DOI: 10.37420/j.mlr.2023.006

Transforming biodiversity policies is critical to global biodiversity conservation evidence from China

Qing Wang; Hong Liu
Law School, Zhejiang Normal University, China
***Corresponding author e-mail:TsingWong00@outlook.com**

Funding Project

A Project Supported by Scientific Research Fund of Zhejiang Provincial Education Department (Project Number: Y202147122)
The Special Project "Serving Provincial Strategy and Promoting Common Prosperity" Supported by the Graduate School of Zhejiang Normal University.

Abstract

Since signing the Convention on Biological Diversity, China has formulated and introduced a substantial amount of biodiversity policies, aiming to achieve the global biodiversity conservation targets. However, there is insufficient understanding of the effectiveness of these policies in achieving biodiversity conservation outcomes. We reviewed 124 biodiversity policies (1994-2021) and developed a content analysis in terms of policy intensity, policy tools, and policy targets. The results show that: (1) China has gradually strengthened the protection of biodiversity. However, legal means, which are fundamental safeguards for biodiversity conservation efforts, have not received sufficient attention; (2) In terms of policy tools, environmental policies seem to be favored by China, but these policies cannot directly influence conservation actions; (3) The Chinese government used to pay more attention to the achievement of indirect targets. Now, the government is increasingly focusing on demonstrating the determination and efforts of a responsible power by enhancing the planning of direct targets and long-term targets. As the post-2020 global biodiversity framework evolves, China, as a major biodiversity country, must immediately improve the structure of conservation policy development and work to increase the positive impact of domestic policies on achieving global biodiversity conservation targets.

Keywords

Biodiversity; Conservation policy; Policy evolution; Content analysis; China

1 Introduction

Biodiversity plays a vital role in human well-being and is an important basis for sustainable development (Tittensor et al., 2014). According to statistics, more than half of global GDP depends to various extents on the contribution of nature and ecosystems (WEF, 2020). Since the Reform and Opening-up, China has es-

tablished the strategic goal of focusing on economic construction, and its GDP has grown rapidly. However, rapid economic expansion has been accompanied by massive ecological degradation (Miller-Rushing et al., 2017). To this end, China formally signed the Convention on Biological Diversity (CBD) in 1992 in response to the global target of sustainable use and conservation of biodiversity. Since then, China has actively participated in related conservation activities and has played an important role in the global biodiversity strategy actions (Mallapaty, 2020). For example, China has successfully increased the number of giant pandas through the establishment of nature reserves (Wei et al., 2018). However, despite the tremendous efforts in biodiversity conservation in China, the loss of biodiversity has still not been completely prevented. For example, in December 2019, a scientist stated that the Chinese paddlefish (Psephurus gladius), which once lived in the Yangtze River in China, had become extinct (Zhang et al., 2020).

Conservation scientists have long emphasized that attention to the socio-economic context of biodiversity loss is key to develop effective policies (Martin et al., 2016). In the past, China's economic development has long been in an extensive model. It has accelerated economic growth while exacerbating the process of biodiversity loss (Meng et al., 2019). Although the causes of biodiversity loss are often multifaceted, including climate change (Román-Palacios & Wiens, 2020), habitat destruction, and environmental pollution (Crooks et al., 2017; Hautier et al., 2014). Indeed, it is these accelerating environmental changes that are putting multiple pressures on biodiversity conservation (Tilman et al., 2017; Hanson et al., 2020). Ultimately, however, these changes cannot be separated from the fundamental impact of economic expansion. Currently, the global biodiversity landscape is suffering from anthropogenic disturbances, with a sixth biological mass extinction underway (Ceballos et al., 2015; Isbel et al., 2017; Johnson et al., 2017). To address this crisis, global biodiversity conservation actions require transformative efforts (IPBES, 2019; Bhola et al., 2021). Meanwhile, in China, the world's fastest-growing country (World Bank, 2015), balancing economic growth and biodiversity conservation has become a challenge that policymakers must face (Lu et al., 2020).

In China, policies and regulations are seen as effective tools for biodiversity conservation and sustainable use (Yang et al., 2019). At present, biodiversity policies are mainly macro policy documents with theoretical guidance, highly incline to indirect guidance, and lack of in-depth research on the value of biodiversity conservation, resulting in passive participation in biodiversity conservation (Qin, 2021), thus limiting the precise implementation and effectiveness of conservation actions. The China Biodiversity Conservation Strategy and Action Plan (CBCSAP) (2011-2030) is a landmark planning document jointly formulated by several government departments to address the above-mentioned issues, aiming to contribute "Chinese wisdom" to global biodiversity conservation work.

Although China has made some progress in the field of biodiversity conservation, the Aichi Biodiversity Targets have not yet been fully achieved (CBD, 2020a). Based on this, we reviewed Chinese policies on biodiversity conservation, using content analysis to understand the evolution of the policies (Kong, 2020), to summarize the determinants of the evolution of the policy stages on biodiversity conservation, and to assess the rationality and effectiveness of the biodiversity policies implemented in practice. To obtain clear results, our study first examines the characteristics of policy evolution in terms of policy intensity, policy tools, and policy targets. Then, we divide the policy development into three stages with a focus on the nodes of policy evolution. Finally, based on the results of our study, we propose policy recommendations that are more likely

to achieve global biodiversity conservation goals (targets) for reference.

2 Methods

2.1 Data collection

We first limited the search period to January 1992 to April 2021, then limited the keywords to "biodiversity" and "policy", and finally limited the search locations to the State Council Policy Document Library and the official websites of various ministries. Our initial search yielded 169 policies for biodiversity conservation. Since China's real biodiversity conservation efforts have begun with the signing of the CBD, the search for policies starts from 1992.

