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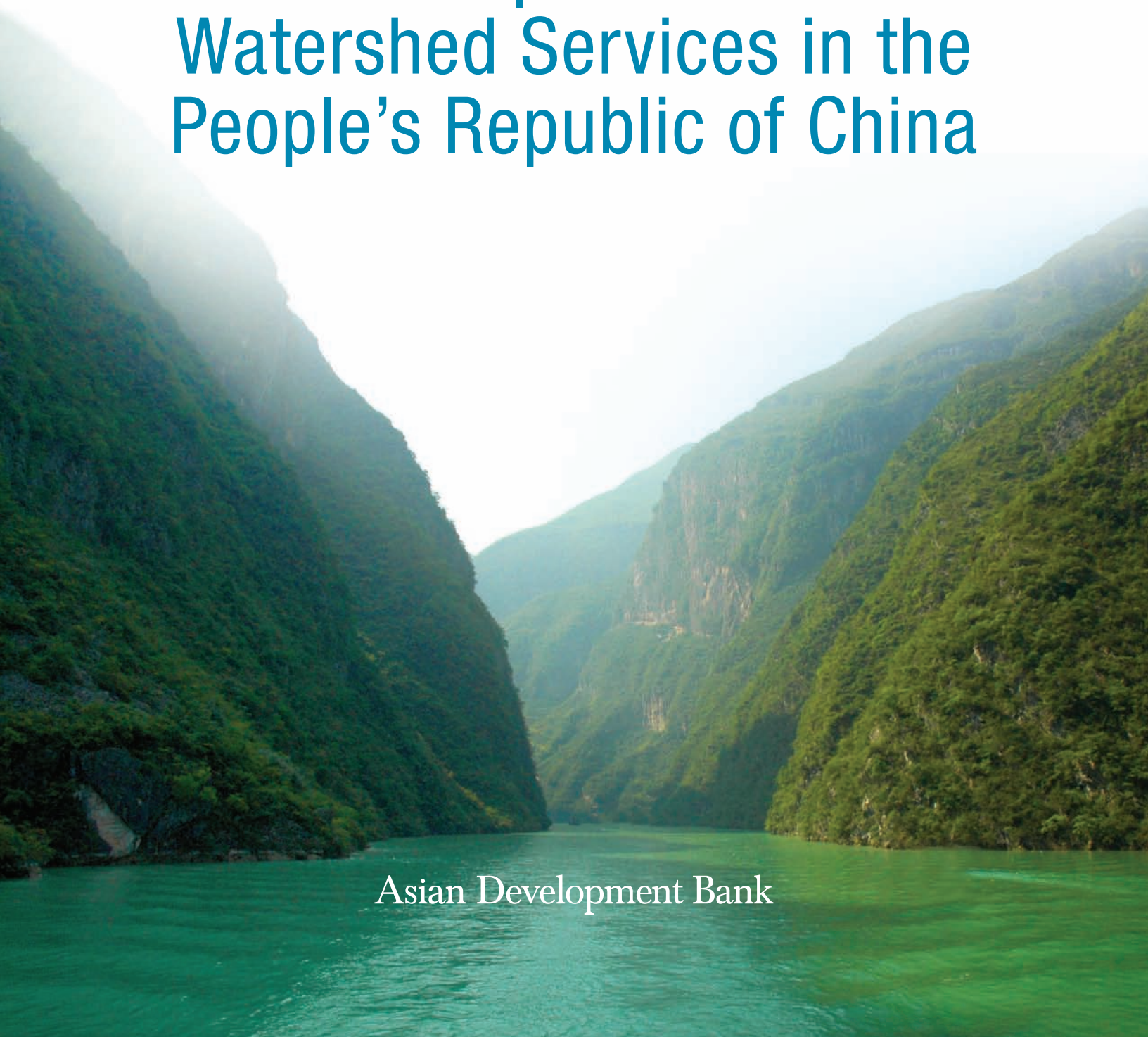
Eco-Compensation for Watershed Services in the People's Republic of China



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Eco-Compensation for Watershed Services in the People's Republic of China

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Preface

This report was produced to complement the International Conference on Payment for Watershed Services and Eco-Compensation Legislation, held in Ya'an, Sichuan Province, People's Republic of China (PRC) on 23–24 October 2010. The conference was cohosted by the National Development and Reform Commission, the Sichuan Provincial Government, and the Asian Development Bank, in partnership with the Chinese Academy for Environmental Planning and the Ministry of Environmental Protection of the PRC. In addition to these agencies, the conference was also attended by representatives from the Legislative Affairs Office of the State Council, the Ministry of Finance, the Ministry of Land and Resources, the Ministry of Housing and Urban–Rural Development, the Ministry of Water Resources, the Ministry of Agriculture, the State Administration of Taxation, the State Forestry Administration, the State Statistical Bureau, and the State Oceanic Administration, as well as representatives from provincial government development and reform commissions and environmental departments in the provinces of Anhui, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Shaanxi, Shandong, and Zhejiang. More than 150 people participated in the conference.

While developed as a stand-alone knowledge product, this publication is a continuation of the collaboration with the National Development and Reform Commission in developing the national Eco-Compensation Ordinance. Two publications have already been produced from this collaboration—*An Eco-Compensation Policy Framework for the People's Republic of China: Challenges and Opportunities;* and *Payments for Ecological Services and Eco-Compensation: Practices and Innovations in the People's Republic of China.*

Acknowledgments

This paper was jointly prepared by Qingfeng Zhang and Michael T. Bennett, with the guidance and inspiration of Klaus Gerhaeusser, director general of the East Asia Department of the Asian Development Bank (ADB). Mr. Gerhaeusser also led the international team of experts and speakers at the International Conference on Payment for Watershed Services and Eco-Compensation Legislation, which was held in Ya'an, Sichuan Province, People's Republic of China (PRC) on 23–24 October 2010. Reports and findings presented during the conference were the bases of this publication. ADB staff, including Kunhamboo Kannan, Wouter T. Linklaen Arriens, and Alvin Lopez, who attended and spoke at the conference, contributed to the preparation of this paper.

Consultants Robert Crooks and Leshan Jin, who were also speakers at the conference, helped in developing the concept and refining the recommendations. External peer review was also provided by John Talberth, Evan Branosky, and Cy Jones from the World Resources Institute. Melissa Alipalo, Anthony Victoria, and Joy Quitazol-Gonzalez contributed in the editing, design, and production of this publication.

This knowledge product benefited from the strong support and close collaboration of ADB with the National Development and Reform Commission (NDRC), through whose successful organization and hosting of the conference, the information provided in this report has been made possible. ADB is particularly grateful to Vice Chairman Du Ying of the NDRC, for his leading role in cross-ministerial efforts on payment for ecological services in the PRC. ADB would also like to thank Qin Yucai, director-general of the Department of Western Region Development of the NDRC, and his colleagues Zhang Yadan, Tong Zhangshun, and Xiao Weiming for their excellent coordination and technical capacity in dealing with this cross-agency work.

Abbreviations

ADB	–	Asian Development Bank
CCFG	–	Conversion of Cropland to Forests and Grassland
IRBM	–	integrated river basin management
NDRC	–	National Development and Reform Commission
NFPP	–	National Forest Protection Program
NPS	–	nonpoint source (pollution)
MoF	–	Ministry of Finance
MWR	–	Ministry of Water Resources
PES	–	payment for ecological services
PRC	–	People's Republic of China
SEPA	–	State Environmental Protection Administration (now called Ministry of Environmental Protection)

Executive Summary

Water is possibly the single most pressing resource bottleneck to the ongoing economic growth of the People's Republic of China (PRC) over the next 10–15 years. Annual per capita freshwater resources are among the lowest for a major country, and effective water resources are further reduced by pollution. According to the country's Macro Strategic Research Report on the PRC's Environment, released in April 2011, drinking water for one in seven Chinese does not meet national pollution standards, while 300 million rural Chinese lack access to safe drinking water. A recent report by the World Bank estimated that the PRC's water crisis is already costing the country 2.3% of its gross domestic product, of which 1.3% is attributable to water scarcity and 1.0% is from the direct impacts of water pollution. This, however, is a conservative lower-bound estimate of the true costs.

