Policy Note

Eco-compensation in China’s Evolving Environmental Management Regime

Ecological Protection and Water Pollution Control in the Yangtze River Basin
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This policy note was prepared by a World Bank team led by Xiawei Liao (Water Resources Specialist) and David Kaczan (Economist), and included Zeng Xiangang (Environmental Economist, Renmin University), Marcus Wishart (Lead Water Resources Specialist), Si Gou (Water Resources Specialist), Daniel Mira-Salama (Senior Environmental Specialist), Xiaokai Li (Lead Water Resource Specialist), Michael T. Bennett (Environmental Economist, Consultant), Qi Tian (Water Resource Specialist), and Xiaojun Yang (Associate Professor, Xi’an Jiaotong University). Jieli Bai (Program Assistant), Dan Xie (Program Assistant), Jingjing Sun (PhD candidate, Xi’an Jiaotong University), and Jehona Gashi (Program Assistant) provided administrative and research support.

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The DRC team is led by Dr GU Shuzhong (Deputy Director General of the Institute for Resources and Environmental Policies) and includes Li Weiming (Director of Research Division, Institute for Resources and Environmental Policies), and Yang Yan (Associate Research Fellow, Institute for Resources and Environmental Policies) along with other researchers from the DRC, the Chinese Academy of Sciences (CAS), the Chinese Academy of Agricultural Sciences (CAAS), the Institute of Water Resources and Hydropower Research (IWHR), and the DRC of the Ministry of Water Resources (MWR).

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Section 1.

Introduction

The Yangtze River and the economic belt it defines are central to China’s economy, yet they face severe environmental challenges. The river plays a major role in the historical, cultural, and political identity of China, and is a key driver of the country’s economy. It is one of the world’s most biodiverse regions, with ecosystems and natural resources that underpin national water, food, and energy security. Yet over the past four decades, the Yangtze River Basin has experienced large-scale, high-intensity development that has severely impacted ecological and hydrological conditions. The region is emblematic of the challenges China faces as it looks to transition toward higher quality green development.

The government has made a more balanced approach to development of this region a major priority, with a “Yangtze River Economic Belt Development Plan” released in 2016. This was supported by the country’s first basin specific law in 2020, which along with provincial-level plans and other guidance promotes an overall goal of improved ecological protection, improved water quality, and sustainable development. Eco-compensation mechanisms—fiscal transfers used to incentivize and compensate for the costs of ecological protection—are increasingly being used to support implementation, with their number growing rapidly in varied forms along with funding flows. Given experience to date, there are opportunities to learn from the application of eco-compensation across the basin, as provinces and the national government look to scale and replicate.
This policy note reviews experiences with eco-compensation in the Yangtze River Economic Belt (YREB), and makes recommendations for enhancing outcomes. Specifically, the note: (1) provides an overview of the development progress of eco-compensation schemes in the YREB in support of the national strategy for ecological protection and green development in the YREB; (2) assesses the effectiveness of the current eco-compensation schemes in the YREB through a series of case studies; and (3) proposes policy recommendations for improving eco-compensation schemes in the YREB.

MAP 1.1: Eleven Provinces and Municipalities Included in the Yangtze River Economic Belt

Section 2.

An Overview of the Yangtze River Basin and the Yangtze River Economic Belt (YREB)

The resources within the basin drive China’s economy and are of global significance. The basin includes 19 provinces and autonomous regions in total, including 9 provinces and 2 municipalities that define the Yangtze River Economic Belt (YREB) (Map 1.1).¹ Its annual water resources are estimated at over 995 billion cubic meters, roughly 35 percent of China’s total water resources. The waters of the YREB supply more than 200 billion cubic meters to industries and populations along the river and provide drinking water for almost 600 million people.² It is home to 50 percent of grain production and more than 70 percent of fishery production, and is one of the world’s busiest inland waterways for freight traffic, with the basins manufacturing hubs lying at the heart of global supply chains. In 2018 the gross domestic product (GDP) generated in the region was estimated to be US$5.7 trillion (Chinese yuan [CNY] 40.3 trillion, accounting for 45 percent of GDP)³—effectively the third largest economy in the world.⁴

¹ Yunnan, Sichuan, Chongqing, Guizhou, Hubei, Hunan, Jiangxi, Anhui, Jiangsu, Zhejiang, and Shanghai from west to east.
² The direct beneficiaries of the South-to-North Water Transfer have reached over 120 million with the water transfer from the first phase projects of middle and east lines. Source: CCTV news, December 5, 2019, (Chinese) (link).
⁴ After the US (US$22.32 trillion) and China (US$15.27 trillion) (link).
The basin has some of the highest levels of biodiversity in the world. The Yangtze River is the longest river to flow entirely within one country, traversing a wide range of ecosystems. It is one of the world’s most biologically diverse eco-regions due to its climatic, geographical, and geomorphological diversity and the hydrological complexity and interconnectedness of the river, its floodplain, and the numerous lakes. The basin supports over 200 fish species, more than 84 mammal species, 60 amphibian species, and 87 reptile species. Over 40 percent of the basin is covered by forest, and is home to some of China’s most iconic and endangered species, including the Chinese sturgeon, Chinese alligator, and the Giant Panda. The basin is also home to 33.0 percent of China’s rare or endangered freshwater fish species, and 39.7 percent of the country’s rare or endangered plants. The basin’s lakes provide critical habitat for internationally migratory birds, including 95 percent of the wintering Siberian crane population.

Water pollution, changes in flow, reductions in wetland area, and eutrophication of lakes have significantly impacted the basin’s ecosystems and biodiversity. Over the past four decades, the Yangtze River Basin has experienced large-scale, high-intensity development and today contains most of the nation’s water-polluting industry. Urban areas have increased by 40 percent over the past 20 years, and lake and wetland areas have decreased significantly, with more than 800 lakes within the central basin lost to land reclamation. Over 40 percent of lakes and reservoirs in the basin are subject to eutrophication. According to the Changjiang Water Resources Commission, of the 329 drinking water resources monitored, only 59 percent met relevant water quality standards all year round. The river reportedly contributes between 0.31 and 0.48 million of the estimated 2.40 million tons of total plastic waste deposited into oceans globally by rivers each year, making it one of the world’s largest plastic-contributing rivers.

Despite the economic significance of the Yangtze River Basin the region also faces persistent development challenges, especially in the middle and upper reaches. As indicated in figure 2.1, in 2019, GDP per capita in the lower reaches was 1.5 times of that in the middle reach, and 1.7 times of that in the upper reaches. GDP per capita is the lowest in Guizhou (approximately US$7,144 in 2019) and the highest in Shanghai (approximately US$24,090 in 2019, which is three times that in Guizhou). The urbanization rate is the lowest in Guizhou and Yunnan (49 percent) while highest in Shanghai (88 percent). In 2019, there were 237 nationally designated poverty counties in the YREB out of 584 in total in the country, which were primarily located in the upper and middle reach provinces. While extreme poverty was eradicated by the end of 2020, there are still persistent challenges in addressing and ensuring equitable socio-economic development across the basin. However, it should be noted that the GDP growth rate was the highest in Guizhou Province in the upstream, with an annual growth rate of nearly 16 percent over the last 10 years; while the lowest was in Shanghai with an annual growth rate of just above 9 percent.

The government’s strategy for the Yangtze River Economic Belt emphasizes the need to balance economic development and environmental protection in the context of rapid development in the middle and upper reaches. The national program for the Yangtze River Economic Belt is articulated through the “YREB Development Plan” issued by the National Development and Reform Commission (NDRC) in October 2016. This emphasizes prioritizing ecological protection, river basin coordination, and integrated development. Implementation is guided by the “Action Plan for the Yangtze River Protection and Restoration” released by the NDRC with the Ministry for Ecology and Environment.