After the initial search to ensure the effectiveness and scientific validity of the policies, we screened 169 policies in strict accordance with the following principles: (1) The policies must be closely related to biodiversity conservation; (2) Policies must be currently valid laws, regulations, ordinances, opinions, and other documents that reflect the intent of state policy, excluding temporary guidance documents and announcements with extremely low validity; (3) The policies must be issued by the Central Committee of the Communist Party of China, the National People's Congress and its Standing Committee, the State Council and its subordinate agencies at the central level; (4) Duplicate documents that require the implementation of existing documents, are deleted. Based on these principles, 124 valid policy documents are eventually obtained. The first document was issued in 1994, so the results of the subsequent analysis all take 1994 as the initial time.

2.2 Review protocol

Content Analysis is a combination of quantitative and qualitative analysis in which texts are classified and transformed into quantitative data according to certain rules, and then the data are analyzed descriptively using statistical methods (Pan et al., 2020; Schneider & Ingram, 1990), overcoming the subjectivity and uncertainty in qualitative analysis. Thus, Content Analysis is well suited for studying the rationality of biodiversity policies.

2.2.1 Policy intensity

The Libecap-based method of constructing a legal index (Libecap, 1978) scores policy types according to the principle that different policy issuing departments produce different levels of effectiveness (Table 1). In general, the higher the administrative level, the stronger effectiveness of the policies issued by the government department, with values (1-4) indicating a gradual increase in the policy intensity of different policy documents. Then, based on the number of policies issued per year and the type of policies, the policy intensity can be calculated for each year.

Table 1. Policy intensity assignment criteria.

The Assignment	Policy Publishing Department
4	Laws and plans promulgated by the National People's Congress and the Standing Committee of the National People's Congress
3	Regulations, decisions, opinions, plans and outlines promulgated by the State Council
2	Plans and opinions issued by the General Office of the State Council, regulations, methods and opinions issued by various ministries and commissions
1	Notices

Note: For policy documents jointly issued by multiple departments, the department with the highest administrative level will be assigned; if each department has the same administrative level, only the first department will be recorded.

2.2.2 Policy tools

Based on the classical classification of policy tools by previous experts on the subject (Rothwell & Zegveld, 1985; Xiang et al., 2021), and considering the actual research context of this paper, we classify policy tools into three categories: Supply Type, Demand Type, and Environmental Type (Table 2). Supply-and-demand biodiversity policies play a direct driving or pulling role in biodiversity conservation, and environmental type biodiversity policies play an indirect role in biodiversity conservation. Supply type policies refer to the direct expansion of government investment in support of biodiversity conservation through the provision of talent, technology, and funding to promote the development of conservation and sustainable use. Demand type policies refer to government support for service projects related to biodiversity conservation and research and focus on promoting the development of markets for biodiversity conservation and sustainable use to compensate for the lack of resources of a single government administrative force. Environmental type policies refer to the government's indirect influence on the conservation and sustainable use of biodiversity by creating an institutional and social environment that is conducive to the development of the cause of biodiversity conservation.

Table 2. Classification of each type of policies.

Tool Type	Detailed Classification	Mode of Policy Action
Supply Type	Talent Development	Provide talent guarantee for biodiversity conservation activities.
	Capital Investment	Provide financial support for biodiversity conservation activities.
	Technical Support	Provide support for the innovation of biodiversity conservation theory and technology.
	Public Service	The government provides supporting public services for biodiversity conservation activities, such as delimiting key protected areas.
Demand Type	Social Participation	Encourage and support all social forces to participate in biodiversity conservation.
	Science and Technology Projects	Carry out technological research and development projects related to biodiversity conservation activities, etc.
	Demonstration Promotion	Construction of demonstration projects related to biodiversity conservation, such as the construction of conservation demonstration areas.
	Overseas Exchange	The government and overseas countries exchange experiences in biodiversity conservation, such as participating in international exchange activities.
	Use Control	The government prepares land use plans and restricts ecological land construction.

Environmental Type	Goal Planning	Formulate goals and plans related to biodiversity conservation strategies.
	Financial Services	Provide a good financing environment for biodiversity conservation.
	Tax Incentives	The government gives preferential tax policies for biodiversity conservation related projects.
	Regulatory Control	The government strengthens the supervision and regulation of biodiversity conservation activities, such as perfecting a series of laws and regulations.
	Strategic Measures	The government uses administrative measures to influence biodiversity conservation, such as guidance and publicity activities.
	Ecological Assessment	Evaluation and assessment of activities that have an impact on biodiversity.
	Technical Standard	Formulate and improve industry norms or standards for biodiversity conservation related projects.
	Targeting Policies	Targeted requirements for biodiversity protection in key areas or regions.

2.2.3 Policy targets

Policy Targets are the expected effects to be achieved after policy implementation, thus guiding policymakers to choose appropriate policy tools (Li et al., 2021). Based on this, and considering the research context of this paper, we divide the policy targets into direct, indirect, and long-term targets. The direct targets refer to the promotion of species richness through biodiversity conservation, which is urgently needed to achieve the biodiversity conservation target; the indirect targets refer to the protection and sustainable use of biodiversity to bring into play its ecological and economic value and guarantee the stability of economic development; the long-term targets refer to the stabilization of the ecosystem through biodiversity to achieve the harmonious coexistence between human and nature.