In the face of these challenges, the central and the provincial governments across the PRC have been investing in and seeking new ideas and methods for improving both supply-side and demand-side management of water resources. This has included numerous national, provincial, and local experiments over the past decade in market-based environmental policy tools under the broad heading of "eco-compensation," with this trend culminating in central government uptake wherein the National Development and Reform Commission (NDRC) has been tasked with developing a national eco-compensation ordinance.

Eco-compensation not only shares characteristics with payments for ecological services, but also encompasses fiscal transfer schemes between provincial governments to improve the apportioning of funding for and clarify responsibilities and tasks on environmental management, especially on ecological service flows that cross administrative and regional boundaries, such as watershed ecological services. Such innovations have been at the core of the government's ongoing efforts to identify and address the underlying institutional drivers of the PRC's water crisis. The degree to which this will ultimately be successful is not only critical for the PRC, but also has major global ramifications, impacting world food and fuel markets most directly, and having repercussions throughout international commodity and production chains.

This paper details progress to date on the development of the national Eco-Compensation Ordinance, and highlights the ongoing institutional challenges faced by policy makers in developing an effective ordinance. In particular, water management in the PRC is scattered across multiple central government and provincial agencies. No less than 10 national ministries, for example, have some form of water management responsibility. Furthermore, while water resources are state owned according to both the original and revised Water Law of the People's Republic of China (1988, 2002), with the state responsible for allocating resources through government orders and water quotas, this system has resulted in poorly defined water use rights and artificially low water prices, leading to de facto open access, conflict, and inefficient distribution of resources. As such, water management in the PRC remains fragmented, uncoordinated (both horizontally and vertically), and lacking in sufficient legal structure and foundation, with numerous overlapping and/or ambiguous regulatory mandates and rights. This, combined with relatively weak central government enforcement capacity, has hindered effective watershed and water resource protection and management.

There is already a significant and growing body of national and provincial rules and policies that either directly mention or have an important bearing on eco-compensation.Thus, while strengthening legal foundations will be important, the NDRC also faces the challenge of developing the national Eco-Compensation Ordinance in a way that complements and strengthens current institutional and regulatory frameworks governing environmental management (or at a minimum does not create additional administrative and regulatory conflicts), while retaining sufficient flexibility to be able to anticipate, evolve with, and if possible, influence the ongoing reforms of the PRC's environmental management system, in general, and watershed management, in particular.

Given these challenges, this paper makes three key recommendations for the design of the Eco-Compensation Ordinance as it relates to water:

1. Consider eco-compensation as a potential tool for integrated river basin management

   Much work still needs to be done in the PRC, as elsewhere, to develop effective, comprehensive frameworks for integrated river basin management. While this presents a significant challenge, it also provides numerous opportunities for the application of eco-compensation mechanisms. Eco-compensation mechanisms can be valuable as a means to sustainably finance watershed investment and management. Such mechanisms can likewise help identify key obstacles to achieving sustainable watershed management, and serve as important platforms for watershed protection engagement and negotiation among the key stakeholders. While the institutional labyrinth of water management in the PRC highlights the challenges ahead, a well-designed eco-compensation ordinance coupled with sufficient follow-up supporting regulations, funding, and activities could be an effective platform and focal point to harmonize the disparate water-related management responsibilities that are distributed across various ministries and regional government units.

2. Balance firmness with flexibility—focus on outcomes

   As watershed ecological services significantly depend on scale and location, policy makers need to strike a balance between creating a strong regulatory framework to ensure compliance, and allowing for flexibility in how outcomes are achieved so as to allow for and catalyze local-level innovation and adaptation of central policies to fit local needs and constraints. Significant effort has been devoted to developing criteria and formulas for calculating eco-compensation subsidies and fiscal transfer rates. Greater focus on the ultimate goals or outcomes of eco-compensation policy—the effective protection, restoration, and improvement of key ecological service flows and environmental resources—will help keep the discussion centered on the importance of developing appropriate incentives, rather than, as is currently the case, on the development of formulas for calculating subsidy rates. Ultimately, the most basic and fundamental question for an eco-compensation program is whether the benefits outweigh the costs. All that should matter, fundamentally, is that outcomes are achieved and that both parties benefit from participation in an eco-compensation scheme. Focusing on outcomes, but allowing for flexibility in how they are achieved, will not only help to engender innovations that can ultimately lower program costs, but the resultant regional variations in eco-compensation programs could also reveal the regional costs and benefits of ecological services provision, which could then serve as a guide to better target limited funds to achieve maximum conservation outcomes. Focusing on outcomes also highlights the point that eco-compensation is only one of a number of potentially useful policy tools.

3. Take account of the scale of actors

While the Eco-Compensation Ordinance hopes to encompass all levels of potential buyers and providers of ecological services—from central government to individual land users—within a common framework, the institutional "size" of the parties involved will have important impacts on how they should be treated in the ordinance. The degree to which different stakeholders have clear property rights and responsibilities over specific ecological service flows influences the feasibility of developing eco-compensation schemes in different contexts, while the "size" of actors has important bearing on the degree to which such property rights are already clearly delineated within the PRC's regulatory system.

In the case of "large" buyers and suppliers (e.g., provincial governments), the most challenging environmental management issues relate to ecological service flows that spill across multiple administrative and regional boundaries, such as from watershed ecosystems. In the PRC, much work needs to be done to strengthen and clarify both the legal frameworks governing water use rights and the relationships between the multiple government-level stakeholders of watershed ecological services; but, to a large degree, this is work that needs to be done outside the eco-compensation regulatory framework. Thus, the ordinance will need to be structured in a way to anticipate this and, if possible, help facilitate and influence the transition to a watershed management regime wherein regional and administrative rights and responsibilities are more clearly delineated.

In contrast, land rights in the PRC are *de jure* already strong enough to support the development of an eco-compensation program targeting individual land users. Furthermore, in cases where actual tenure is shorter and less stable than that stipulated by law, eco-compensation programs targeting individual land users can often help strengthen tenure by providing additional guarantees over land enrolled in programs, and can thus create legal precedence. As such, in regulating eco-compensation programs that target individual land users, policy makers need not be as concerned about the delineation of property rights, but rather could spend more effort on developing guarantees to protect the rights and welfare of individual land users that participate in these schemes. Given such guarantees, eco-compensation policies targeting individual agricultural land users have the potential to serve as a valuable means to proactively address future environmental stresses on and resulting from the agricultural sector.

The International Conference on Payment for Watershed Services and Eco-Compensation Legislation, held on 23–24 October 2010 in Ya'an, Sichuan Province concluded that while the challenges and constraints to watershed eco-compensation schemes are still significant and will require all stakeholders to continue to strive for better solutions, there is already a strong foundation of experience, commitment, and capacity to build upon as policy makers develop the national Eco-Compensation Ordinance.

Introduction

Water is possibly the single most pressing resource bottleneck to the ongoing economic growth of the People's Republic of China (PRC) over the next 10–15 years.[1] Annual per capita freshwater resources are among the lowest for a major country, and effective water resources are further reduced by pollution.[2] According to the country's Macro Strategic Research Report on the PRC's Environment, released in April 2011, drinking water for one in seven Chinese does not meet national pollution standards, while 300 million rural Chinese lack access to safe drinking water.[3] A recent report by the World Bank has estimated that the PRC's water crisis is already costing the country 2.3% of its gross domestic product, of which 1.3% is attributable to water scarcity and 1.0% is from the direct impacts of water pollution. This, however, represents a conservative lower-bound estimate of the total costs.[4]

In the face of these challenges, the central and provincial governments across the PRC have been actively investing in and seeking new ideas and methods for improving both supply-side and demand-side management of water resources.[5] This has included numerous national, provincial, and local experiments since 2000 in market-based environmental policy tools under the broad heading of "eco-compensation," with this trend culminating in central government uptake wherein the National Development and Reform Commission (NDRC) has been tasked with developing a national eco-compensation ordinance.[6]

Eco-compensation not only shares characteristics with payments for ecological services (PES), but also encompasses fiscal transfer schemes between regional governments to improve the apportioning of funding for and clarify responsibilities and tasks on environmental management, especially regarding ecological service flows that cross administrative and regional boundaries, such as watershed ecological services. Such innovations have been at the core of the government's ongoing efforts to identify and address the underlying institutional drivers of the PRC's water crisis. The degree to which this will ultimately be successful is not only critical for the PRC, but also has major global ramifications, impacting world food and fuel markets most directly, and having repercussions throughout international commodity and production chains.