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8 For the purpose of this report, the terminology “plastics” includes macro-plastics (size > 5 mm, according to GESAM Report #99) and microplastics (size < 5 mm, according to GESAM Report #99) leaking to waterways from point and nonpoint sources.
9 Lebreton et al. 2017. River plastic emissions to the world’s oceans, Nat. Commun. 8, 15611 (link).
10 As of January 2019, 67 counties in Yunnan, 47 in Guizhou, 37 in Sichuan, 26 in Hubei, 20 in Hunan, 18 in Anhui, 13 in Jiangxi, and 9 in Chongqing.
of Ecology and Environment (MEE) in 2019. Tasks include establishing integrated land-water management systems, reducing rural point and nonpoint source pollution, reducing industrial and water vessel pollutions, enhancing drinking water security, and ensuring ecological flows in rivers.

The government’s efforts are supported by a legislative plan for protection of the Yangtze River. Approved by the National People’s Congress on December 26, 2020, the law came into effect in March 2021 and is the first law for a specific river basin in China. In line with the Development Plan and Action Plan, it was formulated to strengthen the protection and restoration of ecosystems in the Yangtze River Basin and facilitate the effective and rational use of water resources. The law requires establishing a National Yangtze River Basin Coordination Mechanism and infers obligations on national government line agencies and provinces toward its objectives. Among others, the law calls for local governments to develop laws and regulations that would establish water quality baselines, reduce pollutant discharge, promote ecological restoration (including through ecological flows), protect biodiversity, and improve systems for information sharing. The law institutes regular inventories of natural resources and biodiversity and strengthens systems for disaster prevention and mitigation. The law is relatively high level, and its implementation will require the development of detailed regulations and guidelines, and the preparation of investments by multiple levels of government.

The law represents the latest in a series of national level reforms aimed at improving the management of natural resources and the coordination of water resources development. In 2012, the “Most Stringent System for Water Resource Management,” also known as the “Three Red Lines,” was established to set specific targets for water withdrawals, water use efficiency, and water quality. Recognizing the need for improved interjurisdictional coordination, the Water Law was amended in July 2016 to support integrated planning and

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coordinated basin development. A ministry restructuring in 2018 reorganized responsibilities for water resource management, transferring many of the responsibilities for water pollution control to MEE, establishing the Ministry of Natural Resources (MNR), and consolidating responsibilities within the Ministry of Water Resources (MWR). Earlier in 2007, the government established a system of river and lake chiefs, a network of individuals at local, county, and provincial levels responsible for overseeing each section of every major waterway. This system incentivizes action via attribution of outcomes to specific officials, and creates a platform for collaboration that has proven useful in coordinating trans-jurisdiction issues and enhancing citizen engagement in basin management. China now has over 1.2 million river and lake chiefs, including more than 200,000 in the Yangtze River Basin.

**Eco-compensation mechanisms are increasingly being used to support implementation of national and provincial plans for ecological protection and water pollution control in support of the national strategy for the YREB.** These are implemented in line with the *Guiding Opinions on Establishing Eco-Compensation and Long-Term Protection Mechanism in the YREB* issued in 2018 by the Ministry of Finance. Specific provisions have also been codified in the Yangtze River Protection Law, which provides for the establishment of new eco-compensation schemes, as well as improvements in existing schemes that pay compensation for key ecological zones and incentivize reductions in cross-province and cross-county water pollution levels.

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12 Clause 15 of the amended “Water Law of the People’s Republic of China,” indicates that “planning for regions within the boundary of a river basin should follow the river basin planning, and the sector planning should follow the integrated planning.”

13 The River and Lake Chief System is intended to strengthen enforcement and accountability regarding water use control, water quality protection, and restoration of degraded waterways. River chiefs at the village level are required to patrol no less than once a week, while also promoting river protection and mobilizing the community to assist in the removal of waste.

14 These mechanisms could include horizontal eco-compensation (payments from one province to another, or one county to another), a water pollutant discharge rights exchange, and a carbon emissions right exchange.
Section 3.

The Role of Eco-compensation in the YREB

The development of eco-compensation mechanisms for environmental management and protection in China has evolved over more than two decades. Early efforts were first codified in 2005 when the State Council proposed using eco-compensation to support environmental protection in the State Council decision to implement the scientific outlook of development and protect the environment (State Council No. 39). In 2007, the Environmental Protection Bureau issued Guidance opinion on implementing eco-compensation pilots. In 2014, the No. 1 Central Policy Document proposed to establish eco-compensation schemes in river headwater regions, important water source regions, important water ecological regions, and flood retention areas. In 2015, the State Council issued Opinions to accelerate the construction of ecological civilization, which proposed to improve eco-compensation schemes and issue related legislations. In 2016, the State Council General Office issued Opinions on improving eco-compensation schemes, which required the establishment of eco-compensation schemes in all important ecological areas by 2020. In November 2020, the National Development Reform Commission (NDRC) published the draft National Eco-Compensation Regulation online for public consultation.
Eco-compensation is a diverse set of tools, operating on different governance levels and scales. It is not a single policy or program; it is a conceptual approach to environmental management rooted in the use of fiscal transfers to reduce environmental externalities. Eco-compensation is defined by monetary incentives for ecologically beneficial actions, including direct government payments to individuals and communities for the protection and provision of ecosystem services; compensation to households, communities, or regional governments for regulatory takings; and frameworks for cooperation and fiscal transfers between jurisdictions, among others. Over the past decade, the term has broadened considerably as it has increased in prominence. Four of the more common eco-compensation types include (1) vertical fiscal transfers between different levels of governments; (2) horizontal fiscal transfers between governments of the same level; (3) direct payments to individuals, e.g., farmers; and (4) market-based mechanisms, such as water trading and water pollution trading. The concept has many parallels with payments for ecosystem services (PES), which could be seen as one form of eco-compensation.

High-level documents see eco-compensation as a desirable means to address the unbalanced development needs between upstream and downstream regions of the Yangtze River Economic Belt (YREB). In 2018, the Ministry of Finance issued the Guiding Opinions on Establishing Eco-Compensation and Long-Term Protection Mechanism in the YREB which outlined four tasks for central government to (1) emphasize ecological protection in general fiscal transfers; (2) increase national key ecological zone transfers to the YREB provinces (discussed further, below); (3) implement the “YREB Ecological Protection and Rewards Policy” in 2018, which committed CNY 18 billion (US$2.7 billion) from 2017 to 2020 to incentivize the establishment of horizontal eco-compensation schemes in the YREB, including intra provincial and inter-provincial schemes; and (4) increase various special funding in the YREB, including for energy efficiency and reforestation, among others.

The guiding opinions on establishing eco-compensation for ecological protection in the YREB also outline six tasks for subnational governments. These include obligations to (1) increase financing to compensate ecological protection; (2) promote location- and topic-specific funding arrangements; (3) improve performance-based incentive mechanisms; (4) establish river basin horizontal eco-compensation mechanisms; (5) improve financial and fiscal systems, e.g., environmental taxes, to create stable revenues for ecological protection; and (6) attract private sector participation.