3 Results

3.1 Policy quantity and policy form

Since 1994, China's biodiversity policies have shown phase changes. Before 2010, the quantity of biodiver-

sity policies in China is relatively sparse and shows a slow-growth trend. From 2010 to 2017, the number of policies shows dramatic fluctuations of surge-plunge-surge. Thereafter, from 2018 to April 1, 2021, the quantity of policies again shows a slow-growth trend. In terms of policy issuing departments, there are only a handful of policy issuing departments dealing with biodiversity conservation until 2010. 2010-2014 shows a spike. After 2014, there has been a fluctuating rise.

We categorized the 124 policy forms into 10 types, such as laws, plans, and notices. It is worth noting that the proportion of laws, which represent the highest policy effect, is only 4.03%, far less than that of notices and opinions.

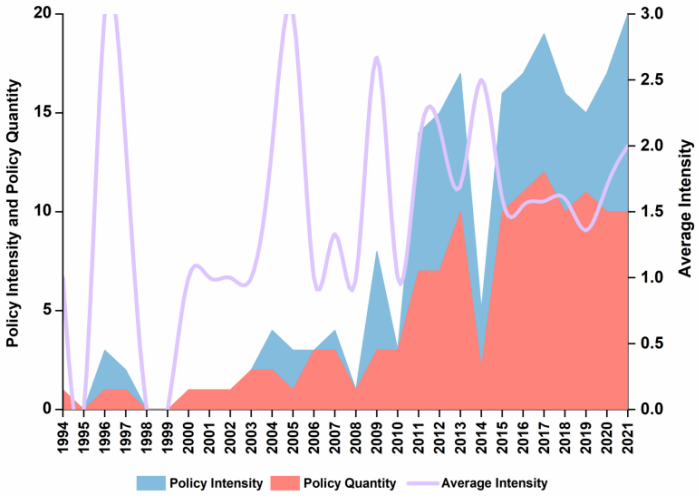
3.2 Policy issuing department

As of April 2021, there were 22 issuing departments involved in biodiversity policies (Table 2), of which the main issuing departments are the State Council (28), the General Office of the State Council (20).

3.3 Policy intensity

In general, policies with higher levels of effectiveness represent a higher level of national importance. As shown in Figure 1, policy intensity and quantity show consistent changes. before 2010, policy intensity is generally low and the average policy intensity shows extreme instability; after 2010, policy intensity as a whole shows an upward trend and the average policy intensity is less volatile. Notably, a dramatic change in policy intensity occurs from 2013-2015.

Figure 1 The numbers and intensity of China's biodiversity policies, 1994–2021.



3.4 The evolutionary trend of policy tools and policy targets

Figure 2 provides the evolutionary trend of the various types of policy tools and targets. In terms of policy tools, each type of policy tool has been on a fluctuating trend, with the number of each type peaking in 2010.

The number of environmental type policy tools is relatively high, but the gap with other types is small. From 1994 to 2009, the use of each type of policy tool has been more confusing. There were many years when only one type of tool was used or even no tools at all. Since 2010, the proportion of the use of each type of policy tool has remained relatively stable. But in general, demand-type policy tools have experienced a dramatic change from more to less.

In terms of the evolution of policy targets, the various types of policy targets largely maintain a consistent trend of change. Among them, the fluctuation of changes in indirect targets is the most unstable, but their absolute number far exceeds that of direct and indirect targets. Moreover, it is not difficult to find that Figure 2 also shows the development process of policy targets from chaotic to progressive and orderly.

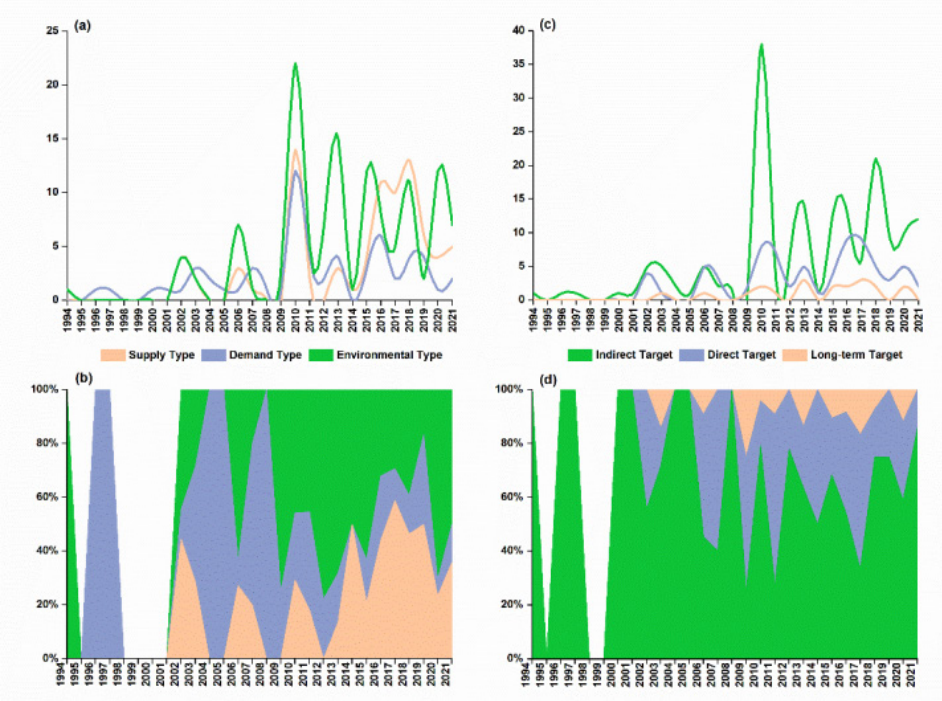


Figure 2 (a) The quantitative evolution of China's biodiversity policy tools, 1994–2021; (b) The proportional evolution of China's biodiversity policy tools, 1994–2021; (c) The quantitative evolution of China's biodiversity policy targets, 1994–2021; (d) The proportional evolution of China's biodiversity policy targets, 1994–2021.