The concept of eco-compensation has been an important focus and catalyst for debate and experimentation on the future direction of the PRC's evolving environmental management framework, and thus has been at the lead in what could be a historic shift in the country's economic development paradigm. Though this shift has been quietly taking place over the past decade or more, it was formally given voice by Premier Wen Jiabao at the Sixth National Conference on Environmental Protection in 2006, when he announced that the PRC would adopt a more sustainable approach toward economic development that emphasizes

A recent report by the World Bank has estimated that the PRC's water crisis is already costing the country 2.3% of its gross domestic product, of which 1.3% is attributable to water scarcity and 1.0% is from the direct impacts of water pollution

the quality of growth, proactively pursues environmental protection, and more equally balances environmental management with economic development.[7] As part of this new direction, the government completed in 2010 a national function-based land zoning plan to serve as the basis for a more comprehensive system of environmental planning and management that will also include (i) reforms to the public sector fiscal system to better apportion funding for environmental management and target key ecological function zones, and (ii) revision of the system for evaluating the performance of local officials to place greater emphasis on environmental and sustainable development targets.[8] Eco-compensation is to serve as a key component of this system.

Box 1 discusses the work being undertaken by the NDRC toward the development of the PRC's Eco-Compensation Ordinance.

Box 1 Phases in Developing the National Eco-Compensation Ordinance

The National Development and Reform Commission (NDRC) has taken a number of important steps toward developing the Eco-Compensation Ordinance of the People's Republic of China (PRC). The work has been developed in three phases:

Phase 1: Planning and Organization

The first phase involved the establishment of a steering committee, a small working group, and an expert consultative committee for the development of the draft ordinance. The steering committee is comprised of key officials from 10 central government ministries, including the NDRC, the Ministry of Finance, the Ministry of Land and Resources, the Ministry of Environmental Protection, the Ministry of Agriculture, and the Ministry of Water Resources, with NDRC Vice Chairman Du Ying serving as leader and Ministry of Finance Vice Minister Liao Xiaojun serving as deputy leader. The small working group is comprised of representatives from the 10 ministries and has over 30 members. It is situated in the offices of the NDRC and is headed by Director General Qin Yucai of the NDRC's Department of Wester Region Development. The expert consultative committee, comprising 25 academics and experts, is headed by Shen Guofang of the Chinese Academy of Engineering. Li Wenhua of the Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, serves as deputy leader.

Phase 2: Survey Work and Solicitation of Public and Expert Input

The second phase involved comprehensive survey research. The draft ordinance working group was divided into seven research groups to conduct surveys in 13 provinces, with high-quality research reports produced at the end of each survey. The NDRC has also been eliciting both public and expert feedback on the draft ordinance. It established a page on its website to elicit online public feedback, and has been hosting annual international conferences, with the support of the Asian Development Bank (ADB), to inform the development of eco-compensation in the PRC. The first conference was in Shizuishan, Ningxia Hui Autonomous Region, in September 2009. From this, two publications were produced to synthesize findings and provide policy input.[a] The second conference, from which this publication has been developed, was held in Ya'an, Sichuan Province in October 2010. A third conference will take place in Jiujiang (on Boyang Lake), Jiangxi Province, in November 2011.

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Box 1 *continued*

Phase 3: Develop the Draft Ordinance and Key Policy Documents

The third phase has involved the development of a core framework for the Eco-Compensation Ordinance and the drafting of a preparatory policy document entitled Several Opinions Regarding Establishing and Refining Eco-Compensation Mechanisms. This document is a critical, formal step for the establishment of a national ordinance. To date, the document has gone through three central government revisions and two formal reviews from the State Council, and has received significant feedback and suggestions from the country's 31 provinces, municipalities, and autonomous regions in three separate symposia held in Hefei (Anhui Province) for central PRC, Xiamen (Fujian Province) for east PRC, and Chongqing Municipality for west PRC. A revised draft of the document will be completed and formally submitted for input from the State Council and relevant ministries by the end of 2011.

Based on expert and government feedback, the draft Eco-Compensation Ordinance currently consists of eight sections: general principles, scope and targets, methods, subsidy standards, payment reporting procedures, monitoring and ex-post program evaluation, penalties and legal responsibilities, and appendix, with a glossary of terms and the details of the period of effect for the ordinance. In drafting the Eco-Compensation Ordinance, the working group considered that three laws already contain explicit eco-compensation components within them. These are the Forest Law of the PRC, which has regulations governing the Forest Ecological Compensation Fund; the Mineral Resource Law of the PRC, which has regulations governing mineral resource compensation fees; and the Water Pollution Prevention and Control Law of the PRC, which has regulations regarding financial transfer payments.

[a] Zhang et al. 2010a. *An Eco-Compensation Policy Framework for the People's Republic of China: Challenges and Opportunities*. Manila: ADB; and Zhang, et al., eds. 2010b. *Payments for Ecological Services and Eco-Compensation: Practices and Innovations in the People's Republic of China*. Manila: ADB.

Source: Xiao, Weiming. 2011. The Development of a National Eco-Compensation Regulatory and Policy Framework. Report from the Eco-Compensation Technical Assistance Grant Initiation Meeting, cohosted by ADB and the NDRC. 17 May; and Du, Ying. 2010. Vigorously Building a Regulatory System of Safeguards, Accelerating the Development of Sound Eco-Compensation Mechanisms. Address from the Vice Chairman of the NDRC at the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

The process of developing the national Eco-Compensation Ordinance also reveals much about the remaining challenges in reforming the PRC's system of environmental governance regarding water. As elsewhere, water management responsibilities in the PRC are scattered across multiple central government ministries and regional entities (endnote 1). The resulting system of overlapping and/or ambiguous regulatory responsibilities and rights, combined with relatively weak central government enforcement capacity, has hindered effective management, and this is something the central government has pledged to address.[9] The various central and provincial government agencies involved in the development of a national eco-compensation regulatory framework have thus all been keen to provide input and retain their footing in this evolving institutional landscape. This has been most clearly articulated in the multiple ongoing initiatives being developed by the different ministries. The Ministry of Environmental Protection and the Ministry of Water Resources, for example, are both developing their own watershed eco-compensation pilot projects, while numerous provincial pilot projects vie for the attention of the central government. Viewed from this perspective, the disparate eco-compensation-related activities taking place across the country can be seen to represent an ongoing dialogue

Box 2 Eco-Compensation Primer

What is eco-compensation?

The National Development and Reform Commission (NDRC) of the People's Republic of China (PRC) has developed what it considers to be a fairly consistent tentative definition of "eco-compensation" for the purpose of the ordinance, which is as follows:

> Eco-compensation is a type of public system or institution that brings to bear either public or private sector measures to adjust the relative benefits and costs of ecological service provision among the key stakeholders in order to realize the goals of protecting the environment; promoting the harmonious coexistence of man and nature; and comprehensively considering the costs of conservation, opportunity costs of foregone development, and the value of ecological service provision.

This definition contains three key components:

(i) **Subject and object of eco-compensation:** The subject of eco-compensation are the beneficiaries of ecological services: the government (central and provincial), organizations, enterprises, communities, and individuals. The objects of eco-compensation (i.e., those that receive payments) are those that supply and protect the provision of these ecological services, whether they are individuals, organizations and enterprises, or provincial or local governments. The NDRC is also developing a separate class within the Eco-Compensation Ordinance for those who degrade ecological services and those who suffer from the impacts of degradation, with limited liability regarding past degradation.

(ii) **Eco-compensation subsidy standard:** This will be calculated taking the conservation cost as the basis, while also adding opportunity cost (referred to in PRC policy documents as the "development opportunity cost") and the value of the ecological services being targeted.

(iii) **Eco-compensation methods:** At present, two types of payment methods or sources are defined to be addressed separately in the Eco-Compensation Ordinance: public sector instruments and private sector instruments.[a]

What is the scope of eco-compensation?