In response, transfers under the National Key Ecological Zones Program (NKEZP) have increased significantly in the Yangtze River Economic Belt from 2018. The NKEZP program is one of the largest ecological fiscal transfers in China and aims to support local governments in complying with the National Key Ecological Function Zones Spatial Plan, which designates development restrictions in certain local regions of ecological importance. Transfers under the NKEZP to the 11 provinces (figure 3.1) in the YREB increased from CNY 23.99 billion (US$3.6 billion) in 2017 to CNY 32.51 billion (US$5.0 billion) in 2020. Provinces in the upper reach (i.e., Yunnan, Guizhou, and Sichuan) received higher transfers than middle-reach provinces (i.e., Hunan, Hubei, and Jiangxi) while the lower-reach provinces (i.e., Shanghai, Jiangsu, and Zhejiang) received the least transfers. From 2018 to 2020, among the total National Ecological Zone Transfers, CNY 4 billion (US$ 615.3 million) was dedicated as “YREB subsidies,” which are targeted at ecological and environmental protection in the YREB region. However, to put it into context, China Development Bank alone disbursed loans of CNY 488 billion (US$75.0 billion) in 2020 to support Yangtze River Ecological Protection and Green Development, among which CNY 89.4 billion (US$13.0 billion) were used for ecological protection and restoration. Therefore, the amounts of eco-compensation funds are relatively small compared to other channels of funds in China, but they play an important incentivizing function.

Plans for intra-province river basin eco-compensation schemes, i.e., programs that pay local governments within a specific province for watershed protection actions, have been in place for all 11 provinces/municipalities in the YREB since 2016. These documents outline the approach to funds management, resource allocation, and methods for evaluation. The intra-provincial river basin eco-compensation schemes are primarily managed by the
There are three principle types of intra-province river basin eco-compensation schemes. These include (1) fiscal transfers from province to cities/counties, known as vertical transfers; (2) fiscal transfers between cities/counties, known as horizontal transfers; and (3) pooled funds among cities/counties:

1. **Vertical eco-compensation schemes:** fiscal transfers from higher-level governments (i.e., central and provincial) to lower-level governments (i.e., municipal and county) to compensate for the costs of ecological and environmental protection, including actual costs and foregone opportunity development costs, and/or to incentivize local governments for water quality improvement. For instance, Hunan Province set up a *Dongting Lake Ecological Protection Fund* from 2018 and 2020 and allocated CNY 3.2 billion (US$492.3 million) to incentivize environmental protection by local governments, including urban and rural wastewater management, rural nonpoint source pollution reduction, and wetland restoration, among other activities.

2. **Horizontal eco-compensation schemes:** fiscal transfers between the same level of jurisdiction, such as between provinces, municipalities, or counties. For example, payments are made to an upstream county to compensate for foregone development opportunities if water quality at a designated cross-section meets certain targets. If the targets are not met, the payment is made to the downstream county to compensate for damages brought by the poor water quality and costs to improve water quality.
3. **Pooled eco-compensation funds**: an aggregation of funds provided by several jurisdictions for an agreed purpose. For example, municipalities in the Tuo River basin, Sichuan Province, contribute CNY 0.5 billion (US$76.9 million) every year for ecological protection in the shared basin. Funds are then allocated according to an agreed formula used to evaluate the environmental performance of the participating municipalities.

**Pooled funds and direct fiscal transfers are also used to support inter-provincial river basin eco-compensation schemes.** In 2018, Sichuan, Guizhou, and Yunnan signed the Chishui River Eco-compensation Agreement, jointly setting up a CNY 200 million (US$30.7 million) fund for water pollution reduction. In 2012, Zhejiang and Anhui signed the first three-year inter-provincial river basin eco-compensation agreement on the Xin’an River basin. If the water quality at an inter-provincial section meets annual targets, downstream Zhejiang pays CNY 100 million (US$15.3 million) to upstream Anhui, and vice versa. The central government supplements the payments with CNY 300 million (US$46.1 million) every year. For the second (2015–2017) and third (2018–2021) three-year phases, the financing commitment from Zhejiang and Anhui increased to CNY 200 million (US$30.7 million) per year, specifically to address rural wastewater and solid waste management. Similar agreements have been signed on the Chu River basin between Anhui and Jiangsu, the Lu River basin between Jiangxi and Hunan, and the You River basin between Hunan and Chongqing. For the Xin’an River eco-compensation, cross-sector joint leading groups are set up in each province, based in the provincial Department of Natural Resources (DNR). Other inter-provincial river basin eco-compensation schemes are jointly managed by the respective provincial PDFs and DEEs.

**Besides river basin eco-compensation schemes, governments (including central, provincial, municipal, and county) are also paying farmers and agencies to compensate for their efforts in protecting wetlands, forests, farmlands, and grasslands.** Wetland areas in the YREB account for about 20 percent of the national total, amounting to 0.25 million square kilometers. While wetland and farmland compensation schemes are often jointly managed by DNR, the Department of Agriculture and Rural Affairs (DARA), DEE, PDRC, and PDF, eco-compensation for forests and grasslands are primarily managed by the Forestry Bureau and PDF. A main challenge for these eco-compensation schemes is that the compensation standards are often lower than the foregone development opportunities for the farmers, especially in the context of rapid social-economic development, which poses challenges for the sustainability of such compensation schemes. There is a risk that farmers could return to livelihoods that are destructive to the environment in the future, although other trends such as urbanization or a strategic program design (that increases income through economically valuable activities) could mitigate this risk.
Section 4.

Eco-compensation Case Studies in the YREB

The World Bank has been requested to support the Government’s strategy for ecological protection in the Yangtze River Economic Belt (YREB) (Box 4.1.). The proposed US$400 million IBRD loan uses a Program for Results structured around three pillars: (1) improving institutions and innovations to promote cross-sector and interjurisdictional coordination through policies, regulations, and guidelines for green development and ecological protection; (2) advancing ecological protection through Integrated River Basin Management supporting implementation of policy measures, regulations, and guidelines aimed at improving ecological protection and integrated water resources management in demonstration subbasins; and (3) reducing water pollution and transmission of plastic waste through investments aimed at reducing pollution loads, including plastic wastes, in demonstration counties within these subbasins.

This policy note presents an overview of five eco-compensation schemes within the Yangtze River Economic Belt. As shown in Map 4.1., these include (1) a multi-provincial pooled water fund in the upper reach; (2) a vertical earmarked fund in the upper-middle reach; (3) a vertical general fiscal transfer in the lower-middle reach; (4) an inter-provincial horizontal eco-compensation in the lower reach; and (5) a water pollution trading market in the Yangtze delta region. Selection of the case studies is primarily focused on water pollution reduction and water ecology protection purposes to inform the preparation of the proposed World Bank–financed Yangtze River Protection and Ecological Restoration Project, while acknowledging that other types of compensation schemes also exist and play significant roles in the YREB, e.g., conversion of cropland to forest, a forest eco-compensation scheme.

Box 4.1.

Yangtze River Protection and Ecological Restoration Program

The proposed program’s development objective is to improve institutional coordination, enhance ecological protection, and reduce water pollution in select regions of the YREB. The program is intended to contribute to the government’s national strategy for the ecological protection of the Yangtze River by financing a series of provincial subprograms through the Program-for-Results instrument supported by a basin subprogram financed through Investment Project Financing.

Outcome indicators are proposed that include (1) improved coordination mechanisms for river basin management; (2) enhanced integrated water environment management in demonstration basins; and (3) reduced pollutant loads entering waterways from demonstration areas. Intermediate outcomes relate to investments associated with wastewater collection and treatment, solid waste management, and agricultural nonpoint source pollution control.