3.5 The joint framework of policy tools and targets

The use of policy tools depends on the degree of policymakers' preference for policy targets, and the achievement of policy targets can test whether policy tools are justified. This paper constructs a joint analytical framework (Figure 3) based on policy tools and policy targets, as well as a table of the number of policy tools dedicated to achieving the corresponding policy targets (Table 3), to test the rationality of China's biodiversity policies.

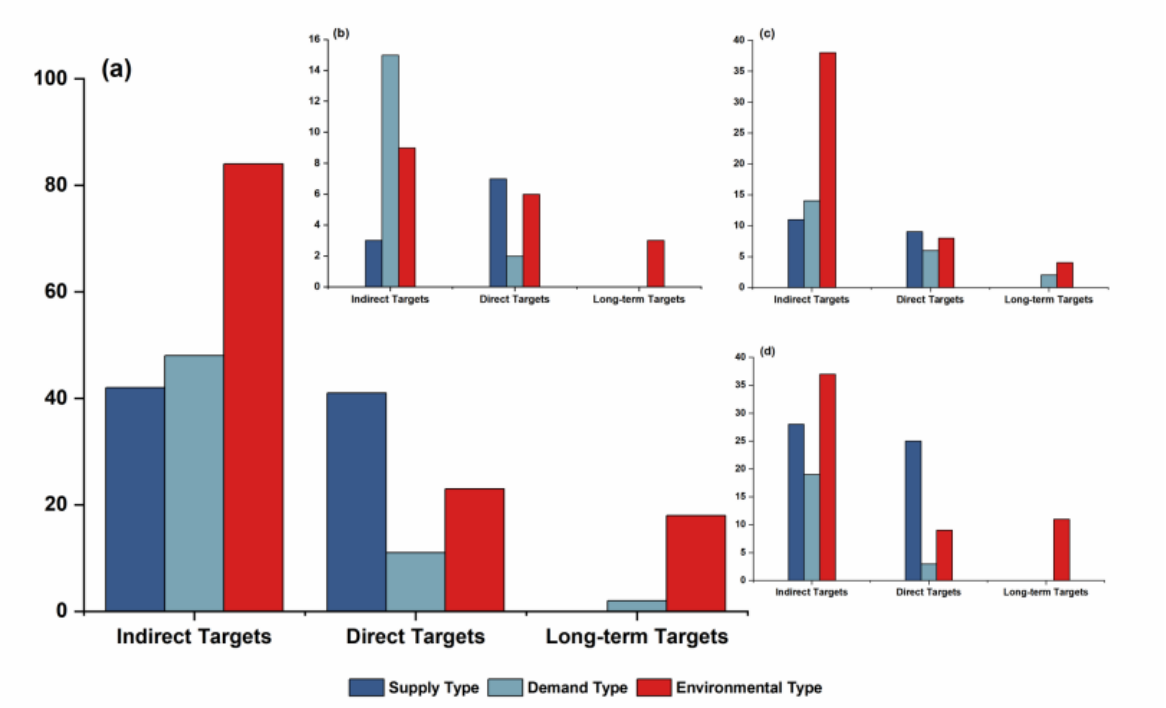
Table 3. Types of policy tools corresponding to different policy targets, 1994-2021.

Tool Type	Target Type	Specific Tools
Supply Type	Indirect Target	Talent Development (5), Capital Investment (9), Technical Support (26), Public Service (2)
	Direct Target	Technical Support (6), Public Service (35)
	Long-term Target	
Demand Type	Indirect Target	Social Participation (8), Science and Technology Projects (12), Demonstration Promotion (8), Overseas Exchange (10), Use Control (10)
	Direct Target	Science and Technology Projects (2), Demonstration Promotion (7), Use Control (2)
	Long-term Target	Demonstration Promotion (1), Overseas Exchange (1)
Environmental Type	Indirect Target	Goal Planning (7), Financial Services (2), Tax Incentives (1), Regulatory Control (10), Strategic Measures (24), Ecological Assessment (10), Technical Standard (8), Targeting Policies (22)
	Direct Target	Goal Planning (15), Targeting Policies (8)
	Long-term Target	Goal Planning (18)

The numbers appearing in parentheses represent the number of times the tool was used.

We find that supply-type policies are all applied to direct and indirect targets. For indirect targets, the amount of Technical Support is dominant. As for direct targets, the government prefers to use effective administrative control to provide supporting Public Services, such as the designation of key conservation areas. Demand-type policies act on all types of policy targets. We can see that the tools for the long-term targets are used the least, with only Demonstration Promotion and Overseas Exchange, and each is used only once. Many environmental type policies focus on the achievement of indirect goals. Governments focus on the use of strategic measures and targeted policy tools to achieve indirect targets. Moreover, the variety of policy tools used for indirect targets is the greatest compared to the other two policy targets. For long-term targets, governments mainly regulate the direction of action for biodiversity conservation through Goal Planning.
Collectively, the government devotes more policy tools to achieving indirect targets and less attention to direct and long-term targets. Also, looking at the various types of policy tools, it is clear that the use of environmental type policy tools is more popular.

Figure 3 (a) The statistics of China's biodiversity policy tools and policy targets in the period of steady exploration, 1994–2021; (b) The statistics of China's biodiversity policy tools and policy targets in the period of steady exploration, 1994–2009; (c) The statistics of China's biodiversity policy tools and policy targets in the period of steady exploration, 2010-2014; (d) The statistics of China's biodiversity policy tools and policy targets in the period of steady exploration, 2015-2021.