The government is currently developing eco-compensation regulations around seven key areas: forestland, grasslands, wetlands, water, marine resources and ecosystems, desertified areas and wastelands, and mining zones. For the moment, the government is not considering the inclusion of the agriculture sector or of climate regulatory services, since the national government already has numerous subsidies in place for agriculture, and the inclusion of the ecological services of climate regulation would significantly complicate the task of completing the Eco-Compensation Ordinance. Of these seven areas, forestry is the most developed; the Forest Ecological Compensation Fund, for example, currently protects around 193 million hectares (2.9 billion *mu*)[b] of forests. The second most developed is for grasslands, with eco-compensation subsidies for the goal of effectively protecting 246.7 million hectares (3.7 billion *mu*) of grassland. Pilot projects for wetlands and watershed eco-compensation are currently under development, while mining eco-compensation pilot projects in places such as Shanxi Province have been promoting sustainable development funds procured from mining fees.

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Box 1 *continued*

What are the Eco-Compensation Policy Instruments?

This includes both public and private sector payments and instruments. Public sector measures that will be addressed in the Eco-Compensation Ordinance consist of the following:

(i) **Financial transfer payments:** These include vertical fiscal transfers—central-to-local government transfers, and provincial-to-subprovincial government transfers. For the 12th Five-Year Plan period, the central government plans to have eco-compensation or ecological payment transfer systems to cover all key national level ecological function zones, though it still needs to establish a viable system for this. Provincial governments similarly want to set up analogous provincial to subprovincial systems.

(ii) **Continuation of preexisting ecological programs that have eco-compensation characteristics and functions:** This includes the continuation of the Conversion of Cropland to Forests and Grassland Program, the Beijing-Tianjin Sandstorm Source Control Program, and the Natural Forest Protection Program.

(iii) **Improvement of the related system of natural resource environmental taxes and fees:** At present, the PRC has 14 types of environment-related taxes and fees. The NDRC has the goal of incorporating an eco-compensation component into these to establish a stable and sustainable source of revenue for public sector eco-compensation.

Regarding private sector measures, the Eco-Compensation Ordinance will emphasize the development of programs in the PRC's developing western regions, including between upstream and downstream areas, between protected areas and beneficiary areas, and between economically lagging and economically developed regions. This will also include instruments such as water rights trading, carbon trading, and eco-labeling.

To ensure the operability of these policy measures, the NDRC has expressed interest in developing a central government-level inter-ministerial coordination small group led by the NDRC and the Ministry of Finance that will include representatives from the key ministries. This group would meet regularly to discuss and resolve the significant empirical and theoretical questions regarding the effective development and implementation of eco-compensation policies, with each ministry responsible for providing guidance on its particular realm of responsibility. The establishment of this type of institutional structure could be a significant step toward setting up a national eco-compensation system.

[a] These are referred to in Chinese as zhengfu shouduan (政府手段) and shichang shouduan (市场手段), respectively.

[b] A *mu* is a traditional Chinese unit of land measurement (1 *mu* = 1/15 hectare).

Source: Xiao, Weiming. 2011. The Development of a National Eco-Compensation Regulatory and Policy Framework. Report from the Eco-Compensation Technical Assistance Grant Initiation Meeting, cohosted by ADB and the NDRC. 17 May; and Du, Ying. 2010. Vigorously Building a Regulatory System of Safeguards, Accelerating the Development of Sound Eco-Compensation Mechanisms. Address from the Vice Chairman of the NDRC at the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

between different central government ministries and central and provincial governments regarding the direction that the reforms to the PRC's institutions for water management should take.

Box 2 summarizes the Eco-Compensation Primer developed by the NDRC to clarify the definition and scope of eco-compensation for the purpose of facilitating the development of the ordinance.

This report discusses current developments in the PRC, and provides suggestions for the watershed component of the national Eco-Compensation Ordinance.

The Water Crisis in the People's Republic of China

In the summer of 1998, massive floods along the central Yangtze River and in the Songhua and Nen rivers in the northeast killed 3,000–4,000 people, left 14 million people homeless, and caused $26 billion in damages. While high rainfall was an important contributor, many domestic experts concluded that excessive deforestation in upper watershed areas and the extension of agriculture onto marginal and sloping lands significantly degraded key watersheds and exacerbated the severity of the floods.[10] The previous year, the Yellow River had experienced a severe dry-out, failing to reach the sea for a record 267 days.[11]

The 1997–1998 floods and dry-out were important milestones, bringing home to policy makers the importance and adverse impacts of unsustainable development on water quality and quantity. However, the degradation of water resources and watershed ecological services had been occurring long before the 1998 floods; several decades of breakneck economic growth, high population densities in key watersheds, and ongoing institutional complexities and challenges in achieving effective water resource governance had long set the groundwork for these and subsequent water-related disasters.[12]

The 1997–1998 floods and dry-out were important milestones, bringing home to policy makers the importance and adverse impacts of unsustainable development on water quality and quantity

Water is possibly the single most pressing resource bottleneck to the PRC's ongoing economic growth over the next 10–15 years (endnote 1). Although the PRC may have the world's sixth-largest annual renewable water resources at around 2,812 cubic kilometers, it ranks 128th in the world in terms of per capita water availability (estimated to be 2,156 cubic meters in 2007) (endnote 2). The availability problem is exacerbated by the uneven distribution of water resources: the north has only 31% of available supplies but contains 64% of the country's arable land as well as some of the country's largest cities (43 million people in Beijing–Tianjin alone).

When the effects of pollution are factored in, only about 30% of the country's total renewable water resources are available for use (endnote 2). For decades, factories and municipalities have dumped untreated waste directly into streams, rivers, and coastal waters.[13] As a result of this legacy, the Macro Strategic Research Report on the PRC's Environment, released in April 2011, reports that drinking water for one in seven Chinese does not meet national pollution standards, while 300 million rural Chinese lack access to safe drinking water (endnote 3). While in general more than 90% of southern PRC's water withdrawal comes from surface water, in the first half of 2010, almost a quarter of the PRC's surface water was so polluted that it was not even usable for industry, and less than half of the total water supplies were found to be drinkable.[14]

Overall, it is clear, in the face of these multiplying pressures, that unless significant improvements in the country's system of

water resource management are made, and mechanisms are developed to sustainably finance the needed conservation and improvement of watershed ecological services, the economic consequences of the country's ongoing water resource challenges will be severe. A recent report by the World Bank, for example, has estimated that the PRC's water crisis is already costing the country at least 2.3% of gross domestic product, of which 1.3% is attributable to water scarcity and 1.0% is from the direct impacts of water pollution. This, however, is likely to be a conservative lower-bound estimate of total costs (endnote 4).

Institutional Responses and Policy Innovations

The 1997 and 1998 disasters were a wake-up call for the government that significantly affected its thinking on ecological conservation. They led to the earliest and most successful eco-compensation programs targeting watershed ecological services. These include the Conversion of Cropland to Forests and Grassland (CCFG) program, the Forest Ecological Compensation Fund, and the Natural Forest Protection Program (NFPP).[15] Although forest-based, these programs are critically concerned with protecting watershed ecological services, since program documents indicate direct targeting of such services (e.g., soil erosion control and water conservation) or have a provision stating that the program has important watershed co-benefits.[16]

These early experiments in direct-payment mechanisms for conservation spurred additional national and provincial policy experiments, and have culminated in a national call to action to achieve more sustainable economic development. Premier Wen Jiabao, during the Sixth National Conference on Environmental Protection in 2006, outlined this when he announced that the PRC would adopt a more sustainable economic model that places greater emphasis on the quality of growth via "three shifts" in policy (endnote 7):

(i) Shift from the previous environmentally extractive and destructive mode of economic growth toward one that balances environmental protection with economic growth.

(ii) Shift from environmental protection lagging behind economic development to environmental protection that is synchronized with economic development.

(iii) Shift from primary dependence on administrative measures for environmental protection to a more comprehensive array of legal, economic, and technical measures in addition to administrative measures.