Proposed activities and envisaged outputs under the basin subprogram are structured in five areas: (1) integrated control strategy and piloting of key water pollutants in the Yangtze River, focusing on total phosphorus; (2) database for the environment and natural resources in YREB; (3) Yangtze River Basin integrated ecological restoration study and piloting; (4) Yangtze River ecological assets value realization mechanisms; and (5) River-Lake Relationship focusing on Poyang Lake and Dongting Lake.
MAP 4.1: Five Case Studies of Eco-compensation Schemes in the YREB

- **Jiangxi River Basin Eco-Compensation Program** (vertical program)
  - Payments are made by Jiangxi Province to counties, based on each county’s water quality, forest area, and water management outcomes.
  - **Period:** Since 2015
  - **Amount:** CNY 14 billion (US $2.2 billion) over 5 years
  - **Scope:** 100 counties in Jiangxi

- **Tai Lake Water Pollution Trading** (market-based program)
  - A pollution emission permit and trading system pilot in Jiangsu Province, with trading between major water pollution emitters. Revenues from permit sales are used for water quality improvement measures.
  - **Period:** Since 2010
  - **Scope:** Tai Lake Basin

- **Dongting Lake Ecological Protection Fund** (vertical program)
  - Payments are made by Hunan Province from a special fund to subsidize water pollution reduction and ecological restoration measures by counties.
  - **Period:** 2018 - 2020
  - **Amount:** CNY 3.2 billion (US $493 million)
  - **Scope:** 25 counties

- **Xin’an River Eco-Compensation Program** (horizontal and vertical program)
  - Payments are made between downstream Zhejiang and upstream Anhui Provinces, based on water quality improvements. Central government also provides budget to support this program.
  - **Period:** Since 2012
  - **Amount:** CNY 5.7 billion (US $885 million)
  - **Scope:** 2 Provinces

- **Chishui River Program** (horizontal program)
  - Yunnan, Guizhou and Sichuan Provinces jointly contribute to a fund for ecological restoration and management. Payments are made based on water quality improvement.
  - **Period:** Since 2018
  - **Amount:** CNY 200 million per year (US $31 million)
  - **Scope:** 3 Provinces

Case 1.
Chishui River Water Fund: A Multi-Provincial Water Fund

In 2018, Guizhou, Yunnan, and Sichuan signed the first multi-provincial eco-compensation agreement. These three provinces were co-signatories to the Chishui River Basin Horizontal Ecological Protection Compensation Agreement, in which they jointly contributed CNY 200 million (US$30.7 million) each year from 2018 to 2020 to a Chishui River horizontal watershed eco-compensation fund (Yunnan paid CNY 20 million (US$3.0 million), Guizhou CNY 100 million (US$15.3 million), and Sichuan CNY 80 million (US$12.3 million)). From this fund, payments for ecological restoration and management were allocated at a set ratio (Yunnan received CNY 60 million (US$9.2 million), Guizhou CNY 80 million (US$12.3 million), and Sichuan CNY 60 million (US$9.2 million)). Each province allocated the funds they received to the counties based on their ecological importance and the difficulties in environmental protection.

Water quality targets included targets on the permanganate index, ammonia nitrogen, and total phosphorus. The objective of the agreement was to maintain Chishui River’s good quality. For example, the annual average water quality indicators at the Qingshuipu section in Yunnan and Lianyuxi in Guizhou were to meet the Class II requirements. Assessments are based on the water quality monitoring data from the China National Environmental Monitoring Center, automatically monitoring or jointly monitoring by concerned provinces.

The allocation to an upstream province was deducted and transferred to downstream provinces if the water quality at the cross-provincial section failed to meet the target. For example, if the water quality failed to meet the requirements at Qingshuipu, the fund that was allocated to Yunnan would be deducted and reallocated to Sichuan and Guizhou, half and half. Similarly, if water quality at Lianyuxi failed to meet the targets, funds allocated to Guizhou would be deducted and reallocated to Sichuan.

Implementation arrangement: Three provinces established joint management mechanisms and took turns hosting the Annual Chishui River Ecological and Environmental Protection
Section 4. Eco-compensation Case Studies in the YREB

Coordination Meeting, as well as environmental information sharing, joint law enforcement, and so forth. Each province was responsible for implementation of the eco-compensation fund as well as for organizing the review of the annual river basin ecological and environmental protection implementation plan, and providing oversight on the use of eco-compensation fund and project implementation.

There were also private sector financial resources in addition to the multiprovincial water fund contributed by the governments. From 2014 onward, the Maotai liquor company committed CNY 0.5 billion (US$76.9 million) (CNY 50 million per year (US$7.6 million)) over a 10-year period to protect the water quality of the Chishui River in Guizhou. Maotai and other liquor companies directly provided financial assistance to local farmers to change their lifestyle and associated land use.

Successes and challenges encountered within the Chishui River Multi-Provincial Water Fund hold lessons for the development of programs across the Yangtze, as well as for further refinements or scaling of the fund itself. Opportunities include:

1. To establish national guidelines and standards: While the Chishui River Water Fund represents the first multi-provincial eco-compensation agreement in China, its establishment required a large amount of transaction costs due to many rounds of negotiations, which were a result of the lack of nationally unified rules and guidelines in terms of the scope of compensation, compensation standards, fund allocation, and so forth.

2. To improve the fund allocation method based on improved compensation standards: In the current fund allocation method, more economically developed counties may be prioritized in fund allocation because they face more difficult tasks in pollution reduction as well as higher foregone opportunity costs. However, this creates concerns over equity issues as the less developed counties need the funding the most to protect their relatively good environment.

3. To diversify funding sources and enhance funding sustainability: While the Chishui River basin represents one of the most pristine water environments and least developed regions in the YREB, with the social-economic development of the under-developed counties, their foregone opportunity cost is growing and therefore would require increasing amounts of compensation. With limited public financial resources and insufficient private sector participation, funding sustainability poses a major challenge, while fund allocation methods also need improving.

Case 2.
Dongting Lake: An Environmental Protection Subsidy in the Middle Reach

Dongting Lake is a wetland of international importance in the upper-middle reach of the Yangtze River Basin. It is the second largest freshwater lake in China, and along with its slightly larger cousin, Poyang Lake, is considered one of the “Kidneys of the Yangtze.” It provides a variety of ecosystem services, including flood regulation, biodiversity, navigation passage, and water supply. It has an area of 2,625 square km, a catchment area of 0.2633 million square km, and a total storage of 16.7 billion cubic meters. The east part of the lake is recognized as a Ramsar site for its significance for migratory birds.

Dongting Lake has been suffering from ecological degradation due to increasing human activities. The Dongting Lake area is an important region for China’s crop and livestock production, producing about 20 percent of the national crop production and 5 percent of live hogs. Due to land use change, lake encroachment, and water pollution discharges from agricultural, industrial, and domestic point and nonpoint sources, Dongting Lake has been suffering from ecological degradation, including a shrinking lake area, water quality deterioration, sediment accumulation, and biodiversity loss. The lake area has shrunk by one-half from the last century, and the water quality of the lake is only Class IV (not suitable

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17 Qiu. 2014. The research about the countermeasures of environmental destruction and ecological restoration in Dongting Lake area. Nanjing Forestry University.
for human consumption) with total phosphorous (TP) being the main pollutant. Agriculture is the main polluting source for chemical oxygen demand (COD), total nitrogen (TN), and TP, followed by domestic sources.

**Ecological restoration and protection of the Dongting Lake basin is considered a national and provincial priority.** In 2014, the State Council approved the “Dongting Lake Ecological Economic Zone Plan” issued by the National Development and Reform Commission’s (NDRC’s) Regional Department, aimed at balancing ecological protection and economic development in the basin, protecting and restoring ecological systems, ensuring water security in the basin, and contributing to national and regional food security and agricultural modernization. In 2018, Hunan Province issued the “Dongting Lake Water Environment Integrated Management Plan” with an “Implementation Plan” for 2018 to 2035, with specific targets for water supply, water pollution reduction, and hydro-ecological restoration.