4 Discussion

Our review reveals important insights into the inadequacy of China's biodiversity policies. We provide preliminary evidence that: biodiversity policies have so far been overly focused on short- and medium-term plans; laws are not fully effective as the strongest conservation tool in biodiversity conservation actions; and, as a major biodiversity country, domestic policies lack communication and cooperation in achieving global biodiversity conservation goals.

We find some gaps between current Chinese biodiversity policies and the new global need for biodiversity conservation. Some reports suggest that China's decades of experience in how to balance economic development and biodiversity governance is something the world should learn from (https://www.nature.com/articles/d41586-0 20-02697-4). However, our review shows that the current Chinese biodiversity policy is not fully effective in achieving biodiversity conservation goals. Instead, our findings reveal that the evolutionary process of biodiversity policy is constrained by socio-economic development. Therefore, we divide the evolution of biodiversity policies into three stages in the context of socioeconomic background, then discuss the policy characteristics of each stage separately, and finally make some generalized suggestions for changing biodiversity policies.

4.1 Stage division

4.1.1 Passive participation stage

From 1994-2009, it was a period of passive participation in biodiversity policy development. In 1992, China signed the CBD and became one of the first parties to the Convention. Since then, China has been actively involved in international activities and has studied and formulated a series of policy documents for biodiversity conservation, such as the 1994 China Biodiversity Conservation Action Plan. However, at this time, the foundation of domestic legal construction is relatively weak, and most of the relevant policies and regulations are formulated in the context of passive participation in international conservation actions, and there is an obvious lack of targeted policies and regulations for biodiversity conservation. Meanwhile, in 1992, China established the development goal of reforming the socialist market economy system. The growing demands of economic development have caused the country to largely ignore the drawbacks of the traditional sloppy economic development model. Ultimately, the expanding economy will inevitably harm biodiversity (Otero et al., 2020).

After 2000, China recognized that ecological and environmental problems caused by a rapidly expanding economy were constraining the country's sustainable economic development, and in 2003, in response to the consensus on the concept of sustainable development, China proposed the Scientific Outlook on Development. At this time, biodiversity policies mainly involved regulating the exploitation of biodiversity resources and improving the management of biodiversity resources.

4.1.2 Active exploration period

The period from 2010-2014 is a period of active exploration in policy research and formulation. Before 2010, the total quantity of biodiversity policies in China was low and the strategic planning of conservation actions was vague, resulting in a lack of targeting in policy formulation and implementation. In 2010, to promote the mainstreaming of biodiversity conservation and to guide the UN Decade of Biodiversity China Action. The State Council organized 25 departments to set up the 2010 International Year of Biodiversity China National Committee (CNC-DIVERSITAS), but a year later it was renamed the China National Committee for Biodiversity Conservation, which is responsible for coordinating national biodiversity conservation efforts. This is a clear indication that China is actively exploring a collaborative sectoral model for biodiversity conservation policy research and development. At the same time, in 2010, the State Council adopted the CBCSAP (2011-2030), marking the end of a period of passive participation in the study and formulation of biodiversity policies in China, which has been transformed into a period of active exploration at the national strategic level. Our findings suggest that, since 2010, the quantity of biodiversity policies in China as a whole has shown a proliferation trend and the structural ratio of policy tools and targets has been optimized. However, in the latter part of the active exploration period, China's economic development entered a new normal period with a declining trend in the demand for resource factors, which in turn mitigated the impact on biodiversity (Li, 2015), which was reflected in a change in policy as China temporarily shifted its focus on biodiversity, thus the abrupt change in trend in 2014.

2010-2014, the level of strategic planning for biodiversity conservation in China has improved significantly compared to the previous period. In 2011, the 12th Five-Year Plan specifically emphasized the need to strengthen the management of biological resources and effectively prevent the loss of species. The Outline of China's National Economic and Social Development Plan is an important part of China's national economic plan, which is decisive for China's economic management. The inclusion of biodiversity conservation in the national development plan highlights the importance that China attaches to biodiversity policy research and development at the national strategic level. And then in 2012, the 18th Party Congress proposed to vigorously promote ecological civilization and protect biodiversity, providing a new opportunity for China to promote biodiversity mainstreaming (Zhang et al., 2015).

4.1.3 Deepening development stage

Starting from 2015, China's biodiversity policy has entered a period of deepening development. After the meeting of China's National Committee for Biodiversity Conservation at the end of 2014, China has adapted to the situation of the new economic normal and has made new deployments for biodiversity conservation. For example, China has been implementing major biodiversity conservation projects and continuously evaluating the progress of the CBCSAP (2011-2030) to provide technical references for the study and formulation of relevant conservation policies. In 2016, the State Council issued the 13th Five-Year Plan for Ecological Protection of the Environment (2016-2020). This policy is a response based on the new normal of economic development and the significant changes in the international economic and political landscape of China. The plan proposes to build a biodiversity conservation network, strengthen the management of biodiversity priority areas, and carry out systematic conservation of biodiversity. And then in 2018, the Chinese government completed a major departmental institutional reform, with the former Ministry of Environmental Protection merged into the Ministry of Ecology and Environment, establishing the Department of Nature Conservation and Ecology as an internal agency responsible for biodiversity conservation (Qin, 2021). So far, China's biodiversity conservation has achieved a great articulation from theoretical planning to practical guidance, strongly promoting the formation of a scientific and rational biodiversity governance system. In 2019, Yunnan Province took the lead in releasing a special local regulation on biodiversity conservation in China. This provides important experience for future research on relevant legislation at the national level and highlights China's determination and efforts to actively fulfill its international biodiversity conservation responsibilities as a responsible country.

