentage points higher than the growth rate of all loans during the same period. In 2023, a total of 3.556 billion yuan worth of green bonds was issued by Jilin Province.

The second is to create a "project library + financing" support model and promote the pilot of EOD projects. It should promote the combination of ecological environment governance projects with strong public welfare but poor profitability and their related industry development projects, promote industrial integration, and open up the path for social capital and financial institutions to participate in ecological environment governance^[8]. As of now, there are 20 EOD projects jointly planned in Jilin Province, and 10 of them have been approved by the state and included in the ecological and environmental protection financial support project library. The infrastructure construction of Ruyi Lake area in Shuangyang City, Changchun City (EOD model) has obtained a loan credit of 1.7 billion yuan from Jilin Branch of China Development Bank.

Thirdly, it should steadily and orderly promote investment and financing in response to climate change^[9]. Six departments in Jilin Province, including ecological environment, development and reform, finance, and the People's Bank of China, have issued the *Several Measures to Accelerate the Implementation of Investment and Financing in Response to Climate Change*, including establishing a climate investment and financing project library, innovating carbon finance products and services, improving financial and tax supporting policies of climate investment and financing, expanding the scale of green bonds, optimizing climate investment and financing services, *etc.*, to help Jilin Province accelerate its green and low-carbon transformation and high-quality development. In May 2022, a third-party organization was introduced in Hunjiang District, Baishan City, Jilin Province to establish a state-owned platform and enterprise shareholding joint-stock company to account for and develop forestry carbon sinks. In August of 2022, the first forestry carbon sink development project design in Jilin Province was completed. In October, it was approved as a pilot county for forestry carbon sink development in Jilin Province. In December, it completed 27 000 t of CCER pre-sale transactions and 564 000 t of expected income pledge loans worth 30 million yuan in green financing, becoming the first county or district in Jilin Province to achieve green financing for forestry carbon sink development,

CCER pre-sales, and expected income pledge loans. At the end of June 2023, Jilin Bank used carbon reduction support tools to issue a pre project loan of 15 million yuan with a preferential interest rate of 2.55% to support the wind power project in Baicheng, achieving innovative practice in supporting carbon reduction.

3.3 Establishing and improving a water ecological compensation mechanism In 2017, Jilin Province formulated and issued the *Implementation Measures for Regional Compensation of Water Environment in Jilin Province (Trial)*, which first carried out pilot projects for ecological compensation of water environment regions. In 2018, a horizontal ecological compensation mechanism was established in the upstream and downstream of the Liaohe River basin, including seven water quality assessment sections in the basin's ecological compensation scope. In 2020, the *Regional Compensation Measures of Water Environment in Jilin Province* were issued, which included 35 assessment sections and 17 centralized drinking water sources in prefecture level and above cities in the compensation scope, and the ecological compensation work for water environment basins was fully implemented throughout Jilin Province. Since 2020, Jilin Province has implemented more than 200 million yuan in regional compensation funds for water environment.

The implementation of regional compensation for water environment has fully mobilized the enthusiasm of water environment governance in various regions, and historic breakthroughs have been made in the quality of water ecological environment^[10]. In 2023, the proportion of excellent water bodies in nationally controlled sections in Jilin Province reached 86.2%, and the proportion of excellent water bodies in the Dongliao River basin reached 100%, achieving three consecutive improvements in water ecological environment quality.

3.4 Fully implementing the ecological damage compensation system In recent years, Jilin Provincial Party Committee and Jilin Provincial Government have listed the compensation for ecological environment damage as an important reform task, key promotion content, and key inspection direction of the ecological civilization system, and have conducted overall research and deployment. A total of 609 ecological damage compensation cases have been handled, with a total compensation amount of 117 million yuan involved in the settled cases. At present, 66 out of 72 counties (cities, districts) in Jilin Province have carried out damage compensation case practices, with a coverage rate of 91.7%. "The environment has value, and it should undertake responsibility for damage" has gradually become a consensus in the whole society.

4 Main problems of financial support for biodiversity conservation

4.1 Top-level policy framework needing further improvement At present, the existing green finance classification standards have preliminarily included some projects related to biodiver-

sity conservation^[11]. However, in practical applications, clear credit standards have not been established, and there is a lack of basis for customer access, credit approval, risk assessment, and other aspects. Bank credit investment in biodiversity conservation lacks clear projects and lists, and there are difficulties in collecting information and identifying risks for biodiversity projects. At the operational level, it also has certain challenges in supporting biodiversity financing. In addition, Jilin Province has introduced policies to encourage social capital to participate in biodiversity conservation. In practice, due to factors such as long investment return cycles and relatively high risks in biodiversity conservation projects, the enthusiasm of social capital participation has not been fully mobilized^[12]. The breadth and depth of social capital participation are insufficient to meet the diversified funding needs of biodiversity conservation.

4.2 Lack of effective incentive mechanisms and needing to improve the efficiency of fund utilization Biodiversity conservation projects usually have problems such as long investment periods, large funding requirements, low economic benefits, and high investment risks^[13]. Due to the mismatch between risk and return, financial institutions have low enthusiasm for supporting biodiversity conservation for the sake of stable operation and risk control. Therefore, multidimensional policy support such as finance and fiscal policies is needed. Although Jilin Province has raised funds for biodiversity conservation through various channels, there is still a significant gap in the total amount of funds compared to the actual needs of biodiversity conservation. Especially in areas such as large-scale ecological restoration and the improvement of biodiversity monitoring systems, funding shortages have limited the in-depth development of conservation work. In the process of using biodiversity conservation funds, there are problems such as unreasonable allocation of funds, slow project implementation progress, and inadequate supervision, which have led to some funds not fully realizing their benefits. Some projects have phenomena such as redundant construction and resource waste, which have affected the overall effectiveness of biodiversity conservation work.