**The Hunan Department of Finance (PDF) issued the “Dongting Lake Ecological Financial Subsidy Methods (2018–2020)”**, which set up a CNY 3.2 billion (US$492.3 million) earmarked fund for ecological protection and restoration, occupying a very small proportion of the provincial government expenditure (less than 0.2 percent). The fund is managed by PDF with technical support from line departments, including the Department of Ecology and Environment, Department of Housing and Urban-Rural Development, Department of Transport, Department of Water Resources, Department of Agricultural and Rural Affairs, Forestry Bureau, Provincial Health Commission and Livestock, and Fishery Bureau.

**The fund disburses based on the achievement of targets set for water pollution reduction and water ecological restoration tasks.** These include livestock pollution management, fertilizer and pesticide pollution reduction, urban and rural wastewater management, rural solid waste management, rural sanitation, ship pollution and hazardous waste management, water source protection, urban water treatment, river channel dredging, wetland protection and restoration, and schistosomiasis control. For example, the fund subsidizes CNY 0.3 million (US$46,153) per km of new and upgraded urban wastewater pipeline, CNY 200 (US$30) per household for a rural toilet upgrade, and CNY 1,000 (US$153) per hectare of wetland restoration.
Successes and challenges encountered within the Dongting Lake Financial Subsidy hold lessons for the development of programs across the Yangtze, as well as for further development or scaling of the subsidy itself. Opportunities include:

1. **To evaluate the comprehensive values of water:** To justify the use of public resources and leverage private sector and community resources, it is important to identify and evaluate the ecosystem services that the Dongting Lake provides. Attempts at ecosystem valuation have been made by the National Forestry Bureau, as well as under the “Wetland and biodiversity conservation and sustainable use in China” project (supported by the Global Environment Facility). However, results have been abstract and high level, and not sufficiently actionable for policy decisions.

2. **To promote results-based financing:** Dongting Lake Environmental Protection Subsidy is used to subsidize both outputs, e.g., construction of network, and outcomes, e.g., reduced pollution loads. The outcome-based approach enhances financing efficiency and should be promoted where possible.

3. **To avoid unnecessary duplicate financing:** Farmers by the lakeside are often entitled to different compensations or subsidies from different sector departments, e.g., water, wetland, and the environment for the same activities. Stacking resources is needed if a single compensation cannot cover the opportunity costs. In order to improve the financing efficiency, a unified implementation arrangement is needed with sufficient information sharing to avoid inefficient resource stacking.

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**Case 3.**

**Jiangxi River Basin Eco-Compensation Program: A Vertical Fiscal Transfer in the Middle Reach**

Jiangxi launched its provincial River Basin Eco-Compensation Program (RBECP) in 2015. The RBECP provides support for 100 counties throughout the province. Funds are used for ecological protection, water environment management, forest protection and improvement, water conservation and protection, ecological poverty alleviation, and livelihood improvement projects, targeted toward Poyang Lake and its tributaries, the Yangtze itself, and the Dong River basin. The program aims to balance environmental considerations with development needs given the province’s relative economic disadvantage: in 2019, Jiangxi’s provincial gross domestic product (GDP) per capita ranked 21 among China’s 31 mainland provinces, higher only than that of Guizhou and Yunnan in the YREB.

The RBECP draws on national key ecological function zones (NKEFZ) funding, demonstrating the way in which central government programs interact and facilitate provincial programming. From 2008 onward, the Ministry of Finance has made special fiscal transfers to protect ecological areas of high significance that are also in need of poverty reduction, through the NKEFZ program. From 2008 to 2019, the scale of NKEFZ funding nationwide increased from CNY 6.05 billion (US$930.7 million) to CNY 81.8 billion (US$12.5 billion), with Jiangxi receiving between CNY 1.6 billion (US$246.1 million) and 2.6 billion (US$400 million) per year.

The RBECP is a cross-sector program that involves seven provincial departments and indicator-based funding allocations. RBECP funding flows to counties according to four sets of indicators: (1) water quality; (2) forest quality; (3) water resource management; and (4) the ecological importance of the county. PDF manages and disburses the funds, while the Department of Ecology and Environment (DEE), PDF, the Department of Water Resources (DWR), the Department of Agriculture and Rural Affairs (DARA), and

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19 In November 2015, Jiangxi Province issued the “River Basin Ecological Compensation Methods in Jiangxi Province (for Trial Implementation)” (The Methods).
The Department of Housing and Rural-Urban Development (DOHURD) were responsible for monitoring the relevant indicators and providing data. The results of evaluation are used to determine the fund allocation for the subsequent year (figure 4.1). Counties were required to submit reports on the funding usage and impacts.

The program’s funding allocation is also aimed at supporting poverty reduction. The amount of RBECP funding allocated to each county (cities, districts) is reduced in line with the level of local fiscal capacity. This is consistent with the program’s intention to compensate for foregone development opportunities in less-developed counties that are protecting their environment and ecology.

RBECP funds are mainly used for ecological protection, water environment management, forest quality improvement, forest resource protection, water conservation and protection, ecological poverty alleviation, and livelihood improvements. While the fund uses are not mandated, 75 percent of local governments use the RBECP as earmarked funds, while around 21 percent blend RBECP funds with other financial sources at the county level. Based on county-level self-review reports, in 2018, around 30 percent was used for water environment improvement and water resource management, and 55 percent for ecological protection and conservation, including 18 percent for forest protection and improvement.

While a causal impact analysis is not currently available, the RBECP has likely contributed to improved measures of ecology and the environment in Jiangxi. In 2019, forest cover in Jiangxi reached over 63 percent (the second highest nationally), while the surface water quality compliance rate reached over 80 percent, exceeding the national average by over 30 percent. The drinking water source water quality compliance rate reached 100 percent, and water flowing from Poyang Lake into the Yangtze River met Class III standards. The RBECP is an instrument for activities that support these outcomes.

**FIGURE 4.1:** Institutional Arrangements for the RBECP

Source: Authors’ elaboration.
Successes and challenges encountered within the RBECP hold lessons for the development of programs across the Yangtze, as well as for further refinements or scaling of RBECP itself. Opportunities include:

1. **To optimize basin-level compensation outcomes:**
   While implementation is focused within subbasins, eco-compensation is carried out within administrative areas (i.e., county, municipality, or province), missing an opportunity for gains through coordinated approaches between administrative units within a river basin. These can be informed through establishing environment goals at the basin level to guide the design of eco-compensation schemes, including the targets and locations, by focusing on hot spots and synergies. An integrated, basin-wide eco-compensation program would reenforce command and control mechanisms to address water pollution control and ecological restoration, and promote more robust protocols for monitoring environmental outcomes, such as water quality and quantity. Such a scheme could also provide the foundation for cap- and trade-mechanisms for specific water pollutants within the river basin.

2. **To strengthen performance evaluation systems:**
   While the program’s actions are correlated with improved ecological conditions in the province, limitations in monitoring limit the possibility of causal attribution. Demonstrating impact could support efforts to target the program toward high-impact activities and locations, and increase funding support from other levels of government. Evaluation would be strengthened by using independent third-party monitoring, as opposed or in addition to local governments, who are themselves responsible for implementation.

