China Council for International Cooperation on Environment and Development

Ecological Compensation and Green Development Institutional Reform in the Yangtze River Economic Belt (YREB)

Research Report

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Executive Summary

As stretching over 6000 km, the Yangtze River Valley has a unique ecosystem, which has a precious ecosystem in China. The Yangtze River Economic Belt (hereinafter referred to as "YREB") covers 11 provinces or municipalities with a population and GDP accounting for over 40% of total amounts in China. It is the economic center in China with great vitality, and also an important support for the sustainable development of Chinese nation. It is of great significance to promote the YRBT to step a path of ecology priority and green development, and build it into a green demonstration belt with great influence throughout the country. With reference to the successful experiences in both domestic and international watershed management, this project is to study how to promote the green development of the whole Yangtze River basin, especially the upper reaches of the Yangtze River Basin through the innovative institutional reform of watershed management among the provinces within the YREB, so as to ensure that the clear water of Yangtze River will last for future generations.

1. The challenges faced to green development of the YREB

Firstly, a unified and comprehensive legal system is still not in place for the river basin. Although certain provisions have been stipulated in view of the ecological protection and pollution prevention and control in river basins in some applicable laws and regulations, such as ***Water Law, Water Pollution Prevention Law, Water and Soil Conservation Law*** and ***Environmental Protection Law***, some common provisions can't solve various issues during the ecological construction and coordinated development of green industries in the YREB. **Secondly, the green development must be further coordinated effectively within whole basin**. The homogeneous industrial distribution is seriously in some areas along the Yangtze River. Moreover, the layout is also unreasonable for some sewage outlets, harbors, wharfs and intakes. The level of green basic public services varies greatly from region to region. **Thirdly, it is necessary to further play the role of market mechanism in the green development of the YREB.** Most of the funds are sourced from the general public budget of the central finance and local finance, which is not so market-based during fund raising. At present, it has not been linked with the projects related to ecological economy and green economic development, and the path has not been fully opened up to compensate for ecological loss with the economic development. **Fourthly, the eco-compensation mechanism still lacks the legal regulation, and the scientific and long-term eco-compensation mechanism still needs to be improved continuously.** It is difficult to smoothly implement the existing normative documents of basin eco-compensation due to their low level of legislative

effectiveness and poor rigid constraints. The eco-compensation ways are simplified, compensation fund is insufficient and the public participation is also insufficient. **Fifthly, as an important means to solve the environmental issues within the river basin, the executive capacity of "river-chief system" is relatively insufficient**. Many sectors can't participate in it actively as they regard the river-chief system as the work of the water conservancy sector. It is failed to form the organizational structure for the river-chief office at county and township level, which can't ensure the relevant work proceed smoothly.

2. Recommendations

Recommendation1: Accelerate the Formulation of Strategies for Ecological Environment Protection Within the Yangtze River Economic Belt

1.1 Scientifically and Reasonably Determine the Target Index System

Emphasis should be laid out in the report of the Nineteenth National Congress of the CPC on how the strategic vision for the next hundred years (2035 and 2050) will be developed. It should be made clear as to how we can define the Target Index System into policy that conforms to the ecological environment characteristics of the Yangtze River Economic Belt.

We should adhere to the maxim of *Harmonious Yangtze River, Clean Yangtze River, Healthy Yangtze River, Graceful Yangtze River, and Safe Yangtze River*. These words were put forth in the *Eco-environmental Protection Plan of the Yangtze River Economic Belt*, and they have further highlighted the goal orientation of a harmonious relationship between rivers and lakes, clean water quality, a healthy ecosystem, beautiful urban and rural environments and controllable environmental risks. (1) The harmonious Yangtze River emphasizes the unison of rivers and lakes, people and water, adhering to the concept of water-based, fixed production and a water-based, fixed city. Therefore, we should break the barriers between water resources, water environment, and water ecology. We should take the rational utilization of regional water resources and the effective guarantee of ecological water quantity of rivers and lakes as the baseline measurement. Moreover, attention should be paid to whether the carrying capacity of water resources and the environment will not be surpassed. (2) A Clean Yangtze River emphasizes continuous improvement of water environment quality, and we should pay closer attention to the continuous improvement of "good water." At the same time, we need to look at the dramatic reduction of "poor water," and utilize a grade of sections better than Class III and inferior to Class V as our baseline measurement. Attention should be paid to whether high-functional water

bodies, such as drinking water sources, meet the corresponding objectives and requirements. (3) In order to improve the health of the Yangtze River, it is necessary to use effective soil and water conservation, the diversity of biological species, stability of wetland ecosystems, and gradual improvement of ecosystem services as criteria. Notice should be given as to whether the land area, with a high ecological function, can be maintained and increased. (4) A graceful Yangtze River requires the livability of urban and rural settlements based on the continuous improvement of urban air quality and the steady improvement of soil environmental quality in major agricultural producing areas. Emphasis should focus on whether the environmental rights and interests of urban and rural residents can be guaranteed. (5) A safe Yangtze River must emphasize a level of environmental risk management and control. It must take sound environmental risk prevention and a control system with an effective environmental risk control of enterprises at risk as its baseline measurements. Attention should be paid to how well environmental emergencies are controlled.

It is necessary to systematically study the key issues at work here, such as environmental benchmarks, quality standards, use functions, resource endowments, carrying capacity, and emission standards. We must then build a management and control system with the improvement of ecological environment quality as its core objective. The following issues are recommended to be prioritized. (1) Effective convergence of river and lake water quality standards to enhance the degree of synergistic improvement of river and lake water quality; (2) Selection and determination of the water Ecology Index Target; (3) Integrated design of river and sea standards to solve the problem of continuous improvement of freshwater environmental quality with no obvious change of water quality in coastal waters; (4) The scientific calculation and stability guarantee of ecological flow index.

1.2 Determine the Key Tasks of Yangtze River Protection and Restoration in the short and medium term

After the implementation of documents such as the program to protect and restore the Yangtze River, the main ecological environment problems facing the Yangtze River will gradually change from short-term and urgent to long-term and potential. This will require our overall consideration as "continuous efforts and long-term achievements."

(1) Effective control should strengthen the hydro-logical regime, phosphorus transformation law, reservoir thermal accumulation effect, and the river-lake relationship of water conservancy and hydro-power projects in the middle and upper reaches of the Yangtze River. For the completed water conservancy and Hydropower projects, we need to reduce their ecological impact through a joint effort. We need to

reconstruct a harmonious relationship between rivers and lakes, and gradually realize the transformation from engineering water conservancy to ecological water conservancy.

(2) Rehabilitate and restore the environment by reversing the reduction and degradation of wetlands caused by urban development and agricultural production. These steps will take full advantage of landscape function, but also its ecological function in protecting biodiversity, regulating runoff, improving water quality, and regulating local climate.

(3) Chemical oxygen demand, ammonia nitrogen, and other conventional pollution indicators should be effectively controlled. Besides, the effective control of nutrient emissions, such as nitrogen and phosphorus, the further control of toxic organic pollutants, such as persistent organic pollutants and environmental hormones, are needed. Furthermore, in order to focus on the current outstanding problems and take into account the long-term potential risks, we should improve the environmental quality standards and health impact assessment technical specifications of rivers, lakes, and seawater.

(4) Deepen the control of pollution sources, gradually reduce the loss of nitrogen and phosphorus due to planting, improve the collection rate of urban domestic sewage, and reduce the occurrence of eutrophication in key lakes.

1.3 Improve the Eco-environmental Protection Mechanism of the Yangtze River

Suggestions on improving and deepening the effective mechanism for the ecological environmental protection currently being implemented:

(1) Perfect a system of river and lake chiefs to build the alliance of river and lake chiefs. These developments will provide an institutional guarantee for the realization of the "Combined Treatment of Three ‘Waters’ (water pollution control, water ecological restoration, and water resources protection)."

(2) The Party and government should bear the same responsibility, and they should do so at the same time. Furthermore, each institution should bear two responsibilities. We must complete the design of the implementation path, identify and correct any acts of unreasonable development, utilize in Eco-environmental protections, and fully implement an action programme of "Ecological Priority, Green Development."

(3) Perfect the system of pollution discharge permit policies, promote further development of the key and difficult tasks, such as space control constraints, industrial transformation and upgrading, and protect the Eco-environment with the strictest system of enforcement and the strictest rule of law.

Recommendation2: Establish a Natural Capital Accounting System in the Yangtze River Economic Belt

2.1 Establish a Value Accounting System for Stock and Flow of Natural Capital

In order to take the road of ecological priority and green development, we need to understand the innate capitalist background of the Yangtze River Economic Belt and the relationship between the increase (input) and decrease (consumption) of natural capital behind economic changes. The establishment of a balance sheet is necessary to take stock of natural resources, economic development quality, lucid water transformation analysis, lush mountains, invaluable assets, and other ecological benefits. Meanwhile, when every leading politician leaves office, it is necessary to carry out an audit of natural resource assets in order to improve the management system of natural capital.

Natural capital includes both ecological capital and non-ecological capital. While non-ecological capital mainly includes mineral resources, fossil energy, solar energy resources, water resources, wind resources, etc.; ecological capital includes forests, grasslands, wetlands, farmlands, and other ecosystems. Usually, this includes the value of land resources and the value of ecosystem services. Therefore, a comprehensive natural capital accounting system for the Yangtze River Economic Belt must be established，with Economic Wide-MFA proposed by Eurostat, value accounting of Gross Ecosystem Product initiated by the United Nations Statistics Division, and Natural Resources Balance Sheet Accounting proposed by the National Bureau of Statistics.

2.2 Set up a Leading Group and an Expert Committee for Coordination of Natural Capital Accounting

Natural capital accounting involves the Ministry of Natural Resources, the Ministry of Ecological Environment, the Forestry and Grass Bureau, the National Bureau of Statistics, and other departments. In order to construct a system framework of natural capital accounting in the Yangtze River Economic Belt, we need to establish a leading group and an expert committee for the coordination of natural capital accounting in the Yangtze River Economic Belt to establish this system framework for natural capital accounting. We need to study and promulgate the *Guiding Opinions on Natural Capital Accounting.* We need to establish a data sharing platform for natural capital accounting where we can clarify the objectives, principles, scope, objectives, contents, technical methods, working mechanism, and application suggestions of natural capital accounting.

2.3 Establish Technical Norms for Natural Capital Accounting

Having learned from the experience of natural capital accounting, the application of policies in developed countries, and international organizations in the fields of natural capital, natural assets, ecological assets and ecosystem services, we are going to put forth and publish a series of technical documents. Typical subject titles will be the "Framework of the Eco-Capital Accounting Method," "Technical Guidelines for Eco-Capital Accounting (Operational Standards)," "Natural Capital Survey Method," "Detailed Rules for Assessing the Value of Natural Capital," and other relevant works. The scope of these documents must take into consideration the actual situation in China and the practice utilized in related fields in recent years. At the same time, we plan to study and establish technical norms for natural capital accounting in different types of environmental and economic policies, decision-making and implementation, and the formulation of policy and system design based on natural capital accounting.

In order to enhance our ability to effectively manage capital accounting, we must first strengthen international cooperation in the field of natural assets accounting. This is especially true with regards to the United Nations Statistics Division, Eurostat, the World Bank, and OECD. Furthermore, we must learn from the advanced experience and practices of developed countries. Second, we should strengthen the institutions and practices of personnel operating in the field of natural capital accounting. To be the most effective, this must be done in the relevant local government departments or research institutes to better clarify the business division of government agencies on Ecological Capital Accounting, strengthen relevant responsibilities, and strengthen the construction of natural capital accounting support institutions, third-party evaluation institutions, and the talent team base. Third, we should strengthen the construction of big data, the database of natural capital accounting, the investigation and analysis of basic data, technical parameters of ecological capital accounting, and the big data of different types of ecological capital accounting in order to ensure the quality of the data provided.

2.4 Pilot Demonstration of Natural Capital Accounting with Multi-sectoral Joint Accounting

To begin with, we should select typical cities in the Yangtze River Economic Belt to carry out pilot projects on natural capital accounting. The basis for these exploratory activities should be on the basis of the *Guiding Opinions on Natural Capital Accounting*. Next, based on the characteristics of natural capital accounting and considering the different elements of natural capital, we must selectively carry out special natural capital accounting pilot projects in different regions. Some of these

projects would include such topics as mineral accounting projects, water resources accounting projects, etc. Then, we should set up financial budget projects, international cooperation research projects, increase research funding, and develop special natural capital accounting model tools and case studies. We should strive to establish this system at the beginning of the 14th Five-Year Plan period. In doing so, we will be better able to improve the level of innovation in the ecological civilization and the scientific decision-making of the environmental economy.

Recommendation3: Implement an Omni-Directional and Multi-Scale Ecological Compensation Mechanism

3.1 Construct a "one vertical + multi-horizontal" Ecological Compensation Framework for the Yangtze River Economic Belt

We will continue to play the leading role of central finance, urge the 11 provinces and municipalities along the Yangtze River to speed up the establishment of a financial reward and punishment mechanism linked to the quality of water in the ecological environment within those administrative areas, and encourage the adjacent provinces in the upper and lower reaches of the basin to choose typical areas with important ecological functions, prominent contradictions between supply and demand of water resources, and serious pollution hazards or threats to carry out horizontal ecological compensation and expand the scope of horizontal ecological compensation. Moreover, we will establish an ecological compensation fund for the Yangtze River Economic Belt and form a "one vertical + multi-horizontal" ecological compensation mechanism with local finance as its core, central finance as the incentive, and social active participation in the whole river basin. At the same time, we should give full opportunity to the guiding and leveraging role of a complimentary fiscal policy, rely on the open development platforms of the Yangtze River Delta, the middle reaches of the Yangtze River and Chengdu-Chongqing urban agglomeration to implement a comprehensive, multi-faceted and diversified ecological compensation mechanism. This mechanism will provide better support in the production of more high-quality ecological products. Therefore, we will further open the way for lucid waters and lush mountains to be transformed into invaluable assets, promote the two-way flow of resources in the middle, upper, and lower reaches, and truly form a large pattern of ecological compensation integrated with green development.

3.2 Increase the Direct Compensation of the Central Finance

It has been suggested to increase the investment in central finance, and further increase the transfer payments to ecologically important areas in the upper and middle

reaches of the Yangtze River Economic Belt. These investments could be made in areas such as ecological barrier areas, key ecological function areas, and red line areas for ecological protection. When calculating the balanced transfer payment, the allocation weight of the related factors of ecological environment protection should be increased, and the investment in the central budget should be inclined to the construction of infrastructure and basic public service facilities in key ecological functional areas.

It has also been suggested to strengthen the integration of financial funds at all levels. Through consolidating the vertical integration of upper, middle, and lower levels of funds, as well as the horizontal integration of related funds such as overall planning of environmental protection tax retention, transfer payment funds of key ecological function areas, carbon emissions trading funds, etc.; financial departments at all levels should gradually form a stable amount of multi-channel sources of ecological compensation funds.

3.3 Establish and Expand the "Fund Pool" of Ecological Compensation

On the face of the complex problems of ecological compensation in the Yangtze River economic belt, such as too many provinces, left and right banks, mutual upstream and mutual downstream differences, difficulties in defining prominent, beneficial and protected areas, and insufficient linkage between upstream and downstream, we should weaken the power-responsibility relationship between upstream and downstream regions and consider each region in terms of the whole Yangtze River economic belt. When calculating the ecological compensation responsibility of a certain area, we should follow the principles of "who contributes more to pollution, who contributes more to investment, who uses more water, who contributes more to investment?" When determining the right of ecological compensation in a particular area, we should follow the principles of "who contributes more to protection, who get more compensation, who saves more water, who gets more compensation?" In this way, we will link 11 provinces and cities in the Yangtze River Economic Belt, clarify their powers and responsibilities, and form a joint force. In addition to financial transfer payments such as horizontal ecological compensation funds for upstream and downstream of the basin and incentive funds for ecological protection and restoration of the Yangtze River Economic Belt, we should actively promote and encourage the participation of market-oriented funds, improve the landing conditions of green finance, and establish a payment compensation mechanism for beneficiary enterprises. We may also consider levying reasonable, additional charges on sales revenue of beneficiary enterprises and industries directly utilizing natural resources (such as liquor-making enterprises, mineral water

enterprises, power stations, etc.)

3.4 Promote the Participation of Multiple Subjects in Ecological Compensation

Make up the gap between the national financial transfer payment and the actual demand of local ecological compensation through market-oriented means. Through the establishment of unified water rights, emission rights, and a carbon emissions trading market throughout the river basin, we should establish a market-oriented price trading platform that best reflects the interests and needs of all parties. In this way, we will be able to form a paid use system of ecological resources assets. Starting from the both ends of the supply and demand of ecological products, we should establish a price formation mechanism for ecological products which reflects externality and internalization and inter-generational equity by means of green labeling and green procurement. Consequently, the protector may obtain full compensation for the benefit of ecological protection through the market transaction of ecological products. In addition, we should innovate financial services and make full use of the advantages of financial institutions, such as capital, intelligence, and products. The end result will allow us to play an active role in the construction of major regional cooperation projects, the preparation of cooperative planning, and the promotion of industrial undertaking and transfer. We should also explore the basin ecological credit evaluation system, increase financial support for industrial transfer in upstream areas to implement ecological poverty alleviation, and explore franchise and pledge financing modes.

3.5 Explore the Ways to Realize the Value of Eco-products

Although the Yangtze River Economic Belt has made many explorations into the aspects of co-construction of industrial parks and enclave economy, it has been mainly confined to the Yangtze River Delta. The larger-scale approach has not yet been carried out. However, the Yangtze River Economic Belt has already possessed the conditions of a benefit-sharing mechanism in the region. Its factor endowment and superior products are complementary. While the upper and middle reaches of the Yangtze River have abundant natural resources and labor advantages, which are just the shortcomings of industrial development in the lower reaches of the Yangtze River, the downstream region of the Yangtze River has the advantages of innovation, technology, talent, capital, and other high-end elements. This represents is the urgent need for the transformation and upgrade of the upstream industry. Therefore, we should actively summarize and popularize the experience of benefit sharing. Beginning with the key issues of benefit sharing, such as land using and tax sharing,

we should plan functional space and strategies according to the functional characteristics of different ecosystems in different regions of the Yangtze River Economic Belt. We need to explore new models and practices of benefit sharing, innovate regional cooperation forms, promote the direction of compensation from the simple economic field to the social field, and implement a series of docking policies, such as social security, education, credit, and employment.

Recommendation4: Strengthen Policing of Yangtze River Protection through the Rule of Law

4.1 Learn from the Successful Experience of Foreign Watershed Legislation

There have been many successful cases of river basin legislation in developed countries. In the 1930s, Congress passed the *Tennessee Valley Authority Act*. This law provides detailed regulations for the specific management of the Tennessee River Basin in detail, so that its natural resources can be protected by a unified legal system. It calls for the unified management of the water resources in the basin. At the same time, it also clarifies the benign operating mechanism of the basin to implement government support, develop profitable projects, accumulate funds, and issue bonds.

The Rhine River in Europe is the largest river in Western Europe. It runs through nine countries. The main waters flow through Switzerland, Germany, France, Luxembourg, and the Netherlands. Since the 1950s, many environmental problems have arisen due to human activities and a lack of disturbance management. The ecological environment of the whole basin has been destroyed and aquatic biodiversity has declined. Due to environmental problems, the countries in the basin have jointly established the International Committee for the Prevention and Control of Pollution in the Rhine River. In 1998, countries in the Rhine river basin signed *The Convention on the Protection of the Rhine*. This piece of legislation requires each country to take action to achieve corresponding governance objectives and put forward specific protection requirements. The convention has played an important role in the improvement of the Rhine River environment and river basin management.

4.2 Systematically Identify the Specific Ecological Environment Problems and Management Needs of the Yangtze River.

The protective law of the Yangtze River should be oriented towards problem-solving. We should specify its basic principles for "jointly protecting and not developing the Yangtze River, while giving priority to ecology and green development." All areas, from upstream and downstream, left and right banks, main waterways and tributaries, and regardless of water transportation, power generation,

flood control and irrigation, ports, shorelines and industrial development, they must all be subordinated and focused on the protection and restoration of the ecological environment of the Yangtze River. This must be done in order to upgrade the traditional "consequence-controlling legislation" and for the best "risk-preventing legislation."

The Yangtze River Protection Law should have three characteristics. First, it must feature system comprehensiveness. The Yangtze River Protection Law should be positioned as a comprehensive law, focused on water assets, the coordination of resources, environment, ecology, and other relevant fields. This river protection law must emphasize the direction of space control, protection and restoration, risk prevention and control, and take ecosystem integrity as the fundamental compliance of legislation. Second, it must consider the difference in different basin areas. The Yangtze River Protection Law should focus on the Yangtze River Basin as its primary objective of protection. It should systematically consider the natural resource endowment, economic and social development characteristics, and regional differences of the Yangtze River Basin. It must account for a better phased objectives design of ecological environment protection. It should be based on the current situation and take into account the long-term effects to the river basin, so as to ensure the applicability of the law in the long run. Third, the must address the issue of special pertinence. On the premise of strictly abiding by the existing laws on the protection of the ecological environment in China, the special orientation and requirements of the protection of the Yangtze River will be solidified in the form of law, the key tasks in the development plan outline of the Yangtze River Economic Belt, the ecological environment protection plan of the Yangtze River Economic Belt, and the action plan for the protection and restoration of the Yangtze River will be upgraded to legal constraints. In this way, we will fundamentally solve such problems as unreasonable spatial distribution, disharmonious river-lake relations, unscientific coastline development, and inadequate prevention and control of ecological environment risks.

4.3 Construct the Framework System of Yangtze River Protection Law through Total Factor Protection and Whole Process Control

The Yangtze River Protection Law should take full account of the existing characteristics of the Yangtze River Basin, emphasize the ecological protection and restoration as the main line, strive to deal with the relationship between the right to subsistence, the right to development, and the right to the environment. It must focus on establishing and improving the system and mechanism of coordinated protection of the ecological environment between the central and local governments, various bureaus and departments, as well as between numerous local governments.

When drafting the Yangtze River Protection Law, we need to clarify the legal constraints in the areas of space control, water resources development and utilization, water environmental protection, ecological protection and restoration, and risk prevention and control. This document must clarify what can not be done and what activities need to be discouraged within the Yangtze River Basin. 1) Space management and control should include three lines and one single implementation, natural shoreline protection, river and lake ecological buffer zone delimitation, and other relevant requirements. 2) The development and utilization of water resources should include total water consumption control, ecological flow guarantee, and constraints on hydro-power development, etc. 3) Water environmental protection should include the protection and treatment of different types of water bodies and pollution sources. 4) Ecological protection and restoration should include river and lake wetlands, forest grasslands, biodiversity conservation, soil erosion control, and sand mining control, etc. 5) Risk prevention and control should include enterprise environmental risk, transportation environmental risk, and supervision of toxic and harmful substances. In addition, the cost of violating laws and ecological regulations within the Yangtze River Basin should be clearly defined in this legislation. The cost of destruction should be greater than that of protection.

Recommendation5: Establish the Eco-environment Protection Strategy of "Land-Sea Integrated Management" and "Landscape, Forest, Field, Lake, and Grass Systems"

5.1 Establish a Land-Sea Integrated Marine Eco-environment Management System

For China, an oceanic power comprising 3 million square kilometers advocating jurisdiction over sea areas and 18,000 kilometers of continental coastline, a healthy marine ecosystem is an important component of national ecological security. In recent years, although the overall quality of marine ecological environment in China has tended to be stable and other regional ecosystems have been restored, these systems are still at the peak of pollution emissions and environmental risks. The imbalance and insufficiency of marine development in China are still serious. Therefore, it is suggested that the fundamental starting point should be to improve the marine ecological environment and prevent the risks of the marine environment. We must take the comprehensive management of the marine ecosystem as the guidance, and adhere to the principle of land-sea integrated and linkage protection. Thus, a land-sea integrated marine ecological environment management system will be established, and a new protection pattern of "protecting the sea from the source, jointly governing

the river and sea, jointly clearing the sea, strictly governing the sea, and ecologically using the sea" will be constructed. We will return the blue sea, blue sky, and clean beaches to the people.

5.2 Implement Regional Systematization and Meticulous Management.

Legislation must take the red line of ecological protection, the bottom line of environmental quality, the up line of resources utilization and the negative list of environmental access as the effective grasps to implement regional systematization and fine management. At present, the delimitation of ecological protection red line in the Yangtze River Economic Belt has been completed. We plan to systematically identify the surrounding ecological space and establish a zoning management system with ecological protection red line as its core. We will strengthen water quality target management in water function areas, carry out environmental risk assessment through a control unit, and construct a basin control unit management system with a core focus of improving ecological environment quality. Additionally, the total amount and intensity of water resources consumption must be controlled. Accounts of small hydro-power development should be established. The interconnected operation and management of rivers and lakes should be deepened, and the optimal allocation system of water resources should be established. On this basis, a spatial management and control system of the ecological environment of the Yangtze River Economic Belt will be formed to realize the systematization and refinement of the ecological environment protection of the Yangtze River Economic Belt.

5.3 Improve the System of Ecosystem Development and Protection in the Entire Basin

It has been suggested that attention should be paid to the degree of ecosystem health and self-regulation ability, as well as the degree of coordination with social and economic systems. These measures must be taken so as to coordinate the comprehensive development, protection, and management of ecosystems in the Yangtze River Economic Belt. Furthermore, they will establish an ecosystem development and protection system covering the whole basin. In order to formulate a systematic solution to the problems of water environmental pollution, solid waste pollution, soil erosion, and other ecological environment problems in the Yangtze River Economic Belt, the coupling, heterogeneity and diversity of natural ecology, economic development, and social-cultural factors in various provinces and cities should be fully considered. We should take Dongting Lake, Poyang Lake, and Taihu Lake as experimental sites, take the health assessment of each lake ecosystem as the

basis, and proceed from the dimensions of atmosphere, water, soil, and biology to carry out the restoration and reconstruction of the three-dimensional ecosystem structure from point to line to surface. We should then speed up the summary of the experience of ecological environment management in small watersheds, such as lakes, and gradually spread the experience to the whole Yangtze River basin.

As for the improvement of solid waste management methods, the principle of "3R" (reduction, availability, and recycling) should be followed to reduce waste throughout the product life cycle. National policies for circular economy and green supply chain should be formulated to further strengthen the pollution control capability of micro-plastics. In addition, it is necessary to innovate solid waste collection and treatment technologies, improve pollution control measures for livestock and poultry breeding, improve the performance of sewage treatment plants and sludge treatment capacity, and enhance residents' awareness of environmental protection by involving the entire community. Doing so will reduce the water pollution of solid waste for the whole Yangtze River Basin and on to the ocean.

5.4 Innovate the Management Mode of Landscape, Forest, Field, Lake, and Grass Systems

We must identify the important restoration space of "landscape, forest, field, lake, and grass", innovate a new management model, and systematically promote ecological restoration projects. It will also be necessary to deeply carry out the background investigation of natural resources and ecological environment in the Yangtze River Economic Belt to identify the spatial distribution and main characteristics of key areas for the protection and restoration of "mountains, rivers, forests, fields, lakes, and grasses." Priority must be given to delineating the important restoration spaces in areas with extremely important ecological service functions and extremely sensitive ecology in the Yangtze River Economic Belt. Active exploration of a restoration and management mode of "ecology + green financing" should be utilized in the important ecological function areas of the upper reaches of the Yangtze River. Priority should be given to the restoration of seriously damaged habitats, such as the important coastlines, coastal areas, estuaries, and bay wetlands of the Yangtze River Economic Belt including the coastal belt around Lake Taihu. We must actively promote the treatment of abandoned mines in important ecological areas and residential areas with an emphasis on the restoration of sensitive mine hills along transportation lines. We must harmonize the ecological relationship between the Three Gorges Reservoir and the middle and lower reaches of the river system, stabilize the basic ecological water use of the middle and lower reaches of the river and lake, and strengthen the flood detention and storage capacity of large lakes such as Dongting

Lake, Poyang Lake, and Honghu Lake. Through the above measures, we will establish the ecological corridor of the Yangtze River National Park and form a biodiversity protection network.

5.5 Coordinate the Construction of "Water, Land, Port, Shore, Industry, and City"

Accelerate the construction of key water conservancy and hydro-power projects in the Jinsha River cascade hydro-power station and Danjiangkou Reservoir basin, as well as water system nodes, state-controlled and provincial-controlled sections, and water resources monitoring system of important rivers and lakes. We must strictly manage water resource demonstrations, water intake permits, and carry out water rights trading at an appropriate time. We must formulate water allocation plans in batches according to the main waterway and its tributaries to coordinate ecological water demand, production water use, and domestic water use. We must accelerate the construction of key ports and branch waterways along the Yangtze River, plan and construct the railway along the Yangtze River in advance, and promote the interconnection and swift transformation between the high-speed rail system along the Yangtze River, as well as the access channels of the port areas along the Yangtze River. We must attach great importance to the protection of the coastline along the Yangtze River and establish a negative list of access to the ecological environment. We must comprehensively protect the green forest resources along the Yangtze River, focus on building a bamboo and wood planting belt with composite economic and ecological benefits, and strengthen the construction and maintenance of nature reserves, forest parks, and wetland parks. We must strictly limit the zoning of transfer access space for heavy pollution industries such as petrochemical, coal, paper making, printing and dyeing, electroplating, and so on. We must have an integral urban construction and industrial development plan to vigorously develop the circular economy based on the Chishui River Basin as a template. This will allow us to form a new pattern of green urban space with regional linkage, structural optimization, intensive and efficient, low-carbon, clean and ecological livability.

Recommendation6: Establish a "Digital Yangtze river" Platform Involving Cross-sector, Cross-regional and Multi-subject Participation

6.1 Make Every Effort to Establish an Online and Offline Linkage Platform for the Environmental Management of the Yangtze River Economic Belt

We should extend environmental supervision to the public through grid management and form a model of environmental governance for benign activities of

the public and the government. At present, the main way for the public to participate in environmental protection in the Yangtze River Economic Belt is to set up an "exposure platform" by the government. This form is relatively singular, and the main way is through terminal treatment. Only after the public is affected by pollution, can they participate in environmental protection with this system. Therefore, we can divide environmental governance units by grid management, referring to geographical and historical factors, draw regional grid distribution map, and achieve full coverage of grid environmental management. To build a grid management platform for social governance, we should firstly set up the post of a social grid member who will undertake the collection and submission of all kinds of environmental protection information and update it in real time. In this way a "living map" of the grid can be established. Meanwhile, the government should set up a grid management center to manage and coordinate the grid members in a more unified way. Next, we should encourage the public to actively report potential environmental problems through the platform. The government should evaluate the information reported by the public and reward the suppliers of useful information through the establishment and use of a bonus mechanism.

Through big data technology, we can realize all-round and multi-faceted environmental monitoring of the Yangtze River Economic Belt. In addition, we should establish a unified management platform for all kinds of environmental data in the Yangtze River Economic Belt. In addition, we should strengthen cooperation with different departments. We also need to strengthen cooperation with Alibaba, Tencent, and Baidu, which handle large amounts of industry data. Through data sharing, we will integrate meteorological data, emission inventory data, ground monitoring data, urban pollution source data, and environmental law enforcement data. We will also be able to build prediction models, produce meteorological predictions, air quality predictions, environmental health impact predictions, and carry out trace tracking and determination. Position investigation and targeted governance will effectively enhance the ability of environmental governance and early warning.