4.2 Policy characteristics

4.2.1 Policy characteristics of the passive participation stage

Our study finds that the quantity of effective policies in force during this period is low, totaling 21. In addition, none of the policies were issued by joint departments. This indicates that there was a lack of synergistic cooperation between departments in the formulation of biodiversity policies in China at this time. At the same time, policy intensity at this stage was low, with extremely erratic changes in average policy intensity. This also implies that the overall emphasis on biodiversity policies in China is low.

Environmental type policy tools are widely used by various policy targets. In terms of policy targets, the Chinese government pays particular attention to indirect targets and focuses on pulling that target through demand-type policy tools. However, there is a lack of sufficient emphasis on long-term targets. This suggests that China's understanding of biodiversity is not sufficiently advanced at this stage and that environmental interests have given way to economic development rather than more consideration of long-term planning for biodiversity. In addition, for indirect targets, China focused more on improving biodiversity through Science and Technology Projects to secure economic development and lacked Regulatory Control over biodiversity use activities. In fact, during this period, China's focus on economic development was so central that biodiversity conservation actions were not adequately supported and thus faced serious threats (Liu et al., 2003).

4.2.2 Policy characteristics of the active exploration stage

Our study finds an overall surge in the number of policies during this period, with the total quantity of policies reaching 29 from 2010-2014. At the same time, the policy intensity tends to increase overall, and the change in the magnitude of the average policy intensity gradually narrows. Combined with the context of national institutional reform during this period, it is clear that the improvement of biodiversity conservation institutions directly contracted the magnitude of change in average policy intensity. In addition, the quantity of policy issuing departments increased rapidly. In 2010, the State Council adopted the CBCSAP (2011-2030), which sets out the specific tasks for biodiversity conservation in China in the next 20 years, requiring the integration of biodiversity into socio-economic development plans and the daily work plans of relevant government departments.

Indirect targets remain the focus of China's efforts. However, in a change from the previous period, China is pursuing this goal mainly through indirect guidance by environmental type policy tools. Since 2010, environmental type policy tools no longer simply play an indirect steering role through Goal Planning. Many regulatory regulations and targeted policies have played an important role in biodiversity conservation actions. In particular, the proportion of regulatory regulations has increased significantly, which indicates that the concept of biodiversity conservation has been more affirmed in legislation and that China has actively conducted research and construction of a biodiversity legal system. In addition, demand-type policies are beginning to invest more in direct targets, mainly involving the Demonstration Promotion of conservation results, indicating that China has achieved some success in its biodiversity conservation efforts.

The Chinese government is working on biodiversity conservation from a new historical starting point at this stage. Unfortunately, while China has made efforts to strengthen conservation efforts through multiple policy tools and to advance the implementation of long-term conservation plans, it has still neglected the supply side of the equation where the implementation of long-term plans requires attention to the most fundamental source of motivation.

4.2.3 Policy characteristics of the deepening development stage

According to the statistical results, the trend of policy quantity growth slowed down in this period, but still maintained a high number of policies introduced each year. From 2015 to April 1, 2021, the total quantity of policies reached 74, far more than the sum of policies in the previous two periods. 2017, the 19th Party

Congress report called for improving the quality and stability of ecosystems, which indicates that the state's understanding of biodiversity has further deepened, and the concept of policy formulation has changed from relying on quantity to win to high quality and strong stability. As a result, the state focuses more on the stability and continuity of policy content when studying and formulating policies, and highlights the policy launch points by slowing down the growth rate of policies. In addition, around 2016, the Chinese government was undergoing a major ministerial reform, which to some extent influenced the trend of the number of policy-issuing departments. With the increased synergy of departments, the number of policies issued by joint departments has rapidly increased.

It is not difficult to find that indirect targets have been in the absolute position in biodiversity conservation efforts and that the state has been more mature in the level of policy tools used to achieve indirect targets. In terms of direct targets, the number of demand-type policy tools has increased significantly, and it can be said that China has increased its attention to the conservation of ecological values of biodiversity at this stage. Technical Support and Public Services dominate the use of supply-type policy tools. In particular, there is a significant surge in the number of public service policies compared to the previous period, indicating the state's increased awareness of the bigger picture and enhanced research and planning of corresponding supporting measures. Notably, environment-based policies are beginning to move away from limiting themselves to the conservation of a single dimension of biodiversity and are beginning to consider how biodiversity contributes to sustainable human development through the provision of ecosystem services, and what future efforts are needed to ultimately achieve this goal. At the same time, there is a global consensus on the sustainability of global biodiversity impacting ecosystem services (Crist et al., 2017; Mori, 2017). In response to this consensus, the overall plan for the reform of the ecological civilization system jointly issued by the Central Committee of the Communist Party of China and the State Council calls for vigorous participation in global governance and contribution to global biodiversity conservation initiatives in China. In addition, the CBD 15th Conference of the Parties (COP15) will be held in Kunming, China, in October this year, which will develop the post-2020 global biodiversity framework and thus plan a new global biodiversity conservation action plan for the next 10 years (http://www.mee.gov.cn/ywgz/zrstbh/swdyxbh/202103/t20 210319_825327. shtml). This also explains the significant increase in the long-term targets for this period.

During this period, there has been an increased sense of synergy between policy-making sectors, a better understanding of biodiversity in China, and policy research and development that takes into account the long-term planning between biodiversity and sustainable human development. However, there is still a lack of sufficient attention to supply and demand type policy tools that have a direct impact on achieving the long-term targets.