3. **To develop opportunities for diversified public or private sector funding contributions:**
   Stronger monitoring of outcomes and greater transparency around fiscal flows over time create confidence among a wider group of stakeholders, creating opportunities for diversified co-financing. These could take the form of matching grants for private entities engaged in investments with ecological benefits aligned with the program’s objectives, or matching funds for local governments to develop highly localized interventions (for example, to protect their local watersheds). These can also support program fiscal sustainability and stakeholder support, strengthening long-term sustainability.

4. **To support counties with the potential for improvement (in addition to support that rewards high performance):**
   The fund allocation method prioritizes regions with already high environmental performance, with the intention to incentivize continuing strong outcomes and penalize environmental degradation. However, some counties may lack the initial support required to make necessary improvements to receive rewards. A tranche of fund allocation (and monitoring) could follow a hot spot approach, in which particularly difficult environmental problems areas are identified and supported with time-bound up-front investments.

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**Case 4.**

**Xin’an River Eco-Compensation: An Inter-provincial Horizontal Transfer in the Lower Reach**

Anhui and Zhejiang provinces launched China’s first inter-provincial watershed eco-compensation pilot project in 2012. In order to protect the water resources of Qiandao Lake, while compensating the upstream areas that protect those resources, Zhejiang and Anhui launched a pilot project for horizontal eco-compensation in the upper and lower reaches of the Xin’an River basin, with guidance from the Ministry of Finance (MOF) and the then Ministry of Environmental Protection (MEP).

The first round of pilots lasted for three years (2012–2014). As recorded in the program’s agreement between the provinces, the Jiekou section at the junction of Jiangsu, Anhui, and Zhejiang in Xin’an was used as the assessment section, with permanganate, ammonia nitrogen, total phosphorus, and total nitrogen used as the assessment indicators. The central government granted a subsidy of CNY 300 million (US$46.1 million) to Anhui Province each year, and the provinces of Zhejiang and Anhui allocated...
CNY 100 million (US$15.3 million) each year, respectively, totaling CNY 1.5 billion (US$230.7 million) over three years. These funds were used for industrial structural adjustment, watershed management, water pollution prevention, and ecological protection.

The success of the pilots resulted in increased financing. After the first round of pilots achieved significant results, a second-round pilot was implemented in 2015–2017, with funds increasing from CNY 1.5 billion (US$230.7 million) to CNY 2.1 billion (US$323 million). The central government continued to support the second round of pilots, but decreased its subsidy to Anhui Province year by year, from CNY 400 million (US$61.5 million), to CNY 300 million (US$46.1 million), and then to CNY 200 million (US$30.7 million) over this period. The two provinces each allocated an additional CNY 100 million (US$15.3 million) in funds, with these mainly used for the treatment of sewage and garbage, especially rural sewage and garbage in the border area between the two provinces.

Each year, the compensation is paid after calculating the compensation index, $P$, based on monitoring data of the water quality of the monitoring cross-section in the previous year. The index is calculated from the average concentration value of four pollutant indicators (permanganate index, ammonia nitrogen, total phosphorus, and total nitrogen). When $P \leq 1$, Zhejiang Province would allocate CNY 100 million (US$15.3 million) to Anhui Province; when $P > 1$ or a major pollution accident occurred in the section of the Xin’an River basin in Anhui Province, Anhui Province would allocate CNY 100 million (US$15.3 million) to Zhejiang Province. In all cases, the central government would allocate CNY 300 million (US$46.1 million) to Anhui Province.

The water quality of Qiandao Lake remained stable during the compensation period. It ranks among the top among 61 key lakes in the country, and was included in the first batch of the five “China’s Good Water” sources. Water quality has improved: 70 percent of the 88 rivers in Chun’an County, Zhejiang, for example, are of Class I water quality. Huangshan City, Anhui, has returned 24,000 hectares (ha) of farmland to forests, and the forest coverage rate has increased from 77.4 percent to 82.9 percent. The area of wetland and grassland has increased, with natural ecological landscapes accounting for more than 85 percent of the watershed. Huangshan City has also shut down more than 220 polluting companies, relocated more than 90 companies, and promoted rural tourism (with the participation of more than 100,000 farmers).

Successes and challenges encountered within the Xin’an River eco-compensation hold lessons for the development of programs across the Yangtze, as well as for further refinements or scaling of the Xin’an River eco-compensation itself. Opportunities include:

1. To improve understanding on how to reduce nonpoint source pollutions. The main challenges identified for the third-phase implementation of the Xin’an River eco-compensation agreement include how to effectively reduce nonpoint source pollution in the upstream counties in Anhui Province and how to formulate appropriate compensation standards without sufficient understanding of the effectiveness of different nonpoint source pollution reduction measures.

2. To optimize the use of compensation funds. In particular, the compensation funds from Zhejiang Province were used on key areas of water pollution control and water environment protection, mainly for rural sewage treatment in the upper reaches of the border area between two provinces, centralized waste disposal, management of agricultural nonpoint source pollution, upgrading of sewage treatment plants, and so forth.

3. To promote diversified compensation mechanisms. The third-phase pilot explored diversified compensation mechanisms in addition to monetized compensation, including co-development of natural parks, eco-industries, cultivating talents, exchanging culture, promoting tourism, and other aspects.
Case 5.
Taihu Lake Water Pollution Trading in the Yangtze River Delta region

Water pollution permit trading is used in the Yangtze delta region to combat water pollution. Trading systems for emissions or water use are increasingly emphasized in eco-compensation policy documents, with the draft National Regulation on Eco-compensation (2020) promoting their further development as part of efforts to bring greater market elements to eco-compensation. The first Water Pollution Permit Trading was conducted in Shanghai Minhang District in 1987. Trading programs nationwide for water quality have remained relatively small.

Taihu Lake in the Yangtze delta region is the third largest freshwater lake in China; with a basin that is an important economic center. Roughly crescent-shaped, the lake is about 70 km from north to south with a total surface area of 2,338 square km and a total storage capacity of 5.77 billion cubic meters. The Taihu Lake basin occupies the majority of southern Jiangsu, three cities in Zhejiang province, and the majority of Shanghai city. The basin is one of the most economically developed regions in China. Although its area only makes up about 0.4 percent of the national total, it produces about 10.0 percent of the national GDP and plays other important roles, including flood management, irrigation, navigation, fishery production, and tourism. It is also an important water source that serves over 20 million people (55 percent of the Taihu Lake basin population).

Deteriorating water quality in Taihu Lake resulted in toxic algae blooms. The blooms resulted from increasing wastewater discharge due to rapid industrialization and urbanization in the basin. Eutrophication, caused by excessive nitrogen and phosphorus discharge, affected the water quality as well as drinking water security for the surrounding population. In late May 2007, a drinking water crisis took place in Wuxi, Jiangsu Province, China, following a toxic algae bloom in Taihu Lake, which was the city’s sole water supply, leaving

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Photo: Aerial view of Taihu Lake in Wuxi, Jiangsu Province, China. iStock.
approximately 2 million people without drinking water for at least a week.

**Different levels of government undertook measures to combat the water crisis.** The national government pledged more than US$14 billion as part of a large-scale cleanup project. Many local factories were closed and water treatment regulations were enhanced as part of a five-year plan to improve water quality. The government of Wuxi city introduced the system of river chiefs, assigning government officials responsibility of stretches of a river or lake, and including the results of water quality testing in the administrative assessment of the people in charge. Water quality improvements were seen following these measures.