6.2 Establish the "Intelligent Platform of Eco-industry" in the Yangtze River Economic Belt

We should set up the "Intelligent Platform of Eco-industry" in the Yangtze River Economic Belt, focus on agricultural production, and realize the functions of agricultural digital archives, life cycle management, intelligent farming analysis, and a full link trace, so as to form a network linking the government, consumers, and producers. These steps will be used to express the relationship between supply and demand in the market. We should also collect the basic data of agricultural production,

circulation, sales, and so on. We should carry out the mining and analysis of big data, guide farmers to adjust agricultural production rationally, effectively cope with the fluctuation of supply and demand of agricultural products, increase the sales channels of agricultural products, and enhance brand awareness and market competitiveness. In addition, we should strengthen the supervision of an agricultural products trace, while making full use of the IOT to trace the information of agricultural products from production to harvesting, processing, warehousing, logistics, and sales. Through the integrated management system of agricultural production and sales, we can seek to expand the field of agricultural services across borders, and effectively realize the coordinated development of ecological agriculture, ecological industry and ecological tourism in the Yangtze River Economic Belt.

6.3 Innovate Cross-Regional Green Cooperation Platform

We must explore a green finance cross-regional cooperation platform. Taking the Yangtze River Delta region as the pilot, we will set up a cross-regional cooperation platform for green finance in the Yangtze River Economic Belt to study and formulate a unified green financial normative system. We will bring into play the collective advantages of provinces and cities while considering many aspects, such as supervision, technology, capital and talent, to more fully realize the sharing of green financial information in the region. Relying on the Shanghai Free Trade Belt, we will begin our efforts in the aspects of system innovation, market innovation, product, and service innovation of green finance, to actively promote replication in the upper and middle reaches of the region.

We must establish a Green Supply Chain System in the Yangtze River Economic Belt. Green supply chain management refers to the integration of "green factors" such as energy saving and environmental protection within the entire supply chain management system, so as to minimize resource consumption and environmental impact in every link of products. This includes raw material acquisition, production, use, consumption, scrap to recycling, and utilization. At the same time, every member of the supply chain has an environmental responsibility and obligation according to the cooperative mechanism. We will extend the pilot green supply chain policy previously explored in Shanghai and other locations on to the whole Yangtze River economic belt. We will establish a platform for sharing government green procurement information, and bring some major public projects into the procurement scope. We should also take the leading enterprises as the breakthrough point, take the lead in developing the green supply chain system, and issuing social responsibility reports, so as to promote the green transformation of upstream and downstream suppliers.

6.4 Build an Open Platform for Diversified Cooperation with "The Belt and Road."

We must strengthen communications and docking with "The Belt and Road" national ecological protection and compensation policy. Through the platform of "The Belt and Road," we should further learn and understand the advanced concepts and policies of ecological protection, and share those policies and experiences of ecological compensation to promote and strengthen the role of ecological compensation policy in the work of ecological protection.

We should give full opportunity to the role of green trade and promote eco-friendly trade with the countries involved in “The Belt and Road" plan, enhance the level of ecological economy, and promote the great protection of the Yangtze River economic belt. In addition, we should establish, deepen, and carry out the mutual recognition of standards and lists of ecological products, promote the entry of environmental label products into government procurement, establish a green supply chain management system, promote the opening of the market for environmental services, encourage the expansion of imports and exports of environmental products and services such as air pollution control, water pollution prevention, hazardous waste management and disposal, and come up with methods to facilitate the trade in environmental goods and services.

To promote the integration of green finance, we will provide financial support for the greater protection of the Yangtze River and for the construction of "The Belt and Road" to jointly promote ecological construction. We should focus on green project identification and screening, environmental and social risk management, explore the standard of green investment and financing, share our practical experience in the field of green finance, and encourage Asian investment banks, Silk Road funds, and other "Belt and Road" national and international funds to enter the Yangtze River Economic Belt construction.

We should establish a mechanism for sharing interests in industries along "The Belt and Road" area and the Yangtze River Economic Belt. Through the government's planning guidance and policy support, we must break the barriers of today’s standards and rules between “The Belt and Road" state and the Yangtze River economic belt. We must promote the standardization of industry standards, build a unified large market, and achieve free flow of goods and elements. The Yangtze River Economic Belt should extend its experience in environmental protections, infrastructure construction, and industrial transfer to “The Belt and Road." It must play an exemplary role on a higher level and with a wider scope. At the same time, we must use our resources and market advantages of "The Belt and Road" to establish a differentiated development of the industrial chain to create a win-win industrial

pattern.

Contents

Chapter 1 Project Implementation

The project of "Eco-Compensation and Green Development Institutional Reform in the Yangtze River Economic Belt" of China Council for International Cooperation on Environment and Development (hereinafter referred to as "YREB Project") was kicked off in June 2018 with purposes to address some issues of the institutional reform on how to build an eco-compensation mechanism and implement the green development in the YREB under the premise of ecological protection and sustainable development. Mr. Wang Jinnan, President of Chinese Academy for Environmental Planning (CAEP) and Academician of the Chinese Academy of Engineering, and Mr. Stephen P. Groff, Vice-President of the Asian Development Bank, jointly lead the project team and organize a special seminar attended by above 30 experts from international organizations, such as the ADB (Asian Development Bank), TNC (the Nature Conservancy), INBAR (the International Bamboo and Rattan Organization), the Stockholm Environmental Institute, and some domestic organizations, such as CAEP, DRC (the Development Research Center of the State Council), the Chinese Academy of Fiscal Sciences, Tsinghua University, Wuhan University, the Three Gorges Corporation, Yunnan Institute of Environmental Sciences, Guizhou Institute of Environmental Sciences and Sichuan Institute of Environmental Sciences. From August 23 to 26, 2008, the first large-scale special survey for the project was organized on Chishui River Basin; a joint meeting of Chinese and foreign experts was convened on September 22nd, 2018; in November 2nd, 2018, the annual theme forum "Green Development and Innovation in the Yangtze River Economic Belt" of CCICED will be held, so as to promote the project to achieve the positive progress through various means, such as desk work, on-site research, and meetings.

1. Establish a Sound Working Mechanism

The project team immediately carried out the research after the kick-off, set up the project research framework, and made division of labor for experts according to their specialized fields, as well as timely exchange the research progress by means of e-mail, WeChart groups and so on. Although the research time is limited with heavy tasks, each expert has submitted own respective research results on time with quality and quantity assured. The Policy Recommendations (Draft) has been submitted on time. Moreover, according to the outcomes of investigation and joint expert meeting, the legislation for protection of Yangtze River has been ranked as a priority component by the project team, and the ***Yangtze River Protection Law*** (draft) has been studied and formulated.

2. Project Preparation and Kick-off

Since March 2018, academician Wang Jinnan, head of the Chinese expert group,

has organized the relevant experts to formulate the project working outline, which has been finalized after it was revised on the basis of discussions with the ADB and CCICED for many times. In June 6th, the kick-off meeting was held successfully in Beijing, which was attended by nearly 40 representatives from some international organizations, such as the ADB, INBAR, TNC, International Rivers, WWF (China), and some domestic organizations, such as Tsinghua University, Wuhan University, Tianjin University, the Chinese Academy of Fiscal Sciences, Chinese Academy of Social Sciences, Sichuan Institute of Environmental Sciences and Yunnan Institute of Environmental Sciences. The issues discussed and exchanged on the meeting mainly focused on the implementation plan, project outcomes, work plan, expert team, and budget arrangement and so on. Professor Hu Baolin, special adviser of the CCICED and former Deputy Director of the Office of the Three Gorges Project Construction Committee of the State Council, and Ms. Amy Leung, Director of the East-Asia Bureau on behave of Grove, deputy president of the ADB, chairman of the foreign expert group attended the meeting and made the opening address. Mr. Wang Jinnan introduced the overall project framework. Professor Hansen, chief foreign consultant of the CCICED, introduced the status quo of researches of the CCICED and the relations between such subjects and the Yangtze River policy research. Some international organizations, such as ADB, INBAR and TNC have introduced respectively their research results and project experiences related to the eco-compensation, such as risk prevention and control for water resources, bamboo resources utilization, agricultural development compensation, and river-chief system. After the kick-off meeting, the project team revised the work outline, drew up the work schedule, the expert division table and budget arrangement, and submitted the bidding materials for the ADB project as required by the ADB and CCICED.

3. Special Investigation on Chishui River Basin

From August 23rd to 26th, Mr. Wang Jinnan led the research team to carry out a four-day special field survey on the Chishui River Basin. The research team is composed of the experts from the Secretariat of CCICED, the Chinese Academy of Fiscal Sciences, Tsinghua University, Three Gorges Corporation, Sichuan Institute of Environmental Sciences, Guizhou Institute of Environmental Sciences, Yunnan Institute of Environmental Sciences and so on. The research team started from Hejiang County, Sichuan Province, where Chishui River flows into the Yangtze River, and traveled nearly 1,000 km to Chishuiyuan Town, Zhenxiong County, Yunnan Province, where Chishui River originated. Along the way, they gain a thorough understanding on eco-compensation between the upstream and downstream, watershed pollution control, ecological protection and restoration, operation and maintenance of sewage treatment facilities of liquor enterprise, rural green

development and environment improvement in Hejiang County, Gulin County in Sichuan Province, and Xishui County and Renhuai County, Guizhou Province by means of the symposiums, on-site investigations and interview to peasant households; and preliminarily understand the background of eco-compensation and green development in the Chishui River Basin, demands of all stockholders and existing problems.

4. Joint Working Meeting

In September 22nd, the joint working meeting was held successfully in Beijing. The relevant leaders were specially invited from the Department of Regulations and Standards of the Ministry of Ecology and Environment, the Department of Administration and Personnel; moreover, Art Hanson, the Chief Adviser of the CCICED, and Ms. Fang Li, the Deputy Secretary-General of the CCICED were also invited to attend this meeting. The meeting was co-chaired by Mr. Wang Jinnan and Amy Leung. The experts from nearly 20 institutions attended the meeting, including the Development Research Center of the State Council, Tsinghua University, Peking University, Renmin University, Wuhan University, China Academy of Fiscal Sciences, ADB, INBAR, Stockholm Environmental Institute, WWF, and TNC and so on. The delegates held in-depth discussions on many issues, such as "eco-compensation and case study", "green development institutional reform and river-chief system", "rural revitalization and green development", "green development innovation and technology", " legislation on Yangtze River protection ", "cooperation and gender mainstreaming" in the YREB. Particularly, the discussion was focused on "Yangtze River Protection Legislation". Experts have proposed to determine the objectives, ideas and models of Yangtze River Protection Legislation by problem-oriented approach, it is necessary to clarify the scope of legislation in the YREB and relationship with other applicable laws, so as to link up the relevant laws and regulations.

Chapter 2 Basis, Issues and Needs

A lot of valuable experiences have been learned in management organization model, eco-environmental management and eco-compensation practices in some typical international trans-boundary watersheds, such as Mississippi, Tennessee, Amazon, Rhine and Danube. Based on the national development strategy of the YREB, 11 provinces and municipalities concerned have made joint efforts to firmly uphold the concept of green development, optimize the industrial structure, strengthen environmental management, and coordinate efforts, which positive results have been achieved in aspect of the green development. However, some challenges still exist when breaking through the barriers of regional administrative divisions, innovating the mechanism for regional coordinated development, and promoting the construction of integrated market system.

1. International Watershed Management Experiences

1.1 Mississippi Valley

As a large basin, Mississippi Valley is jointly managed by various sectors and groups. The mature experiences have been obtained at the upper reach of Mississippi Valley. The Upper Mississippi Valley Association was originated from the Mississippi Valley Committee and dismissed under the Reagan Administration in 1975-1980. Either the Ministry of Natural Resources or the Ministry of Agriculture and Transportation will be designated by the Governor to perform the state functions; usually the former was selected since 1980. Federal agencies, USACE, USFWS, USGS, USEPA, and the Maritime Authority are all technical advisers and NGOs; they encourage the public participation which has greatly promoted the watershed management.

Fig. 1 Map of Mississippi Valley

The management experiences in the Mississippi Valley are mainly composed of six aspects below:

(1) **Strictly implement the drainage permit system:** The NPDES (National Pollutant Discharge Elimination System) licensing system in the United States is to address water pollution through managing point sources with pollutants discharged into United States waters. The EPA authorizes each state government to issue, administrate and enforce the project licensing; the rainwater runoff that absorbed pollutants, such as garbage, chemicals, oil, and dirt/sediment, can cause water pollution of rivers, streams, lakes and coastal waters. The NPDES rainwater program aims to prevent harmful pollutants from being discharged into local surface waters with rainwater runoff.

(2) **Federal watershed management policy:** Various federal agencies, including the Ministry of Commerce and Ministry of National Defense, have played certain role in managing or supervising water resources. Some agencies have played a major role in water policy, such as the U.S. Army Corps of Engineers (USACE) and the Bureau of Reclamation. Especially, the USACE manages about a quarter of hydropower in the USA. It also created and manages water infrastructure projects and maintains waterway navigation along Mississippi River.

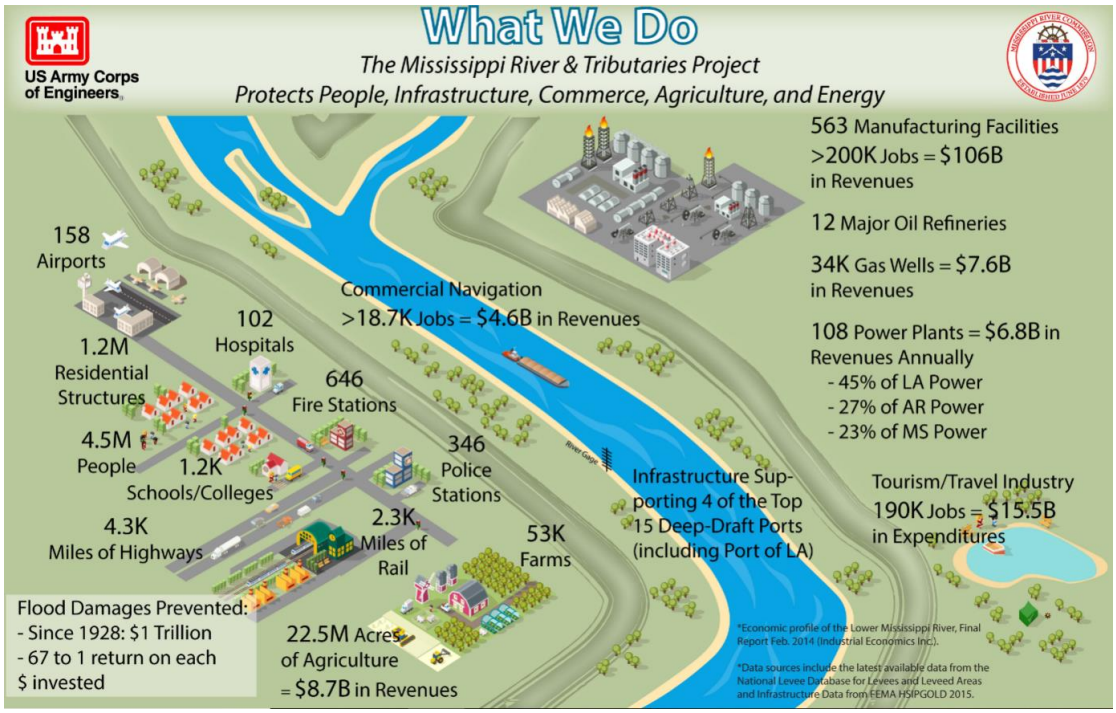

Fig. 2 Plan of the USACE's projects along Mississippi River

(Source: USACE)

(3) **Coordination and federal cooperation mechanism among states**: The MICRA (Mississippi Interstate Cooperative Resources Association) is an organization composed of 28 state natural resources management body with rights to manage fisheries within Mississippi Valley. It aims to improve the management of fish and other aquatic resources across its jurisdiction. The UMRBA (Upper Mississippi Valley Association) is responsible for coordinating projects and policies related to Mississippi River of states; the LMRCC (Lower Mississippi River Conservation Commission) focuses on habitat restoration, long-term natural conservation planning and economic development.

(4) **Special national action plan**: One of the main tasks of the Hypoxia Task Force (HTF) is to develop and implement nutrient reduction strategies in the states. The figure below shows the priority watersheds of the HTF states.

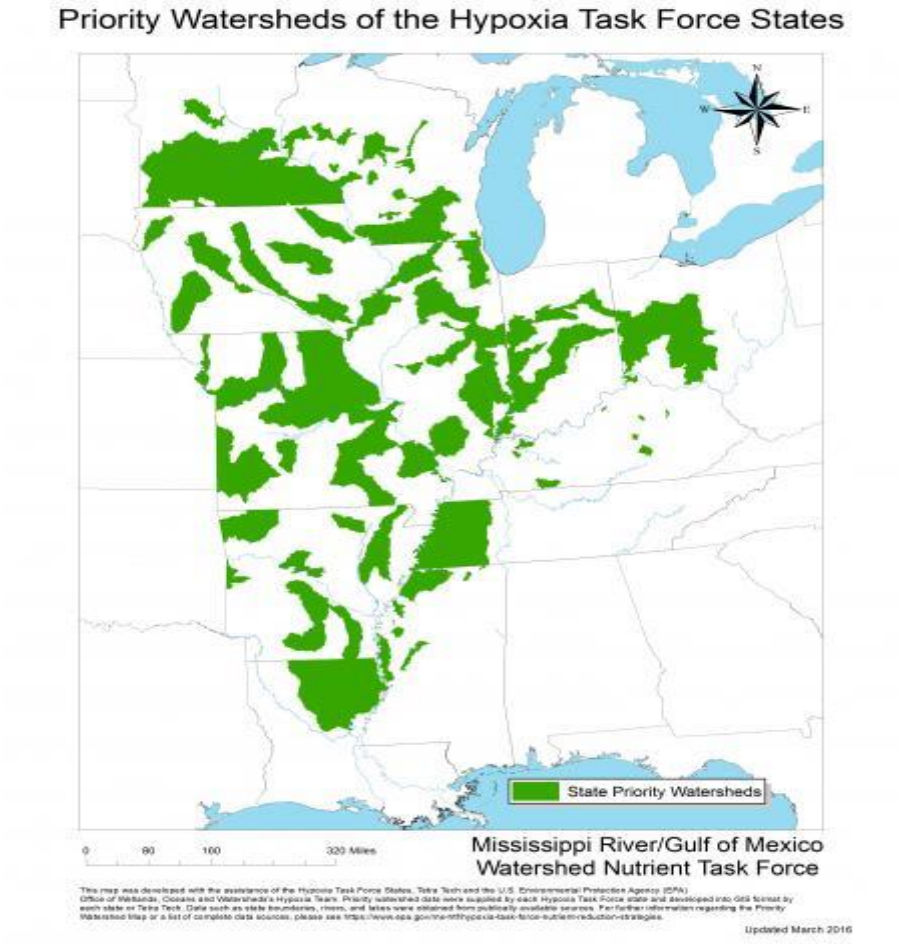

Fig. 3 priority watersheds of the HTF states

(5) **Multi-channel fund-raising**: Most of the collaborations and initiatives benefit from multi-channel funding, which can include federal, state and local funds, as well as participation by corporations and NGOs. Several states in the Mississippi Basin have approved significant funding for conservation based on referenda approved by voters in those states.

(6) **Drainage monitoring and evaluation system for the Mississippi River**: The National Oceanic and Atmospheric Administration (NOAA), covers most of the monitoring of the dead zone in the Gulf of Mexico. The United States Geological Survey, USGS, has sophisticated monitoring techniques and provides data on river water quality. The EPA has its own monitoring of different data points and individual states sometimes have their own monitoring systems which have relevancy to the Mississippi.

1.2 Tennessee River Basin

The Tennessee and Cumberland River Basins are two of the most biologically diverse river systems in North America. Home to more than 300 species of fish and 125 species of freshwater mussels, these river systems are an irreplaceable part of

Tennessee's natural heritage. Their watershed management experiences are mainly embodied in five aspects below:

(1) **Comprehensive management**: The Nature Conservation has many successful management experiences in the Tennessee River. It works with partners to strategically prioritize, remove or modify aquatic barriers, with purposes of helping to improve agricultural practices to keep these rivers cleaner, and bringing science, planning, and project management expertise to watershed planning, ecosystem restoration and river management efforts.

(2) **Eco-compensation approach:** A watershed planning approach for the Stones River provide recommendations related to the compensatory mitigation techniques. Federal regulations outline allowable forms of compensatory mitigation for wetland impacts. These include restoration, creation, enhancement, and preservation. In Tennessee, this preference is given to restoration over other forms of compensation. Compensatory mitigation for stream impacts is guided by a classification system which includes replacement, restoration, enhancement II, enhancement I, and preservation categories for determining credit ratios (TDEC 2004). Replacement, the removal of artificial structures and re-creation of a natural stream channel, and preservation are applied less often than restoration and enhancement.

(3) **Diversified financing system**. The Tennessee River Basin Authority is committed to providing cleaner and more reliable energy for its customers at the lowest possible cost, especially in the area of electricity. Through some measures, such as installing control devices and expanding power upgrades, these actions have enabled our diversified generating fleet to produce more than half of their power from carbon-free sources and the Tennessee River Basin Authority can maintain a lower price for its customers.

(4) **Water resources development and economic development**: Through its partnerships with other economic development organizations, TVA's help foster capital investment and job growth in the area. TVA Economic Development works to attract new companies which results in more jobs and investments in the Valley and to engage existing businesses and industries to help them grow in a sustainable way.

(5) **Legal and regulatory experience:** TVA constantly adjusts management of its water system to those varying conditions to make sure it continues to efficiently provide all its life-supporting benefits, which are flood damage reduction, navigation, power production, water quality, water supply, and recreation.

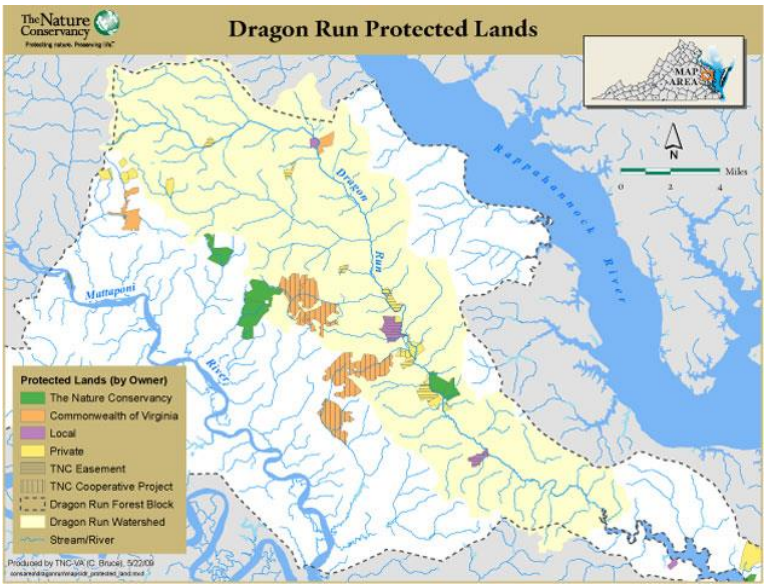

Fig. 4 "all system" protection case of the Nature Conservancy

1.3 Management Experiences in Amazon Basin

(1) **Pay attention to river management and regulation:** Tapajós River is one of the largest tributaries of the Amazon. At 1,200 miles long, the Tapajos touches three Brazilian states (Mato Grasso, Para and Amazonas) and runs through 65 municipalities. Several dams have been built on the river way, which poses a great threat to water environment in river basin. The Nature Conservation is embarking on a global campaign to protect land on an unprecedented scale, save the world's great rivers and lakes, spur climate action, revolutionize ocean protection and make cities more resilient. The Amazon is a big part of this campaign, and the Nature Conservancy is working on the protection of Tapajós River Basin.

(2) **Pay attention to environmental protection and water resources protection:** By promoting the sustainable technologies, such as the electronic maps and satellite remote sensing, the Nature Conservation helps the local residents comply with forest laws and shares science and technology with local businesses, governments and developers, so as to balance the environmental protection and economic development. A series of measures contained in the Amazon Basin Comprehensive Sustainable Development Inter-regional Water Resources Project are used to address climate change and variation in the entire basin. The overall goal of the project is to develop a strategic action program for the Amazon Basin with a purpose to achieve sustainable development.

(3) **Establish a protection mechanism for Amazon River together with neighboring countries:** In view of the transnational natural and cultural heritage, Colombia, Ecuador and Peru have established joint management zones: Cuyabeno Wildlife Reserve, Güepp íSekime National Park, Airo Pai and Huimeki Native

Reserve, and La Paya National Park, etc. The Guiana Shield Facility (GSF) is a multi-donor funding facility for the long-term financing of national and regional activities related to Guiana Protective Area.

(4) **Management system and law**: Each country in the Amazon Basin has its own legal system to bind human activities, which provides an overall framework for government, community and group to jointly protect the ecosystem in Amazon. The Nature Conservation has established a basic law for the state-wide program: reward rural landowners in Rio de Janeiro who conserve forests and give priority to watershed wetlands.

(5) **Ecology- monitoring system integrated the space and earth with total factors:** MAAP (Monitoring of the Andean Amazon Project), is a project to protect the Amazon Environment, aims to use advanced and feasible technologies to timely grasp the scale, hot spots and causes of deforestation in the Amazon region of the Andes; and distribute the above-mentioned technical information to the users in a real-time, accessible and friendly manner, including policy makers, government authorities, civil societies, journalists, researchers and ordinary people.

1.4 Management Experiences in Rhine Basin

The Rhine, which flows into the North Sea from the Alps, is the most important cultural and economic axis of Central Europe. It is used more busily and diversified than all other rivers in the Europe. A population of above sixty million of six countries is lived in the Rhine Basin. Its watershed management experiences are mainly composed of two aspects below:

(1) **Restore the zoological and botanical diversity in the basin:** Currently, great progress has been made in restoring the zoological and botanical diversity in the Rhine River basin. In 1998, the Council of Europe set the objective of extending the restoration of a single ecosystem to the entire natural ecological region, including the Rhine Estuary, Jurassic Mountains, Alps, Rhine Mountains, the ancient coniferous forests of the floodplain, the Rhineland-Pfaltz stream, Hessen and Vosges Mountains in southern Germany. The concerted efforts of all countries along the Rhine are conductive to restore the healthy river. The return of fish is a clear signal for water quality improvement. Although river water quality is excellent, it needs further improvement as a natural habitat.

(2) **Pay attention to international cooperation**: In January 2001, the minister in charge of the Rhine approved the Rhine 2020 Plan, which is a "plan for sustainable development of the Rhine River" following the most successful Rhine Work Plan (1987-2000). In this Plan, the overall goals are set for the policies and measures to achieve Rhine River conservation in the next 20 years. The core contents include interconnection of small habitats in the Rhine River, Salmon 2020 and the Work Plan

for Flood Prevention to lower the economic losses caused by floods, further improvement of water quality and protection of the groundwater environment, and continued monitoring of the Rhine River.

1.5 The Management Experiences in Danube Valley

The Danube Valley covers an area of over 800,000 km^2, accounting for 10% of land area in Europe and stretching to the territory of 19 countries. It is considered to be the most international river basin in the world. The management experiences in Danube Valley laid emphasis on the **multilateral and multi-level coordination mechanisms and supporting laws & regulations**. According to the ***Danube River Protection Convention***, the International Commission for the Protection of the Danube River (ICPDR) is committed to the sustainable and rational utilization of water resources in the Danube Basin. The Convention is the general legal instruments for cooperation and trans-boundary water resources management in the Danube Basin, which main objectives are to ensure the sustainable and rational management and utilization of surface water and groundwater in the Danube Basin. It involves the protection, improvement and rational use of surface water and groundwater; preventive measures against the flooding, freezing or hazardous material accidents; and reduction of pollutants from the Danube Basin into the Black Sea.

2. River Basin Management Experience of the YREB

Traversing the West, Middle and East China, the Yangtze River Economic Belt (hereinafter referred to as "YREB") is one of our country's areas with the most powerful comprehensive strength and the largest strategic support, accounting for 40% of the national overall economic output. It has formed a development momentum of the lower reaches of Yangtze River Delta as the lead, and cities groups in the middle reaches, Chengdu-Chongqing cities groups in the upper reaches as the supports. Integrating mountains, water, forests, fields and lakes, the Yangtze River basin possesses a lot of enormous ecological service value, such as flood adjustment, water sources preservation, water and soil conservation, biological variety maintenance and environment purification, and it is our country's essential treasure house as well. In addition, 8 concentrated exceptional poverty areas, such as Qinba mountain region, Wuling mountain region in the middle and upper reaches, are regarded as the national key ecological function zones, and the mineral & water resources concentrated distribution area, so an acute contradiction stands out between the resource exploitation and ecological protection.

2.1 Basic Advantages

2.1.1 Nature Resource Value of the YREB

Spanning across the tropical, the subtropical and the warm temperate zone, Yangtze River basin has a complex geomorphological type and a diverse ecological system. Many ecosystems here, such as, the river, valley and forest ecosystem in western Sichuan, the subtropical evergreen broad-leaved forest ecosystem in the southern subtropical zone, and the wetland ecosystem in the middle and lower reaches of the Yangtze River, are the priority biodiversity protection area with the global great significance. The forest coverage in Yangtze River basin can reach 41.3% with an abundant biological species, where the river, lake, reservoir and wetland area accounts for 20% of the whole country, the rare and endangered plants, 39.7% and the freshwater fish, 33%. It is also the concentrated distributed area for the national rare and endangered wild animals and plants, such as Chinese sturgeon, finless porpoise, Chinese alligator, giant panda, golden monkey, and silver fir, metasequoia, davidia. The eight concentrated exceptional poverty areas, such as Qinba mountain region, Wuling mountain region, are regarded as the national key ecological function zone, and the mineral & water resources concentrated distribution area. Nearly half of the national key heavy metal prevention and control regions are located in the YREB.

2.1.2 Water resource value of the YREB

Extremely abundant in the water resources, the Yangtze River basin is the strategic place of water resources for the Chinese nation. According to the national ecological function zone division, 8 important water conservation and ecological service functional areas are distributed in the YREB, among the national 17 total, which accounts for 47.1%, including Qinba Mountain, Dabie Mountain, Huaihe Source, Nanling Mountain, Dongjiang Source, Zoige, three Gorges Reservoir Area and Danjiangkou Reservoir Area, etc. The high value area of water conservation quantity per unit area in the Yangtze River Basin is primarily located in Hunan, Jiangxi, Zhejiang, Yunnan, etc. The Yangtze River is deemed as the life river of the Chinese nation. For many years, the average annual water resources amount to about 995.8 billion cubic meters, accounting for about 35% of the national total. The annual water supply of the Yangtze River exceeds 200 billion cubic meters, which sufficiently meets the demand of living and production water for 400 million people along the Yangtze River. Moreover, the people in North China, Northern Jiangsu, Shandong Peninsula and other large areas can also get the benefit through the south to north Water Diversion Project.