4.3 Policy implications

The Chinese government seems to believe that it will be more effective by creating an external environment for biodiversity conservation actions than by taking direct measures to promote them from within. However, biodiversity conservation is a systematic and complex project, and the balance of supply and demand is the basis for long-term conservation actions. In addition, the lack of long-term targets has become a bottleneck for future biodiversity conservation actions in China, and the lack of targets may cause conservation actions

to deviate from the direction. Although the government has been trying to increase the number of long-term targets, balanced use of various policy tools should be the fundamental guarantee for achieving the conservation goals.

Finally, are the results of our review of global importance and policy universality? China is one of the most biodiversity-rich countries in the world (http://paper.people. com.cn/rmrbhwb/html/2021-02/27/content_2035791.htm), and with its hosting of COP15 and growing global influence, its policy efforts to conserve biodiversity have become a global focus (Mallapaty, 2020). Thus, our review provides some reference value for global biodiversity policy improvement while transforming China's biodiversity policy. It should be noted, however, that the policies we reviewed may not be comprehensive enough in qualifying keywords. In addition, we mainly refer to review methods from other policy research fields when designing tools and target categories for policy content. As a result, our review is likely to deviate from the actual effectiveness of biodiversity policy implementation. However, our findings are intrinsically relevant to current trends in biodiversity change. Therefore, without being 100% certain of our findings, we believe that our review can conclude with some general recommendations:

(1) Enriching the content of vulnerable policy tools, and optimizing the internal structure of policy tools. The current new global action plan for biodiversity conservation for the next 10 years is about to be developed, yet the traditional Aichi targets have not been fully achieved so far (Xu et al., 2021). Policymakers must realize that biodiversity conservation goals are difficult to achieve at all without changes to the existing biodiversity policy system.

(2) Focus on the actual progress of conservation actions and pay attention to the planning research of long-term targets. At a time when the continued loss of biodiversity is undermining human well-being (Pennekamp et al., 2018; Naeem et al., 2016) and the conservation of biodiversity in China has important global implications (Ma et al., 2017), the inadequacy of long-term targets policies may ultimately make it difficult to ensure that the global trend of biodiversity decline is effectively be curbed.

(3) Integrate the existing conservation policy system and formulate special conservation laws and regulations. It is necessary to formulate a comprehensive, basic, and systematic biodiversity conservation law at the national level to provide strong support for conservation actions and behavioral regulation of conservation subjects.

References

Bhola, N., Klimmek, H., Kingston, N., Burgess, N.D., van Soesbergen, A., Corrigan, C., Harrison, J., & Kok, M. (2021). Perspectives on area-based conservation and its meaning for future biodiversity policy. Conservation Biology, 35, 168–178.

Crooks, K.R., Burdett, C.L., Theobald, D.M., King, S.R.B., Marco, D.M., Rondinini, C., & Boitani, L. (2017). Quantification of habitat fragmentation reveals extinction risk in terrestrial mammals. Proceedings of the National Academy of Sciences of the United States of America, 114, 7635–7640.

Ceballos, G., Ehrlich, P.R., Barnosky, A.D., García, A., Pringle, R.M., & Palmer, T.M. (2015). Accelerated modern human-induced species losses: Entering the sixth mass extinction. Science advances, 1, e1400253.

CBD. (2020a). Secretariat of the convention on biological diversity. Global Biodiversity Outlook 5. Montreal.

Crist, E., Mora, C., & Engelman, R. (2017). The interaction of human population, food production, and biodiversity protection. Science, 35, 260-264.

Hautier, Y., Seabloom, E.W., Borer, E.T., Adler, P.B., Harpole, W.S., Hillebrand, H., … Hector A. (2014). Eutrophication weakens stabilizing effects of diversity in natural grasslands. Nature, 508, 521–525.

Hanson, J.O., Rhodes, J.R., Butchart, S.H.M., Buchanan, G.M., Rondinini, C., Ficetola, G.F., & Fuller, R.A. (2020). Global conservation of species' niches. Nature, 580, 232–234.

Isbel, F., Gonzalez, A., Loreau, M., Cowles, J., Díaz, S., Hector, A., Mace, G.M., Wardle, D.A., O'Connor, M.I., Duffy, J.E., Turnbull, L.A., Thompson, P.L., & Larigauderie, A. (2017). Linking the influence and dependence of people on biodiversity across scales. Nature, 546, 65-72.

IPBES. (2019). Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES Secretariat, Bonn, Germany.

Johnson, C.N., Balmford, A., Brook, B.W., Buettel, J.C., Galetti, M., Guangchun, L., & Wilmshurst, J.M. (2017). Biodiversity losses and conservation responses in the Anthropocene. Science, 356, 270-275.

Kong, Y., Feng, C., & Yang, J. (2020). How does China Manage its Energy Market? A Perspective of Policy Evolution. Energy Policy, 147, 111898.

Lu, Y., Yang, Y., Sun, B., Yuan, J., Yu, M., Stenseth, N.C., Bullock, J.M., & Obersteiner, M. (2020). Spatial variation in biodiversity loss across China under multiple environmental stressors. Science advances, 6, eabd0952.

Libecap, G.D. (1978). Economic variables and the development of the law: the case of western mineral rights. The Journal of Economic History, 38, 338–362.

Li, Q., Li, H.Q., & Guo, J.W. (2021). Quantitative Analysis of Blockchain Policy Texts - Based on Policy Tools and Policy Objectives Perspective. Finance and Accounting Monthly, 2, 148-154. (In Chinese).