Regional Zoning

The PRC government completed its National Key Function Regional Zoning Plan in 2010.[17] The plan was compiled over a period of more than 4 years by 14 government departments to serve as the basis for a comprehensive system of environmental planning and management that will include (i) development restrictions on areas deemed to be important ecological or agricultural zones, (ii) revision of national and provincial government fiscal systems to apportion funding for the environmental management of these zones, and (iii) reforms to the system for evaluating the performance of local officials to place greater emphasis on

These early experiments in direct-payment mechanisms for conservation spurred additional national and provincial policy experiments, and have culminated in a national call to action to achieve more sustainable economic development

environmental and sustainable development evaluation criteria (endnote 3). The plan delineates four major types of development zones: preferential development zones, key development zones, restricted development zones, and banned development zones (Figure 1). Preferential and key development zones are areas targeted for ongoing industrial development and urbanization, while restricted and banned development zones are areas deemed to provide key agricultural or ecological services (endnote 17).

Banned development zones consist of the PRC's various protected areas, while restricted development zones are divided into "agricultural commodity zones" and "key ecological function zones." Key ecological function zones consist of 436 county-level administrative districts across the country deemed to be of critical importance for the provision of ecological functions and services.[18] These areas total 386 million hectares (around 40% of the PRC's total land area) and contain 113 million people (around 8.5% of the PRC's total population).

Water-related ecosystem functions are clearly important within these zones; the largest ecological function category in terms of land area is "water source protection," making up almost one-third of the total land area of these zones, while "water and soil conservation" is the most important in terms of population, with this ecological function category containing 31% of the total population of these zones (Table 1).

Water Conservation Targeted in the 2011 No. 1 Document

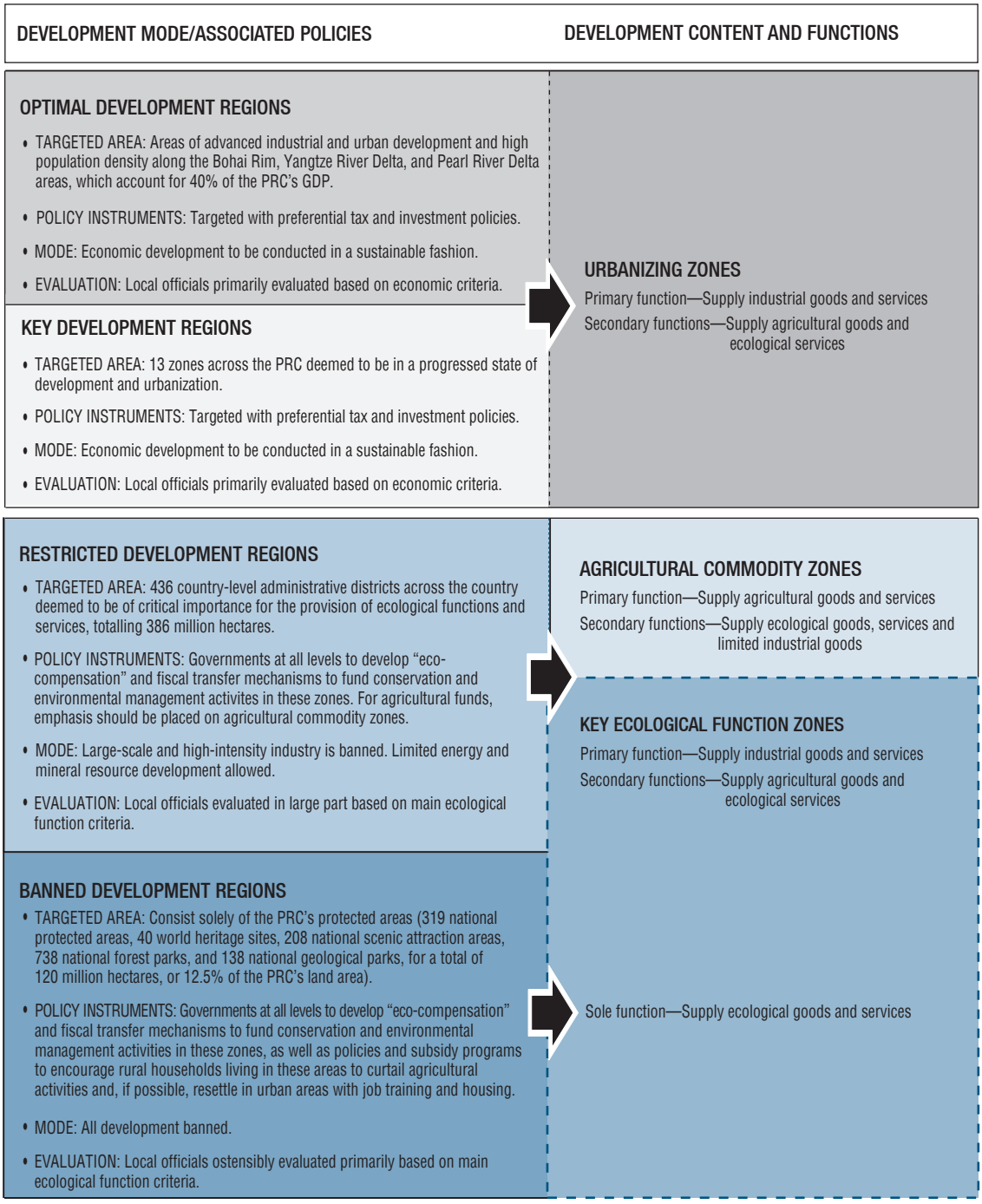
In January 2011, in response to the record-breaking droughts, floods, landslides, and blizzards that occurred in 2010, the PRC's 2011 No. 1 Central Document, which prioritizes the government's work in a given year, for the first time in the 62-year history of modern PRC explicitly targets water conservancy and watershed management, with planned spending estimated to be CNY4 trillion (about $618 billion) through 2020. The No. 1 Central Document also urges local governments to set aside 10% of their revenue from land sales for use in agricultural water conservancy and irrigation work.[19]

While much of the new wave of investments will involve engineering-based solutions (e.g., installation of treatment facilities, adoption of water-saving technologies, and improvements in pollution monitoring), the trends in eco-compensation and general reforms to the PRC's water environmental management framework that have preceded this indicate that significant investments will also be made to address the underlying institutional drivers of watershed ecological service degradation.

Eco-Compensation and Market-Based Approaches

Eco-compensation features prominently both within this national land zoning system and in the country's evolving environmental management landscape in general. The National Main Function Regional Zoning Plan specifically details that both the central and provincial governments are to develop fiscal transfer and eco-compensation mechanisms to increase public sector finances in banned or restricted development zones to ensure that key ecological functions are protected and improved. Such funding is to be directly invested in environmental protection and restoration activities, either for new programs or to continue funding preexisting initiatives, such as the CCFG program (endnote 17). The Ministry of Finance has already drafted its own provisional rules regarding such fiscal transfers—the (Pilot) National Key Ecological Function Zone Fiscal Transfer Mechanism—with pilots launched in 2008 for 372 counties and cities, increasing to 600 counties and cities in 2010.[20] CNY12 billion in subsidies were paid in 2009, increasing to CNY25 billion in 2010 (endnote 3).The development of a national eco-compensation ordinance is thus partly intended to help articulate and refine the standards, mechanisms, and measures for fiscal transfers based on ecological functions and services under this zoning system.

Figure 1 Basic Structure of the National Function-Based Land Zoning System of the People's Republic of China



GDP = gross domestic product, PRC = People's Republic of China.

Sources: Government of the People's Republic of China, State Council. 2010. *State Council Notice Regarding Promulgation of the National Key Function Regional Zoning Plan*. National Issue [2010] No. 46; and *China Daily*. 2011. China Defines Functions of Regions to Sustain Development. 6 September. www.chinadaily.com.cn/business/2011-06/09/content_12666580.htm

Table 1 Total Land Area and Population of National Key Ecological Function Zones

Key Ecological Function Zone	Land Area		Population	
	Hectares	%	Number	%
Water source protection	124,425,400	32.24	31,297,000	27.56
Water and soil conservation	24,739,940	6.41	35,692,000	31.43
Anti-desertification[a]	121,195,810	31.41	12,833,000	11.30
Biodiversity conservation	115,518,550	29.94	33,725,000	29.70
Total	**385,879,700**	**100.00**	**113,547,000**	**100.00**

[a] Literally "wind-breaking and sand-stabilizing."

Source: Government of the People's Republic of China, State Council. 2010. *State Council Notice Regarding Promulgation of the National Key Function Regional Zoning Plan*. National Issue [2010] No. 46.