2.1.3 Ecological service value of the YREB

The upper reaches of Jingsha River and Minjiang River and Three Parallel Rivers, the Danjiangkou Reservoir Area, the upper reaches of Jialing River, Wuling Mountain,

the upper reaches of Xin'an River, Xiangjiang River, Zijiang River, and Yuanjiang River, and others, are the national key soil erosion prevention areas. The lower reaches of Jinsha River, Jialing River and the middle and lower reaches of Tuojiang River, Three Gorges Reservoir Area, the middle reaches of Xiangjiang River, Zijiang River, and Yuanjiang River, and the upper and middle reaches of Wujiang River and Chishui River and others are the national key soil erosion governance areas. Guizhou and other southwest Karst areas are one of the three largest rocky desertification areas in the world. Some areas in the Yangtze River Basin, such as the hilly areas around Sichuan Basin, Nanling Mountains, Wuyi Mountains and southern Anhui Mountains, have the strong ecosystem soil conservation function. There are totally 140 nation-level nature reserves and 297 national forest parks in the YREB. According to the latest regulated red line of ecological protection issued by the different provinces, the total area of the red line of ecological protection in the YREB is about 518, 500 square kilometers, accounting for 25.34% of the land area of 11 provinces and cities in the YREB.

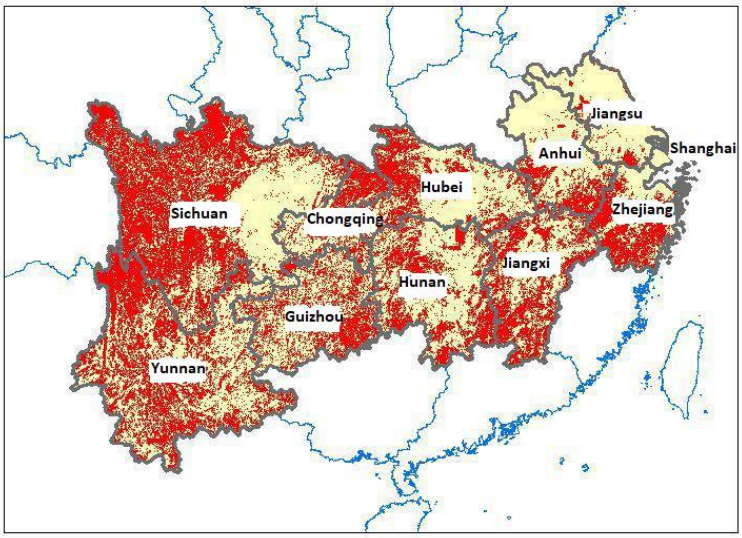

Diagram 5 Illustration to the red line of ecological protection in the YREB

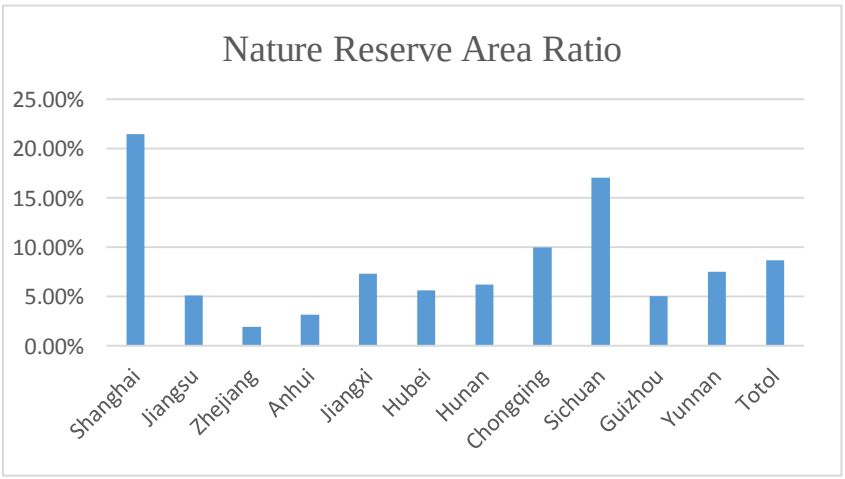

Diagram 6 Illustration to the area ratio of nature reserves in different provinces along the YREB

2.1.4 Outstanding contradiction between protection and development

There is a strong geographical distribution coupling between the important ecological function zones and the poverty areas in the YREB. The YREB has eight national key ecological function zones, including Sichuan-Yunnan Ecological Function Zone for Forest and Biodiversity, Three Gorges Reservoir Ecological Function Zone for Soil and Water Conservation, Qinba Biodiversity Ecological Function Zone, Wuling Mountain Ecological Function Zone for Biodiversity and Soil and Water Conservation, Dabie Mountain Ecological Function Zone for Soil and Water Conservation, Zoige Ecological Function Zone for Grassland and Wetland, accounting for 1/3 of the national key ecological function districts and counties (676 county-level administrative districts), this area covers 254 counties, among which 154 counties belong to the state-level poverty-stricken counties. With the protection areas highly overlapping with the poverty areas, this area not only plays the role of "ecological security" and "resource reserve", but also undertakes the task of poverty alleviation and development. For a long time, China's ecological compensation policies in these zones have been primarily project-based, and a huge amount of financial transfer payment fund has provided a good basis for the ecological compensation, and has given a certain compensation for the loss of development opportunity cost in ecological protection area. However, at the same time these policies have brought great risks to the implementation effect, due to a clear time limit without sustainability. Once the funds are cancelled, it is easy to cause a vicious circle of "poverty-destruction-poverty". Therefore, in order to keep a long-term mechanism of ecological compensation, it is necessary to combine the state's precision-poverty relief and alleviation program to promote the coordination between the ecological protection and poverty-alleviation development in the ecological protection area.

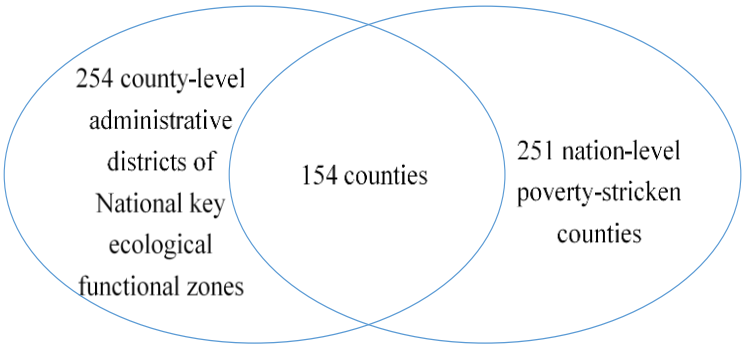

Diagram 7 Illustration to the key ecological function zones and nation-level poverty-stricken counties in YREB

Chart 1 List of the key ecological function zones in YREB

No.	Name of the key ecological function zones
1	Sichuan-Yunnan Ecological Function Zone for Forest and Biodiversity
2	Three Gorges Reservoir Ecological Function Zone for Soil and Water Conservation
3	Qinba Biodiversity Ecological Function Zone
4	Wuling Mountain Ecological Function Zone for Biodiversity and Soil and Water Conservation
5	Dabie Mountain Ecological Function Zone for Soil and Water Conservation,
6	Zoige Ecological Function Zone for Grassland and Wetland
7	Nanling mountain Ecological Function Zone for Forest and Biodiversity
8	Guangxi, Guizhou and Yunnan Ecological Function Zone for Karst Rocky Desertification Control

2.2 All-basin management experience

2.2.1 Ecological compensation experience of the YREB

The single factor ecological compensation projects have been tamped continuously. The ecological compensation mechanism has been established in the key river basin of all the provinces (cities) along the Yangtze River, and there are six provinces (cities) that have covered the whole province with the ecological compensation mechanism, so the basin ecological compensation mechanism has become an important means to carry out the comprehensive governance for the upper and lower reaches of the YREB. The forest and wetland ecological compensation mechanism has been continuously improved, and the restoration project for the mountain, water, forest, field, lake and grass system has been accelerated. The comprehensive ecological compensation has been further promoted, the transfer payment method for the key ecological functional zones have been kept optimizing, and the scope of subsidies has been continuously expanded. The ecological compensation is also expanding from intra-province to trans-province, and gradually realizing the share of cost and benefit, and co-governance between trans-zone ecological protection and environmental governance.

All provinces (cities) along the YREB have established the ecological compensation mechanism in the provincial key river basins or even throughout

whole province.

Shanghai and Jiangxi provinces have established a vertical ecological compensation transfer payment mechanism covering the whole province.

In 2017, on the basis of *Opinions on Establishing and Improving Ecological Compensation Mechanism in Shanghai* and *Ecological Compensation Transfer Payment Measures* in 2009, Shanghai issued the *"City-to-District Ecological Compensation Transfer Payment Measure* to further detail the original payment method, so the transfer payment funds for ecological compensation have always maintained a significant growth momentum. Take the ecological compensation of water source areas for example, which is in the charge of Municipal Environmental Protection Bureau, the accumulative compensation funds during 2009 to 2018 exceeded RMB5.9 billion, and the compensation funds in 2018 was up to RMB 1.15 billion.

Jiangxi province has formally issued *Jiangxi Province Basin Ecological Compensation Measures*, which basically retains the content of *Jiangxi Province Basin Ecological Compensation Measures (Trial)* issued in 2015, and continues to include the five major rivers of Poyang Lake and Ganjiang River, Fuhe River, Xinjiang River, Raohe River, and Xiuhe River, as well as the Jiujiang River section of the Yangtze River and Dongjiang River basin into the scope of implementation, covering all the 100 counties (cities and districts) over the whole province. In 2018, the scale of ecological compensation funds will exceed RMB2.89 billion. In order to promote the establishment of trans-provincial and intra-provincial horizontal ecological compensation mechanism, an investigation on the provincial river basin ecological compensation will be carried out in the counties (cities) with the all-provincial representative maturity.

According to the principle of "Anyone who exceeds the standard should compensate, anyone who reaches the standard should benefit", Jiangsu and Anhui provinces have established a "two-way compensation" mechanism for basin water environmental quality covering the whole province.

There are 112 compensation sections throughout Jiangsu province, including 76 compensation sections in 8 cities along the Yangtze River. Up to now, the total amount of compensation funds for water environment area in Jiangsu province has accumulatively reached nearly RMB2 billion, which, together with provincial reward funds, has been returned to the local governments for dedicated use in water pollution prevention and control, thus effectively promoting the improvement of regional water environment quality. The regional compensation program of Jiangsu province is also

developing extensively and further, and referring to the provincial compensation practices, Wuxi, Xuzhou, Changzhou, Suzhou, Nantong, Huai'an and other cities also carry out trans-county (city, district) river regional compensation within their jurisdictions. On December 30, 2017, the General Office of Anhui Provincial Government issued *Provisional Measures of Ecological Compensation for Surface Water Section in Anhui Province*, and established an ecological compensation mechanism for surface water section mainly based on municipal-level horizontal compensation and supplemented by provincial-level vertical compensation, which includes 121 sections within the whole province and covers the Yangtze River, Huaihe River and major tributaries, and important lakes throughout Anhui Province. During January to March, 2018, the ecological compensation fund of Anhui province amounted to RMB117 million. In addition, five municipalities in the upper and lower reaches of the Yangtze River were organized to sign *Ecological Compensation Agreement on Surface Water Section in the Yangtze River Basin within Anhui Province*.

Zhejiang and Chongqing provinces promote the establishment of a horizontal ecological compensation mechanism in the upper and lower reaches of the Yangtze River throughout the whole province.

On the basis of previously issued *Opinions on Establishing a horizontal Ecological Protection Compensation Mechanism in the upper and lower reaches of Yangtze River Basin within Province (No. 184 of Zhejiang Finance Construction [2017])*, and in accordance with the requirement of "Early Signing, Early and More Gaining", Zhejiang province has timely distributed and arranged the reward funds for protection and governance of the YREB, so by the end of March, six pairs of regions in upper and lower reaches of the Qiantang River and Puyang River basins have all signed horizontal ecological protection compensation agreements, which are included in the first batch (required to be completed by the end of March). Chongqing Municipal Government has promulgated *Implementation Plan of Establishing a horizontal Ecological Protection Compensation Mechanism for Yangtze River Basin in Chongqing (Trial) (No.53 of Chongqing Municipality, [2018])*. By 2020, the district & county horizontal ecological protection compensation mechanism will totally have covered the river basin area of more than 500 square kilometers within the city's administrative area, and 19 secondary rivers flowing through two or more districts and counties. At present, three districts and counties in Binan River basin have signed the horizontal compensation agreement, and the other districts and counties related to 18 secondary rivers have all showed their willingness to sign it this year.

Hunan province, Guizhou province and Sichuan province have established the

ecological compensation mechanism based on water environmental quality in the key river basins throughout the whole province.

On the basis of the ecological compensation program for water quality and quantity assessment in the Xiangjiang River basin that has been implemented for three years, Hunan province plans to carry out the ecological compensation for water environment in an overall way throughout the whole province, actively study and construct the horizontal ecological compensation mechanism for the four river basins of Xiang River, Zi River, Yuan River and Li River within the province, and explore the implementation of the ecological compensation awards for atmospheric environment throughout the whole province. Since 2009, Guizhou province has successively carried out the river basin ecological compensation in Qingshui River, Chishui River, Wujiang River and Hongfeng Lake of the Yangtze River basin. Through a Valuation Adjustment Mechanism (VAM) on water environmental quality between the relevant cities (prefectures) of the river basin, RMB330 million of ecological compensation dedicated funds have been invested in improving the environmental quality of the river basin, and the ecological compensation mechanism of main river basins in different cities and counties along Guizhou section of the Yangtze River has been initially established. In 2011, Sichuan province firstly attempted to carry out the river basin horizontal ecological compensation for the Minjiang River and Tuojiang River, the important first-level tributaries of the upper reaches of the Yangtze River within the province. In 2017, Sichuan province issued *Ecological Compensation Measures for Water Environment at Provincial Boundary Sections of Three Rivers Basin (Trial)*, and established a closed-cycle assessment mechanism for the "Three Rivers" Basin within the province. At present, *Implementation Plan of Ecological Protection Compensation in Tuojiang River Basin* is being drafted.

The substantial progress of trans-provincial river basin ecological companion needs to be perfectly made.

The pilot project of the ecological compensation in the trans-provincial Xin'An River basin has been steadily advancing.

Based on the previous two rounds pilot projects of the ecological compensation in Xin'anjiang River basin, we firstly, together with the provincial financial departments, will evaluate the performance of the two rounds of pilot projects, and joining Anhui province, apply to the Ministry of Finance and the Ministry of Environmental Protection for the continuous guidance and support on the ecological compensation in Xin'anjiang River basin. At present, the two provinces are conducting an in-depth consultation and communication on the new round of compensation benchmarks,

compensation methods, compensation standards, joint prevention and co-governance mechanism and others in Xin'anjiang River basin. Meanwhile, we will actively explore the way to strengthen the cooperation in industry, talent, tourism and other aspects, and the way to establish a diversified compensation mechanism.

The pilot progress of the ecological compensation in trans-provincial Chishui River basin needs to be speeded up.

March 21 to 23, 2018, the environmental protection departments and financial departments from three provinces of Yunnan, Guizhou and Sichuan held a project promotion meeting in Renhuai city, Guizhou province on the trans-provincial ecological compensation in Chishui River basin. The meeting adjusted and updated the list of members of the Coordinating Group on the pilot project of the ecological compensation mechanism in the Chishui River basin of Yunnan-Guizhou-Sichuan area, and discussed the compilation of *Implementation Plan of the Horizontal Ecological Protection and Compensation in Chishui River Basin*. At present, its exposure draft has been completed and is soliciting the opinions of the relative departments from Yunnan, Guizhou and Sichuan provinces.

Other trans-provincial river basin projects are still under negotiation.

Guizhou province has initiated a pilot study on the horizontal ecological compensation in Xijiang River basin and reached a preliminary consensus with Yunnan province. Moreover and it is planning to jointly initiate a proposal to establish a horizontal ecological compensation mechanism for Xijiang River in the near future, to negotiate with Guangxi and and Guangdong provinces located in the lower reaches of Yangtze River. The related departments from Hubei, Hunan, and Anhui, Chongqing and other provinces and municipalities have carried out an early communication to promote the trans-provincial horizontal ecological compensation mechanism in Yangtze River basin, and to sign the compensation agreements, etc. Hubei and Hunan provinces are negotiating on launching the horizontal ecological compensation of the trans-provincial river basin for Huanggai Lake that is located at the border of the two provinces. Chongqing Environmental Protection Bureau, together with the Municipal Finance Bureau, has completed the drafting of compensation agreement (draft) of trans-provincial river basin in Chongqing, pending a discussion with the neighboring provinces and cities.

2. Experiences of green development institution and mechanism in YREB

A multi-level mechanism for consultation and cooperation has been formed. The Yangtze River Valley spans three major economic zones in the eastern, central and

western China, totaling 19 provinces, municipalities and autonomous regions. In recent years, in order to protect the trans-boundary environment and promote the healthy economic and social development in river basin, the local governments along the Yangtze River have also made certain innovations and practices in the administrative supervision system in aspect of environmental protection. In Sichuan, Guizhou and Yunnan Provinces, the provincial departments of environmental supervision, in accordance with the working ideas of "striving for breakthrough by means of reform, governance-oriented, mechanism guarantee and heavily punishment", vigorously carry out comprehensive environmental improvement through establishing long-term mechanism, building infrastructure and carrying out joint law enforcement, and severely crack down on illegal and criminal activities in river basin. The ecosystem and water quality in Chishui River basin have been improved significantly. Some provinces have issued opinions on fully implementing the river-chief system, and established a river-chief system in an all-round way in the YREB. Some administrative regions of the YREB spontaneously signed relevant agreements on inter-basin joint prevention and control. Through establishing the joint watershed prevention & control organization, joint working meeting system and signing joint agreement, the mode of "information exchange, data sharing, joint prevention and control, and joint emergency response" is gradually realized in the river basin.

A green, orderly, coordinated and standardized pattern has been preliminarily established: The key to promoting the development of the YREB under the new situation is to deal with the relationship between self-development and coordinated development well. The coordinated green development is essential component of the coordinated development of the YREB, it is particularly important to scientifically and rationally plan the green industry system which links up and coordinates each other within the river basin. Therefore, the relevant provinces and municipalities shall implement a strict negative list system for industrial access in the river basin. The local and coastal areas are actively promoting industrial upgrading, optimization, transformation and so on, and focusing on how to combine the green development with planting and tourism, etc, so as to truly achieve the coordinated development among the primary, secondary and tertiary industries during the ecological construction within the YREB. In order to promote the ecologic agriculture and industry, some villages are merged and restructured in the YREB to build some special bases, and gradually realize large-scale, intensive and standardized production.
A supervisory mechanism from the central to the local level has been formed. In the Yangtze River basin, the natural resources assets allocation is decentralized, so the

determination of the ownership, distribution and structure of natural resources are the prerequisites for implementing this form of supervision. Many provinces have carried out a pilot audit of the responsibility of natural resources assets, and hold leading cadres accountable accordingly. People's Congress at all levels have established a system for people's governments to report to People's Congress and their Standing Committee of the National People's Congress at the corresponding levels on environmental protection. Central Environmental Protection Inspectors inspect the administrative areas in the YREB on environmental protection related issues. The local provincial party committee and the provincial government environmental protection inspection team shall, every two years, make rectification suggestions and demands on the implementation of the environmental protection responsibilities of local party committees and governments and their relevant departments. And Monitors will publish the main situation and the whole rectification situation through the media to the public. In December 2016, the General Office of CCCPC and the office of Sate Council published *the Measures for Evaluating the Objectives of Ecological Civilization Construction*. The YREB, covering 11 provinces and cities including Jiangsu, Zhejiang, Hubei, Shanghai, Yunnan, Sichuan and Guizhou, has also issued corresponding assessment measures.

An enterprise involvement mechanism has been initially established. According to the decision and deployment of the CPC central committee, under the energetic support of the relevant ministries and commissions of the state, China Three Gorges Corp. is integrating the internal and external resources and tries to: first, establish China Yangtze River Ecological & Environmental Protection Group Co. as a subject to implement the comprehensive environmental protection in an effort to cultivate ecological environment protection industries, develop the environment protection industries in the Yangtze River Economic Belt in both size and strength through market-oriented, professional and corporate operations; second, launch the establishment of China Yangtze River Green Development Investment Fund and Special Fund for Comprehensive Protection of the Yangtze River, encourage various types of capital to increase investment in green development, and guide social capital to focus on ecological environmental protection and clean energy development; third, establish the Yangtze river Eco-environmental Protection Industry Alliance, give play to the industrial synergistic advantages of eco-environmental enterprises, and create a large regional cooperation platform with integrity, professionalism and coordination; fourth, plan to build the national engineering research center for the ecological environment of the Yangtze River economic belt to provide technical support for the comprehensive protection. By using the above 4 platforms, basing on the center of continuously improving the water quality of the Yangtze River, urban sewage

treatment pilot projects have been implemented in Yichang of Hubei, Yueyang of Hunan, Jiujiang of Jiangxi, Wuhui of Anhui and other provinces and cities presently in a bid to actively explore sustainable, c and propagable new mechanisms and new models in technology, policy, management and commerce etc. On this basis, the models of plant-network-river (lake) integration and equal emphasis on sludge-water will be comprehensively popularized in 11 provinces and cities along the river, so as to promote water pollution control, water ecological restoration and water resource protection in an all-around manner.

2.3 Problems in river basin management

Lack of unified and comprehensive river basin legal system. The coordinated development of green industries in the Yangtze River Economic Belt not only involves the protection and utilization of resources in the river basin, pollution prevention and control etc., but also involves the development coordination of 11 provinces and municipalities as well as industry, transportation, agriculture, animal husbandry, water conservancy, urban construction and other industrial sectors. The current laws and regulations such as *Water Law, Law on Prevention and Control of Water Pollution, Law on Water and Soil Conservation* etc. have laid down some regulations on the ecological protection and pollution prevention of the river basin, but some common rules will not solve the problems of the Yangtze River Economic Belt in aspects of ecological civilization construction and coordinated development; second, local government and relevant functional departments have laid down some related provisions for strengthening the river basin management, but there is possibility that local government and some departments maintain the interests, what is more important is lack of communication and negotiation among different departments in formulating rules, resulting that the rules and resolutions formed are inevitable to avoid overlap or conflict and make no material contribution to the coordinated development of the Yangtze River Economic Belt. Therefore, unified and comprehensive river basin laws and regulations are required to provide action guidance for the coordinated development of green industries in the entire river basin and even the Yangtze River economic belt.

The green development of the whole river basin calls for further effective coordination. The industrial layout in some areas along the river is seriously homogeneous. There are tens of thousands of chemical enterprises along the Yangtze River, and the total emission of major pollutants exceeds the bearing capacity of the environment. Some polluting enterprises are too close to residential areas and riverside. The environmental protection measures taken by some enterprises remained inadequate. Besides, the sewage discharge outlets, ports, docks and water intakes in some areas is not reasonably arranged, and there exist a lot of risks and hidden

dangers. Green development of the Yangtze River Economic Belt is closely related to factors such as capital, technology, manpower and market, especially in some cities which develop by relying on the planned economy system, for realizing the transformation and upgrading, such cities must face the market and reasonably arrange their own industries in a market-oriented manner. However, in the practice, the coordinated development process of industry in the Yangtze River Economic Belt process remains dominated by government as the key player and the market mechanism is still playing a relatively weak role therein. The green basic public service level of the Yangtze River Economic Belt varies greatly from area to area. For example, in 2015, the urban green space in the Yangtze River Economic Belt was 1.042 million hectares, of which the urban green space in the Yangtze River Delta accounted for 51.7% of the total in the Yangtze River Economic Belt, while the proportion of the central and western provinces and municipalities was only 28.6% and 21.7% respectively.

Column 1: The industry of the Yangtze River Economic Belt has a distinct characteristics of "heavy" and shows a serious homogeneity

From the perspective of the industry layout in the Yangtze River Economic Belt, three industrial clusters have taken shape in the region: the first is heavy chemical industry cluster, except Chongqing and Sichuan, the output value of enterprises above designated size of enterprises engaging in chemical raw material and chemical product manufacturing in the provinces is among the top five. Among others, the industries of iron and steel, petrochemical, energy, building materials has a large scale, with lot of domestically well-known leading enterprises gathering in the region; the second is mechanical and electrical industry cluster, represented by automobile manufacturing industry in Shanghai, Hubei and Chongqing; the third is new and hi-tech industry cluster, which are mainly distributed in large and medium-sized cities in the lower reaches and nodes of the river basin. Since the 12th Five-year Plan period, the industrial structure of the Yangtze River Economic Belt has been constantly adjusted, and the proportion of primary industry has been decreasing; the secondary industry first rose and then fell, reaching a peak of 49.92% in 2011; The tertiary industry fell and then rose; it has grown by an average of 2 percentage points a year since 2011. On the whole, the industrial structure of the Yangtze River Economic Belt is constantly being optimized, but the homogenization of the industrial structure remain serious. One fifth of the industrial output value of the Yangtze River Delta region comes from petrochemical and chemical industries. More than 80 chemical industrial parks or concentration areas have been built, mainly distributed in eight cities along the Yangtze River in Jiangsu and Zhejiang, five cities along the Hangzhou Bay and the coastal areas such as Nantong, Yancheng and Lianyungang in

northern Jiangsu. Among the 12 manufacturing sectors in Shanghai, Jiangsu and Zhejiang, the three most developed provinces (municipalities) in the Yangtze River Economic Belt, there are 11 same industries in Jiangsu, 10 same industries in Zhejiang and Shanghai, and 10 same industries in Shanghai, Zhejiang and Jiangsu respectively. In addition, the convergence of industrial structures in various provinces and municipalities along the Yangtze River is also obvious. For example, there are more than 20 chemical industrial parks in 8 cities along the river in Jiangsu, 60% of which are along the two sides of the river. Among the 16 cities in the Yangtze River Delta, 11 cities choose automobile as the key development industry, 8 choose petrochemical industry and 12 choose electronic information industry. The serious homogenization of industrial structure makes it difficult to give play to the comparative advantages and characteristics of different regions, weakens the ability of regional division of labor and cooperation, and is not conducive to the integration process of the Yangtze River Economic Belt.

Regional difference in urban green area of the Yangtze River Economic Belt
(Unit: 10,000 hectares)

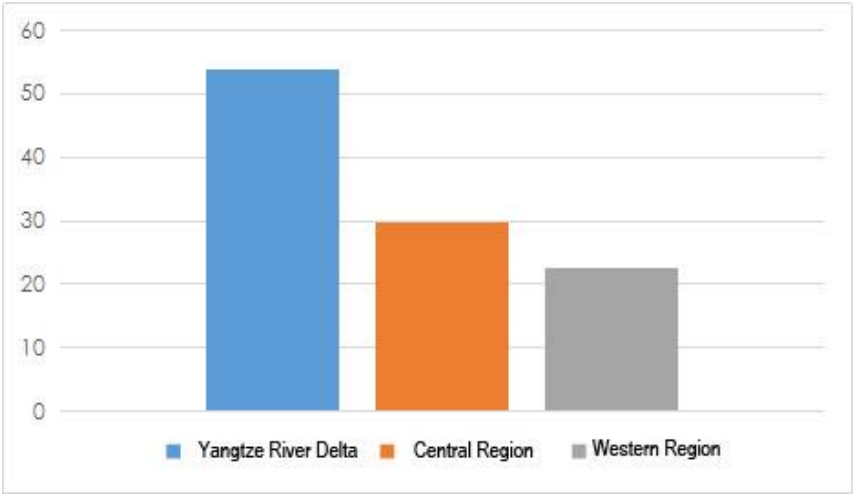

Figure 8 Regional difference in urban green area of the YREB

The role of market mechanism in the green development of the Yangtze River Economic Belt needs to be further improved. Judging from the current sources of funds for ecological compensation and green development in the Yangtze River Economic Belt, the central government and local governments are still the key provider of funds, and the most of funds are financial funds from general public budgets of the central government and local governments, including general transfer payments, special transfer payments and horizontal transfer payments. On the whole, the degree of marketization of capital source is very low. At present, it has not been connected with relevant projects such as ecological economy and green economy

development, and the path to compensate for ecological losses by economic development has not been fully opened up. The less-developed regions are usually located in the upper reaches of the river basin, facing the dual problems of economic development and ecological constraints. The financial mechanism with the government as the subject cannot meet the demand for green development, and the degree of marketization for financial support is low and the financial support is insufficient. In the developed regions, the sources of funds such as policy-based finance, green finance, and PPP model and enterprise compensation are more diversified, and the degree of marketization of financial support is higher than that of upstream less-developed regions.

The ecological compensation mechanism lacks laws and regulations, and scientific and long-acting ecological compensation mechanism still needs to be improved. As for some river basin ecological compensation problems in the Yangtze River Economic Belt, through active practice of local governments, an effective mechanism has taken shape and relevant laws have been enacted, however, lower level of effectiveness and weak rigid constraint make it difficult to be implemented smoothly, with inadequate power in solving the problem of cross-river basin ecological compensation due to the administrative barriers and other constraints. The mode of ecological compensation is single and the compensation fund is insufficient. Though Guizhou Province, for example, has actively explored the horizontal transfer payment mechanism between the upstream and downstream in terms of river basin ecological compensation, the compensation funds are simply sourced from government financial allocation. The success of ecological compensation after basin water pollution occurs depends on the financial ability of local governments. For the regions in which the economic strength is relatively weak, the limited compensation is an utterly inadequate measure. Meanwhile, such an ecological compensation advanced by the superior government can not mobilize the enthusiasm of the inferior government to exploit the market compensation, thus restricting the sources of compensation funds, making the compensation mechanism to be weak in adaptability, flexibility and effectiveness. In addition, public involvement in ecological compensation is insufficient, and the participation of non-governmental organizations and citizens is weak, especially in economically under-developed areas, where there are few non-governmental organizations or citizens getting involved in.

"River-chief system" as an important means to solve the environmental problems of the river basin, the executive ability of the executive body is relatively weak. Although local authorities have repeatedly stressed that the river chief office is the river chief office of the Party committee and the government, but the river chief office is set in the water conservancy department, less powerful

compared with other power departments, resulting in less driving force in the relevant work and less authority and deterrent in the supervision and inspection notification. Many departments regard the River-chief system as the work of water conservancy department and fail to actively participate in it. The professional competence of local river chiefs remains insufficient. The river chief office undertakes the daily work of comprehensively implementing the River-chief system, which is very strenuous and involves many departments. However, Due to the limit of staffing level, the staff of river chief office at county and township level cannot be fulfilled, with most of them being part-timers, making it difficult to ensure the smooth implementation of the relevant affairs. In addition, the assessment system of "River-chief system" is not perfect, and the assessment subject is not reasonable. The existing assessment is simply a "self-assessment" in the top-down system, without introducing third-party independent evaluation and seeking opinions from the public, thus, the assessment results lack fairness and credibility.