Li, G.J. (2015). How to do a good job of biodiversity conservation in China under the new situation. https://epaper.gmw.cn/gmrb/html/2015-04/23/nw.D110000gmrb_ 20150423_1-07.htm.

Liu, J.G., Ouyang, Z.Y., Pimm, S.L., Raven, P.H., Wang, X.K., Miao, H., & Han, N.Y. (2003). Protecting China's biodiversity. Science, 300, 1240-1241.

Miller-Rushing, A.J., Primack, R.B., Ma, K., & Zhou, Z.Q.A. (2017). A Chinese approach to protected areas: A case study comparison with the United States. Biological Conservation, 210, 101-112.

Mallapaty, S. (2020). China takes centre stage in global biodiversity push. Nature, 578, 345-346.

Martin, J.L., Maris, V., & Simberloff, D.S. (2016). The need to respect nature and its limits challenges society and conservation science. Proceedings of the National Academy of Sciences of the United States of America, 113, 6105–6112.

Meng, H.H., Zhou, S.S., Li, L., Tan, Y.H., Li, J.W., & Li, J. (2019). Conflict between biodiversity conservation and economic growth: Insight into rare plants in tropical China. Biodiversity and Conservation, 28, 523-537.

MINISTRY OF ECOLOGY AND ENVIRONMENT THE PEOPLE'S REPUBLIC OF CHINA (MEEPRC). (2010). http://www.mee.gov.cn/gkml/sthjbgw/qt/20100 9/t20100921_194839.htm.

Mori, A.S. (2017). Biodiversity and ecosystem services in forests: management and restoration founded on

ecological theory. Journal of Applied Ecology, 54, 7-11.

Ma, K.P., Shen, X.L., Grumbine, R.E., & Corlett, R.T. (2017). China's biodiversity conservation research in progress. Biological Conservation, 210, 1–2.

Naeem, S., Chazdon, R., Duffy, J.E., Prager, C., & Worm, B. (2016). Biodiversity and human well- being: an essential link for sustainable development. Proceedings. Biological Sciences, 283, 20162091.

Otero, I., Farrell, K.N., Pueyo, S., Kallis, G., Kehoe, L., Haberl, H., ... Pe'er, G. (2020). Biodiversity policy beyond economic growth. Conservation letters, 13, e12713.

Pan, D., Tang, J., Yang, J.Q., & Chen H. (2020). Evolution of rural environmental management policies from 1978 to 2018: Based on 206 policy documents quantification. Journal of China Agricultural University, 25, 210-222. (In Chinese)

Pennekamp, F., Pontarp, M., Tabi, A., Altermatt, F., Alther, R., Choffat, Y., … Petchey, O.L. (2018). Biodiversity increases and decreases ecosystem stability. Nature, 563, 109–112.

Qin, T.B. (2021). The Process and Challenges in China's Implementation Of The Convention on Biological Diversity. Wuhan University Journal (Philosophy & Social Science). 74, 95-107. (In Chinese)

Román-Palacios, C., & Wiens, J.J. (2020). Recent responses to climate change reveal the drivers of species extinction and survival. Proceedings of the National Academy of Sciences of the United States of America, 117, 4211–4217.

Rothwell, R., & Zegveld, W. (1985). Reindusdalization and technology. Logman Group Limited, New York, 83-104.

Schneider, A., & Ingram, H. (1990). Behavioral assumptions of policy tools. J. Polit. 52, 510-529.

Tittensor, D.P., Walpole, M., Hill, S.L.L., Boyce, D.G., Britten, G.L., Burgess, N.D., ... Ye, Y. (2014). A mid-term analysis of progress toward international biodiversity targets. Science, 346, 241-244.

Tilman, D., Clark, M., Williams, D.R., Kimmel, K., Polasky, S., & Packer, C. (2017). Future threats to biodiversity and pathways to their prevention. Nature, 546, 73–81.

World Economic Forum, Pw C. (2020). Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy.

Wei, F., Costanza, R., Dai, Q., Stoeckl, N., Gu, X., Farber, S., ... Zhang, W. (2018). The Value of Ecosystem Services from Giant Panda Reserves. Current Biology, 28, 2174-2180.e7.

World Bank. (2015). http://data.worldbank.org/country/china.

Xiang, C., Wen, T., & Ren, Q.Y. (2021). A Study of "Separation of Three Rights" of Homestead from the Perspective of "Target-tool"—Based on Content Analysis and Quantitative Analysis of Policy Texts. Social Sciences in Yunnan, 136-144. (In Chinese)

Xu, H., Cao, Y., Yu, D., Cao, M., He, Y., Gill, M., & Pereira, H. M. (2021). Ensuring effective implementation of the post-2020 global biodiversity targets. Nature ecology & evolution, 5, 411–418.

Yang, R., Peng, Q.Y., Cao, Y., Zhong, L., Hou, S.Y., Zhao, Z.C., & Huang, C. (2019). Transformative changes and paths toward biodiversity conservation in China. Biodiversity Science, 27, 1032-1040. (In Chinese)

Zhang, H., Jarić, I., Roberts, D. L., He, Y., Du, H., Wu, J., Wang, C., & Wei, Q. (2020). Extinction of one of the world's largest freshwater fishes: Lessons for conserving the endangered Yangtze fauna. The Science of the total environment, 710, 136242.

Zhang, F.C., Liu, W.H., & Li, J.S. (2015). Current Situation and Countermeasures of Biodiversity Mainstreaming in China. Environment and Sustainable Development, 40, 13-18. (In Chinese)