At the same time, eco-compensation also appears to be evolving into a broader regulatory system for direct payment and fiscal transfer mechanisms for conservation and environmental management in general. Note that an important backdrop to this is the fact that national, provincial, and local governments had been experimenting for more than a decade with a range of innovative and market-based programs and policies that have been labeled "eco-compensation."[21] As a result, the term has encompassed a range of programs that involve one or more of the following mechanisms or characteristics:[22]

- Direct payments from the government to individual and community-level suppliers of ecological services to ensure and improve ecological service provision;
- Compensation to households, communities, or regional governments for regulatory takings associated with environmental policy (e.g., the creation of protected areas or restricted development zones for conservation, and the associated introduction of land-use restrictions or requirements);
- Creation of clear, fair, lateral cooperation and financial transfers between regional or administrative levels of government to ensure and improve ecological services;
- The adjustment or introduction of fees, levies, taxes, tax reductions, or subsidies on resource uses to increase funding and/or incentives for conservation, environmental management and/or restoration;
- Increased financial transfers from upper- to lower-level governments to better fund environmental management; and
- Compensation to regions, especially in the PRC's less-developed western region, for past and current extractive and environmentally damaging resource uses.

Watershed Eco-Compensation Schemes—Sustainable Financing and Institutional Mechanisms to Address Water Challenges

Various forms of watershed eco-compensation are emerging as key tools for providing financial and economic incentives for integrated river basin management. The total number of schemes has surged from eight in 1999 to over 30 in 2008, covering about 290 million hectares (Figure 2), while the value of annual transactions under these schemes has increased from an estimated $860 million in 1999 to $7,800 million by 2008 (Figure 3).[23] In a number of cases, these schemes involve agreements by downstream water users (such as municipalities, irrigation schemes, or hydropower facilities) to reward or compensate upstream land and resource managers (such as farmers, forest users, or government environmental agencies) for the economically valuable water supply and water quality benefits they provide.

The Conversion of Cropland to Forests and Grassland is the largest afforestation payment for ecological services (PES) scheme in the world, paying farmers annual subsidies to retire and afforest or plant grasses on marginal or sloping cropland. Since its launch in 1999, it has enrolled more than 9 million hectares of cropland and has invested more than CNY174 billion ($26.9 billion).

The NFPP targets the restructuring of the state forest sector to be more economically and environmentally sustainable

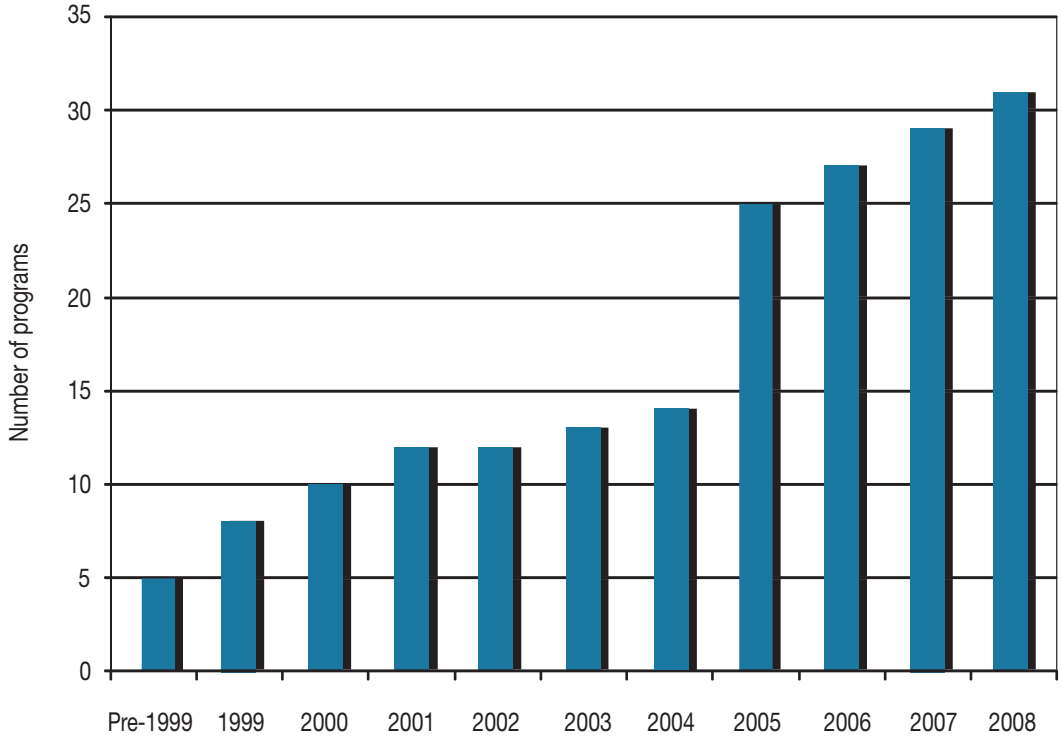
The National Forest Protection Program (NFPP) targets the restructuring of the state forest sector to be more economically and environmentally sustainable. In addition to banning or significantly reducing logging in forest areas, the NFPP has introduced a menu of subsidies to state forest management units for afforestation, reforestation, and forest management tasks and to facilitate restructuring, with expenditures of more than CNY7 billion ($1.08 billion).[24]

The Forest Ecological Compensation Fund pays annual subsidies to households, communities, and the relevant local forest management authorities for the management and protection of preexisting forestland that is deemed to be a "public benefit forest area." It has already enrolled 70 million hectares of forestland and invested CNY29.6 billion ($4.58 billion) since its launch in 2001. Furthermore, in 2010, the government increased the subsidy rate from CNY75 per hectare to CNY150 per hectare.[25]

Numerous other eco-compensation and market-based programs that either directly target watershed ecological services or provide important watershed co-benefits have also been taking shape. These programs have experimented with various different market-based approaches, including

(i) national experiments in water pollution emission permits trading,
(ii) local and provincial experiments in water use rights trading,

Figure 2 Growth in Payment for Watershed Services Programs in the People's Republic of China, 1999–2008



Note: This excludes 16 provincial-level forestry programs, for which no data on starting year is available, but which began sometime after 2001.

Source: Stanton, Tracy, Marta Echavarria, Katherine Hamilton, and Caroline Ott. 2010. *State of Watershed Payments: An Emerging Marketplace*. Washington, DC: Forest Trends. http://forest-trends.org/publication_details.php?publicationID=2438

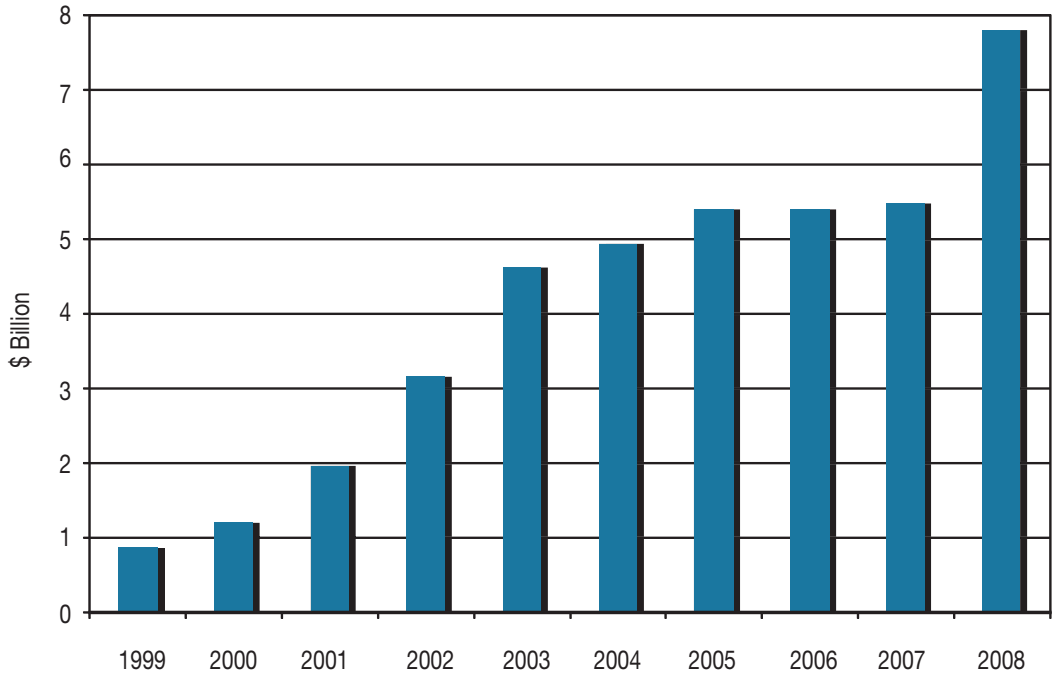
(iii) provincial programs that create a system of penalties or rewards that are transferred between administrative sections of rivers based on water pollution targets, and

(iv) programs providing downstream development concessions to upstream governments to offset losses associated with upstream development restrictions created to protect important drinking water source areas.