2.4 Experience of Xin'an River basin management

In order to accelerate the establishment and improvement of the ecological compensation mechanism, the Ministry of Finance, the former Ministry of Environmental Protection and the two provinces of Anhui and Zhejiang have actively negotiated for promotion, jointly signing *the Agreement for Xinan River Basin Water Environmental Compensation* in 2012. By the end of 2017, the two rounds of pilot projects were successfully concluded, and the water environment quality in the river basin was stable and improved further. Economic development has been maintained at a relatively high speed and quality. Public awareness of ecological civilization and participation in ecological and environmental protection have been significantly improved. The linkage mechanism of upstream and downstream of the river basin has been improved continuously and the pilot target has been basically achieved.

The upstream and downstream of the river basin have adhered to the most rigorous ecological and environmental protection system, forced the continuous improvement of the quality of development, strengthened the publicity and guidance to the public, and achieved multiple wins in ecological, economic and social benefits, realizing the goal of promoting the overall protection and coordinated development of the upstream and downstream of the river basin through ecological compensation. After two round of pilots in a row, with the joint efforts of various parties, the comprehensive governance effect of Xin'an River has been continuously amplified with remarkable results. 1. Ecological benefit: Since the pilots, the overall water quality of Xin'an River basin is good and stably positive, the water quality of Jiekou section across the provincial boundary has kept at class II stably and reached the compensation condition for years. Thousand island lake

synchronization to improve water quality, nutrition state index decline gradually. The water quality in Thousand-islet Lake has also achieved an improvement in the meantime, with the trophic status index declining gradually. The proportion of natural ecological landscape area in the river basin has hit more than 85%, presenting an excellent ecological landscape pattern. According to the estimation, the carbon fixation and oxygen release of the ecosystem in the Xin'an River basin are 5.743 million tons and 4.93 million tons respectively, and the ecosystem service value of carbon fixation and oxygen release is RMB 7.58 billion and RMB1.68 billion respectively. 2. Economic benefit: Huangshan City has, by drawing up a plan of ecological economic demonstration zone in Xin'an River in a scientific way and combining with the pilot of ecological compensation mechanism, forced the industry transformation, built a green industrial system. While maintaining a rapid development of economy, the structure proportion of three industries has changed from 12.7, 44.1, 43.2 to 9.8, 39.0, 51.2, achieving a change of industrial structure from "231" to "321". The energy consumption per unit GDP has been reduced gradually and the pollutants emission intensity of main industries has declined obviously. 3. Social benefit: The pilot of the Xin'an River basin was selected as one of the National Top 10 Reform Cases by the Central Reform Office in 2015. It has obtained the in-depth reporting and high evaluation of mainstream media such as CCTV, People's Daily and Xinhua News Agency. The awareness of ecological and environmental protection for the public has been strengthened.

Under the current system and mechanism in China, the central government coordinates the relevant provinces and promotes them together through the combination of vertical and horizontal ways, which is a feasible path to establish the cross-provincial ecological compensation mechanism. During the two rounds of pilot, Xi'an River have actively explored the "Xi'an River model" of river basin compensation mechanism. The "Xi'an River model" mainly includes the following three aspects. First, top-level design is launched on the level of nation. Under the current condition that lacks laws and regulations, related to ecological compensation, by issuing the printing of the *Pilot Implementation Plan for Water Environment Compensation of Xin'an River Basin* and *the Pilot Implementation Plan for Horizontal Ecological Compensation of Xin'an River Basin Upstream and Downstream (2015-2017)*, specifying the water quality objectives, the division of the responsibilities for the two provinces, and clear sources and use of the funds and other key issues, launching an overall design of the compensation frame and ensuring the implementation of the compensation system by national administrative means; second, in the early stage of the establishment of the compensation mechanism, the appropriate support of central financial funds has played a leading and amplifying role

of "seed fund", which is conducive to inspiring the willingness of upstream and downstream of the river basin to actively cooperate and strengthening the guidance and supervision of the central government on local areas; third, the related provinces in the river basin, by means of agreement, further clarify their respective environmental responsibilities, strengthen the provinces' horizontal communication, establish a long-acting working mechanism of joint monitoring by upstream and downstream, joint law enforcement, emergency linkage etc., which is helpful to push forward the joint prevention and control throughout the whole basin, form a joint effort in water environmental protection gradually, lay a foundation for the horizontal compensation between related provinces next step. At present, the horizontal ecological protection compensation mechanism established in trans-provincial basins such as Water Diversion Project from Luanhe River to Tianjin City, Dongjiang River, Ting River (Han River), Jiuzhou River and Yangtze River has generally followed the framework of the Xin'an River pilot, which has proven that the "Xin'an River model" is a successful model that can be copied and referenced.

Established a perfect linkage mechanism for trans-regional water environment protection, pushed forward the coordinated governance of the river basin's upstream and downstream, enhanced the joint efforts in river basin environmental regulation and administrative law enforcement, realized the unified planning, unified monitoring, unified law enforcement, which has provided a useful exploration to perfect the system of environmental governance and promote the reform of ecological civilization system. As for the prevention and control of the river basin's water pollution, "Xin'an River model" has effectively promoted the communication and collaboration between governments of the upstream and downstream of the river basin. Anhui and Zhejiang provinces have broken the administrative boundary, established a river basin upstream and downstream visit and consultation mechanism, actively built a linkage mechanism of cross-regional water pollution prevention and control, pushed forward the joint prevention and control of the whole basin, clearly established the mechanisms such as joint monitoring, joint salvage at flood season, joint law enforcement by polluting enterprises along the river, emergency linkage between Huangshan and Hangzhou and the system like holding a joint meeting on regular basis. In respect of a joint control of trans-boundary water pollution, prevention and treatment of trans-boundary pollution disputes, the upstream and downstream make joint efforts in improving the ability and efficiency of pollution treatment, promoting the benign interaction of trans-regional environmental protection, pushing forward the collaborative control between the basin's upstream and downstream, enhancing the efforts in basin's environmental regulation and administrative law enforcement, realizing the unified planning, unified monitoring

and unified law enforcement, and effectively solving the problems of trans-boundary water environmental protection so as to ensure the safety of the river basin water environment.

The "Xin'an River model" has proved through practice that the "Lucid waters and lush mountains are invaluable assets", pushing forward the development on the premise of protecting the ecosystem of the river basin, transforming the "green welfare" of the ecosystem into the "economic dividend" that will benefit the people for a long time. The upstream of Xin'an River basin has carried out the exploration and practice of "Lucid waters and lush mountains are invaluable assets". Huangshan municipal Party committee and municipal government have profoundly realized that green is the biggest advantage for the sustainable development of Huangshan, which must give full play to the comparative advantage of ecological environment, establish an ecological economic system of green, low carbon and sustainable development, based on the working idea of "being fine in primary industry, being strong in secondary industry and being superior in tertiary industry" and propose such two main lines of economic development as "speeding up the new industrialization process and actively pushing forward the tourism plus". In the aspect of agriculture, Huangshan City develops intensive agriculture and increases the added value of characteristic agricultural products such as tea by means of ecological planting, clean processing and reduction of agricultural residue; make use of local quality water resource to develop spring fish farming, with the market price 3 times higher than that of common grass carp, realizing the transformation of "grass fish" into "gold fish" and promoting the income increase of the masses, especially the poor ones. In terms of service industry, it has not only paid attention to the building of national-level “large scenic spots" like Mount Qiyun and Taiping Lake etc., actively created exquisite "small scenic spots" in rural areas, developed 298 Anhui province star agritainment hotels, nearly 1,000 farmhouse inns, nearly 200 administrative villages which engage in rural tourism. More than 100,000 farmers engage in tertiary industry based on tourism, with annual per-capita income exceeding RMB 8,000. In respect of industry, Huangshan City firmly upholds the concept of "ecological city", actively optimizes its industrial structure, and develops leading industries that are adapted to the environment, such as green food, green flexible packaging, automobile electronics and new materials. By virtue of abundant water resources and excellent water quality, a batch of "aquaculture", such as Master Kong, Liugujian and Wujixue, have been cultivated and introduced. While strengthening the three industries, it also endeavors to cultivate brand competitions and sports economy by relying on natural geographical advantages, the cultural resources such as the hometown of Huizhou merchants and the birthplace of Huizhou culture, and taking the ways of photography

and painting etc. to drive the traveling craze so as to make the protection of local ancient dwellings be a project to enrich the people.

There are still some problems with the ecological compensation of Xin'an River basin, such as single compensation method, low compensation level and high pressure of water quality protection. It is recommended that the upper reaches should strengthen the prevention and control of nitrogen and phosphorus pollution, the provinces of Anhui and Zhejiang should actively promote the diversified compensation, the central government should continue to provide appropriate subsidies for a certain period of time, and a long-acting compensation mechanism should be established for completely horizontal and benign operation. In terms of water quality protection for Xin'an River upstream region, in addition to the total nitrogen, other indicators have basically maintained in Class I or II. The space of further optimization and improvement is narrowed, non-point source pollution is serious and water quality is difficult to be continuously kept at an high level. In terms of funds, the upstream region of Xin'an River is relatively weak in financial resources, with rigorous constraints on economic development and difficulty in sustainable investment. The use of the pilot compensation funds is limited to ecological and environmental protection, and there is no direct or indirect compensation for the ecological protection and people's livelihood that have sacrificed for the environmental protection of Xin'an River. In terms of water quality protection, it is suggested to keep on deepening the systematic protection and control of river basin, with emphasis on the prevention and control of nitrogen and phosphorus pollution and non-point source pollution. In terms of compensation mechanism, it is recommended that the two provinces, on the basis of the existing compensation scheme and compensation agreement, establish a normalized compensation mechanism as the goal, continue to deepen cooperation method and content, form strategic cooperation in industrial output, ecological tourism and infrastructure construction, personnel training etc. across the whole basin, break the time limit of compensation, establish a normalized compensation scheme and compensation agreement through consultation, make a dynamic adjustment according to the changes. The central government shall continue to provide appropriate subsidy for a certain period, coordinate to establish a trans-provincial long-acting basin ecological protection mechanism of cost-sharing, benefit-sharing, and co-governance for ecological protection.

3. Case analysis of Chishui River basin

3.1 Favorable conditions

An important economic corridor in the Yangtze River Economic Belt. The Chishui River basin, which runs through four prefecture-level and 13 county-level

administrative units in such three provinces as Yunnan, Guizhou and Sichuan, is an important economic corridor for the three provinces to integrate into the Yangtze River Economic Belt, giving birth to the most important famous and superior liquor industry in China. As a pilot model of trans-provincial river basin compensation in the Yangtze River Economic Belt, the ecological compensation in Chishui River basin has been given preferential policies and business guidance by the state. The financial support of the central government, based on the horizontal guidance funds, is conducive to promoting the establishment of a long-acting mechanism for the ecological compensation in Chishui River basin.

Having a relatively clear object of protection. Chishui River basin has four clear protection contents: one is to protect good water quality. As three-quarters water of Chishui River is hidden in the deep mountains, it is the only tributary of Yangtze River not polluted in China. The water quality is good and can reach Class II on the whole. The second is to protect the sound ecological environment. The Chishui River basin is ample in biological diversity, with 10 nature reserves. It is a priority area for biodiversity conservation and an important habitat for the protection of unique and rare fish species in the upper reaches of the Yangtze River. The third is to protect the liquor industry. Chishui River is the water source of national liquor Moutai and other enterprises, and also the water source of well-known liquor brands such as Langjiu and Xijiu. The fourth is to protect cultural resources. Chishui River has been an important channel of economic and cultural exchange in the three provinces of Yunnan, Guizhou and Sichuan since ancient times, which enjoys a unique ecological culture. The current ecological compensation scheme mainly focuses on the protection of good water quality and ecological environment and has also protected the liquor industry and cultural resources indirectly.

The development of Chishui River basin is characterized by sub-regional gradient. On the middle and lower reaches of the Chishui River basin, utilization of water resources in the three provinces is not balanced, showing a great differences in development level of different areas. The middle and lower reaches are higher than the upper reaches in development level, of which, the middle reaches are the highest in development level. For instance, in Guizhou, only nearly 60 of the basin area and nearly 47% of the the trunk length have achieved 79% of the total GDP. In 2015, the GDP of Renhuai City, the most developed city (Moutai distillery is located) amounted to RMB 50.57 billion, accounting for 20.3% of the basin, with the per-capita GDP up to RMB 91778, while the GDP for the upstream Weixin County in Yunnan was RMB 2.988 billion, accounting for only 1.19% of the basin, with the per-capita GDP at only RMB 7,426, indicating that the gradient difference of development is very obvious. Moreover, the pollution brought by the development of middle reaches is also the

most serious, thus, its development must be based on the sustainable development of water environment protection in the upstream to ensure the water to be fine in both quality and quantity. The unbalanced relationship between the upstream and downstream environment and economic interests featuring "upstream protectors suffer poverty and midstream and downstream utilizers become rich" needs to be straightened out by establishing an ecological compensation system to achieve the overall sustainable development of the upper, middle and lower reaches of the basin.

Table 2. Areas covered by the Chishui River basin

Province	City	County
Yunnan	Zhaotong City	Zhenxiong County
		Weixin County
Guizhou	Bijie City	Qixingguan District
		Dafang County
		Jinsha County
	Zhunyi City	Zhunyi County
		Renhuai County
		Tongzi County
		Xishui County
		Chishui City
Sichuan	Luzhou City	Xuyong County
		Gulin County
		Hejiang County
		Jiangyang County
		Naxi District

3.2 **Restrictive factors**

As a typical and representative river basin with good ecological environment and low development intensity, it is heavy to undertake the task of continuously safeguarding the "green mountain and green water" of Chishui River. Besides, as a typical poor area, the local development impulse is more intense, and all parties also hope that people in the basin can live a well-off life, and find a way to turn "green mountain and lucid water" into "invaluable assets". Therefore, the content of ecological compensation shall not only lay focus on ecological protection, but also find a way to harmonize ecological protection and sustainable development through ecological compensation.

The watershed relations are complex. Chishui River basin involves such three provinces as Sichuan, Yunnan and Guizhou, but it is not a plain river basin with a

clear upstream and downstream relationship. Firstly, judging from the position of the river basin, the part of Chishui River basin is not fully in the middle and lower reaches, in which, there is a river known as Daoliu River within the territory of Xuyong County, Sichuan Province, which is originated from Sichuan, flows into Yunnan, then converges with Chishui River and leaves the territory of Yunnan, thus, some areas in Sichuan are located in the upstream, midstream and downstream. Secondly, Guizhou and Sichuan, which are located in the middle and lower reaches, have a large part of common boundary sections (nearly 57.4% of the trunk in Sichuan and Guizhou are the common boundary sections) in the middle and lower reaches, making it difficult to accurately define the responsibilities of related subjects.

The population is concentrated but relatively poor. Chishui River basin is a typical under-developed area in China, most of which belong to the poor mountainous areas at the national level. The per-capita GDP is only 34% of the national average. In addition, the Chishui River basin is one of the densely populated areas in Yunnan, Guizhou and Sichuan, especially in such two counties as Zhenxiong and Weixin in the upstream Yunnan, the total population has reached 2 million, but their land area is only 3817 km2, with the population density up to 524 persons per km2, far beyond the average population density in three provinces of Yunnan, Guizhou and Sichuan three provinces. It is the most densely populated area and also the counties with the lowest per-capita GDP. As the poor population in the river basin is relatively concentrated, the emphasis on ecological protection also needs to take into account the appeals of local development, especially the appeals of a large number of poor people for poverty alleviation. The pressure of economic and social development coexist with that of ecological protection.

Attention should be paid to the hidden danger of non-point source and industrial source in agriculture and countryside. The basin is a typical agriculture area, so the non-point source in agriculture is a main pollution source, especially in Zhenxiong and Weixin within the territory of Yunnan. The single planting structure, intense use of chemical fertilizer, unreasonable use of pesticide, low recovery rate of agricultural film and low recycling degree of stalk are liable to cause secondary pollution to the surrounding environment and the water quality of Chishui River. There are abundant reserves of coal, sulfur and metal mineral in the basin, with mining industry occupying a considerable share in local economy, especially in Guizhou and Sichuan in the middle and lower reaches, where mineral processing and manufacturing industries have become local pillar industries, thus, hidden risks of industrial pollution sources remain.

The historical arrears for basic public services related to environment are considerable. The basic public services related to environment lag behind, the

sewage collection pipe network and garbage collection system in the basin are not sound, the treatment capacity of sewage treatment plants is inadequate, the leachate treatment in landfill is not standard and the basic public services of the overall environment in the basin are lagging behind. Moreover, the water quality monitoring system in the river basin is not sound, most of the tributaries lack automatic monitoring capacity, making it difficult to assess the water quality to some extent and hindering the subsequent joint prevention and control of environmental risks in the upper, middle and lower reaches of the river basin.

3.3 **Practical basis**

1. The central government promotes the establishment of ecological compensation for the Chishui River basin

The *Agreement on Compensation for Horizontal Ecological Protection in Chishui River Basin* has been signed. The realization and implementation of ecological compensation in the Chishui River basin largely benefited from the strong promotion and coordination of the central government. The *Cooperation Agreement on Exploring New Roads for Development and Protection to Promote Guizhou's Ecological Civilization Construction* was signed by the Ministry of Environmental Protection and Guizhou Provincial Government in 2017, which clearly proposed that ecological protection compensation across the Chishui River basin should be included in the national pilot. The General Office of the CPC Central Committee and the General Office of the State Council issued the Pilot Program of Setting Up Environmental Supervision and Administrative Law Enforcement Agencies in Accordance with River Basin, taking the Chishui River basin as the sole inter-provincial agency for pilot. In January 2018, the Ministry of Finance, the former Ministry of environmental protection, the National Development and Reform Commission and the Ministry of Water Resources convened three provincial finance and environmental protection administrations for two times successively, and held a "compensation agreement" three provinces coordination and communication meeting in Chengdu. Under the strong promotion of relevant ministries and commissions, in February 2018, Sichuan, Yunnan and Guizhou signed the *Agreement on Compensation for Horizontal Ecological Protection in Chishui River Basin*, which became the first compensation agreement for the river basin ecological protection across multiple provinces in the Yangtze River basin.

The consultation on the *Implementation Plan for Horizontal Ecological Protection in Chishui River Basin was carried out.* In March 2018, the Ministry of Ecology and Environment held a promotion meeting for inter-provincial ecological compensation in Chishui River basin in Huairen, Guizhou for accelerating the implementation of the spirit of the Compensation Agreement. In march and June 2018,

the Ministry of Ecology and Environment organized and held the seminar on the *Implementation Plan for Horizontal Ecological Protection in Chishui River Basin* (hereinafter referred to as "the Implementation Plan") respectively in Chengdu and Beijing, and clarified the specific content of compensation assessment indicators and assessment rules. In July 2018, the Ministry of Ecology and Environment joined hands with Chinese Academy For Environmental Planning released the latest version of the Implementation Plan (draft for comment), which clarified and detailed the compensation term, compensation indicators, compensation objectives, compensation standards and compensation funds etc.

2. Local governments collaborate to protect the Chishui River basin

(1) The three provinces of Yunnan, Guizhou and Sichuan jointly carry out joint law enforcement actions

In order to strengthen the ecological and environmental protection of the Chishui River basin, the environmental protection departments of the three provinces of Sichuan, Yunnan and Guizhou signed the *Agreement on Joint Environmental Law Enforcement for Trans-boundary Region of Three Provinces* in Guiyang July 2013, forming an environmental protection mechanism of "data sharing, information sharing and joint prevention and treatment". For the purpose to ensure the orderly, effective and powerful implementation of joint law enforcement, a cooperative security mechanism has been established, that is, establishing of a joint consultation system, an information notification system, a joint monitoring and early warning system, an environmental emergency response linkage system, a unified environmental access threshold system and a coordination mechanism of special funds for the prevention and control of trans-boundary river pollution in three provinces. The joint monitoring of such three provinces as Yunnan, Guizhou and Sichuan was conducted under the guidance of the Notice of the General Office of the Ministry of Environmental Protection on Implementation Plan of Water Quality Joint Monitoring of Trans-boundary (Provincial Boundary and Municipal Boundary) Water Bodies. They have conducted coordinated law enforcement for many times successively, identified and rectified more than 150 environmental problems, broken the situation of "fighting alone" in river basin protection, and pushed on joint law enforcement in an all-around way. The three provinces of Sichuan, Yunnan and Guizhou have also formulated a series of laws, regulations and policies based on their actual conditions. Meanwhile, the three provinces have also signed the *Agreement on Joint Working Mechanism for Fishery Administration in the Jointly-managed Waters of the Chishui River*, which will ban fishing for 10 years from January 1, 2017.

(2) Guided by the central government, the joint monitoring and law enforcement work of the three provinces are organized and collaborated

Under the coordination of Ministry of Environmental Protection, since 2011, they have gradually established a joint law enforcement mechanism for environmental protection for trans-boundary region in three provinces, realized the joint law enforcement system of "information exchange, data sharing, joint prevention and control", requiring joint prevention and control of Chishui River's trans-provincial boundary section, provincial boundary watershed joint prevention and control among provinces, key pollution source joint and cross law enforcement inspection, municipal and county joint law enforcement inspection, trans-regional environmental violation behavior investigation, major environment emergency joint disposal.

(3) Yunnan, Guizhou and Sichuan jointly protects the Chishui River basin by issuing a series of plans, regulations and measures

- **Yunnan Province**

As a birthplace of Chishui River, Yunnan Province attaches great importance to the protection of Chishui River basin and has made a powerful contribution to the development of downstream industry. Yunnan has compiled the *Work Plan of Yunnan Province's Compensation and Incentive Policy for Promoting Ecological Conservation and Restoration of the Yangtze River Economic Belt* on provincial level, and supported the establishment of a trans-provincial river basin ecological protection compensation mechanism for water bodies, with the ecological compensation mechanism covering 47 counties and districts including Zhaotong City. It has compiled and completed the *Opinions on Establishing the Ecological Compensation Mechanism in Chishui River Basin within Yunnan Province*, clarified the general requirements, governance priorities, capital management requirements and division of responsibilities at all levels, and strongly guided the protection work of Zhaotong City, Zhenxiong County and Weixin County in the basin. Zhaotong City, Zhenxiong County and Weixin County on the upstream of Chishui River have carried out actions of "efforts in seven aspects" to protect the Chishui River basin, adjusted the industrial structure and canceled some key projects in the basin. They have implemented environmental access and banned all industries from entering the range of 38 square kilometers of Chishui River. Since 2014, the two countries have jointly restructured 24 enterprises involving coal within the basin by means of closing down, suspending operation, merging with others or shifting to different line of production. To strengthen the ecological governance, Zhenxiong County has completed more than 960 hectares of afforestation of closed hillsides and artificial afforestation, more than 9,500 hectares of returning farmland to forests and returning grazing land to grassland. Weixin County has implemented the water and soil conservation projects in Zhaxi Town and Shuitian Township, controlled 4 small river basins and 49 km2 soil erosion area, planting 1050 hectares of water and soil conservation forest and economic fruit

wood and implemented blocking and governance of 1,700 hectares.

- **Guizhou Province**

In November 2007, Guizhou government implemented the *Planning of Ecological Protection Zone for the Upstream of Chishui River (within the Territory of Guizhou)*, taken "environmental pollution and ecological environment within the ecosystem function protection zone are generally governed, regional ecological environment is obviously improved and the ecosystem begin to move towards virtuous circle" as long-term goals of planning, and delineated the special wellhead protection areas and special economic zones for national liquor, strictly controlled the pollution of water pollutants to the national liquor special wellhead protection areas. Since then, Guizhou Province has released more than 40 relevant regulations, documents, plans and schemes related to river basin protection. In terms of financial support to the projects, Guizhou Province has further increased its capital investment in the Chishui River basin. Since 2014, the provincial finance has injected RMB 50 million into environmental improvement of the Chishui River basin, and Zunyi City has also invested about RMB 10 million in the upstream Bijie City annually in the way of ecological compensation. Kweichow Moutai Company Limited will donate RMB 50 million a year to prevent and control water pollution in the Chishui River basin per annum. For the aforesaid three funds alone, the total investment has reached RMB 110 million. In terms of fund-raising, Guizhou Province explored the ways to solve the problem of capital bottleneck through the pilot program of ecological civilization reform and proper river project application, tried to improve the investment and financing system of ecological and environmental protection in the river basin, boldly introduced social funds, and strengthened cooperation with international and domestic famous organizations and enterprises; finance departments at all levels will also explore the building of investment and financing platforms, strengthen the concept of asset management, and make money and pool wealth from assets; the provincial environmental protection department has also joined hands with the provincial finance department, the provincial government finance office and Zunyi municipal government to explore the building of a higher-level platform for the connection between government, banks and enterprises, open a "green channel" for eco-environmental investment and financing in the Chishui River basin, and raise funds for the construction of pollution source control projects through multiple channels in PPP mode.

Ecological compensation system is one of 12 regulations of Guizhou Province's Chishui River basin on river ecological civilization system and mechanism reform pilot. Since 2013 when *Interim Measures of Guizhou Province on Ecological Compensation for Chishui River Basin Pollution Prevention And Control* was issued,

various governments at all levels and scientific research institutes of Guizhou Province have studied and explored the river basin's ways of ecological compensation, responsibility identification, use of compensation fund, supporting system and mechanism etc. In addition to government-led ecological compensation, Guizhou Province is also actively exploring more ways of ecological compensation. Since 2015, the "Global Environment Fund (GEF) Guizhou Chishui River Basin Ecological Compensation and Global Important Biodiversity Conservation Demonstration Project" was implemented in Renhuai, Guizhou Province, aiming to establish a market-oriented ecological compensation mechanism based on the concept of "payment for watershed service" (PWS) in the pilot of Chishui River basin in Guizhou. In 2018, more than 20 households of villagers and three liquor enterprises of Renhuai City in the basin pilot area signed the ecosystem service contract under the coordination of Renhuai Municipal Environmental Protection Bureau, Renhuai Municipal Environmental protection Promotion Association and Wuma Town Government, and explored the establishment of an eco-compensation fund management model with trust fund as the core. The compensation under the agreement is not only limited to water quality, but also extended to the ecosystem services with broader implications, taking into account more ecosystem values such as water and soil conservation, changes in land use patterns, and fish biodiversity. The subject of compensation is not only the government, but also the government, liquor enterprises and social organizations; the object of compensation is not only the local government, but also the farmers and the investors and constructors of environmental protection in Chishui River. In addition to financial compensation, other ways of compensation like policy compensation and technical compensation are also in place.

- **Sichuan Province**

Sichuan Province also attaches great importance to the ecological and environmental protection of the Chishui River basin. Through the preparation of the *Environmental Protection Plan for the Chishui River Basin (Luzhou Section) (2014-2020)*, it has strictly controlled the project access, promoted the environmental impact assessment of planning projects and strengthened the control of pollution source; vigorously pushed forward the pollution abatement by strengthening the control of industrial pollution sources, urban pollution control, and agricultural and rural pollution control, closing and ceasing more than 150 small paper mills and brewers; advanced the construction of forestry ecological system in an all-around manner, intensified the soil improvement and rehabilitation and the management of natural ecological protection zones and earnestly enhanced the ecological conservation; issued the documents such as the *Environmental Centralized Rectification and Supervision Scheme for the Chishui River Basin (Luzhou Section)*

and the Assessment Measures on Environmental Centralized Rectification and *Supervision Scheme for the Chishui River Basin (Luzhou Section)*, pushed on the implementation of river-chief system in an all-around way, launched special monitoring and implemented incentive and restrictive assessment. On the basis of the *Agreement on Compensation for Horizontal Ecological Protection in Chishui River Basin* and *the Implementation Plan for Horizontal Ecological Protection in Chishui River Basin*, Sichuan Province is drafting the Rules of Sichuan Province for Implementation of Horizontal Ecological Protection in Chishui River Basin, specifying the model that the funds are jointly raised by the province, city and county, the allocation right of the funds is enjoyed by the city and the county and the ecological environment protection responsibilities are jointly assumed by the city and the county. The efforts have played a supporting and coordinating role on provincial level and activated the linking and coordinating role of Luzhou City in connecting the provincial level and county level.

3.4 **Common appeals**

The current compensation criterion is difficult to determine the responsibility of sections with common boundary and the value of ecological environmental protection scientifically. Due to a great number of sections with the common boundary of Sichuan and Guizhou, the current solution, for the purpose of realistic operability and timeliness, has not carried out elaborate and scientific calculation, distinguished the respective responsibilities of each subject of the common-boundary sections in a proper and scientific way, but taken a treatment way of simple equally sharing, in this case, the measure is not so reasonable and fair and cannot accurately clarify the responsibilities and obligations of the parties concerned. In addition, for the existing scheme, the amount of compensation funds is not based on scientific calculation of the region's direct cost in water environment protection of direct cost and the loss of development opportunity and the the positive externalities brought by the middle and lower reaches of the Yangtze River basin. As the Chishui River basin in located in the upper reaches of the Yangtze River, the water quality is good throughout the river basin (Class II stably for the trunk and Class III stably for the tributaries). First, it has made a positive contribution to providing good water for the middle and lower reaches of the Yangtze River and the positive externalities arisen therefrom have exceeded the range of the river basin itself; second, according to the latest requirements of building the ecological barrier on the upper reaches of the Yangtze River and the comprehensive environmental protection of the Yangtze economic belt, the water quality of the river basin can only remain stable on the basis of current good condition without worsening, which will inevitably increase the difficulty of the protection and the restraint to the economic development of the

region; third, the economic and social development of the river basin is relatively backward, with large quantity of poverty-stricken peoples, wide range and deep level in poverty; at the same time, the region also faces the dual tasks of ecological environment protection, poverty alleviation and industrial revitalization, etc., the current solution cannot accurately provide a scientific ecological compensation criterion obviously.

The existing compensation ways and funds are limited, which are not powerful enough to drive the sustainable development of the river basin. For ecological compensation of the river basin, on the one hand, the direct cost of pollution control and ecological protection in protected areas should be taken into account; on the other hand, the cost of development opportunity lost for ecological conservation in the protected areas shall also been considered. The current ecological compensation scheme of Chishui River basin has given insufficient consideration to the cost of development opportunity lost for ecological conservation in the protected areas, which has resulted in inadequate driving force for the sustainable development of the protected areas. First, the way of compensation is single, with fund compensation as a main approach, lacking insufficient hematopoietic ability; second, the use of funds is limited, which is obviously insufficient to support regional sustainable development and maintain the sustainable livelihood of relevant groups to make up for the loss arisen from the development opportunities. The construction of domestic sewage treatment plants in towns(townships) of three counties has basically been completed or the funding sources have been in place, and only a few have not started in construction yet.

The participants are single, which can't effectively promote the common governance among multiple subjects. The participants are mainly the governments, which has not involved in the important economy (large liquor enterprises in the middle reaches) and the masses, which depend on the development of the ecological environment of the river basin, so it failed to effectively promote the multiple subjects to participate in the joint protection and governance of the river basins. The relevant enterprises have created huge economic benefits by relying on good ecological environment resources. Meanwhile, they have also caused considerable impacts on river basin water pollution, but they have not assumed corresponding social responsibilities in the ecological compensation mechanism; the people who lose the opportunity cost of development due to the construction of ecological protection have not got sufficient compensation from the mechanism of ecological compensation. The people lack the sense of obtaining the benefits from ecological compensation and are not highly motivated, which makes the ecological compensation not adaptable to the rapid promotion of ecological construction, social and economic development,

poverty alleviation and difficulty tackling etc..