**Jiangsu Province piloted a pollution emission permit and trading system in 2008.** The MOF and then State Environmental Protection Administration (SEPA) allowed the Jiangsu provincial government to carry out a pilot trading system among factories around Taihu Lake in 2008. In 2010, the provincial environmental department, financial department, and price bureau jointly issued the “Jiangsu Taihu Lake Basin Main Water Pollutants Emission Permit Trading Management Method” and officially launched the pollution emission permit and trading system. By 2010, 1,357 enterprises with an annual COD discharge of more than 100 tons were included in the system.

**Tradeable pollution emission permits are available from several sources, including** (1) government reserves during an initial allocation; (2) excessive permits sold by private permit holders due to industrial upgrade and pollution treatment; and (3) returned permits from enterprises that are closed. Fiscal revenues for the government from selling emission permits can only be used for Taihu Lake water quality improvement measures.

**The Water Pollution Permit Trading schemes face a number of challenges, with a limited number of transactions.** Opportunities to improve the water pollution permit trading systems in China include:

1. **To scientifically determine the environmental capacity of a specific water body:** It is difficult to scientifically determine the maximum water pollutant emission permit, especially considering the impacts of future climate change and the resultant change of water availability in the lake.

2. **To establish a unified pollution emission permit and trading system across the different jurisdictions within the basin:** For example, Huzhou city in Zhejiang has included TP, TN, and COD in its pollution emission permit and trading system, while Jiaxing city has only included COD, which could create a leakage problem for TN and TP pollution.

3. **To include agriculture nonpoint source pollutions:** Agricultural nonpoint sources contribute the majority of TP and TN pollution in Taihu Lake. However, the current Taihu Lake water pollution emission trading system only includes industrial enterprises. Nonpoint source pollution is particularly difficult to monitor.

4. **To promote the vitality of the market:** Many enterprises are unwilling to sell their emission permits in light of emissions policies that are becoming increasingly strict. Without sufficient trading, it is difficult to realize the market’s role in minimizing the cost and reaching the optimal emission reduction levels.

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21 Targets and Assessment Measures of Water Quality Control for River Cross-sections in Wuxi.


24 Polaris Energy Conservation and Environmental Protection Network (June 15, 2016). Emissions trading has “tested the waters” in the past ten years (link).

Section 5. Challenges and Recommendations for Improving Eco-compensation in the YREB

The rise of eco-compensation is illustrative of China’s efforts toward balanced development. The evolution of institutional provisions, incentives, and information required for successful eco-compensation programs provides lessons for their scaling within the Yangtze River Basin in line with the national government’s priorities, and for their application in other river basins across China. They are also informative for efforts to promote ecological outcomes in river basins globally. While the substantial public investments made in support of improving ecosystem services in the Yangtze River Economic Belt (YREB) have yielded significant benefits, the incremental benefits of future investments are likely to yield diminishing returns without improvements in institutional design, and in the data, information, and knowledge base. The following conclusions reflect on the common challenges identified through this assessment of eco-compensation within the YREB, with a view to informing the next generation of programs.
INSTITUTIONAL AND REGULATORY FRAMEWORK

**Challenge:**
There is a need for a stronger national-level legal and institutional framework to reduce transaction costs.

**Recommendation 1:**
Develop national guidelines, standards, and protocols.

The National Regulation for Eco-compensation, formulated by the National Development and Reform Commission (NDRC) in 2020 and currently under consultation, should provide an improved legal basis for the national implementation of eco-compensation schemes. However, more specific protocols, regulations, and methods are needed from the national level to guide development and implementation. Among others, national-level guidelines, standards, and protocols are required to ensure consistency and compatibility in water quality monitoring and verification, including the determination of river and lake health indices and environmental flows.

**Challenge:**
There is a need for inter-provincial coordination and consultation mechanisms.

**Recommendation 2:**
Enhance river basin coordination and consultation mechanisms.

Inter-provincial eco-compensation schemes require the cooperation of governments across provinces, and the cooperation of multiple line departments, Provincial Development and Reform Commissions (PDRCs), finance, and other agencies. However, there is no authoritative platform for consultation in the YREB, and the river basin management institutions are currently unable to sufficiently provide this function. Even though some cooperative actions have been taken by local governments on river basin pollution, the degree of institutionalization of these cooperative actions is relatively low, and they stay at the level of meetings. They generally take the form of a collective consultation, which is strictly a noninstitutional cooperation and coordination mechanism advocated by local governments. Once substantive interests are involved in this coordination mechanism based on collective consultation, it is often unable to reach a consensus.

In order to facilitate eco-compensation schemes at the river basin scale, (1) river basin authorities could be given the mandate to act as a platform or convenor to promote coordination between different sectors and jurisdictions;
Challenge: Water management responsibilities are fragmented in different ministries and sometimes conflicted sector plans.

Recommendation 3: Enhance cross-sector coordination with clear and separated functions and harmonize planning processes.

To address implementation issues relating to the separation of policy areas and provide clear demarcation of implementation and service delivery roles from consultative, executive, regulatory, monitoring, and evaluation roles within and between government agencies (1) harmonize the different sector planning processes and sector plans, for instance, the river basin master plan, spatial planning, the environmental and ecological protection plan, and so forth; and (2) enhance consultative mechanisms and their effectiveness during different sector planning processes.

INFORMATION AND KNOWLEDGE

Challenge: Basin-level objectives and understanding of conditions are lacking.

While there is a proliferation of eco-compensation schemes, current eco-compensation schemes are focused at subbasin levels and often carried out with a specific administrative region, i.e., county, municipality, and province. There is a lack of holistic basin-level environment goals to guide the design of eco-compensation schemes, including no systematic framework for monitoring and assessment to determine the baseline, establish objective targets, and identify key locations with the highest marginal returns. There is also a lack of pollutant inventories, baselines, and estimates of the environmental carrying capacity of the Yangtze River Basin, both in the main stem and in the tributaries.
**Recommendation 4:**
Conduct basin-level studies and establish basin objectives.

River basin hydrological and water quality modelling should be carried out based on an inventory analysis of water use and polluting activities. Basin-level environmental objectives, for instance maximum pollutant loads, should be determined to guide the development of eco-compensation schemes. A hot spot analysis should also be conducted at the basin level to identify locations for the most cost-effective interventions.

**Challenge:**
Eco-compensation rates are often low and cannot compensate for the foregone opportunity development cost in upstream reaches.

The determination of compensation standards is cited as a challenge to the development of eco-compensation across the YREB (and more broadly, China). Robust compensation standards should consider (1) the damage caused by the externality in total, or at least the treatment cost (i.e., the portion of the damage caused that is most economically relevant to downstream communities); and (2) foregone opportunity costs of upstream economic activity, plus any transaction and administration costs. In many cases, the compensation paid to local governments in the upper reaches of the basin does not cover the opportunity cost of efforts to protect the environment. For example, in the case of the Xin’an River, Huangshan City has forgone some development opportunities and made large investments in pollution control. Funds received by Huangshan City are far from covering these costs. There is also a need to quantify the causal relationship between the program’s measures and the ecological effects that result as part of the program design process.

**Recommendation 5:**
Improve the identification and evaluation of water’s values.

Water provides a wide range of benefits associated with context-specific values. It is important to evaluate a wide range of the ecological and cultural, as well as economical, benefits that ecological protection and improved water management provide. Those exercises need to involve the full range of stakeholders. There are well-established techniques for valuing ecosystem services, including through participatory means; technical guidance from basin organizations, such as the MWR or MEE, could be used to help ensure consistent quality. More broadly, negotiations between parties in a voluntary context or reverse auctions (where parties bid for the right to provide ecological services) can determine appropriate compensation amounts.