Provincial eco-compensation programs that directly target watershed ecosystem services fall into two general groups: those developing ways to better coordinate watershed management across jurisdictional boundaries, and those directly targeting better management in the upper watersheds of reservoirs and river systems that are important sources of drinking water. Programs in the first group involve the creation of cross-jurisdictional management frameworks that map out responsibilities, rights, and targets, and include a range of different financial transfer mechanisms. An example of this is Fujian's eco-compensation programs to manage the Jiulong, Min, and Jin river watersheds using cost-sharing arrangements and lower- to upper-watershed financial transfers to improve funding for upper watershed water quality management.

Programs in the second group, which are also cross-jurisdictional in a number of cases, generally involve some form of direct compensation from downstream beneficiaries (water users and local governments) to upstream ecosystem service providers (local governments, communities, and households),

Figure 3 Annual Payment for Watershed Service Program Transactions in the People's Republic of China, 1999–2008



Source: Stanton, Tracy, Marta Echavarria, Katherine Hamilton, and Caroline Ott. 2010. *State of Watershed Payments: An Emerging Marketplace*. Washington, DC: Forest Trends. http://forest-trends.org/publication_details.php?publicationID=2438

with compensation linked to the implementation of upper-watershed zoning restrictions and land-use requirements. One classic example is a program to protect the upper watershed of the Miyun Reservoir (Beijing's main water supply), which involves direct payments from Beijing Municipality to upstream counties in Hebei Province (where per capita incomes are half that of Beijing residents) for the imposition of development restrictions to reduce watershed impacts. Almost $60 million is transferred each year to fund land conversion from irrigated rice fields to rainfed farming, water pollution control, water resource protection, afforestation, and forest management. Of this amount, 60% is distributed to forest owners as a basic payment, and 40% channeled as incentive payments for forest management and landscape restoration.

An important goal for both groups of programs is to improve financial sustainability by diversifying funding sources to include earmarked funds from various government departments and/or by requiring local matching funds. The financial sustainability of these programs will also be improved by better linking of the costs and benefits of ecosystem services provision through the addition of resource use fees, such as surcharges on water fees that pay into watershed program or reservoir management funds (endnote 22).

The development and refinement of provincial-level initiatives continue unabated. One new initiative is Shaanxi's Wei River Watershed Water Pollution Compensation Scheme, which was launched in February 2011 and has already collected some CNY2 million in environmental penalties from Xi'an, Xianyang, and Baoji municipalities.[26]

Provinces that already have established watershed eco-compensation programs are expanding these with additional policy instruments and funding sources for watershed protection

Provinces that already have established watershed eco-compensation programs are expanding these with additional policy instruments and funding sources for watershed protection. For example, Fujian Province is building upon the successful establishment of its eco-compensation schemes for the Min, Jin, and Jiulong rivers by piloting a system of mandatory "green insurance" for polluting enterprises.[27]

A national grasslands eco-compensation program in the Three Rivers Headwaters Area (a region encompassing the upper watershed of the Yangtze, Yellow, and Mekong rivers) that has been piloted since 2009 was formally launched in 2011. To protect the important upper watershed grassland ecosystems of the region, annual subsidies to herdsmen in grasslands where grazing will be banned will be CNY90 per hectare, and there will be an award subsidy of CNY22.5 per hectare for grasslands where institutions regulating sustainable grazing practices have been established.[28] As such, NDRC's task of developing a national eco-compensation regulatory framework straddles trends in both the evolving national environmental management framework and the numerous decentralized provincial and local environmental policy innovations and experiments in operation.

Challenges and Opportunities for a National Eco-Compensation Ordinance

While it is logical, in the face of the PRC's water crisis, that the watershed component of the national Eco-Compensation Ordinance should be tackled first, this is also the most challenging component. Water management in the PRC is scattered across multiple central government and regional agencies. No less than 10 national ministries, for example, have some form of water management responsibilities (Table 2). Furthermore, while water resources are state owned according to both the original and revised Water Law of the People's Republic of China (1988, 2002), with the state responsible for allocating resources through government orders and water quotas, this system has resulted in poorly defined water use rights and artificially low water prices, leading to de facto open access, conflict, and inefficient distribution of resources.[29] As such, water management in the PRC remains fragmented, uncoordinated (both horizontally and vertically), and lacking in sufficient legal structure and foundation, with numerous overlapping and/or ambiguous regulatory mandates and rights. This, combined with a relatively weak central government enforcement capacity, has hindered effective watershed and water resource protection and management.[30]

Aware of these ongoing challenges, the central government set out in the 11th Five-Year Plan (2006–2010) the goal of adopting a unified and better-coordinated water management system, shifting from supply-side to demand-side management, integrating regional river basin management with regional management, and establishing a preliminary system of water use rights trading. However, many of these planned reforms have yet to be completed (endnote 2).

Reflecting this reality, a common refrain of provincial and local government officials attending the Ya'an conference was the need for the central government to strengthen the legal and regulatory foundations for watershed eco-compensation. Ironically, however, numerous related rules and policies already exist at the central and provincial level. Wang et al. (2010) reports that in addition to the 15 or so key central government documents that in part or in whole explicitly concern eco-compensation (Table 3), 25 national laws, 41 national administrative documents (e.g., implementation rules, management measures,

Table 2 Water-Related Responsibilities of Agencies under the State Council of the People's Republic of China

Agency	Major Functions	Water-Related Responsibilities
Ministry of Water Resources	The planning of water resource development and conservation, flood control, water and soil conservation, regional water function zoning, and unified water administration.	Surface and ground water management, basin management, flood control, and water and soil conservation.
Ministry of Environmental Protection	Supervision and management of major environmental issues and ecological protection work, pollution control, environmental impact assessment, supervision and management of nuclear safety, and environmental monitoring.	Prevention and treatment of water pollution, and supervision of watershed management and restoration.
State Forest Administration	Forest protection, reforestation, wildlife management, protection of biodiversity via management of terrestrial nature reserves.	Forest-related watershed ecological protection and restoration, and water conservation.
Ministry of Agriculture	Management of agricultural chemicals, aquatic nature reserves, agricultural biodiversity, and grasslands; and regulation of township and village enterprises.	Agricultural water use management (irrigation), nonpoint source pollution control, protection of fisheries and aquaculture ecosystems, and management of aquatic nature reserves.
Ministry of Land and Resources	Land use planning, mineral and marine resource management, land rehabilitation and mapping, and cadastral mapping.	Development of plans for sustainable groundwater exploration, and management and protection of coastal ecosystems and marine resources.
Ministry of Housing and Urban–Rural Development	Planning, construction, and management of water supply, drainage, and sewage disposal projects.	Management of urban and industrial water use, urban water supply, wastewater treatment, and solid waste treatment.
National Development and Reform Commission	Economic planning and allocation of productive resources, including the coordination, planning, and development of related policies for agriculture, forest, and water resource development; and "construction of the ecological environment."	Participation in the planning of water resource development and watershed ecosystem conservation, management, and restoration.
Ministry of Communications and Transportation	Inland navigation management and pollution control.	Pollution control related to navigation of ships on rivers.
Ministry of Health	Supervision and management of environmental health.	Supervision and management of drinking water standards.
State Grid Corporation of China	Development, construction, and management of electrical power generation capacity.	Hydropower development.