A community of interests and lacks lasting protection incentives has not been established. On the upper, middle and lower reaches of Chishui River basin, the utilization of the water resources by the three provinces is not balanced. Though the agreement signed among them is conducive to the establishment of joint prevention and control of the upper and lower reaches by the three provinces, however, as the compensation agreement failed to give an overall consideration to the economic and social development on the upper, middle and lower reaches and the left and right banks of the river, the unbalance for the basin water resource utilization will continue to exist. In addition, the development of liquor industry in Guizhou and Sichuan faces different policy environment, which will continue to expand the unbalance of three provinces for the basin water resource utilization. The interests of joint protection cannot be transformed into the interests of economic and social development shared by the three provinces, which makes it difficult to motivate the lasting protection of some provinces.

3.5 **Recommendation Improvement**

The responsibility relationship of the stakeholders in the basin ecological compensation shall be established. In the current "Implementation Plan on Horizontal Ecological compensation in Chishui River Basin" (Draft) and "Recommendations on the Establishment of Ecological Compensation Mechanism in YunNan Province in Chishui River Basin", the conformance of the section water quality standards are both considered as the main assessment index, and the proportion to assess the water quality is very large in the assessment rules. However, the ecological protection compensation should be a means to reasonably compensate the ecological protectors on the comprehensive consideration of the ecological protection cost, the development opportunity cost, the ecological products and the ecological service value. Therefore, it is suggested to properly adjust the assessment rules in the Implementation Plan, and to add the relative indexes such as the opportunity cost loss value and the ecological service contribution value of the compensation object.

The ecological compensation fund source for Chishui River Basin shall be enriched. At the present, a special fund for the ecological compensation fund of Chishui River Basin, is only established jointly by Yunnan, Guizhou and Sichuan Provinces, and the Central Government, and the single fund source channel and a large fund raising amount will bring the governments at all levels with a new debt pressure. In some regions, the compensation funds are depended on the upper-level

funds and the economical environment protection investment increases sharply, which will seriously influence the collection of the economical compensation fund. At the same time, the environmental protection tax paid by the beneficiary enterprises, is not enough to make up for the negative effect brought by them, that is, the enterprises fail to fully assume the ecological compensation, which is not conducive to advance the ecological compensation as scheduled. A reasonable compensation fund source is the important focus for the basin ecological compensation mechanism to exert its effect. A government-coordinating, multi-level and multi-channel ecological compensation mechanism shall be established, with the government leading as the basic principle, the beneficiary enterprises mobilized to participate in the basin environmental protection and the ecological compensation, and the preferential loans from the financial institutions shall be strived for, which will be conducive to promote the diversification and rationalization of the compensation fund source structure. Therefore, firstly, the integration of the financial funds at all levels shall be increased. By the consolidation of the vertical integration of the upper-level, middle-level and lower-level funds and the coordination of the horizontal integration of the funds related to the environmental protection tax retention, the ecological function zone transfer payment fund, and the carbon emission trading fund by the finances at all levels, a source of the ecological compensation fund with a stable amount and diverse channels is formed step by step. Secondly, the market-oriented funds shall be promoted and stimulated to participate in. The conditional regions shall be promoted to issue the local government special bond for the environmental protection, the financial institutes and the powerful enterprises (such as Maotai Group) mobilized to participate in establishing the special funds for the ecological compensation, the participation of the social capital deepened further, and the compensation capital amount shall be guaranteed. Thirdly, the financial institutions shall be encouraged and guided to innovate for the green financial service. The green credit support mechanism such as the financial discount, the insurance premium, etc. shall be explored to establish, and the financial institutions shall be encouraged to increase the green credit distribution. The green guarantee shall be supported to develop, and the various guarantee mechanisms for the energy-saving and low-carbon, eco-environmental protection projects improved, and the stability of the compensation fund source shall be consolidated. Fourthly, the current bias trend that the ecological compensation fund and the water pollution prevention fund are managed and used as the same nature shall be transferred. Due to the complexity and additionality of the water quality response, the loss of the development opportunity cost and the public product production are not necessarily and directly reflected in the form of the “improvement” of the water quality. It should be emphasized that the ecological

compensation funds are the compensation for the loss of the development opportunity cost, and the purchase of the production of the ecological public products, and it shall not be directly linked to the water quality requirements in the aspects such as the assessment.

The use direction of the ecological compensation funds shall be expanded. At the present, the use scope of the ecological compensation funds is not specified in the compensation agreements and the implementation plans in Yuannan, Guizhou and Sichuan Provinces. If the fund use scope is strictly in accordance with the one of the water pollution control fund, it will be narrow, which is not conducive to supporting the green development and the mechanism construction projects, contrary to the basic principles of the ecological compensation development opportunity cost and the ecological asset value. If the use scope of the funds is not reasonably constrained, it may be the used for other purposes, not widely supporting the ecological civilization and the environmental protection, contrary to the original intention of the policy that the ecological compensation supports the environmental protection. It is recommended to specify the use direction of the ecological compensation funds according to the fund sources and categories. Firstly, for the funds supported by the nation, if they come from the central finance's special funds for the water pollution, they must be strictly managed in accordance with the relevant requirements of the document Measures for the Administration of Special Funds for the Prevention and Treatment of Water Pollution, and the special funds shall be used exclusively in the fields such as the water pollution prevention and treatment, the good water body and the drinking water source ecological environment protections. Secondly, for the horizontal compensation funds sponsored by the 3 provinces, the use scope of ecological compensation funds shall be flexible, and the funds can be used in the fields for promoting the development and improving the livelihood, such as the supports of the environmental protection capacity construction, the environmental protection mechanism and policy construction, and the ecological township construction demonstration, the ecological immigration relocation, the River Protector’s job subsidy, etc. Thirdly, in the process of the next marketization and diversified ecological compensation mechanism construction, the key enterprises and the socialized capital shall be introduced into the ecological compensation, the use scope of the ecological compensation funds further broaden to the compensation opportunity cost and the ecological asset value fields, the fields such as the poverty alleviation, the infrastructure construction, the ecotourism development, etc. the 3-province tourism circle built, the adjustment of the High-Energy–Consumption, High-Pollution and Resource industries such as the upstream coal-related industries

shall be promoted so that the upstream and downstream people can share the ecological welfare, and the poverty in regions such as Zhenxiong, Weixin, shall be changed.

A diversified and marketized ecological compensation method shall be built gradually. Under the background that National Development and Reform Commission and Ministry of Finance are inquiring the ***Action Plan for Building a Marketized and Diversified Ecological Protection Compensation Mechanism***, Chishui River basin is the first multi-province compensation pilot in the Yangtze River Economic Belt, the practice and the establishment of a marketized and diversified ecological protection compensation method shall be sped up. It is recommended to refer the ecological compensation experience implemented widely abroad, and guide the enterprises and the beneficiary industries to enter the ecological compensation. On the middle-stream and downstream of the Chishui River basin, there are many famous liquor enterprises such as Maotai，where is popularly named as Liquor River, forming a trillion-level industry scale. At the end of 2017, Maotai's stock market value has exceeded 150 billion US dollars, and the will to protect the water quality on the upstream of the Chishui River is stronger. Maotai Group also continuously recognizes that the good water quality of Chishui River plays a key role in the ecological products, and demonstrates its will to fund for and participate in the ecological compensation in Chishui River Basin. Secondly, it is recommended to actively innovate for the non-fund compensation mode, promote the implementation of the economic assistance compensation modes such as the Counterpart collaboration, the industrial parks and the joint-construction parks, and promote the implementation of the technical support compensation modes such as the personnel training, the population migration. The employment opportunities for the people in the poor regions shall be improved by creating jobs such as River Protector, Environmental Investigator. The beneficiary enterprises shall be encouraged to employ the people related to the ecological product supply regions, forming a stabilized employment mode. In the industrial parks in the ecological beneficiary areas, a certain space shall be specially allocated to build an enclave park to promote the economic development in the underdeveloped areas while reduce the environmental pressure in the compensated regions.

The ecological compensation matching system mechanism shall be improved. The objective of the ecological compensation is, by the upper-level fund guidance to the lower-level and the beneficiary's financial subsidies to the compensated parties, to compensate for the performance assessment to form the mutual restraint, to promote

the joint prevention and control of the upstream and the downstream, the river basin co-governance, and gradually form the benign interaction between the beneficiaries and the compensated parties, and jointly protect a clear water. But it is impossible to form a strong policy combination only depending on the implementation of the single ecological compensation policy, so the linkage of all the various environmental protection policies shall be strengthened, which can further improve the policy performance of the ecological compensation. Firstly, it is recommended to strengthen and play the core role of the River Protector System, rely on the organizational basis and coordination role of the provincial, municipal, county and township level river protector system, promote the ecological compensation and achieve the overall advancement. Secondly, it is recommended to strengthen the linkage of the space management and control, the total control policies with the ecological compensation, and link the implementation requirements of the environmental management and control systems such as the total control, the sewage permit, the regional limit and approval, and 3-**line and 1-list,** with the ecological compensation funds and the performance assessment. Thirdly, it is recommended to improve the joint prevention and control mechanism of the 3 provinces in Chishui River Basin, and establish the joint prevention and control mechanism with the unified planning, monitoring, supervision, assessment and coordination, jointly carry out the pollution remediation actions of the industrial enterprises in the river shore, strengthen the troubleshooting of the environmental risk points in the river basin, and establish an environmental emergency consultation mechanism. Fourthly, it is recommended to incorporate the results of the ecological compensation performance into the performance assessment of the leading groups of the counties (cities) within Chishui River Basin of the Yunnan, Guizhou and Sichuan provinces, and properly raise the assessment weight.

The policy coordination shall be further promoted. Limited by the natural conditions of the high mountains and deep valleys, Chishui River Basin is explored and developed insufficiently, so it has a large poverty area and a severe poverty, facing the double contradictions between the economic development and the environmental protection, and needs urgently the sustainable development. The construction of the ecological compensation mechanism is the strategy choice to achieve the sustainable development, and the measures such as the launch of the ecological poverty alleviation, the implementation of the rural revitalization strategy, the guidance and specification of the industry development under the ecological compensation mechanism, are conducive to improving the production conditions of the local residents, guiding the extensive industrial transformation and upgrading, improving or protecting the ecological environment in Chishui River Basin, which is

the important way to achieve the sustainable development. Therefore, besides the core compensation system, the management methods, the action programs and the layout plans corresponding to the aspects such as the scientific and reasonable use of the compensation fund to conduct the sustainable development, the rational excavation of the ecological product value to develop the ecological product industry chain, and the assessment for the compensation system's implementation, are used to guide the practice. How to systematically plan the functional space and strategy according to the ecosystem's functional characteristics, and combine the advantages of the different types of ecological products to accurately design the mode of ecological products, also needs to follow the scientific methodology to explore.

4. Countermeasures of total nitrogen emission in Danjiangkou

4.1 Variation of total nitrogen in river basin

The total nitrogen concentration (hereinafter referred as "total-N") in Danjiangkou Reservoir area and the upstream basin is generally high. The average total-N in the Danjiangkou Reservoir area was reduced in the past two years, but it was still at a high level (1.19 mg/l in 2016) during 2006-2016. In 2016, among the 39 sections with monitoring data on total-N in the basin water, there are 13 sections with the total-N of class I-III, accounting for 33.3%, 14 with the total-N of class Ⅳ～Ⅴ, accounting for 35.9%, and 12 with the total-N of class V, accounting for 30.8%; Among them, the total-N concentration at the middle sections of dam, Taocha section of water intake and Yangwei section of Han River increased by 13.9%, 51.9% and 49.5% respectively in comparison with these in 2006. The total-N in Zijingguan section of Danjiang River increased by 36.5% in comparison that in 2012. In 2016, the average total-N in 112 national key lakes and reservoirs was varied from 0.11mg/l (Lugu Lake) to 6.62mg/l (Aibi Lake), Danjiangkou Reservoir is ranked the 68th from low to high. The overall situation is not optimistic.

The existing monitoring statistics and research foundation is weak, it is necessary to further study the accurate prevention and control measures. At present, the environment statistics are mainly COD and ammonia nitrogen, and the total-N index has certain missing, it is inefficient to support precise prevention and control measures. Based on the source apportionment model and the existing data in 2015, the total-N into the Danjiangkou Reservoir area was about 52,000 tons, 67.7% from the Hanjiang River and 12.3% from the Danjiang River, the remaining 20% come from other reservoir river and reservoir area source pollution; in terms of the emission source , 50.7% of total-N was contributed by the living source, 20.6% by the planting , 19.0% by the livestock and poultry, and only 1.0% by the industrial point, the

remaining 8.7% from the natural background; when classifying from the administrative district, 49.9% was sourced from Shaanxi province, 40.2% from Hubei province, 6.6% from Henan province, and the remaining 3.3% from the upstream of Sichuan and Chongqing.

The algal blooms appeared in some areas of Danjiangkou Reservoir area, but the mechanism of algal blooms is not clear, the high concentration of total-N may be the main reason. According to *the* ***Measures for Evaluating the Environmental Quality of Surface Water*** *(Trial),* the water quality was maintained at Class II in the Danjiangkou Reservoir area from 2006 to 2016 with the comprehensive nutritive index of 30.6-35.7 (The limit between poor and medium nutrition is 30), which is generally at the level of medium and poor nutrition. As some dams have been constructed on the inflow river and the water flowing in the reservoir area slows down, the water exchange capacity becomes worse. In May, 2015, tens of kilometers of abnormal algae growth zone was observed near the dam of Danjiangkou Reservoir. Although it disappeared quickly, it rings the alarm about the risk of algal blooms. Judging from several water quality indexes, such as permanganate index, total-P and total-N, the permanganate index and total-P of Danjiangkou Reservoir were stably maintained at Class II from 2006 to 2016. Total-N was fluctuated between 1.09-1.46 mg/l since 2008, and the high concentration of total-N may be the main cause of algal blooms in Danjiangkou Reservoir. Reservoir ecosystem succession usually takes over 10 years. The Danjiangkou Reservoir was put into use since 2014. The steady operation has not been reached as designed, including normal storage water level of 170m and the effective water transfer amount of 9.5 billion cubic meters. The ecological system in the reservoir area has not yet reached the equilibrium. Maybe the algal blooms is just an accidental phenomenon in the process of succession, however it may more likely occur after **t**he reservoir is normally dispatched. The critical conditions of algal blooms are different in various lakes. At present, the mechanism of algal blooms in Danjiangkou Reservoir is not clear yet, and the research needs to be further studied.

4.2 Main countermeasures

Strengthen the monitoring and research on total-N to lay the solid foundation for management decision: it is necessary to strengthen the monitoring and statistics of total-N index of waters and pollution sources, and provide the detailed data basis for further refining analysis of total-N sources and migration and transformation laws; study the mechanism of eutrophication of Danjiangkou Reservoir, and determine the threshold of nitrogen and phosphorus concentration and hydrodynamic conditions, which provided the basis for effectively preventing the eutrophication of Danjiangkou Reservoir; establish a monitoring and evaluation system

for the carrying capacity of the water environment and carry out monitoring and early warning on a pilot basis; study how to establish a total-N emission control system in the water source area of the middle line of South-To-North Water Transfer Project; explore the mechanism of eco-compensation in the water source area and the affected area of the middle line of the south-to-north water transfer project, incorporate the cost of ecological protection into the water price of the affected area, and establish a long-term eco-compensation mechanism.

Promote ecological protection of river basins and intensify emergency prevention and control of algal blooms: it is necessary to further intensify management to small river basins, water and soil erosion, ecological isolation zones and rocky desertification zones, and build artificial wetland water purification projects in accordance with local conditions of inflow rivers to improve the water environment carrying capacity; strictly implement the space development system of protected area. The deadline shall be specified for the withdrawal of villages, agricultural land, enterprises and institutions and buildings within the ecological red line, which illegally occupied the coastal line and have a great impact on water quality. The file shall be established for each risk source in accordance with the principle of "one file for one source", so as to implement dynamic management. The emergency mechanism shall be formed for sudden water pollution incidents in water source areas, and the emergency plans shall be formulated scientifically and emergency exercises carried out. For algal blooms, the emergency capacity shall be built and emergency material shall be reserved, meanwhile, the emergency plans shall be formulated to carry out emergency exercises, so as to effectively prevent the occurrence of algal blooms in tributary.

Strengthen construction and operation of infrastructure, and deepen comprehensive prevention and control of non-point sources of pollution: It is necessary to improve the supporting pipe networks of existing sewage plants as soon as possible, and implement rain-sewage diversion in new urban areas; renovate the joints and inspection wells of rainwater and sewage pipeline to control leakage; and solve the pollution from overflow and initial rainwater pollution caused by rain-sewage mixing in the pipeline network. Measures shall be taken to promote the upgrading of sewage treatment plants in the water source area, and reduce nitrogen and phosphorus pollutants. The monitoring and statistics shall be carried out in an all-round way for total-N emission from municipal sewage treatment facilities, and the total-N shall be listed as a daily monitoring index. According to the concept of "balanced cultivation and recycle development", the comprehensive measures shall be taken to utilize livestock and poultry wastes, prevent and control the planting pollution, and control the rural domestic pollution; promote scientific agricultural planting technology, optimize

agricultural planting methods in mountainous areas, rationally fertilize and reduce total-N pollutant emissions.

Chapter 3 Policy Recommendation

On the Symposium on Developing the Yangtze River Economic Belt, General Secretary Xi Jinping pointed out in his important speech that, ***the ecological restoration of the Yangtze River must be placed in an overwhelming position from the perspective of the long-term interests of Chinese nation, we shall focus on the joint protection, instead of massive development in the Yangtze River, and explore a new path for ecology first and green development, so as to strive to build the Yangtze River Economic Belt with a more beautiful ecology, smooth transportation, harmonious economy, unified market and scientific mechanism.*** As the Yangtze River stretches over 6,000 km, and the Yangtze River Economic Zone relates to 103 cities in 11 provinces or municipalities, the population and GDP of this area are more than 40% of the whole country. It is essential to coordinate the relations between the central and local, the governments, enterprises and society, the upstream and downstream, both banks, as well as main and tributaries, and give full play to the coordinating and guiding role of the central government, the leading role of local governments, the market-based role of enterprises and the public participation of all sectors of society. **With "joint efforts" stressed, the effective recommendations on reform-deepened path is put forward from six aspects, namely green development, sustainable financing, residents living, ecological management, institutional mechanism and green energy, to form a benign mode of joint environmental treatment, namely water protection by policy, water protection by law, joint watershed protection, joint industrial planning and joint responsibility sharing**.

1. Protect the Yangtze River by law

1.1 Speed up formulation of the Yangtze River Protection Law

Promote the Yangtze River Protection Law with an orientation of "comprehensive law": It is suggested to take the Yangtze River Protection Law as a basic comprehensive law for watershed administration. The Law will take the ***Property Law*** and other basic law as the legislative guiding, take the improvement of water ecology, water environment and water resources, water safety as the core, make a comprehensive arrangement for ***the Water Law***, ***the Law on Prevention and Control of Water Pollution,*** and will make the fundamental provisions on institutions and mechanism of the space control, development and utilization of water resources, water environment protection, ecological protection and restoration, and the risk prevention and control of ecological environment, etc. It is also suggested to establish a specification on the fields of watershed comprehensive regulation, basin ecological compensation and basin legal responsibility, especially through information platform,

consultation mechanism, planning and coordination and other measures.

Formulate laws from the perspective of ecosystem integrity and systematization: it is essential to consider the ecological and social attributes of the Yangtze River valley, insist the strategic orientation of ecology first, green development, joint protection instead of massive development, take the integrated ecosystem construction and protection as the basic concept of legislation, interact from top to bottom, break the key elements and regional limitation, comprehensively consider all issues in view of the basin ecosystem rules, including water security, flood control, pollution control, port and shore, traffic and landscape, in order to establish an unified resources supervision system for resources, ecology, environment, disaster, and engineering in Yangtze River Basin, especially for prudential regulation water project, which can effectively change the fragmented management.

Engage with existing laws well: It is necessary to consider its cohesion with the laws below as a whole, including ***the Water Pollution Prevention Law, the Water Law, the Environmental Protection Law, the Environmental Impact Assessment Law, the Flood Control Law, the Water and Soil Conservation Law, the Waterway Law*** and ***the Fisheries Law***, as well as the local laws formulated by all provinces along the Yangtze River Basin; evaluate all laws in accordance with the objectives and requirements for the system reform of ecological civilization and the construction of the Yangtze River Economic Belt; sort out the water-related powers granted by the laws and regulations, so as to identify the existing problems in the current legislation and the special needs to formulate the Yangtze River Protection Law.

Strengthen the protection planning and mechanism support of Yangtze River: it is necessary to full play the top-level design role in the ***Outline of the Yangtze River Economic Belt Development Plan***, which will be taken as the general program and blueprint to guide the development of Yangtze River Basin. Consolidate the basin ecological protection system established by the existing laws and regulations, including river-chief system, linkage and coordination mechanism for water environmental protection, early-warning mechanism of water ecological carrying capacity, ecological conservation redline system, eco-compensation system and planning environmental assessment system, etc.; and announce the basic concept, policy orientation, institutional framework and mechanism design to protect the Yangtze River, as well as the rights and obligations of different stakeholders, so as to ensure that they can not only be compatible with the existing administrative regulations and local legislation, but also leave enough space for the formulation and revision of local individual laws and regulations in the future.

1.2 Reform the ecological enforcement system

Set up an integrated basin regulatory institution to promote the system,

institution and mechanism in place: It is suggested to set up a coordinating institution named the Yangtze River Protection Committee or the ecological environment protection bureau of Yangtze river basin, which is under the jurisdiction of the Ministry of Ecology and Environment. Set up a independent comprehensive law enforcement supervisory institutions and monitoring agencies, which is under the condominium of the Ministry of Ecology and Environment and the other involved departments, with the former as main administrative body.

Link up the authorities and responsibilities with the river-chief system, lake-chief system and statutory regulatory authorities: It is suggested that, the applicable statutory supervision systems shall be organically linked up with the river-chief system and lake-chief system in the next revision of the ***Water Law*** and the ***Water Pollution Prevention and Control Law***, so as to promote joint law enforcement and joint assessment through information platforms and coordination mechanisms, which can improve the regulation performance.

Establish a law enforcement agency for the Yangtze River basin management: In view of the comprehensive administrative enforcement pilot in the Yangtze River Basin, it is suggested to set up an administrative enforcement agency to be responsible for the integrated water administration in the Yangtze River Basin, which will carry out joint consultation and law enforcement in different administrative regions between the basin agencies and local agencies, so as to normalize the joint enforcement. For the transport and disposal systems of solid wastes within the Yangtze River Basin, the legislation shall be strengthened to stipulate the unified or coherent examination and approval system and a full-process supervision mechanism.

1.3 Improve the judicial system for ecological environment

It is suggested that the Yangtze river maritime court will accept wade dispute across the region, including damage the ecological environment, regional ecological compensation agreement dispute, etc. It's also suggested to establish a unified court of Yangtze river, as the appeal court of maritime court in the Yangtze river basin. It is required to improve the conditions, scope and procedures of public interest litigation for water administration, and strengthen the legal supervisory role of prosecuting authorities. It is suggested that the system, institution and mechanism of judicial supervision shall be perfected over the executive power of water administration through amending the ***Criminal Procedure Law*** and the ***Administrative Procedure Law***. It is also suggested that the Supreme People's Court shall establish a directory of the public interest, a directory or guidance for litigation claims on public environmental interest, and clarify the compensation conditions, claims and jurisdictions of in public interest litigation; as well as study on how to establish the criminal litigation system with collateral civil suit against water pollution and water

ecological destruction.

2. Establish a sustainable green financing mechanism

2.1 Stabilize financing channels for ecological compensation

With the gradual decline of the central finance support, it is suggested to establish a horizontal eco-compensation fund pool for the Yangtze River Economic Belt, which can effectively solve the complicated issues among the upper, middle and lower reaches, and both banks of the Yangtze River Basin. The annual amount contributed by 11 provinces and municipalities along the Yangtze River is calculated and distributed according to the local water resource, water environment and water ecosystem factors along the Yangtze River Basin, with the principle of "the polluters to govern, and the beneficiaries to be compensated".

2.2 Establish the Yangtze River ecological fund

Set up the Yangtze River ecological fund, give play to the leading role of fiscal investment and leverage, and attract financial institutions and social capital inputs such as Maotai, Lang Liquor and Luzhou Laojiao by the income priority guarantee mechanism. Use the equity investment method to give key support to major ecological environmental protection project of the Yangtze River economic belt with the PPP and the third party governance mode. The first target of the fund is 300 Billion yuan, among them, the government contribution by 25% with the commitment system. The capital will arrive in three years according to fund operation progress, with fund duration for ten years. Financial capital mainly comes from the existing national major water conservancy project construction funds, the central government finance, 11 provinces along the Yangtze River economic belt, and so on.

2.3 Explore the market mechanism involved in wading enterprises

It is suggested to organize natural resources asset management committee of the Yangtze river, to exercise its rights to charge in terms of water resources, water environment, water ecology, water-heads right, water-surface right, and water engineering right of the Yangtze River. Through the contract to exercise the rights of charge for the utilization of resources and environment of the Yangtze River from China Three Gorges, the Gezhou Dam. The ecological beneficial areas should pay for water utilization, sightseeing and other items. The eco-environmental damage areas should compensate for the country's water-related rights damaged. The ecological protection areas should be compensated.

2.4 build a joint-protection platform of enterprises

Organization the wading enterprises that willing to provide funds such as China Three

Gorges group, Maotai group, Lang Liquor group, the enterprises focused on energy conservation and emissions reduction such as CECEP to build a joint-protection platform, explore the ecological industry chain with the overall planning of the Yangtze River and sub-streams, build a green chain from production, processing to sales, to realize the organic circulation of ecological industry chain, industry nurturing agriculture, benefit farmers and improve the basin ecological environment at the same time. The enterprises shall base the "green enterprise" as their development strategy, to establish a management pattern that is featured as strict prevention from the source, strict process control, and strict post-punishment.

3. Build a path to sustainable livelihoods

3.1 Establish benefit platform based on rural revitalization

It is suggested that the relevant ministries and commissions, such as NDRC and MEE, shall promulgate the guiding opinions to develop Characteristic Towns in the Yangtze River Economic Belt specific to the backward areas with beautiful ecological environment in the middle and upper reaches. In accordance with the ecology-first concept, considering the ADB projects such as the green ecological corridor agricultural development project, select the projects and areas with necessary conditions to be cultivate preferentially. For example, select pilot areas to carry out demonstration bases with bamboo industry, further strengthen ties with INBAR to actively promote scientific and technological innovation in the bamboo industry, fully explore its economic, ecological and cultural value, and extend its industrial value.

3.2 Promote the compensation based on rural productivity

It is suggested to increase investment in transportation facilities, open up channels of production factors, such as the export of ecological products, the import of external capital and technology in the upstream areas, broaden the channels and promote the circulation between ecological products and consumer markets. Set up an integrated platform for the production and marketing of agricultural products in the upper and lower levels. The agricultural enterprises in the downstream provinces are encouraged to invest and set up factories in the upstream areas, develop the ecological agriculture and maintain biodiversity; assist to cultivate talents in the upper and middle reaches of the Yangtze River, to promote the industrial cooperation between the downstream and upstream of the Yangtze River.

3.3 Explore protection mechanisms based on community agreement

Take Chishui River as pilot area, build a government-enterprise-third party organization-local communities-personal protection mechanism, sign an agreement by the stakeholders through negotiations to transfer the protection and development

rights to the different stakeholders, formulate the protection plan and development plan, and carry out the evaluation of ecological benefit, economic benefit and social benefit.

3.4 Establish a carbon sink mechanism involving farmers

It is suggested that voluntary GHG emission reduction projects with obvious ecological restoration and protection benefits, such as forestry carbon sinks in the Yangtze River Economic Belt, shall be preferentially included in the national carbon emission trading market. Farmers at upstream ecological protection areas put woodland absorb carbon dioxide by the trees with grassland-use, forest land certificate or artificial afforestation as a product on poverty alleviation platform for social marketing, guide carbon emissions performance enterprises preferred to buy support units.

3.5 Explore the function-replacement compensation mechanism of ecological and construction land

It is suggested that the total amount land for functional replacement of ecological and construction land shall be determined in terms of main function orientation, economic development, ecological environment, and land use in the Yangtze River Economic Belt, and so on. The region to transfer construction land mainly covers the important areas with relative undeveloped economies and ecological missions undertaken, including the important ecological function areas and the ecological conversation redline, which can receive compensation through transferring construction land; while the region to receive construction land mainly covers the areas to be industrialized and urbanized, including the optimized development zones, key development zones, and so on.

4. Implement "mountaintop to ocean" system management

4.1 Coordinate the integrated management of ecosystems

Improve the integrated ecosystem management framework. It is suggested to pay attention to the health level and self-regulation capacity of the ecosystem, as well as the coordination degree with the social and economic system. Coordinate the comprehensive development, protection and governance of the ecosystem in the Yangtze River Economic Belt, and establish an ecosystem development and protection system covering the whole basin. Fully consider the coupling, heterogeneity and diversity of natural ecology, economic development and social and cultural factors in various provinces and cities. Develop systematic solutions to environmental problems such as water pollution, solid waste pollution such as plastics, and soil erosion in the Yangtze River Economic Belt. Taking Dongting Lake, Poyang

Lake and Taihu Lake as pilots, based on the health assessment of the lake ecosystem, carry out the restoration and reconstruction of the three-dimensional ecosystem from point to line from the dimensions of atmosphere, water, soil, biology, etc. Accelerate to summarize the experience of ecological environment management in small watersheds such as lakes, and gradually extend it to the entire Yangtze River basin.

Identify the important restoration space of "mountain, forest, field, lake and grass", innovate new governance mode, and systematically promote the ecological restoration project. Carry out in-depth investigations into the natural resources and ecological environment of the Yangtze River Economic Belt, identify the spatial distribution and main features of key areas for protection and restoration of "mountain, forest, field, lake and grass", and give priority to the designation of important restoration Spaces in areas where ecological service functions of the Yangtze River Economic Belt are important and ecologically sensitive. Explore the restoration and governance model of "ecological + green financing" in the upper reaches of the Yangtze River actively. Give priority to the restoration of seriously damaged habitats such as important shorelines of the Yangtze River economic belt, important coastal and estuary wetlands, and the lakeside belt around taihu lake. Actively promote the rehabilitation of abandoned mines in important ecological and residential areas, and focus on the rehabilitation of sensitive mines along transportation routes. Coordinate the ecological relationship between the three gorges reservoir and the middle and lower reaches of the river system, stabilize basic ecological water use in the middle and lower reaches of the river and lake, and strengthen the capacity of large lakes, such as Dongting Lake, Poyang lake and honghu, to regulate and store stagnant water. Establish the ecological corridor of the Yangtze River national park and form the biodiversity conservation network.