**Challenge:**
Information sharing, especially with broader stakeholders, remains limited.

Information sharing and transparency are not only crucial to facilitating the establishment of credible inter-provincial eco-compensation schemes, they are also necessary for identifying and evaluating the wide range of values associated with the benefits derived from water and ecological protection.
However, information availability both from and to the public is limited, and information flows within the governmental system are often siloed. For example, environmental departments publish routine water quality data that often only list the class of water quality rather than the concentration of specific pollutants, which hinders the ability for stakeholders to undertake their own inventory analysis, and more broadly, undermines confidence in programs.

Recommendation 6:
Promote information sharing, transparency, and citizen engagement.

Sector departments, including environment, water, and urban, and different levels of government, often have their own isolated information platforms. Public access to those data is even more restricted, with some of the data only published in hard copy, if at all. Some nongovernment organizations have made attempts to increase both data from and to the public by (1) machine learning technologies that consolidate various data from online sources; and (2) online platforms and cell phone apps that allow the public to upload and download information. Those advanced technologies and practices can also be introduced to help improve information transparency in eco-compensation schemes.

INCENTIVES AND COST-EFFECTIVENESS

Challenge:
Eco-compensation funding is not diversified, and private sector participation is low.

As seen across the YREB, eco-compensation pilots are organized and implemented by governments, with low participation of enterprises and the public. There is an exception in the Chishui River Basin Program, where eco-compensation contributions are made by the Maotai distillery and other enterprises, but such examples remain atypical. In 2016, 87.7 percent of total ecological compensation funds were provided by the central government, 12.0 percent by the local government, and the proportion of funds from all sectors of society below 1.0 percent. Furthermore, funds within the YREB are characterized by “less horizontal and more vertical,” that is, a high reliance on central government transfers. This reduces the incentive strength of the program, as results are not directly paid for by downstream beneficiaries (either jurisdictions or enterprises).

26 Statistics compiled by the China Ecological Compensation Policy Research Center, China Agricultural University.
There is a lack of benefit sharing between the downstream and upper-middle stream of the Yangtze River Basin. Ecological services have regional characteristics, and the income of ecological services is unevenly distributed among different regions. Enterprises or jurisdictions in the middle and lower reaches of the Yangtze River Basin, as the direct beneficiaries of ecological services, should provide compensation funds to the upper reaches of the Yangtze River Basin through horizontal transfers; diversified benefit sharing mechanisms can also be developed. In addition to financial subsidies, industrial support, technical assistance, talent support, employment training, and other compensation methods lack due attention.

**Recommendation 7:**
Diversify financing sources and leverage the private sector.

Diversified funding can be achieved through matching programs, which pair private or municipal funds contributions (for example, from water utilities) with central or provincial funds. Over time, these matching funds may decrease as familiarity with the program develops and transaction costs are reduced through economies of scale and organizational efficiency. This mirrors the central government’s use of matching funds to encourage provincial development of horizontal programs, beyond the public sector.

**Challenge:**
Fund allocations in vertical schemes do not emphasize the importance of ecological protection.

Transfer payments in many provincial programs are based more on population characteristics (development status, population, and ethnic group proportion) than on ecological indicators. Compounding this, formulas are often not made public. Provincial governments have significant power through their allocation of compensation funds, which may lead to the problem of unequal allocation and biases in performance evaluation. Although the provincial governments of the YREB explicitly require the provincial finance departments to establish performance evaluation mechanisms and implement rewards and punishments accordingly, such mechanisms are not commonly established.

In some cases, the multi-objective nature of allocation mechanisms leads to an inefficient use of funds. Considerations of livelihood and development objectives are built into the allocation decisions of some regional and national funds. For example, in the transfer policy of national key ecological function areas, provincial governments have a large flexibility in allocating the funds, which may lead to “equalitarianism”—positive in terms of equity considerations, but resulting in a large number of funds being invested in regions with lower ecological efficiency.

**Recommendation 8:**
Promote results-based financing to ensure achievement of the environmental and ecological goals.

Recognizing that public spending still constitutes the primary source for ecological and environmental protection activities, it is key to improving their efficiency and maximizing the impacts. Governments have been implementing a policy of “rewards replacing subsidies” for decades for various targets, which has helped direct the allocation of fiscal resources based on the achievement of clearly
defined indicators. International financing institutions, such as the World Bank, have promoted results-based financing instruments (which may interface well with carefully developed and well-functioning results-based eco-compensation programs). Compared to traditional infrastructure financing, results-based financing promotes the effectiveness of the financing. These principles apply equally to government financing. An alternative to results-based financing is to enhance the system of monitoring, tracking and performance evaluation of ecological and environmental spending, which is crucial to maximize the ecological protection outcomes with limited public resources.

**Challenge:**
There is a lack of coordination between different types of vertical eco-compensation schemes due to insufficient integration in river basin management.

**Recommendation 9:**
Avoid duplicate financing where unnecessary to incentivize the desired action.

In one location there are commonly multiple schemes focused on forests, rivers, grasslands, wetlands, and other ecosystems managed by different sector departments. Special transfer payments are made by each department, leading to repeated investment, duplicated payments for the same essential activities, and an overall lack of strategic deployment of public resources. Programs are not typically developed in the context of an integrated river basin management framework, which could otherwise help direct program designs toward the most efficient activities for given ecological and water pollution outcomes.

Map and coordinate flows of funding and interventions to realize synergies and co-benefits between different targeted programs. For example, wetland restoration can provide both biodiversity and water benefits, with some wetland projects potentially eligible for financing from different eco-compensation schemes. This may be justified in cases where such stacking of payments is required to overcome the opportunity cost of the action. However, conditions under which this is permitted should be specified, and stacking otherwise minimized for the cost-effectiveness of payments in aggregate. The management of different channels of funds should be designated to the same department to avoid inefficient stacking, otherwise information sharing between agencies would be critical.
Section 6.

Conclusion

China has ambitious plans for transition from a traditional emissions- and resource-intensive economic growth path, toward high quality and sustainable development with increasing emphasis on the environment. The YREB Development Plan, and the National Strategy for Ecological Protection and Restoration of the Yangtze River, are illustrative of such ambition. However, with substantial regional development disparities, protection of the Yangtze River faces persistent challenges in balancing the need for socioeconomic development in the upper and middle reaches, and the rising national expectation and aspiration for ecological restoration and environmental protection.

Eco-compensation provides a pathway for realizing the government’s aspirations for the Yangtze River. This is recognized by the government, as reflected in the national rhetoric around “clear waters and lush mountains are invaluable assets” (signaling the economic and social value of natural capital). Eco-compensation is being increasingly applied toward the government’s vision for the Yangtze River Basin’s ecological protection and water pollution control.

This policy note has presented an overview of five programs in the Yangtze River Basin, chosen for their differing approaches and geographies. Despite these differences, common themes and challenges faced by each can be seen, leading to a set of broad policy recommendations (figure 6.1). With adaptive policy processes, harmonized and transparent data, and monitoring, China’s extensive experience with eco-compensation can point the way to improved programs in the future.
FIGURE 6.1: Recommendations for Improving Eco-compensation Schemes in the YREB

**INSTITUTIONS**
- Develop national guidelines, standards, and protocols
- Establish inter-jurisdiction coordination mechanisms at the basin level
- Enhance cross-sector coordination and harmonize different sector plans

**INFORMATION**
- Conduct basin studies and establish basin objectives
- Identify and evaluate the value of water and ecosystems
- Promote information sharing and citizen engagement

**INCENTIVES**
- Diversify financing sources and leverage the private sector
- Promote results-based financing on ecological and environmental protection
- Avoid duplicate financing where unnecessary

*Source: Authors’ elaboration.*