4.3 Investment and financing mechanism is not perfect, and the mechanism for realizing the value of ecological products has not yet been established At present, the investment and financing mechanism for biodiversity in Jilin Province is not yet perfect, lacking a unified coordination and management organization as well as an effective risk assessment and regulatory system. The lack of effective integration and collaboration between different funding channels leads to scattered use of funds and difficulty in forming synergy. At the same time, the lack of risk assessment and regulatory systems has increased the risks of investment and financing activities, affecting investors' confidence. The standards for calculating the value of ecological products are not unified, and the evaluation mechanism is not sound. The property rights system for realizing the value of ecological products is not clear, and the

mechanisms for operating and developing ecological products, protecting and compensating, and ensuring the realization of ecological value have not yet been established^[14]. The relevant policies, assessment methods, reward and punishment mechanisms, and other policy opinions supporting the realization of ecological product value need to be introduced, which limit the participation of financial institutions in biodiversity conservation projects to some extent.

5 Policy recommendations

5.1 Strengthening top-level design, and improving policy system and supporting measures It should guide financial institutions to provide a more clear and specific list of projects for protecting biodiversity in the green finance directory, and increase investment in these areas. Overall planning should be strengthened, to guide financial institutions to increase their efforts in the green finance industry and services, broaden project repayment and guarantee methods, explore low pledge loans for environmental rights and interests, and environmental benefit loans. It should further increase the efforts to bond ecological assets, promote the securitization of ecological assets, establish green funds, and introduce social capital to support biodiversity conservation work.

5.2 Increasing financial support and establishing a sound incentive mechanism It should actively seek more special funds for biodiversity conservation from the central government to support major biodiversity conservation projects and ecological engineering construction in Jilin Province. At the same time, it should strengthen communication and coordination with relevant national departments, and strive for policy and project tilt. It is suggested further optimizing the central and local financial subsidy policies. A certain amount of fiscal funds is allocated every year to establish a financial subsidy policy to support biodiversity, play the leverage role of fiscal funds, and establish a normalized project recommendation mechanism. It should further improve the green finance evaluation system, strengthen monitoring and evaluation, policy coordination, publicity and promotion, incentivize and promote green credit, and increase support for ecological construction and biodiversity conservation. Provincial finance should further increase investment in biodiversity conservation, adjust the structure of fiscal expenditures, and increase the proportion of biodiversity conservation funds in the fiscal budget. In addition, new sources of fiscal funding such as ecological compensation taxes and fees could be explored to provide stable financial support for biodiversity conservation.

5.3 Improving the efficiency of fund utilization and establishing a sound mechanism for realizing the value of ecological products It should establish a scientific and reasonable funding allocation mechanism, and allocate funds reasonably based on the key areas and key links of biodiversity conservation. Priority will be given to supporting key projects such as the delineation of eco-

logical protection red lines, the construction and management of nature reserves, and the protection of rare and endangered species, ensuring that funds are directed to the most urgently needed areas. It should establish and improve project management systems, and strengthen the full process management of biodiversity conservation projects, including project initiation, implementation, and acceptance. At the same time, it should strengthen the supervision and inspection of the use of funds, establish a regular audit and public disclosure system, ensure the standardization and transparency of fund use, and improve the efficiency of fund use.

It should further improve the institutional system for realizing the value of ecological products such as ecological protection compensation and ecological environment damage compensation, and establish a government assessment and evaluation mechanism for realizing the value of ecological products. Ecological product value evaluation system and value accounting technology system should be unified. It should establish corresponding accounting institutions and professional teams, establish an ecological product information sharing platform, achieve intelligent and information-based management of ecological products, and effectively solve problems of ecological products such as "difficulty in measurement, mortgage, trading, and monetization".

5.4 Improving the investment and financing mechanism, and forming a joint force for investment and financing A specialized biodiversity investment and financing coordination and management organization should be established, responsible for coordinating the investment and use of various funds. It should strengthen communication and collaboration between different departments and funding channels, and form a joint force for biodiversity conservation investment and financing. It should establish a sound risk assessment and regulatory system for biodiversity investment and financing, conduct comprehensive risk assessments of investment and financing projects, and develop corresponding risk prevention and control measures. Additionally, it should strengthen the supervision of investment and financing activities, regulate market order, protect the legitimate rights and interests of investors, and reduce investment and financing risks.

6 Conclusions and discussion

Through the formulation and implementation of a series of policies, active exploration has been carried out in financial support, market-oriented investment and financing, *etc.*, providing financial support for biodiversity conservation. Jilin Province has achieved certain results in biodiversity investment and financing policies and practices. However, there are still problems and challenges in terms of total funding, social capital participation, efficiency of fund utilization, and investment and financing mechanisms. In the future, it is necessary to further increase capital investment, promote the transformation of ecological benefits into economic benefits, develop and strengthen green industries such

as biomedicine and bio agriculture, and achieve high-quality development of the bio economy, thereby attracting more social capital investment. At the same time, it should encourage financial institutions to innovate financing models, such as implementing the "fund + " model, green bonds, *etc.* It also needs to strengthen the assessment and management capabilities of financial institutions for biodiversity related risks, and enhance their participation enthusiasm. In addition, supporting measures should be improved, including formulating relevant policies and regulations, and clarifying the sources and usage norms of funding for biodiversity conservation, thereby creating a favorable policy environment for biodiversity investment and financing. The investment and financing of biodiversity in Jilin Province require collaborative efforts from the government, financial institutions, enterprises, and society. By innovating and improving investment and financing mechanisms, solid financial support can be provided for biodiversity conservation, achieving coordinated and sustainable development of ecology and economy.

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