4.2 Strengthen rural waste management

Improve solid waste management methods and follow the "3R" principle (reduce, utilize and recycle) to reduce waste throughout the product life cycle. Formulate national policies on circular economy and green supply chains to further strengthen the ability to control micro-plastics pollution. Innovative technologies for the collection and treatment of solid waste. Improve pollution control measures for livestock and poultry farming. Improve performance of sewage treatment plants and sludge treatment capacity, and raise awareness through community participation to reduce the water pollution of solid wastes throughout the Yangtze River Basin to the ocean.

4.3 Coordinate the construction of "water-road-port -industry-city"

Accelerate the construction of water resource monitoring systems for the important

water resources and hydropower projects such as the cascade power stations of the Jinsha River and Danjiangkou Reservoir, as well as for nodes of river systems, faults under national and provincial control, and important rivers and lakes. Carry out the feasibility demonstration of water resources and manage water extraction permits strictly; clarify the allocation of water rights among provinces and municipalities along the Yangtze River; and carry out water right trade when time is right. Work out water distribution plan in batches according to the main stream and tributaries, and coordinate production, living and ecological water use. Speed up the construction of key ports and feeder routes along the river, plan ahead to build railways along the river, and promote the interconnection and interchange between the expressways and access to port along the river. Attach importance to the coastline protection along the Yangtze River and establish a negative list of ecological admittance. Protect the green resources along the Yangtze River comprehensively. Create a bamboo and wood planting belt integrating economic benefits and ecological benefits. Strengthen the construction and maintenance of nature reserves, forest parks and wetland parks. Delineate access zones for transfer of heavily polluting industries such as petrochemicals, coal, paper making, printing and dyeing, and electroplating strictly. Plan the urban construction and industrial development as whole. Develop a circular economy such as modelled on the chishui river basin vigorously, so as to form a green urban spatial pattern which is featured as regional interactive, structural optimized, intensive and efficient, low carbon and clean, harmonious and livable.

5. Promote the reform of the environmental protection and governance system

5.1 Establish an industry planning and coordinating committee

In order for the administrative regions of the Yangtze River Economic Belt to achieve prevention priority and green development, the fundamental solution is to plan, in a scientific and reasonable way, a green industry system that connects and coordinates different regions in the river basin and realize both self-development and coordinated development. As this would entail a green reform of the current industry planning system, we suggest that an industry planning and coordinating committee shall be established under the coordination mechanism of the Central Government for the green development of the Yangtze River Economic Belt and that the Ministry of Ecological Environment and National Development and Reform Commission undertake the daily routines of this committee.

5.2 Explore a Comprehensive supervision system of ecological and environmental protection and natural resources

Relationships should be straightened out between the Central Environmental Protection Supervision and the National Land Resources Supervision, National

Marine Supervision, and forest and grassland administrations. Two patterns are recommended in this regard: first, we suggest that the Central Ecological and Environmental Protection Supervision Team uniformly carry out comprehensive supervision of ecological environment and natural resources on behalf of the CCP Central Committee and the State Council and the National Natural Resource Supervision Office be still established at the Ministry of Ecological Environment. Second, a dedicated central natural resource supervision system may be established in parallel with the Central Ecological and Environmental Protection Supervision; the National Natural Resource Supervision Office is canceled and a Central Natural Resource Supervision Office is set up at the Ministry of Natural Resources.

5.3 Perfect an ecological environment protection supervision system

Establishing a uniform information and audit platform for the Yangtze River Basin by learning from the experience of the Chishui River Basin and some other places. The National People's Congress strengthen its judicial supervision on the ecological environment protection of the Yangtze River Basin and require procuratorates and courthouses to file special annual reports to the NPC Standing Committees on the same level about the status of comprehensive protection. The United Front Work Department of CPC Central Committee strengthen its supervision of provincial and lower-level United Front Work departments on their role in the democracy supervision of environmental protection in the Yangtze River Economic Belt, and that Chinese People's Political Consultative Conference strengthen its supervision of provincial and lower-level political consultative conferences on their role in the democracy supervision of environmental protection.

6. Develop green energy and industry

6.1 exploit renewable energy in the upper reaches

Exploiting more clean electric power[1] and energy storage resource by developing "photovoltaic pumped storage" according to the local conditions in the valleys and ravines around large reservoirs; and solve the problem of irrigation water supply through "photovoltaic pumped storage" in the upper storage reservoirs, in order to promote the development of high-quality feature agriculture in the high-heat regions

1. We suggest making full use of the water surface (2032km^2) of cascade reservoirs in the upper reaches of the Lantsang River and Hongshui River. The total capacity of clean electric power may reach up to 1.65 trillion kWh. The hot-dry valley and the barren slopes in east Tibet may be further exploited. The upper limit of photovoltaic development is determined only by energy storage. With the development of energy storage facilities and energy storage technologies on the consumer side of the power grid (such as apps which guide power consumption), there is still huge room for the development of clean energy in the Southwestern regions.

such as Pangzhihua and east Yunnan. It is suggested that we combine hydropower development and photovoltaic development in the dry-hot valley of the upper reaches of the Yangtze River.

6.2 Develop Bamboo Biomass Energy

Plant energy bamboos on land that is not suitable for grain cultivation, such as mountain and surrounding areas, barren hills and slopes, river Banks, etc.. Explore and develop bamboo energy forests in combination with the project of returning farmland to forest and protecting forest construction. Improve the preparation process of cellulose ethanol, so as to make a good technical reserve for the future development of bamboo biomass energy.

6.3 Promote the construction of green waterways

We shall establish a joint-action plan for the shipping and hydropower generation in the Jinsha River basin. More efforts shall be put into the exchange and cooperation with surrounding provinces and joint efforts shall be made to organize the planning of shipping and to determine the routes to be constructed from Pangzhihua to Shuifu on the Jinsha River. We shall also study and establish a support plan for the Shuifu-Yibin waterway. To realize the grade matching of upstream and downstream channels, and better extend the radiating and driving effects of water transport to the upper reaches of the Yangtze River.

6.4 Build green ports

We should perfect the shore power operation system. Vigorous efforts should be paid to the construction of shore power operation platforms for inland river ports. To popularize the “green shore power technology”, and eventually realize its full coverage, among ports along the Yangtze River. Alternative energy plans shall be made to perfect the standards for construction of shore power facilities of the ports and the incentive policies for use of shore power by ships.

Chapter 4 Prospect

To sum up, for the green development and eco-compensation mechanism in the Yangtze River Economic Belt, it is essential to build a long-term mechanism based on the national strategic opportunities to reflect all stakeholders' interests. In order to strengthen the consciousness of the whole basin, the state shall intensively guide all provinces and municipalities along the Yangtze River in an overall view, and coordinate common development and administration and win-win cooperation among all provinces and municipalities in the Yangtze River Economic Zone as a whole. The local cities and counties shall be guided to initiatively participate in the ecological restoration, protection and construction in the Yangtze River Economic Belt and plan it in the perspective of whole country. Through many approaches, such as mutual benefit and win-win development mechanism of ecological industry, incentive & restraint mechanism, diversified and multi-channel financing mechanism, a long-term green development and eco-compensation system shall be formed to integrate the whole basin and plan the integrated protection and administration of all ecosystems as a whole, so as to ensure the "joint protection, instead of massive development" can be effectively implemented in place.

Appendix

Special Report I: Special Report on Yangtze River Protection Legislation

Special Report II: Fiscal Policy of Green Development in the Yangtze River Economic Belt

Special Report III: The Proposal of Establishing Yangtze River Ecological Fund

Special Report I:
Special Report on Yangtze River Protection Legislation

1. Relevant Legal Construction of the Development and Protection of the Yangtze River Economic Zone

(1) In the 1990s: Preventive Research on Yangtze River Protection Legislation

The legislative research on Yangtze River protection was started in the 1990s, which was conducted by Ministry of Water Resources (MWR) and Yangtze River Water Resources Commission (Yangtze River Commission for short). In 1993, MWR included Yangtze River Law in the five-year legislative plan and reported it to the Standing Committee of the National People's Congress. Meanwhile, in the same period of time, domestic scholars wrote articles to call for Yangtze River Protection Legislation[2]. To some extent, this was initiated by the insufficiency of the legal system itself, so the legislative research on Yangtze River protection was aimed to fill the blank. By the end of the 1990s, the so-called "Four Water-related Orders" had been all introduced, basically fulfilling the legal basis for water resources protection, but most of the orders failed to attach importance to the basin features of water resources protection, which resulted in problems like unclear and inconsistent legal relationship, unclear terms of reference in various administrative departments as well as unclear legal status and authority of office in different administrations. [3]

In the meantime, the water pollution accident in the Huaihe River Basin that happened in 1994 completely exposed the defects mentioned above. In order to supply the gap in the legal system itself, in 1995 the State Council issued "Provisional Regulations on the Prevention and Control of Water Pollution in the Huaihe River Basin", which came out as the first administrative regulations concerning the basin in our country. It was used to solve the problem that the water yield in the Huaihe River Basin is comparatively small and the water quality is severely polluted. But after ten years of harnessing the Huaihe River, the situation has not been improved, and the Huaihe River basically lost its self-purification ability. In view of the lesson, preventive research on the legislation of water resources protection in the Yangtze River Basin was conducted so as to avoid repeating the same mistakes[4]. This is also a "self- reproductive" process inside the legal system. On the other hand, in terms of the

[2] As was advocated in an article written by Mr. Ma Xiangcong, from Institute of Law of Chinese Academy of Social Sciences, at the beginning of the 1990s, "to study and enact the special *Yangtze River Law,* and also to lay down comprehensive and systematic legal rules on the development, utilization and protection of the basin".

[3] Legislative Research Group on Water Resources Protection in the Yangtze River Basin: "Study on Legislation of Water Resources Protection in the Yangtze River Basin", published in "Jurisprudence of China", 2nd issue , 1999.

[4] The differences between the natural elements and the social elements in various basins will result in different focuses of resources protection. In the 1990s, the Huaihe River Basin should focus on preventing the water pollution that has happened, the Yellow River Basin should center on the conservation of water and soil, the Song-Liao River Basin should attach importance to both prevention and administration, and the Yangtze River Basin should pay attention to prevention.

external factors in the legal system, Yangtze River protection legislation does not have the conditions for external "landing", which seems to be relatively abortive. During the period of the Eighth Five- Year Plan and the Ninth Five-Year Plan (1991-2000), much importance was attached to the development and utilization of water resources in the Yangtze River Basin while protection and administration was neglected. For example, the Eighth Five-Year Plan focuses on the work such as projects for diverting water from the south to the north and the three gorges project on the Yangtze River, comprehensive development of the water resources in the upper reaches of the Yangtze River, accelerating the development of hydro-power along the stem streams of the Yangtze River as well as enhancing the inland water transportation along the main lines and main branches of the Yangtze River. However, as to the goal of territorial development and management as well as environmental protection, though much value had been put on the comprehensive treatment of great rivers and lakes, the Yangtze River was not definitely included in the scope of key harnessing and planning targets. [5] Especially in the Ninth Five-Year Plan, it is proposed that a comprehensive economic zone which runs from the east to the west and connects the north and the south will be built in the Yangtze River Delta as well as areas along the Yangtze River in order to take advantage of the favorable economic condition of the water resources in the Yangtze River Basin. But in the task of environmental and ecological protection, the Yangtze River has not yet been included in the scope of key river basin pollution control targets. [6]Hence, in the specific time and space like the 1990s, water resources protection in the Yangtze River Basin is not the major social control issue in this time and space. Since the legislative research on Yangtze River protection is a preventive study, it should be concerned with or attach more importance to legal regulation on the various phenomena that are likely to happen in the future, and also it should be aimed to protect the sustainable development of the water resources in the Yangtze River Basin, [7]which exactly responds to the epoch topic of "sustainable development" strategy at this stage. Meanwhile, in this period, environmentalists represented by Prof. Cai Shouqiu and Prof. Lv Zhongmei conducted a pioneering research on Yangtze River protection legislation. They agreed that a preventive study on water resources protection in the Yangtze River Basin should be conducted from the perspective of legislative theory in view of the

[5] "The 10-year Plan of the People's Republic of China for National Economic and Social Development and the Outline of the Eighth Five-Year Plan", published in the website of National Development and Reform Commission: http://ghs.ndrc.gov.cn/ghwb/gjwngh/200709/P020070912631592692208.pdf, Date of Last Visit: June 21, 2018.

[6] "The Ninth Five-Year Plan of the People's Republic of China for National Economic and Social development and the Outline of the Long-term Goal for 2010", published in the website of National Development and Reform Commission: http://ghs.ndrc.gov.cn/ghwb/gjwngh/200709/P020070912633148897320.pdf, Date of Last Visit: June 21, 2018.

[7] Legislative Research Group on Water Resources Protection in the Yangtze River Basin: "Study on Legislation of Water Resources Protection in the Yangtze River Basin", published in "Jurisprudence of China", 2nd issue , 1999.

conservation characteristics of water resources in the Yangtze River Basin. The problem concerning water resources protection in the Yangtze River Basin is not whether legislation is necessary but what law should be made? What's the target, task, function or effect of the legislation? Why did the existing legal system fail to play its due role?[8] And so on.

(2) **After 2002: Preventive and Curative Research on Yangtze River Protection Legislation**

Unlike the 1990s, in the new century, the task to protect the water resources in the Yangtze River Basin has been included in the periodical state planning and become the major social control issue in the time and space of the day. For example, since the Tenth Five-Year Plan, it has been clearly demanded that comprehensive water pollution control project in the three gorges reservoir area and the upper reaches of the Yangtze River should be launched and also natural forest protection project as well as Green for Grain project in the upper reaches of the Yangtze River should be implemented. [9]Then the following "Special Plans for Ecological Construction and Environmental Protection in the Tenth Five-Year Plan" also defined the ecological construction and environmental protection in the upper reaches of the Yangtze River as the key task during the period of the Tenth Five-Year Plan, including starting as soon as possible the comprehensive water pollution control project in the three gorges reservoir area and the upper reaches of the Yangtze River, accelerating the construction of protection forest system of the middle and lower Yangtze River for the purpose of conserving water and soil, water conservation as well as wind disaster reduction, continuing to implement natural forest protection project, and so on.

"National Tenth Five-Year Plan of Environmental Protection" issued in 2002 continued to emphasize that national ecological function reserve should be built in the source region of the Yangtze River Basin in order to protect and recover the ecological functions of lake wetland in the middle and lower reaches of the Yangtze River and also discharge of sewage within the specified time limit as well as chemical fertilizer and pesticide pollution prevention and control should be implemented in the area of the Yangtze River Delta. These national plans were aimed to prevent and cure the focuses which are likely to emerge or have emerged in the Yangtze River Basin. With the promotion of these national plans, legislative research on Yangtze River protection, upgraded as a national goal and mission, was officially started. The

[8] Legislative Research Group on Water Resources Protection in the Yangtze River Basin: "Study on Legislation of Water Resources Protection in the Yangtze River Basin", published in "Jurisprudence of China", 2nd issue , 1999.

[8] "The 10-year Plan of the People's Republic of China for National Economic and Social Development and the Outline of the Eighth Five-Year Plan", published in the website of National Development and Reform Commission: http://ghs.ndrc.gov.cn/ghwb/gjwngh/200709/P020070912634253001114.pdf, Date of Last Visit: June 21, 2018.

amendment of "Water Law" in 2002 provided legislative basis for the protection and management of basin water resources including the Yangtze River, and later legislative research on Yangtze River protection was also discussed on this basis. The revised "Water Law" further defined that water resources belong to the state, and the State Council assumes the ownership of water resources, which enhances the macro-management of water resources by the state, especially the macro-management of cross-boundary water resources allocation and water pollution control inside the basin. The macro-management is specifically fulfilled via the management system combining river basin management and administrative management. Particularly, river basin management agency is empowered to perform duties of water resources management and supervision within their scope of jurisdiction. At the same time, "Water Law" requests that an integrated planning should be made according to the basin and the region, and also specifies problems such as types of planning, limits of authority and procedures, as well as the effect and implementation of planning. Besides, allocation and application of water resources as well as protection of water resources also involve the basin problem. [10]Under the guidance of the legislative frame, it's just the time for the legislative research on Yangtze River protection. In 2003, the Yangtze River Commission officially started the preliminary study on the legislation of "Yangtze River Law" and also enacted "Preliminary Work Outline of Yangtze River Law", which divided the preliminary work into three stages: the first stage should be accomplished in 2003, whose focus is the research on the necessary and urgent problems in the legislation of "Yangtze River Law"; the second stage should be carried out in 2004, probing into the key issues involved in the legislation of Yangtze River Law. There are two major issues: one is to solve problems such as unified control of the three gorges reservoir, construction and operation management of south-to-north water diversion project, comprehensive improvement of Yangtze River estuary, as well as water resources protection and shipping of the Yangtze River Basin in view of the actual situation of governance development and protection of the Yangtze River, among which the most noticeable problems are flood control of the Yangtze River, water pollution control and conservation of water and soil; the other is to draw on and learn from the foreign experience of river basin legislation, especially the successful experience of basin management and development, basin protection and basin legislation in developed countries, and then make efforts to collect and sort out relevant data and do analysis and research; the third stage was started in 2005, intended to study and propose the legislative contents and draft provisions of "Yangtze River Law", specifically including but not restricted to the basic principles

[9] Wang Shucheng: "Explanation on Water Law of the People's Republic of China (Draft Amendment) at the 25th Meeting of the Standing Committee of the Ninth National People's Congress on December 24, 2001", published in " Bulletin of the standing committee of the National People's Congress", 5th Issue, 2002.

of Yangtze River water management as well as the legal status and specific duties of river basin water management agency. According to the principles of unified management of surface water and underground water, water yield and water quality, as well as water intaking and utilization and sewage discharge, the management of the Yangtze River Basin has been explicitly established in terms of planning, flood control, water intaking, water transfer, water conservation, soil conservation, water administration, hydrology, river course, dyke, marginal bank and store floodwater area, especially the unified management of construction and operation of Yangtze River water control project as well as major issues like the initial rights of the basin and water rights redistribution in order to establish improved engineering system, non-engineering system and social security system of water harnessing, water development and water protection of the Yangtze River. [11] Meanwhile, in this period a group of environmental law scholars represented by the team of Professor Lv Zhongmei continued to further study the problem of Yangtze River water resources protection legislation, arguing for the legislative foundation, conditions and institutional system of Yangtze River water resources protection, and also by taking example by Murray-Darling Basin water management system in Australia, water distribution mechanism for interstate rivers in the United States, and experience in pollution control of the Rhine River in Western Europe, the draft proposal of "Regulations on the Protection of Water Resources in the Yangtze River Basin". [12]

After entering the period of the Eleventh Five-Year Plan, the key national environmental protection mission in this period is still to promote the work of water pollution control in the middle and lower reaches of the Yangtze River and to enhance the environmental regulation of water conservancy development in the upper reaches of the Yangtze River. Accordingly, the heat of studying Yangtze River protection legislation hasn't diminished. From 2006 to 2010, the Yangtze River Commission authorized Professor Wang Shuyi from Environmental Law Institute of Wuhan University to accomplish studying and drafting the clauses of four-phase Yangtze River protection legislation. The main ideas of the law include but are not limited to: in terms of legal name, it is called "Yangtze River Law"; in terms of legal status, "Yangtze River Law" is a river basin law, a special law, a comprehensive law of basin management, a law beyond or across departments, a special law on environmental protection in the Yangtze River Basin, and a basic management of the Yangtze River Basin; in terms of legal content, "Yangtze River Law" is by and large composed of general rules, river basin supervision and management system, planning of the

[10] "2003, Yangtze River Law from Backstage to Foreground", published in Yangtze River Water Conservancy Network: http://www.waterpub.com.cn/info/InfoDetail1.asp?CateID=7&id=2777, Date of Last Visit: June 29, 2018.

[11] Lv Zhongmei, etc.: "Legislative Research on Water Resources Protection in the Yangtze River Basin", Wuhan University Press, 2006, Page One below.

Yangtze River Basin, development, utilization and protection of water resources in the Yangtze River Basin, water pollution control in the Yangtze River Basin, flood control in the Yangtze River Basin, protection and improvement of ecological environment in the river basin, environmental and safety management of water projects, disposition of water dispute, and legal liabilities. [13]In 2013, Yangtze River Commission once again approved the legislative research on the Yangtze River Basin.

In a word, in this period, legislative research on the protection of the Yangtze River began to move from backstage to foreground, with the following several features: First, legislative research on the protection of the Yangtze River belongs to responsive law study, which attaches more importance on responding to social needs and more comprehensively and rationally considers the social facts based on which those laws must be made and applied.[14] Since the Tenth Five-Year Plan, due to the severe contamination of the Yangtze River, Yangtze River protection has been upgraded as a periodical key national mission. What's more, because the existing legal structure was unable to meet the preventive needs for Yangtze River pollution, legislative research on Yangtze River protection steeped onto the stage since then. Second, the major problems in the legislative research on Yangtze River protection, which are comparatively constant, include but are not limited to problems like establishment of water basin management system, water basin planning, design of water basin system, engagement with the existing water law, and reference to foreign experience in water basin management, etc. Third, more importance has been attached to solving problems of protection and pollution prevention of water resources in the Yangtze River Basin while other water-related problems in the Yangtze River Basin are only casually resolved. It can be seen from "Regulation on Water Resources Protection in the Yangtze River Basin (Draft Proposal)" presented by the team led by Prof. Lv Zhongmei that legislative regulation is aimed at problems of water resources protection and pollution control in the Yangtze River Basin. Later, the team led by Prof. Wang Shuyi expanded the research content a bit.

(3) Since 2015: Strategic Research on Yangtze River Protection Legislation

In September, 2015, the Central Committee of the Communist Party of China and the State Council issued "Overall Plan for the Reform of Ecological Civilization System", which from the "top-level design" perspective defined the reform blueprint and elementary path of ecological civilization in our country after entering the "Deep End". The overall plan also clearly listed the eight institutions as the key task of

[12] Wang Shuyi: "Calling for New Legislation on the Sustainable Development of the Yangtze River Basin—Preliminary Consideration on the Formulation of the Yangtze River Law", published in People's Changjiang Daily, December 6, 2008.

[13] [US] Nonet & P. Selznick: " Law and Society in Transition:toward Responsive Law", translated by Zhang Zhiming, China University of Political Science and Law Press, 2004. Page 81 below.

reform of ecological civilization system and issued in succession a couple of special incentive package schemes to ensure implementation. These institutions as well as special incentive package schemes also provided powerful basis for the legislative research on Yangtze River protection.

[15]In January, 2016, General Secretary Xi Jinping stated at the first symposium held in Chongqing to promote the development of the Yangtze River Economic Zone that to restore the ecological environment of the Yangtze River should be put at the overwhelming position, and also extensive protection should be enhanced while further development should be avoided, which for the first time laid a foundation for the construction of the Yangtze River Economic Zone as well as the optimal order in the protection of the Yangtze River ecological environment. In March, "The 13th Five-Year Plan for National Economic and Social Development" was officially issued, definitely including promoting the development of the Yangtze River Economic Zone as a national strategy, and it also demanded strategic orientation of ecological priority and green development, putting restoring the ecological environment in the Yangtze River on top of the list, enhancing extensive protection together and avoiding further development. In the same month, CPC Central Committee Political Bureau approved the "Outline of the Development Plan for the Yangtze River Economic Zone", which further followed the strategic idea of promoting the development of the Yangtze River Economic Zone and specifically defined the general requirements, orientation and arrangement as well as key tasks and supporting measures for the development of the Yangtze River Economic Zone. Meanwhile, the Outline also stressed that by accelerating the legislative process of the Yangtze River Basin and speeding up the release of "Yangtze River Conservation Act", the legislative research on Yangtze River protection has entered the period of strategic development. In July, 2017, Environmental Protection Department, National Development and Reform Commission and Ministry of Water Resources jointly issued "Environmental Protection Plan for the Yangtze River Economic Zone", which made an arrangement for the specific tasks to protect the ecological environment in the Yangtze River Economic Zone. In December, in the report on the committee results proposed by representatives from the presidium appointed by NPC Environmental Protection Committee at the Fifth Session of the 12th National People's Congress, 4 bills concerning the legislation of the Yangtze River Basin proposed by 199 representatives including Zhou Hongyu, Yao Haitong, Lv Zhongmei and Zhang Yan

[14] The eight institutions listed in the "Overall Plan for the Reform of Ecological Civilization System" include: natural resource property rights system, land space development and protection system, spatial planning system, total resources management and comprehensive conservation system, paid use of resources and ecological compensation system, environmental management system, market system of environmental governance and ecological protection, and ecological civilization performance evaluation and accountability system.

had been considered and examined. After seeking advice from the departments concerned such as Ministry of Water Resources, National Development and Reform Commission,

Ministry of Industry and Information Technology of the People's Republic of China, and Ministry of Housing and Urban-Rural Development, it was finally suggested that NPC Standing Committee will include the legislation of the Yangtze River Basin in the legislative planning for the 13th NPC Standing Committee. This indicated that legislative research on Yangtze River protection came out of the academic discussion stage for the first time and officially stepped into the national legislative process. In April, 2018, General Secretary Xi Jinping reinterpreted at the second symposium held in Wuhan to promote the development of the Yangtze River Economic Zone the strategic orientation of enhancing extensive protection but avoiding further development; also he stressed again that to restore the ecological environment of the Yangtze River should be put at the overwhelming position and five relationships in the construction of the Yangtze River Economic Zone should be properly handled, which provided a clear idea for the development strategy of the Yangtze River Economic Zone in the new age.

As can be seen, with the proposal of promoting the development of the Yangtze River Economic Zone as a major national strategy, legislative research on Yangtze River protection will come to a strategic promotion stage. In the specific background of time and space, the establishment of many public policies has drawn the outline for Yangtze River protection. In terms of public policy system, some belong to Yuan policy, such as enhancing extensive protection, avoiding further development, ecological priority and green development, etc.; some belong to fundamental policy such as ecological red line; and some even belong to aspect policy such as ecological compensation in river basins. However, if these public polices in different categories are to be really “implemented”, there would be a lot of difficulties: (1) It’s hard to choose institutional instrument. As to the public policies mentioned above, is it to be executed through policies? Or is it to be implemented as a legal system? Or is it to be carried out by using informal institutional tools? The above choice questions will also be made out in the “blank zone” not included in public policy protection and in the “grey zone” caused by the deficit of existing legal protection. However, this reflection makes for the substantial explanation of “Why Yangtze River Law is essential?”, breaks the fossilized analytic logic of “Yangtze River's economic status is important —— the Yangtze river has suffered severe ecological damage —— Yangtze River legislation is extremely urgent”, and also answers the question of why Yangtze River protection legislation is essential. (2) As for the policies which must be implemented by instruments of legal system, what’s the control objective they are intended to

achieve? "In the current society, law is the main method to fulfill social control by social political organizations",[16] and to choose to protect the ecological environment in the Yangtze River by strong legal control, we have to be confronted with the question to confirm the control objective, which will be concerned with the objective setting of Yangtze River protection legislation. "Objective is the creator of the whole law, and the generation of every rule of law will come from an objective",[17] which will influence the system content setting of Yangtze River protection legislation. (3) In order to accomplish the control objectives in the special time and space, what legislation model should be followed? "In the legislative process, legislation model on a large scale determines a series of significant problems such as options to accept or reject legislative contents, value orientation of legislation and application of legislative technique".[18] In this sense, model selection of Yangtze River protection legislation is very decisive. (4) Legislative model belongs to the category of legislative form, so legislative contents should be taken into account accordingly. After determining the model of Yangtze River protection legislation, contents on Yangtze River protection legislation should be designed on the basis of the established control objective that is to make arrangement for the specific rules, which is the last support for the protection of Yangtze River by legislation.

2. To Establish Perfect Legal System

(1) Legislative Objectives

New age is a brand new political judgment on the current social development stage in China by the 19th CPC National Congress. "Every critical stage of development in the course of national modernization is accompanied by the adjustment of governing methods as well as strategic choice of development goal of law".[19] In different development stages, "every strategic planning will eventually lead to strategic consideration on national law development as well as consequent strategic arrangement".[20] As a result, the construction of the Yangtze River Economic Zone, as a strategic planning in the new age, will confront the strategic choice of legal protection objectives and the strategic arrangement based on this, and moreover, the current legislative research on Yangtze River protection is focused on the mission. As to the strategic choice of the control objective of Yangtze River protection legislation, there have been a lot of public policies which have given definite orientation, but a

[15] [US] Roscoe•Pound: "Social Control Through Law", The Commercial Press, 2003, Page 9 below.
[16] Quoted from [US]E.Bodenheimer: "Jurisprudence: Legal Philosophy and Legal Method", Translated by Deng Zhenglai, China University of Politic Science and Law Press, 1999, Page 109.
[18] Jiang Guohua: "Legislation: Ideals and Reform", Shandong People's Publishing House, Page 243.
[19] Gong Peixiang: "Strategic arrangement for the modernization of Chinese rule of law in the new era", published in "Legal Philosophy in China", 3rs issue, 2018.
[20] Same as the previous note ①, the article by Gong Peixiang.

series of probing theoretical interpretations can best help to accomplish the subsequent legislative transformation, and as to the strategic arrangement under other control objectives of Yangtze River protection legislation, we can study them in later articles.

① Carrying Capacity of Policy Goal: Theoretical Interpretation and Its Legislative Transformation

Yangtze River protection legislation belongs to typical policy legislation that is it's a legislation to implement various policy means and goals concerning national prevention, development, management, planning, encouragement and relief of the environmental pollution in Yangtze River. [21] Therefore, the present theoretical research on Yangtze River conservation policy control objectives will contribute to its final establishment.

—— Theoretical Interpretation of Policy Goals

In terms of public policy, since the 1990s, the control objectives of Yangtze River protection has had no clear policy expression, and some traces can be seen only in periodical national mission and plan. In the 1990s, more importance was attached to the development and utilization of water resources in the Yangtze River Basin while the control objectives of Yangtze River protection provided support for the sustainable utilization of the water resources in the Yangtze River; [22]When entering the period of the 15th Five-Year Plan, especially after the revision of "Water Law" in 2002, with the proposal of developing and utilizing the water resources in the Yangtze River, due importance should be attached to the protection of water resources. In this stage, the control objectives of Yangtze River protection is comparatively fuzzy, so there is need to coordinate between protection and development. But due to disordered arrangement, problems like industries bristling along the river, urban upgrading accelerating and shorelines encroaching badly have actually been aggravated; till January, 2016, "things have changed". At the first symposium held in Chongqing to promote the development of the Yangtze River Economic Zone, General Secretary Xi Jinping proposed to "enhance extensive protection and avoid further development", which laid a good foundation for the control objectives of Yangtze River protection in the new age.

But in the course of actual implementation for over two years, some one-sided ideas have been formed: some think to enhance extensive protection but to avoid further development means not to develop; others think environmental cost has to be

[20] Refer to Chen Yanhui: "Study on Environmental Policy Legislation ——— Reflection Based on the legislative Model of China's Basic Environmental Law", China University of Politic Science and Law Press, 2012, Page 36.

[22] Refer to Legislative Research Group on Water Resources Protection in the Yangtze River Basin: "Study on Legislation of Water Resources Protection in the Yangtze River Basin", published in "Jurisprudence of China", 2nd issue, 1999.

paid in order to catch up with the development stage, which reveals a lack of understanding of the importance of extensive protection. In response to this, at the second symposium held in Wuhan to promote the development of the Yangtze River Economic Zone, General Secretary Xi Jinping made an important judgment[23]: First, to reveal the nature of "enhancing extensive protection and avoiding further development" is to correctly handle the relationship between environmental protection and economic development, the two of which are not self-contradictory but a dialectical unity. it is not right to drain the pond to get all the fish for the sake of economic interest and it is even not right to give up economic development and milk the bull; second, he pointed out the connotation of "enhancing extensive protection and avoiding further development" and to attach importance to the protection of ecological environment is the precondition while avoiding large-scale development is a problem of economic development and is a result. At the same time, he also analyzed the relationship between "ecological priority" and "green development", and the latter emphasizes the future as well as direction and path. Besides, with regard to the latter, ecological priority is the problem of ecological environmental protection, and is a precondition while green development is the problem of economic development, and is a result. Hence, the control objectives of Yangtze River protection policy have been basically formed.

In terms of specification property, these policy control objective mentioned above belongs to Yuan Policy in the public policy system, which is policy's policy. Its effective execution will contribute to the overall improvement of public policy system and thus achieve optimized policy outcome. After proper positioning, a more important problem is to consider why to make arrangement for policy control objectives and how to implement these policy control objectives.

As to why to make arrangement for policy control objectives, on the one hand, analyzed in terms of problem phenomenon and according to the related theories of public policy, "the conditions for the emergence of a problem phenomenon should meet is that there must exist an identifiable objective situation, strong public demand and obvious policy needs", and "the key factors which influence the recognition of a policy problem include political parties and political leaders, interest groups, crisis or special event, protest, mass media as well as differences between new and old things".

[24]However, the emergence and recognition of the control objective of Yangtze River protection policy in the new age can also return to the above theoretical

[23] Xi Jinping: "Speech at the Symposium on Promoting the Development of the Yangtze River Economic Zone" , published in "People's Daily", June 14, 2018.

[24] Zhang Guoqing: "Introduction to modern public policy", Peking University Press, 1997, Page 123 below.

analytical framework of public policy. Given the rationality of the control objective of Yangtze River protection policy, this essay will not discuss in detail; on the other hand, in terms of the nature of the problem, to answer the question "Why to set the policy control objective such as "enhancing extensive protection and avoiding further development" as well as "ecology first, green development" depends on the understanding of civilization. No matter whether to view civilization as a fact or a concept, it will be regarded as the starting point of science. [25]Civilization is a concept of history in contrast to ignorance and savagery, [26] the most classic explanation of its meaning comes from Kohler, a German jurist. Later, it was carried forward by neo-Hegelians in the jurists of social philosophy, who think that "civilization is the social development which maximizes human power", and the word "maximize" means "human beings, for the sake of their own interest, control the nature on a largest scale, even including the control over human nature.

[27]Enlightened by Kohler, Pound, an American jurist pointed out that "civilization is the constant and sound development of human power, the maximum control over the external or material nature as well as the controllable intrinsic human nature[28].

This brings two revelations for us: one is that human's maximum control over the external nature is progress of civilization; another is that control over the inherent human nature is aimed to make it inherit the world and also retain and increase what they have inherited, which is also a progress of civilization.

Based on the analysis, ecological civilization[29], as a form of civilization, does not deny human their maximum control over the external nature; but it cannot be neglected that ecological civilization needs to control the inherent nature of human beings, and instead the latter can meet human's need to control the external nature to the largest extent.

On the contrary, the control objective of Yangtze River protection policy completely agrees with the thinking logic: not to promote further development doesn't mean not to develop, because not to develop is a regression of civilization, but not to develop extensively suggests that development should be restricted and should be made under the precondition of enhancing extensive protection and putting ecology on top priority. To go on a road of green development and not to make excessive development is a favorable benefit distribution to meet human's maximum interest requirements.[30]

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[25] Refer to [US] Roscoe•Pound: "Social Control through Law", the Commercial Press, 2013, Page 8.
[26] Refer to Zhuo Zeyuan: "Theory about Law", Law Press, 1999, Page 212.
[27] [US] Roscoe•Pound: "The Interpretation of Legal History", the Commercial Press, 2013, Page 192.
[28] [US] Roscoe•Pound: "Social Control through Law", the Commercial Press, 2013, Page 8.
[29] "Ecological Civilization" was first started by policy decisions, and the Amendment of "Constitution" in 2018 included it in the Preface, making it the ultimate norms to guide the constitutional life.
[29] Fu Zitang: "Legal Function Theory", China University of Politic Science and Law Press, Page 114.

As to the question of how to implement these policy control objectives, it can be solved by the internal execution of the policy system. The superiority of the method lies in its flexibility and time-validity, and in practice it can adjust measure to local conditions. But its disadvantage is that it is lack of stable expectation and strong backing, which goes against the stable and endurable protection of the Yangtze River. Hence, to speed up the legislative process of Yangtze River protection and to establish the rigid constraint mechanism of ecological environment [31]have become the major task in the current special time and space, and particularly the first task is the legal transformation of the control objectives of Yangtze River protection policy.

—— Legal Transformation of Policy Goals

In terms of legal principles, the internal formative structure of law, from abstraction and concreteness, includes three elements: the value of law —— the rule of law —— legal principle. The legal transformation of the above control objectives of Yangtze River protection policy is directly concerned with the establishment of legal principles of Yangtze River protection, but has indirect impact on the other two elements.

"Enhancing extensive protection and avoiding further development" and "ecological priority and green development" in the control objectives of Yangtze River protection policy indicate in effect the interest order of ecological primacy, and are defined in the policy as a system interest pattern, which suggest when ecological interest and economic interest need to be measured, ecological interest should be given priority. If transforming this policy interest order into law, a normal order is formed, which will directly influence the establishment of the legal principles of Yangtze River protection, that is ecological interest should be include in the Yangtze River Conservation Act as a legal principle. At the same time, the above principle is in line with the preferential protection principle in "Environmental Protection Act", which lays a foundation of legality for the legal transformation.

The principle of ecological priority, as a legal principle in the Yangtze River Protection Act, plays a structural function, i.e. bearing function of the value of law and the governing function of legal principle. [32]The bearing function of the value of law is reflected through the principle of ecological priority or the consistency between the achievable value and the legal value of Yangtze River Protection Act; [33]the principle of ecological priority is created because of adjusting the relationship

[30] Xi Jinping: "Speech at the Symposium on Promoting the Development of the Yangtze River Economic Zone", published in "People's Daily", June 14, 2018.

[31] Refer to Wang Jiang: "The Interpretation and Reflection of *the Liability Principle* of Environmental Law -Damage ---- the Main Line of the Structural Function of the Legal Principles", published in "Law Review", 3rd issue, 2018.

[32] Refer to Yang Jian: "Normative Study on Legal Principles", published in "Northern Legal Science", 5th issue, 2011.

between the ecological protection and economic development in the Yangtze River at present stage. It is aimed at the old tradition of correcting "treatment after pollution" and "environmental cost at the development stage", to guarantee the resources of the Yangtze River for the later generations, so the value of upward search is ecological safety and ecological justice.

The governing function of legal principle is embodied by the fact that the principle of ecological priority can make a foundation and source for the stability and integrity of the legal principles of [34]Yangtze River Protection Act, [34]which should be focused on the principle of ecological priority, and put all kinds of rights and powers to their proper position according to the established normal order, especially including but not limited to properly handling the relationship between right to life, right to development and environmental right; properly handling the relationship between individual right and public right; properly handling the relationship between public law right and private law right; properly handling the relationship between ownership, right to use and right of management in the river basins, [34]and so on.

② Response of Question of Reality: List and Its Legal Runaway

Yangtze River protection legislation is a typical responsive law, responding to the practical problems in Yangtze River protection. These practical problems will turn into the major control objectives in Yangtze River protection legislation. Therefore, it's of utmost importance to "take the pulse" of "Yangtze River Diseases".

—— List of Practical Problems

The diagnosis of "Yangtze River Diseases" is very scattered and one-sided at earlier stage, which can be seen in the Five-Year Plan in different periods as well as essays and reports by experts and scholars, but haven't been integrated authoritatively. In the meantime, due to the quick transformation of "Yangtze River Diseases", besides some common questions in the past, there will be other special problems at some stages, which is hard to "diagnose". However, when entering the period of the 13th Five-Year Plan, there was systematic and authoritative diagnosis of "Yangtze River Diseases", mainly including but not limited to the following problems, which are summarized in the form of table, as can be seen in Table 1.

Attached Table 1 List of Key Problems of "Yangtze River Diseases"

Name of Problem	Major Symptoms	Source of Diagnosis
Water environmental pollution is	The total discharge of waste water in the Yangtze River Economic Zone accounts for above 40% of the national discharge. The discharge intensity of volatile organic compound s such as chemical	"Environmental Protection Plan for the Yangtze River Economic Zone" (2017)

[33] Refer to the previous note ③, an article written by Yang Jian.
[34] Refer to Lv Zhongmei and Chen Hong: "Reflection on Yangtze River Legislation", published in "Environmental Protection", 18th issue, 2016.

serious.	oxygen demand per unit area, ammonia nitrogen, sulfur dioxide, and oxynitride is 1.5 to 2 that of the national average.	
Water resources development is in disorder.	Up to the end of 2017, 10 provinces have built 24,100 small hydro-power stations, whose minimum spacing is only 100 meters and their development intensity is powerful; there are 501 companies which get water without permission and 60 companies which get water excessively.	"Audit results of ecological environmental protection of for the Yangtze River Economic Zone" (2018)
Water ecology is severely spoiled.	The diversity index of aquatic organisms in the Yangtze River keeps decreasing, and a variety of rare species are endangered. Roes and fries of Chinese sturgeon, acipenser dabryanus, common sucker and "four major Chinese carps" declined dramatically. The species of fish endangered in the upper reaches of the Yangtze River accounts for 40% of the total species in the country, among which Chinese river dolphin has been in functional extinction and cowfish has been extremely endangered.	"Environmental Protection Plan for the Yangtze River Economic Zone" (2017)
Shorelines are abused and occupied.	First, the shoreline utilization and distribution in some areas is not reasonable, which will have some impact on flood control safety, flow stability, water supply safety and ecological environment protection; second, layout of many industries along the river lead to the high exploitation and utilization of shorelines along part of the river sections, short supply of shoreline resources; third, part of the river sections have low use ratio, the phenomena of "to occupy but not to use, to occupy more but to use less and to use less deep water are commonly seen, and the waste of shoreline resources is serious; fourth, "each department acts its own and each does things in its own way"; management means like effective market and economic regulation and control are in short supply.	"General plan for the protection, development and utilization of the Yangtze river shoreline" (2016)

The environmental risk is big.	Because heavy chemical industries densely cover the Yangtze River, risk of contamination of drinking water sources keep increasing, and especially 30% of the environmental risk businesses in the Basin are located within 5 kilometers round the drinking water source. Risk of transportation leakage of hazardous chemicals also keeps increasing, and annual throughput of hazardous chemicals at the main ports of the Yangtze River has reached 0.17 billion tons, with an average throughput increasing 10% per year.	"Environmental Protection Plan for the Yangtze River Economic Zone" (2017)
The ecological system is fragmented.	The coordination mechanism of resources and ecological interest in the upper, middle and lower reaches of the Yangtze River has not been established, lack of large integral, professional and coordinated regional cooperation platforms. The ecosystem pattern in the Yangtze River Economic Zone has undergone dramatic changes: in the recent 20 years, the town area has increased 39.03%, some large urban areas have increased remarkably, and ecosystem areas like farmland, forest, grassland, rivers and lakes as well as wetland have decreased.	"Environmental Protection Plan for the Yangtze River Economic Zone" (2017)

—— The Current Water-related Law Failed to Solve the Problem of the Yangtze River Basin

A. Special Water-related Laws and Regulations

One is the national legislation. Now, in our country, centered on "Water Law", we have made systems of water law applicable to the whole nation, including 3 laws such as "Water Law", "Flood Control Act" and "Soil and Water Conservation Law", 9 administrative laws and regulations such as "Flood Control Regulations", "Draught Resisting Regulations", "Hydrology Regulations", "Regulations on Water Licensing and Collection of Water Resource Fees", "River Regulations", "Regulations for the Implementation of the Law on Soil and Water Conservation", "Regulations on Dam Safety Management of Reservoirs", "Regulations on Compensation for Land Expropriation and Resettlement for Construction of Large and Medium-sized Water Conservancy and Hydro-power Projects", "Temporary Compensation Measures Applied in Flood Storage and Detention Areas", and other 50 rules and regulations.

Another is concerning the Yangtze River Basin. After the publication of "Water Law", water conservancy legislation in the Yangtze River Basin has also developed from zero to one. In 2001, the State Council issued "Regulations on Sand Mining in the Yangtze River", and revised "Regulations on the Construction of the Three Gorges Project on the Yangtze River". In 2003 and 2008, Ministry of Water Resources issued two regulations respectively including "Measures for Implementing Regulations on

Sand Mining in the Yangtze River" and "Measures for the Control of Water Resources and River Courses in the Three Gorges Reservoir Area". In the recent 10 years, in response to the management of the Yangtze River, the State Council and Ministry of Water Resources issued dozens of legal documents to regulate water-related activities. They also authorized Yangtze River Commission with responsibilities of water administration, such as "Yangtze River Flood Prevention Program", "Notice on Examination Authority of Construction Projects within the Scope of River Management in the Yangtze River Basin"(1995), "Notification on Granting Water Access Permission to the Yangtze River Water Conservancy Commission"(1994), "Notice concerning Administrative Penalties and Limits of Authority for Administrative Measures Stipulated by the Flood Prevention Law of the River Basin Administrative Authority"(1999), and so on.

- The third is the legislation in terms of administration. Local legislation in different administrative regions in the Yangtze River Basin has also made rapid progress. After the publication of new "Water Law", many provinces (municipalities directly under the Central Government) successively introduced measures for implementation and also introduced local administrative regulations in terms of management and protection of water resources, management of river courses and lakes, management of water resource energy, soil and water conservation, farm irrigation, and water conservation.

B.Other Water-related Rules and Regulations

While making great achievement in special water legislation, other water-related regulations are also introduced including laws concerning ecological environment such as "Water Pollution Prevention and Control Law", "Nature Reserve Regulations", "Detailed Rules for Implementing the Water Pollution Prevention and Control Law", "Provisions for the Administration of Pollution Prevention and Control in Water Source Protection Areas", laws concerning agriculture, forestry and land such as "Fisheries Law", "Land Management Law", and "Wildlife Conservation Law", and also laws concerning transportation such as "Port Law", "Waterway Regulations", "Navigation Regulations", "Regulations on Waterway Transport", "Regulations on Traffic Safety in Inland Waters", as well as "Renewable Energy Law" and "Urban Water Supply Regulations". Different departments also made many regulations concerning water resources, especially in terms of water pollution control, fisheries management, transportation management, energy management, land management, urban water supply, safe production and wetland protection. Other departments have legislation in the Yangtze River Basin, too, such as "Administrative Provisions for Yangtze River Trunk Bridge as well as the Setting and Maintenance of Regional Aids to Navigation", "Measures for the Administration of Navigation Safety in the Water

Traffic Control Area of the Three Gorges Dam on the Yangtze River", "Provisions for the Prevention of Pollution of the Waters of the Yangtze River by Ship Refuse and Coastal Solid Waste", "Measures for Water Safety Management of the Yangtze River Main Line", and "Regulations on the Management of Fishery Resources in the Yangtze River". In terms of administration concerning water pollution control, fisheries management, transportation management, energy management, land management, urban water supply, safe production and wetland protection, other industries also issued many local water-related regulations.

C.Major Problems that Exist

One problem is the disorder of legislative layout and legislative structure. According to the level of legal effect, the legal system in the Yangtze River Basin can be divided into several levels including institution, law, regulation, rule and normative documents. The disorder of legislative layout and legislative structure is mainly reflected in three aspects: First, in terms of law, now only "Water Law" has definite regulations on the river basin management, and other water-related regulations made little progress and promotion, some even becoming weaker such as "Soil and Water Conservation Law"; theoretically, management of water resources is not the problem at the same level as soil and water conservation, flood control and water pollution control. In terms of legislation, "Water Law" is the leader of water law system, whose legal effect is superior to laws like "Flood Control Law" and "Soil and Water Conservation Law". however, in effect, "Water Law", "Water Pollution Prevention and Control Law", "Soil and Water Conservation Law", "Flood Control Law", "Fisheries Law" and "Channel Law" are all made by the Standing Committee of NPC and have the same legal effect. For many years, the management system of the combination of basin management and regional management established by "Water Law" has made little progress. Second, in terms of laws and regulations, the comprehensive management of the river basins is based on administrative regulations, but there are very few administrative regulations on the special problems concerning the Yangtze River and they tend to be very simplex. Third, in terms of regulation and normative document, though they are in great number, they have weak legal effect and poor coordination, and moreover, the comprehensive management of the Yangtze River are often concerned with many water-related departments and have a limited effect.

Another problem is that the current laws and regulations have poor consistency and coordination. In the present departmental legislative system, departments like Ministry of Water Resources, Ministry of Environmental Protection, Ministry of Agriculture, Ministry of Communications, and Ministry of Land and Resources have all made water-related regulations. What "Water Law", "Water Pollution Prevention

and Control Law", and "Fisheries Law" have stipulated is the supervision and administration system focused on the departments in different industries, and the lack of correspondent coordination mechanism between different departments result in poor consistency and coordination. For example, the management system of the combination of basin management and regional management established by "Water Law" as well as "the competent departments of environmental protection of the people's governments at or above the county level shall exercise unified supervision and administration over the prevention and control of water pollution" stipulated by "Water Pollution Prevention and Control Law" lead to the separated management of water resource protection and water pollution control, and even make messy administrative power in water resource supervision and management and water pollution control, which even cause legal conflicts and have negative influence on the unified management of water resources. Legal conflicts are commonly seen in local legislation. Due to the habit of block management in terms of basin management in our country for many years, it's also common to see local laws and regulations on block legislation of the Yangtze River Basin. Without unified legislation goals, block legislation and block management are extremely detrimental, because local legislation put one-sided emphasis on management and neglect basin management. This phenomenon is very common to see in the management aspects like consent to water works planning and examination of construction projects within the scope of river management.

The third problem is its poor pertinence and maneuverability. The present water laws in our country are all made in response to the general situation, unable to reflect the features and problems concerning the Yangtze River Basin. In view of the coordination of the overall water relations of the basin, there exist major limitations as to the comprehensive management of the Yangtze River Basin as well as many special problems in harnessing and development. "Water Law" clearly defines the legal status of the river basin administrative institutes and also stipulates the national management system of the combination of basin management and administrative division management over water resources. However, "Water Law" fails to clearly define how basin management and administrative division management are combined. As to every specific management issue, how the administrative power in basin administrative agency and local water management department is divided, how to combine and where is the combining "point" need to be defined by more specific regulations. "Regulations on sand mining in the Yangtze river" as well as its measures for implementation has greater discretion over the punishment on illegal sand mining in the Yangtze River and the penalty subject of illegal sand mining transportation is not clear enough, which greatly reduces the power of basin management. In terms of

reservoir regulation, "Water Law" and "Flood Control Law" are lack of operable regulations on water dispatch during non-flood season. Besides, a lot of transfer or diversion of water across river basins conducted in the Yangtze River Basin, such as the South-to-North Water Diversion Project, water diversion from the Yangtze River to Taihu Lake, water transfer from the Yangtze River to Chaohu Lake, water transfer from the Yangtze River to Huaihe River, and Hanjiang-to-Weihe River Water Transfers Project, directly impact the reasonable allocation and unified management of the water resources in the whole basin. And they are also lack of specific legal regulations, which increases the difficulty in management work.

The fourth is that the method of basin management has the problem of "double hysteresis". in the development process of basin management, in terms of management concept and organization structuring, it has distinct features of basin management, but in terms of legislation, the construction of water-related regulations is almost completely focused on department legislation and local legislation so that the problem of "double hysteresis" is very conspicuous in basin management legislation. First, basin legislation lags behind national legislation. As the basin management agency has no legislative power, and moreover national legislation on basin management is insufficient, the construction of water-related regulations in the basins obviously falls behind the construction of national water-related regulations and comprehensive basin management legislation is basically blank. Second, basin legislation lags behind local legislation. With the rapid development of regional economy, the contradiction in the development and utilization of water resources sticks out, and water-related legislation in different regions also mends their pace, but only a few are concerned with basin management, which apparently makes basin management legislation lag behind. But it's just "double hysteresis" in basin management legislation that makes basin management short of legal support. There are also problems concerning lack of specific regulations in water laws and lack of pertinence on the Yangtze River Basin.

(2) Legislation Model

① Big Comprehensive Legislation Model

Big comprehensive legislation model means to regard the legislative object as a whole and the interpretation of the whole includes not only lake surface, river surface as well as river levee and river bank but also water, sand and living beings, etc. It can be regarded as both natural resources and environmental elements, with characteristics of rolling development and protection into one, accomplishing the dynamic integration of basin circle and administration circle, highlighting comprehensive plan, scientific criterion and efficient operation. Particularly for the Yangtze River, it's just right to roll development, utilization and protection into one,

highlighting the comprehensive positioning of Yangtze River Law in space control, industry agglomeration and ecological protection, and fulfilling the dynamic integration of basin circle and administration circle, as well as the integrative institution system of economic management, social management, and ecological safety.

② "Small Comprehensive" Legislation Model

Using the current "Regulations on the Management of the Taihu Lake Basin" as a sample, the name of "Regulations on the Management of the Taihu Lake Basin" is aimed to basin legislation but not single factor legislation. Basin refers to the area rivers pass through, focused on water but water is not the most important. The elements in the basin are both environmental elements and natural resources, so the legislative object for the basin is comprehensive and the management content should also be comprehensive. The mission of "Regulations on the Management of the Taihu Lake Basin" is to enhance the water resource protection and water pollution control in the Taihu Lake Basin. It is aimed to guarantee flood control and draught relief as well as the water safety in life, production and ecology, and also it is aimed to improve the ecological environment in the Taihu Lake Baisn. Meanwhile, in this legislation model, system design should be based on the principle of reasonable allocation of central and local authorities, identifying the joint point of central and local authorities and focusing on the problem of the management system in the Yangtze River Basin.

③ Single-line Legislation Model

If not to reform the present management system, only establishing legislation on the the problem concerning the Yangtze River Basin in one aspect or on the problem of ecological environmental protection, we can make single-line legislation similar to "Regulations on Sand Mining in the Yangtze River". Therefore, it's significant to study the legal structure of Yangtze River protection legislation. At the same time, it's necessary to seek theoretical support for Yangtze River protection legislation in terms of legal principle to lay a solid legal foundation for basin legislation.

According to this research, "Yangtze River Protection Law" must be defined as "Comprehensive Method of Basin Development, Utilization and Protection", because only the structure and content of the comprehensive law can meet the demand for "enhancing extensive protection and avoiding further development" in the construction of the Yangtze River Economic Zone, in accordance with the five development concepts of "innovation, harmony, green, open and sharing".

To fulfill the orientation of "ecological priority and green development" in the construction of the Yangtze River Economic Zone, there must be a comprehensive law to make an overall control and planning for the whole basin and all the elements. In response to the problem of region segmentation, "Yangtze River Law", taking into

account by systematic thinking regional reform and development, various regional policies, construction in various industries, various resource elements, is intended to establish a cooperative mechanism in different provinces and cities inside the basins, enhance the joint development of the Yangtze River Economic Zone in the upper, middle and lower reaches as well as the interaction and cooperation between the eastern, central and western parts, and also form the leading demo zone, innovation-driven zone and harmonious development zone for the construction of ecological civilization. In response to the problem of power division, according to the ecosystem rule in the basin, problems like water safety, flood control, pollution treatment, harbor, transportation and view should be taken into consideration as a whole, and to build unified supervision system in the Yangtze River Basin can actually solve the problem of the disordered development of industries along the river and harbor shorelines. In response to the problem of messy planning, it;s advisable to establish multi-regulation system to optimize urban agglomeration layout in the Yangtze River Economic Zone, insisting on integration of big, medium-sized and small cities, linkage of the east, central and west, relying on the three big urban agglomerations of the Yangtze River Delta, the middle reaches of the Yangtze River and Chengyu, the development of the Yangtze River Economic Zone can be enhanced. The "Yangtze River Law" at this level is not a water resource law, water environmental protection law or water economic law, but a legal system based on decisions on the exploitation, utilization and protection of resources in the Yangtze River Basin, the interests of the upper, middle and lower reaches, balanced development of the east, central and western regions as well as coordination between central and local governments; it is also a legal system to comprehensively apply various adjustment methods like administrative law, civil and commercial law, criminal law, economic law, and environmental law and also connect substantial law and procedural law.

(3) **Overall Framework Assumption of Yangtze River Protection Legislation**

In terms of law, guided by the idea of comprehensive management of the basin, "Yangtze River Law" is especially worked out, laws related to basin management like "Environmental Protection Law", "Flood control Law", "Water Pollution Control Law", and "Channel Law" are revised. In terms of legal principle, administrative regulations to deal with special problems concerning the Yangtze River are also worked out, including "Regulations on the Management and Protection of Water Resources in the Yangtze River Basin", "Flood Insurance Regulations for the Yangtze River Basin", "Regulations on Ecological Compensation in the Yangtze River Basin", and "Regulations on Unified Operation and Management of Reservoirs in Dry Tributaries of the Yangtze River". In terms of regulation, in the places and

departments concerning the comprehensive management of the Yangtze River, a series of department and local regulations can be made as needed. In addition, according to the implementation of "Water Law", "Flood Control Law" and "Regulations on Sand Mining in River Courses", a series of legislative interpretation and judicial explanation have been issued to solve the problems like the punishment od serious water offence and to improve the cohesive mechanism in administrative enforcement of law and criminal justice.

When it comes to the Yangtze River protection law especially made, in view of the diagnosis list of the "Yangtze River Diseases" mentioned above, it's right to seek breakthrough from the following aspects. First, as to the problem of water resource conservation, importance should be attached to legislation on unified control of water resource allocation, controlled water engineering project and inter-basin water transfer project management in the basin. Second, as to the problem of water environmental protection, an overall requirement should be proposed, and water functional area management system should be established. Critical consideration should be given to problems like pollution of water-related industries, agricultural non-point source pollution, port pollution, soil pollution, internal pollution as well as river purifying. Third, as to the problem of water ecological protection, due adjustment should be made concerning problems such as water ecological restoration, aquatic biodiversity conservation, fishery protection, wetland protection, protection by connecting river and lake water as well as water-related nature reserve protection. Meanwhile, special chapters should be written to adjust the protection of basin shorelines as well as flood control and disaster reduction, and also activities in shorelines, river course, estuary, dike, flood water storage area, channel and sand mining.

3 Suggestions on the Legal System in the Yangtze River Economic Zone

Legal support is essential for harnessing water legally and enhancing basin management. Yangtze River management is concerned with many departments and 19 administrative regions along the river, so management is hard and it's not enough to rely on negotiation. Only basin legislation can better regulate and adjust the various water-related behavior and interest relationships, and also achieve the aim of basin management, development and protection. Therefore, centered on working out a comprehensive "Yangtze River Protection Law", enhancing basin legislation, formulating single-line regulations and improving the water law system of basin management is an important guarantee for the effective comprehensive basin management.

(1) To Study and Formulate "Yangtze River Protection Law"

Water resources in the Yangtze River Basin play an important role in our national

economy, but the rapid development of the economic society greatly increases the requirements for water resources, and thus water problems in the Yangtze River Basin begin to be prominent. Therefore, basin legislation should be accelerated, management should be enhanced and a most strict water resource management system should be executed. To formulate "Yangtze River Protection Law" is essential for the construction of a perfect water-related legal system in the Yangtze River Basin. Now, no law has been especially made in response to basin management in our country. In view of the important status of the Yangtze River, the management and development of the Yangtze River Basin is concerned with many "rules" and "regulations", interest bodies are diversified and conflicts of interest are also complicated, even including the construction and operation management of major water works concerning basins and national development such as Three Gorges Project, South-to-North water Diversion Project and Yangtze River Estuary Treatment. It's not enough to revise or formulate general water laws and regulations, and comprehensive "Yangtze River Protection Law" can best regulate the complicated water affairs in the Yangtze River Basin.

To formulate "Yangtze River Protection Law" can not be considered for the sake of the interest of industry, department and region, it must be considered in the overall scope of the basin including flood control, hydropower, water supply, shipping, agriculture, fishery, forestry, ecology and environment in multi-department (industry) and multi-region. As "Yangtze River Protection Law" involves a lot of contents, it is not likely to make it specific and fine. Therefore, according to the fundamental legal principles and legal system established by "Yangtze River Protection Law", assorted regulations should be formulated, that is, to make legislation through scientific arrangement, gradually making administrative rules and department regulations based on the order of priority, and thus form a comprehensive management law system in the Yangtze River Basin.

（2）To Enhance legislation on Particular Regions and Problems in the Basin

The release of "Yangtze River Law" is a long-term project, so while steadily promoting its legislation, we should also actively make legislation on the particular regions and special problems in the basin. In terms of law, we should actively carry out the research at the early stage on "Flood Insurance in the Yangtze River Basin" and "Ecological compensation for the Yangtze river basin"; in terms of legal principle, we should draft and study "Regulations on Unified Operation and Management of Reservoirs in Dry Tributaries of the Yangtze River", "Regulations on the Management and Protection of Water Resources in the Han River Basin", "Regulations on the Management and Protection of Water Resources in the Yangtze River Basin", and "Regulations on the Management of the Three Gorges Reservoir"; in terms of

department regulation, we should try to accelerate the publication of “Measures for Water Quantity Control in the Han River Basin”, “Measures for the Management of the Yangtze River Estuary” and “Administrative Measures for Danjiangkou Reservoir Area”.

(3)Scientifically Plan the Draft of Basin Normative Documents

On the one hand, according to the present national laws and regulations, normative documents concerning the Yangtze River Basin should be formulated and published. For example, we should try to draft and revise “Administrative Measures for the Consent Form System of Water Engineering Construction Planning”, “Details of the Water Intake Permit System”, “The Scope and Scale of the Construction Project Examination Consent within the Scope of River Channel Management”, and “Methods for Supervision and Inspection of Water and Soil Conservation in Large-scale Development and Construction Projects in the Yangtze River Basin”; on the other hand, according to national laws and regulations as well as national authorization, within the terms of reference of the basin agencies, a series of normative documents should be formulated and published pertinently and autonomously with regard to the problems concerning the basin treatment, development, protection and management.

(4)Preliminary Research on Key Issues

With regard to the five major regions including the fragile ecological zone in the source of the Yangtze River, hydro-power development concentration area, important water sources, Dongting Lake and Poyang Lake District, as well as estuary, and also in response to the key issues including combined operation of controlled reservoirs in the Yangtze River, transfer water across basins and regions, control of river and lake space use, protection and restoration of water resources and ecological environment, ecological compensation, punishment of serious water offence, preliminary research should be pertinently conducted in order to provide support for basin management legislation.

Special Report II:
Fiscal Policy of Green Development in the Yangtze River Economic Belt

1. Support the Current Eco-Compensation Policy in the YREB

1.1 Promulgate the National Strategic Planning and Regional Development Planning

In recent years, Chinese Government has issued a series of regional plans for the development along the Yangtze River, such as the ***Regional Planning for Yangtze River Delta***, ***the Development Planning for Urban Agglomeration in Yangtze River Delta***, ***Planning of Zhejiang Province for Marine Economic Development Demonstration Zone,*** and ***Development Planning of Zhejiang Zhoushan Archipelago New Area*** specific to Yangtze River Delta; as well as: the ***Planning of Demonstration Zone to Undertake Industrial Transfer in Wanjiang City Belt***, ***Planning of Poyanghu Eco-economic Zone***, ***Comprehensive Reform Pilot Zone to Construct Nationwide Resource-saving and Environment-friendly Society in Wuhan Urban Circle and Changsha-Zhuzhou-Xiangtan Urban Agglomeration***, and ***Comprehensive Reform Pilot Zone for Balance Urban-Rural Development in Chengdu and Chongqing,*** and ***Development Planning for Chengdu-Chongqing Urban Agglomeration*** for the middle and upper reaches of the Yangtze River.

In order to speed up the development of the Yangtze River Economic Belt (hereinafter referred to as "YREB"), Chinese Government promulgated successively the ***Opinions of State Council on Accelerating the Development of Water Transport in the Yangtze River and Other Inland Rivers***, the ***Action Plan for Accelerating the Development of Water Transport in the Yangtze River and Other Inland Rivers (2013-2020), the Comprehensive Planning for the Yangtze River Basin (2012-2030), Guiding Opinions of the State Council on Promoting the Development of the Yangtze River Economic Belt in virtue of the Golden Water Channel*** and ***the Comprehensive Planning for Three-dimensional Transportation Corridor in the Yangtze River Economic Belt (2014-2020)***, etc.

Among them, it is explicitly stipulated in the ***Opinions of State Council on Accelerating the Development of Water Transport in the Yangtze River and Other Inland Rivers*** that, "it is necessary to establish the mechanism of regional interaction and cooperation, establish the mechanism of the coordinated protection and management of ecological environment, and deepen the investment and financing institutional reform for the transportation, and broaden the financing channels for traffic construction". Moreover, it is put forward in the ***"13th Five-Year" Planning for the Protection of the Ecological Environment*** that: "it is necessary to increase the financial investment and broaden the financing channels".

1.2 Current Supporting Financial Policy

The Central Finance actively supports the ecological compensation and protection in the YREB. In 2018, the Ministry of Finance issued the ***Guiding Opinions on Establishing and Improving the Long-term Mechanism for Ecological Compensation and Protection of the YREB*** (CaiYu [2018] No. 19). In the national annual budgetary outlays, the supports for the

eco-compensation and green development of the YREB are mainly embodied in three aspects: 1) general transfer payment from the central government to the local government, including balanced transfer payment; 2) special transfer payment; and 3) the incentive policy for YREB ecological protection and rehabilitation.

1.2.1 Increase the ecological weight in balanced transfer payment

The central government increases the allocation weights of the ecological and environmental factors; raises the financial compensation to the local governments of the relevant provinces (municipalities) in the YREB as their financial revenue reduction and expenditure increase results from the ecological protection, pollution control and emission reduction; and further promotes the eco-compensation and protection in the YREB by means of the balanced transfer payment, so as to ensure that local governments do not lower the level of fundamental public services due to the increased investment or development restriction during the ecological protection.

Since 2008, the Central Government has increased the subsidy coefficient to areas with major ecological responsibilities under the subject of balanced transfer payment, and carried out the pilot work of the transfer payment in key state ecological functional areas. Since the ***Measures for Transfer Payment to Key State Ecological Functional Areas*** (CaiYu [2011] No. 428) was issued in 2011, the state has been increasing the transfer payment to eco-compensation. As shown in Fig. 1 below.

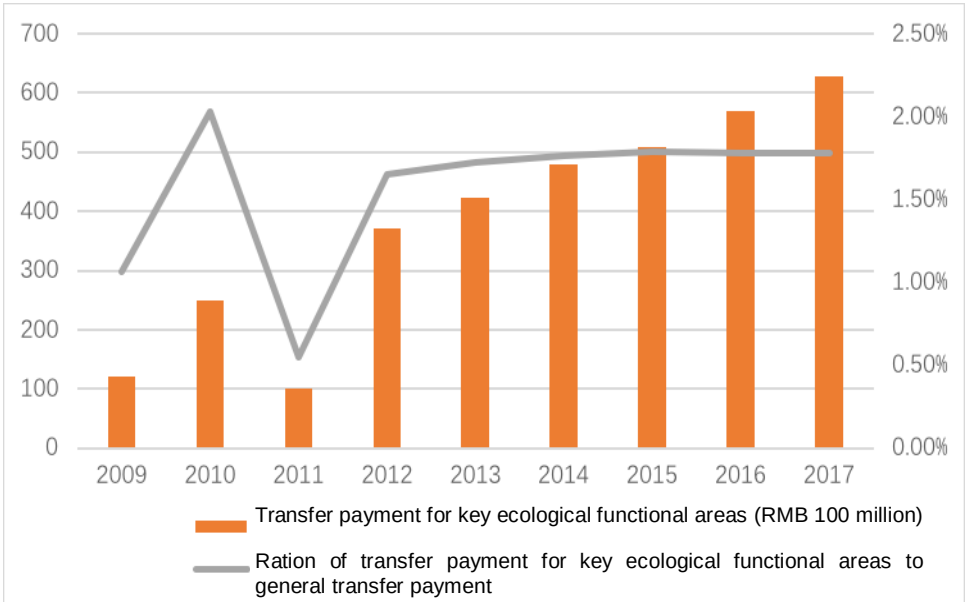

Fig. 1 transfer payment from the central to key ecological functional areas

In August 2017, the Ministry of Finance released the ***Measures of Transfer Payment for the Central Finance to Key Ecological Functional Areas*** (CaiYu [2017] No. 126), the transfer payment subsidized to key ecological functional areas shall cover: key subsidy, development-prohibited subsidy, guidance subsidy, subsidy to forest ranger and incentive funds (possibly positive or negative). In the ***Circular on Transfer Payment for the Central***

Finance to Key Ecological Functional Areas issued in 2018 (CaiYu [2018] No. 86), the Ministry of Finance released the distribution of transfer payments from the Central Finance to local key eco-functional areas in 2018.

The state transfer payment to key ecological functional areas covers all provinces and municipalities along the Yangtze River, and the relevant areas shall be subsidized by sort in terms of the ecological type, financial capacity, and poverty degree, reflecting differences and highlighting the focus. The emphasis shall be laid on the key ecological counties, the serious poverty-stricken areas in the provinces and municipalities along the Yangtze River and "three districts and three prefectures" (Tibet, Tibetan areas in four provinces, four prefectures in southern Xinjiang, Liangshan Prefecture in Sichuan, Nujiang Prefecture in Yunnan, and Linxia Prefecture in Gansu). Subsidies for key ecological counties shall be calculated according to the criteria of fiscal revenue and expenditure gap and allowance coefficient. In 2018, the Central Finance made transfer payment of total RMB 72.1 billion to key ecological functional areas; among them, total RMB 29.558 billion to nine provinces and two municipalities in the YREB, accounting for 41%. The transfer payment of the Central Finance was allocated to various provinces and municipalities in Table 1.

Table 1 allocation of transfer payment of the Central Finance in 2018

Region	**Transfer payment of the central government to local key ecological functional areas, RMB100 million**
Total	721.00
Shanghai	0.68
Jiangsu	2.03
Zhejiang	4.86
Anhui	20.54
Jiangxi	25.68
Hubei	33.30
Hunan	44.49
Chongqing	24.23
Sichuan	42.73
Guizhou	52.81
Yunnan	44.23
Subtotal of the YREB	295.58

1.2.2 Increasing the direct compensation to the YREB from the transfer payment for key eco-functional zones

It is necessary to increase budgetary outlay for transfer payments to key eco-functional zones, adjust the allocation structure of transfer payments to key eco-functional zones, improve the assessment & evaluation system of ecological quality at county level, increase

direct eco-compensation for the YREB, and preferentially support the development-forbidden zone, development-restricted zone and upper reaches of the YREB, so as to improve the ecological protection and people's livelihood in the areas with important ecological functions in the YREB. In 2018, the subsidies for the YREB up to RMB 4.0 billion were separately listed under the transfer payment to key local eco-functional zones by the central government, which were calculated in terms of the ecological red line, forest area, and population and so on. As shown in Table 2 and Fig. 2.

Table 2 allocation of subsidies for the YREB in 2018

Region	**Subsidies for the YREB (RMB 100 million)**
Shanghai	0.46
Jiangsu	1.35
Zhejiang	1.42
Anhui	3.42
Jiangxi	4.86
Hubei	3.24
Hunan	4.01
Chongqing	3.13
Sichuan	5.81
Guizhou	4.65
Yunnan	7.65
Total	40

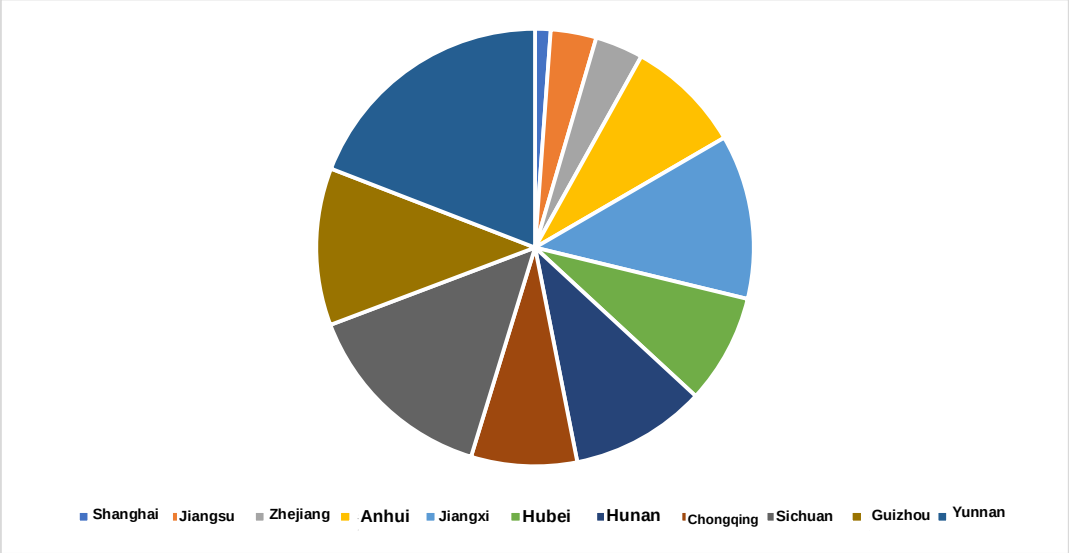

Fig. 2 allocation of subsidies for the YREB in 2018

1.2.3 Increase the special projects for the YREB

The priority shall be given to the YREB through forestry reform and development funds, forestry protection and restoration funds, and subsidies for energy conservation & emission reduction with purposes to support the forest resources cultivation, natural forest management

and protection, wetland protection, ecological migration, energy conservation and environmental protection. Taking major ecological restoration projects as a priority to develop the YREB, the Central Government will increase its support to the construction of shelter forest system in the YREB, soil erosion and rock desertification control projects in Karst areas.

1.2.4 Implement the incentive policy for ecological protection and restoration in the YREB.

In January 2018, the Ministry of Finance promulgated the ***Implementation Plan for the Incentive Policy of the Central Finance to Promote the Ecological Protection and Rehabilitation in the YREB*** (Caijian [2018] No. 6), the incentive policies shall be implemented to 11 Provinces (municipalities) in the YREB, in order to further mobilize the enthusiasm of local governments for ecological protection and restoration, and guide the local governments in the YREB to implement the watershed protection and management. These policies mainly involved three aspects: 1) reward the provincial governments at the upstream and downstream with a compensation agreement signed and horizontal eco-compensation mechanism established for the ecological protection in river basin, in order to encourage the neighboring provinces to establish the horizontal eco-compensation mechanism; 2) reward the administrative region at the provincial level with horizontal eco-compensation mechanism established; 3) reward the provinces with outstanding achievements in the protection and management of river basins, so as to guide the local governments to implement the development plan outline of the YREB, the action plan for water pollution prevention and control, and the strictest water resources management system to protect the ecological environment of the YREB. Considering that Qinghai Province and Tibet Autonomous Region are situated at the source of the Yangtze River, they shoulder an important responsibility to protect the ecological environment of the YREB, the appropriate quota subsidies shall be implemented specific to them. The incentive funds shall be arranged according to the performance evaluation, which are appropriated at firstly and settled at the end of term. Such incentive policies will be effective from 2018 to 2020.

1.2.5 Actively encourage the social forces to participate in the ecological protection and construction of the YREB

It is allowed that the local governments regulate debt financing, introduce PPP projects into the ecological protection, explore pilot experiences in eco-compensation, such as emission trading and water rights trading, implement third-party treatment of environmental pollution, and attract and leverage more social capital into the ecological construction.

1.2.6 Support green development

For example, it is proposed in the File (JiaoShuiFa [2017] No.114) by the Ministry of Communications that, the transportation authorities at all levels shall make full use of the central and local funding policies; actively consult the relevant sectors to increase policy and financial supports; lower limitation to market access for intensive and efficient transport mode;

foster green and eco-friendly port and shipping enterprises, and establish an incentive mechanism for green development; explore how to form a mechanism for public participation in green shipping and supervision system; make full use of the market mechanism to introduce social capital to the green shipping; speed up the pollution liability insurance of river vessels, and encourage shipping companies to explore the mutual insurance of the Yangtze River green shipping.

1.3 The government at provincial level and below

The provinces and municipalities in the YREB actively support eco-compensation and green development through increasing the financial supports and expanding the financing channels.

For example, it is clarified in the ***"13th Five-Year" Ocean Planning of Shanghai*** that, it is necessary to set up the reserve of public welfare and fundamental project, such as marine infrastructure, marine science & technology innovation, marine ecological protection, and marine comprehensive management, and increase the financial support at both urban and rural levels. The financial institutions are encouraged to strengthen credit support for fundamental projects and marine high-tech projects, such as marine infrastructure, marine ecological protection. It is necessary to actively explored to establish the market system of investment and financing for marine-involved enterprises and form a long-acting mechanism for diversified investment into the marine industries. The role of market mechanism shall be fully played to support various social bodies to participate in the development and construction of port and waterway infrastructure, marine ecological protection, marine equipment manufacturing, and innovation of major marine science and technology through direct investment, joint ventures and cooperation, etc.

It is stipulated in the ***"13th Five-Year" Development Planning for Chongming World-Class Ecological Island*** that, it is necessary to strengthen the finance and investment supports at levels of municipality and district, increase the municipal financial support to Chongming Island, strengthen the balanced transfer payment from the municipality to district, innovate the measures for eco-compensation transfer payment, strengthen the utilization and management of transfer payment funds, and improve the efficiency of transfer payment funds; optimize the financial support policies for major ecological projects and major infrastructure projects benefiting the whole municipality and even the Yangtze River Delta; reform and improve the investment and construction mechanism for major projects in Chongming Ecological Island. Chongming District Government shall further optimize the structure of financial expenditure, increase input into ecological island and social undertakings, and strengthen financial support for the grass-roots units such as towns and villages.

It is necessary to innovate the investment and financing mode; develop the diversified investment and financing channels and introduce policy financial institutions; the PPP mode of cooperation between government and social capital shall be promoted for eligible projects;

It is necessary to closely cooperate with the international financial organizations to support the demonstration projects of energy conservation and emission reduction and green loans.

1.4 Summary of funding sources

According to the investigation and evaluation on policy review, the main sources of funds to support the eco-compensation and green development of the YREB can be divided as follows: 1) the financial investment, including general transfer payment, special transfer payment, and incentive funds; 2) policy-based finance; 3) public-private partnership (PPP); 4) loan from the international financial organization; 5) credit guarantee; and 6) enterprise donation.

2. The deficiencies and constraints of the current supporting financial policy

2.1 The funds are mainly provided by the government and sourced from the financial support, which is not so based on the market mechanism.

From the perspective of current fund sources for eco-compensation and green development in the YREB, the governments are still main providers of funds, and most of the funds are from the general public budgets of the central and local governments, including general transfer payments, special transfer payments and horizontal transfer payments. Generally speaking, the market mechanism gives very limited role in raising funds, which has not been linked with related projects of ecological economy and green development. The path has not yet been fully gotten through to compensate the ecological losses by economic development.

2.2 The total amount of funds is still relatively insufficient, and the mechanism has not yet been established for circular utilization of funds

The total amount of funds is still relatively insufficient in terms of eco-compensation and green development in recent years. Anyway, since the majority of the funds are sourced from the government finance, the situations are gradually deteriorated with the slow growth of financial funds; moreover, the demand of eco-compensation and green development for funds is bound to increase with the continuous improvement of industrialization and urbanization, the funds will be increasingly tight in future. The vast majority of the funds that have been input are one-time cost, which has not yet been recycled. Due to low use efficiency, it is not conducive to the long-term sustainable development of eco-compensation in the YREB.

2.3 The fund support is mainly based on market mechanism in developed areas

In the developed areas, the financial support is relatively abundant and more sufficient from the perspective of capital sources; moreover, the sources of funds are more diversified, including policy-based finance, green finance, PPP model, enterprise compensation and so on. The market mechanism plays more roles than that in the underdeveloped areas in the upper

reaches; therefore, the financial support is relatively adequate.

2.4 The underdeveloped areas are mainly located in the upper reaches, which are the top priority of eco-compensation and green development, facing both economic development and ecological constraints.

There are prominent contradictions in 11 provinces and municipalities in the YREB generally, namely the relatively developed provinces are located at the lower reaches of the YREB, while the relatively underdeveloped provinces at the upstream. In view of eco-compensation and green development, the upstream ecosystem conservation has a great impact on the downstream, therefore the upstream has more important task of eco-compensation and green development, while the upstream provinces are facing enormous pressure of development due to their underdeveloped economy. With a policy-based ecological restriction attached now, it is worse than ever. Therefore, on the basis of actively considering the eco-compensation by the downstream to the upstream, it is necessary to set up a relatively reasonable interaction and co-governance mechanism between the downstream and upstream provinces.

2.5 The interaction mechanism and system of cross-regional cooperation has not yet been established between the upstream and downstream, eco-protectors and beneficiaries, so it is difficult to establish the incentive and restraint mechanism and play scale effect.

The YREB covers 11 provinces and municipalities, including Shanghai, Jiangsu, Zhejiang, Anhui, Jiangxi, Hubei, Hunan, Chongqing, Sichuan, Yunnan and Guizhou, with an area of about 2.050 million km^2, and both total population and gross value of production over 40% of GDP. The economy maintains rapid growth in the YREB. In 2017, the growth rate of gross value of production in all provinces above was over 6.9%, among them, Guizhou Province ranked the 1st, reaching 10.2%. However, there are quite imbalance in the level of economic development and financial situations among the 11 provinces and municipalities. The interaction mechanism and system of cross-regional cooperation has not yet been established between the upstream and downstream, eco-protectors and beneficiaries, so it is difficult to establish the incentive and restraint mechanism and play scale effect.

3. Case Analysis on Eco-Compensation and Regional Cooperation in Chishui River Basin

3.1 Institutional arrangement for horizontal eco-compensation in Chishui River Basin

A regional cooperation agreement has been signed among three provinces (Sichuan, Yunnan and Guizhou) in the Chishui River Basin (a tributary of the upper Yangtze River). Three provincial people's governments jointly invested RMB 200 million to set up a horizontal compensation fund for water environment of Chishui River Basin. The proportion

is 1: 5: 4 for contributions from Yunnan, Guizhou and Sichuan. The compensation funds are allocated to three provinces as a proportion of 3: 4: 3. They jointly set up compensation weights section by section according to the setting assessment section, ecological environment function, and difficulty in protection and management. The compensation funds and management tasks were broken down to the responsible cities and counties. Such compensation funds are mainly used for watershed ecological protection and management, water pollution prevention and control.

The compensation funds will be liquidated section by section according to the compensation weight of each section and the compliance rate of sectional water quality specified in the agreement. The region where the water quality meets the assessment target, will receive the full amount of compensation fund; the region with partly compliance of water quality can receive the amount calculated in view of qualified water quality and quantity; for the region with completely incompliance of water quality, the compensation fund shall be deducted entirely. In principle, the deducted fund is used to compensate the downstream provinces of which have signed the agreement.

3.2 Case Analysis

The regional cooperation pilot of eco-compensation in Chishui River Basin has typical significance.

The initial exploration of regional cooperation in eco-compensation among three provinces in China: There are several cases that watershed eco-compensation between two adjacent provinces have been successfully carried out in China, and horizontal transfer payment mechanisms have been established between two provinces under the guidance and support of the Central Finance; for example, Xin'An River Basin management between Zhejiang and Anhui. The case that a mechanism of co-governance is explored to establish among three provinces in Chishui River Basin will provide a reference for further cooperation in the YREB in future.

The conditions for pilots to develop the diversified and market-oriented eco-compensation modes: 1700 wineries along Chishui River are closely related to the eco-compensation. According to the investigation, these enterprises attach importance to water source management and support the ecological protection by investing in sewage treatment and donating the environmental funds. It is possible to further explore how to establish the diversified financing mechanism to attract all sectors of society to participate in the ecological protection in the Chishui River Basin.

Considering the financial and economic status of three provinces, it is advisable to establish a diversified co-governance mode with government leading and enterprise involving at the initial pilot stage in Chishui River Basin.

The cooperation among three provinces just takes the first step, it is necessary to further observe its effect.

4. Countermeasures and Suggestions on Eco-Compensation and Green Development in the YREB

4.1 Build a diversified investment and financing mechanism in the YREB with government guidance, market operation and social participation.

In view of the insufficient funds for eco-compensation and green development in the YREB at the present stage and possible even worsen in the future, it is suggested to actively build a diversified investment and financing mechanism with government guidance, market operation and social participation in the YREB. As public goods with typical positive externalities, eco-compensation and green development shall obviously be provided by the government firstly. The government shall play a more leading role in the process of practical operation, and the financial funds shall play a greater multiplier effect to leverage the market and social funds to participate in as possible.

4.2 Further play the ecological function of general transfer payment

In view of types of financial funds concerned, general transfer payment is one of the important forms of financial support in recent years; however the ecological function of general transfer payment is relatively weak. It is suggested that, when calculating general transfer payment from the central to the local, the ecological functional indexes shall based on some environmental factors, such as geographical location, topography, vegetation coverage and ecological status, and the higher weight shall be given to increase financial support for key ecological protection areas in the YREB.

4.3 Appropriately integrate special transfer payments to form a joint force for ecological protection

As for the governmental supports for eco-compensation and green development, the special transfer payment is a more suitable form of support in the past few years. With the reform direction of reduction and merging the special transfer payment in financial funds in recent years, the original scattered special transfer payment for eco-compensation and green development shall be appropriately integrated to gradually form a joint force of ecological protection and solve the issue of insufficient funds and occupation of part financial funds by the special transfer payment.

4.4 Establish the interaction mechanism of cross-regional cooperation between the upstream and downstream, eco-protectors and beneficiaries to cover wider areas

It is necessary to establish the interaction mechanism of cross-regional cooperation between the upstream and downstream, eco-protectors and beneficiaries to cover wider areas, even for the whole basin, so as to form a fair, reasonable and long-acting cooperation mechanism to achieve benefit and cost sharing. Of course, such mechanism also needs a series of technical supports and corresponding institutional design, such as environmental

monitoring, ecological service value accounting, ecological contribution and opportunity cost.

4.5 Establish the "horizontal transfer payment eco-compensation fund" in the Yangtze River Basin.

It is recommended to establish the "horizontal transfer payment eco-compensation fund" in the Yangtze River Basin through establishing horizontal transfer payment system to cover wider areas, or even the whole basin. The funds may be sourced from the horizontal transfer payment funds for eco-compensation, the consolidated and pooled financial funds originally related to ecological protection, and a certain proportion (e.g.: 30%) of environmental tax revenue. A dynamic adjustment mechanism shall be formed to link with the growth of fiscal revenue.

4.6 Broaden sources of funds, attract and lever more social capital

It is recommended to broaden the sources of funds, and attract and leverage more social capital, mainly including: 1) actively apply the policy-based finance; 2) illegally apply PPP, stabilize the sources of revenue and expectations of PPP eco-environmental projects, increase government purchasing services, and encourage the qualified enterprises and institutions to participate in medium and long-term investment and construction; 3) establish a compensation & payment mechanism for beneficiary enterprises. It is possible to consider to levy a reasonable additional fee on the sales income of the beneficiary enterprises and industries (e.g.: liquor enterprises, mineral water enterprises, and power stations) directly utilizing natural resources in the Yangtze River Valley, and establish an eco-compensation fund for the YREB; 4) improve and implement the green finance in place; and 5) explore the financing modes, such as emission right mortgage; explore how to popularize the experiences of eco-compensation pilot, such as energy conservation, watershed water environment, wetlands, carbon emissions trading, emissions trading and water rights trading; implement third-party pollution control, attract and leverage more social capital into the ecological construction.

Special Report III:

The Proposal of Establishing Yangtze River Ecological Fund

In order to fully implement the spirit of the Nineteenth National Congress of the Communist Party of China and the relevant requirements in the Guiding Opinions on Establishing and Improving the Long-term Mechanism for Ecological Compensation and Protection of the Yangtze River Economic Zone (Financial Prediction [2018] 19) concerning the establishment of diversified investment and financing mechanisms, let finance play a fundamental and important role in the protection of ecological environment of the Yangtze River Economic Zone, and promote the ecological protection and governance of the Yangtze River Basin, it is proposed to establish the Yangtze River ecological fund. The specific plans are as follows:

I. Purpose of the fund

The main purpose of the fund is to support the financing of eco-environmental protection projects in the Yangtze River Economic Zone, and to solve the problem of financing difficulties of pollution control industry by means of marketization. By fully exerting the leading and leveraging effects of financial investment and encouraging social capital to invest in environmental protection projects such as atmospheric, water and soil pollution control in the Yangtze River Basin, the ecological environment quality of the Yangtze River Basin can be improved.

II. Positioning of the fund

The fund will organically combine the strategy of eco-environmental protection in the Yangtze River Economic Zone with the market mechanism, and adopt the equity investment method to support the major eco-environmental protection projects in the Yangtze River Economic Zone implemented by PPP and the third-party governance models for the financing difficulties of eco-environmental protection projects, and Participate in the project companies.

III. Principles of the fund establishment

(1) **Implementing the national major ecological environmental protection strategy.**

The establishment of the Yangtze River Ecological Fund is an important measure to carry out the proposal of General Secretary Xi that the Yangtze River Economic Zone should be protected and not exploited. The fund guides social capital to participate in the protection and management of the ecological environment in the Yangtze River Economic Zone by providing investment orientation.

(2) Implementing market-oriented operation.

The fundraising, investment, management and withdrawal of the fund are operated according to the principle of marketization. The ownership, management, and trusteeship rights are separated, and the management is entrusted to a professional fund management company.

(3) Financial funds playing a guiding role.

The central financial funds and the local financial funds in the Yangtze River Economic Zone will participate in the stock and make appropriate profit-sharing, which will play a guiding role and leverage effect and attracting social capital investment.

IV. The fund size and fundraising

We should give full play to the guiding role of financial funds and attract social capital investment as much as possible. According to preliminary consideration, the first phase of the ecological investment fund in the Yangtze River Economic Zone has a target scale of 300 billion yuan, of which 25% is financially funded, and the fund will be put into place in three years according to the progress of its operation.

The financial funds mainly come from the existing national major water conservancy project construction funds, central financial funds, and the local financial funds of the 11 provinces and cities in the Yangtze River Economic Zone. In order to realize the organic unity of ecological environment protection strategy and market mechanism in the Yangtze River Economic Zone, the main social investors attracted include: first, large commercial banks, industrial investment funds and other financial institutions; second, large-scale enterprises with strong strength, such as Maotai, Langjiu and Luzhou Laojiao, which benefit directly from the ecological environment protection in the Yangtze River Economic Zone.

The fund has a duration of 10 years. After the expiration of the term of validity, the fund may be renewed for five years upon the approval of the shareholders' meeting and the necessary procedures in accordance with the operation of the fund.

V. Operation and management of the fund

Considering that the fund mainly supports the ecological environment protection of the Yangtze River Economic Zone and involves coordination among different provinces and cities, it is suggested that the fund be set up at the central level, jointly led by the Ministry of Finance, the Ministry of Ecological Environment and the China Three Gorges Corporation, with the specific matters being mainly handled by China Three Gorges Corporation. The fund takes the form of company system, and the State Council authorizes the Ministry of Finance to perform the duties of state investor. The Ministry of Finance entrusts China Three Gorges Company to manage the fund on its behalf. The fund management company is responsible for the specific operation and management of the fund.

In accordance with the Company Law, the Yangtze River Eco-Investment Fund Co., Ltd. Will be established, and the shareholders' meeting, the board of directors, the board of supervisors and the investment decision-making committee will be set up. The board of directors shall exercise the power of major business decision-making on

behalf of the shareholders' meeting. The board of supervisors shall supervise the board of directors and management personnel and shall be responsible to the shareholders' meeting. The directors and supervisors shall be recommended by the shareholders contributing capital.

The fund management company is responsible for the specific operation and management of the fund, and is led by social funders with leading management intentions, the largest contribution to the fund and strong professional management ability, or entrust other professional fund management companies to manage. The fund management company is responsible for fund raising, investment and operation, and subscribe to a certain share of the fund, sharing risks and benefits with other funders.

VI. Fund investment methods and orientation

The fund adopts the equity investment method, mainly supporting the major eco-environmental protection projects in the Yangtze River Economic Zone implemented by PPP and the third-party governance models, and participate in the project companies. The key areas of investment are the major ecological environment protection projects in line with the "Ecological Environment Protection Plan for the Yangtze River Economic Zone" and the task of prevention and control of atmospheric, water and soil pollution in the Yangtze River Economic Zone determined by the Party Central Committee and the State Council. In order to ensure the income of the fund, a certain proportion of funds are allowed to invest in environmental protection enterprises with good growth and high profitability in the form of equity investment.

VII. Exit mechanism

The fund investment projects shall be withdrawn by fund management companies with reference to market practices, such as IPO on domestic and foreign capital markets, equity transfers, equity repurchases, and transferring-stocks-to-bonds, etc. In principle, the fund shall be liquidated by expiration; if it meets the objectives of investment performance during the duration, it may also be considered to withdraw through equity transfer and other means.

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