Source: ADB. 2011a. *Environmentally Sustainable Development in the People's Republic of China: Visions for the Future and the Role of the Asian Development Bank*. Manila; Feng, Yan, Daming He, and Beth Kinne. 2006. Water Resources Administration Institution in China. *Water Policy*. 8(4). pp. 291–301.

Table 3 Key Central Government Documents Regarding Eco-Compensation in the 11th Five-Year Plan Period, 2006–2010

Year	Date	Policy Document	Recommendations and/or Requests
2005	3 December	*State Council Decision Regarding Implementing the Scientific Development View to Strengthen Environmental Protection. National Issue [2005] No. 39*	Calls for the establishment of inter-administrative-section river water quality monitoring systems, improvements in eco-compensation policy, and fast development of eco-compensation mechanisms; recommends consideration of eco-compensation factors in central and provincial fiscal transfer payment systems
2006		*Central Government 2006 Work Report*	Comprehensively mobilizes all means available, and in particular economic instruments such as pricing and taxation, to promote the rational and sparing use of natural resources and to develop eco-compensation mechanisms
		The Central Committee of the Communist Party of China, Several Views on the Promotion of the Development of a New Socialist Countryside	Calls for the continued promotion of conservation and environmental restoration and the consolidation of the successes of such work to date, the effective implementation of the key ecological programs (e.g., CCFG, NFPP), the stabilization and improvement of policy, the fostering of next-generation industry (e.g., green technology, renewable energy), the continued promotion of the "Grazing to Grassland" and integrated development of mountain areas programs, and the establishment and improvement of eco-compensation mechanisms
	14 March	*11th Five-Year Plan Program for the Economic and Social Development Program of the People of China*	Calls for the establishment of eco-compensation mechanisms based on the principle of "who develops protects, who benefits subsidizes," and the implementation of paid natural resource development and improved system for paid water resource use
	19 March	*State Council 2006 Work Outline. National Issue [2006] No. 12*	Develops eco-compensation mechanisms, and gradually resolves and improves the evolving mechanisms for pricing natural resources and primary commodities
2007		*Central Government 2007 Work Report*	Calls for the acceleration of the development of eco-compensation mechanisms
	25 March	*State Council 2007 Work Outline. National Issue [2007] No. 8*	Outlines plans to accelerate the development of eco-compensation mechanisms
	23 May	*Energy Conservation and Emissions Reduction Integrated Work Plan*	Improves and perfects natural resource exploitation eco-compensation systems and develops cross-watershed eco-compensation pilot work
	28 June	*Views Regarding Work on Deepening Economic Structural Reforms for 2007. General Office of the State Council Issue [2007] No. 47*	Promotes pilots for the reform of the system of paid mineral resource use, accelerates the establishment of mining eco-compensation mechanisms, and explores the development of subsidy and insurance systems for the phasing out of older industrial production capacity

continued on next page

Table 3 *continued*

Year	Date	Policy Document	Recommendations and/or Requests
2008		*Central Government 2008 Work Report*	Reforms the natural resource tax and fee system, and improves the system of paid natural resource use and of eco-compensation mechanisms
	29 March	*State Council 2008 Work Outline. National Issue [2008] No. 15*	Improves the paid natural resource use system and eco-compensation mechanisms
	22 July	*Views Regarding Work on Deepening Economic Structural Reforms for 2008. General Office of the State Council Issue [2008] No. 103*	Establishes a sound system of paid natural resource use and eco-compensation mechanisms; comprehensively promotes a system for the compensated procurement of mineral exploration and mining rights; improves the system of mine environmental protection and management responsibility; reforms the system for distributing the benefits of natural resources; establishes a system for natural resource compensation for underdeveloped areas; and promotes the establishment of pilots for inter-provincial watershed eco-compensation
2009		*Central Government 2009 Work Report*	Accelerates the establishment of sound eco-compensation mechanisms, and reforms and improves the natural resource tax system
	19 May	*Views Regarding Work on Deepening Economic Structural Reforms for 2009. General Office of the State Council Issue [2009] No. 26*	Accelerates the promotion of cross-provincial watershed eco-compensation pilot work; promotes the reform of the mineral resource subsidy and fee system, establishes mechanisms that vary fee rates to link natural resource use levels with environmental management, and improves the related laws and policies
2010		*Central Government 2010 Work Report*	Continues promoting the key ecological forestry programs, and completes the afforestation of 5,884,666.67 hectares, for achieving a national forest coverage rate of at least 20.36%; achieves integrated water and soil management and protection on 480,000 square kilometers; deepens reforms on environmental protection fees on natural resource-based products

CCFG = Conversion of Cropland to Forests and Grassland, NFPP = Natural Forest Protection Program.

Source: Wang, Jinnan et al. 2010. Considerations Regarding a National Legal Framework for Eco-Environmental Compensation. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

decisions, and ordinances), 21 ministerial and departmental rules and regulation documents issued by agencies under the state council, and more than 100 provincial-level laws and administrative documents exist that either directly concern eco-compensation or have significant bearing on its ecological or legal realms.[31] Most of these laws do not explicitly mention eco-compensation, but rather concern specific aspects of environmental protection and management or govern particular land uses that have an important bearing on the legal foundations and implementation of eco-compensation programs. Notable exceptions are the Forest Law of the PRC, the Water Pollution Prevention and Control Law of the PRC, and the Mineral Resource Law of the PRC. For example, Article 6, Chapter 1 of the revised Forest Law calls for the establishment of a "Forest Ecological Benefit Compensation Fund," for exclusive use in the construction, fostering, and protection of what is deemed by the government to be a "key public benefit forest" area; while Article 7, Chapter 1 of the

Water Pollution Law states that "The PRC will, via fiscal transfer payments and other measures, establish sound water eco-environmental compensation mechanisms targeting the upper watershed areas of drinking water source zones, rivers, lakes, and reservoirs."[32]

Thus, while strengthening legal foundations will be important, the NDRC also faces the challenge of developing the national Eco-Compensation Ordinance in a way that (i) complements and strengthens current institutional and regulatory frameworks governing environmental management (or at a minimum does not create additional administrative and regulatory conflicts), while (ii) retaining sufficient flexibility to be able to anticipate, evolve with, and if possible influence the ongoing reforms of the PRC's overall environmental management system, in general, and watershed management, in particular. While the institutional labyrinth of water management in the PRC highlights the challenges ahead, a well-designed eco-compensation ordinance coupled with sufficient follow-up supporting regulations, funding, and activities could be an effective platform and focal point to harmonize the disparate water-related management responsibilities that are distributed across various ministries and regional government units.

One of the greatest challenges facing the PRC's water management relates to freshwater lakes, many of which are severely polluted. Since the mid-1990s, the government has made substantial efforts to address this problem, with particular emphasis on the "Three Lakes" (Tai Lake, Dianchi Lake, and Chao Lake), mostly without success largely because of the failure to create an effective, cross-jurisdictional management system. A potentially important recent development is the establishment of a management authority for Chao Lake, in Anhui Province. This was done at about the same time as some important administrative changes were made at the local government level in the lake catchment. In particular, one municipality (Chao Lake City) was dissolved and its most urbanized sections were merged into Hefei City (the provincial capital). At the same time, the entire surface area of Chao Lake was placed under the jurisdiction of Hefei City. This means that a very large part of the catchment of Chao Lake will fall within the jurisdiction of Hefei City. On 22 August 2011, the State Council ordered the establishment of the Chao Lake Management Authority to manage all of the Lake's water-related matters, including land use planning, water quality and quantity issues, fisheries, navigation, and tourism. While still at an early stage, the creation of this authority is potentially very significant, and could even serve as a national example, because (i) it could be the first lake or river management agency in the PRC that has a sufficiently comprehensive management purview and the first to effectively deal with all relevant aspects of the water cycle, and (ii) it could also be the first such institution in the PRC that is positioned at a sufficiently high level in the bureaucratic system (it will be located at a level higher than the other sector agencies) to allow it to effectively coordinate and enforce water-related activities and regulations in the catchment.[33]

Since the mid-1990s, the government has made substantial efforts to address this problem, with particular emphasis on the "Three Lakes" (Tai Lake, Dianchi Lake, and Chao Lake), mostly without success largely because of the failure to create an effective, cross-jurisdictional management system

Recommendations for Advancing Watershed Eco-Compensation

The Government of the PRC has invested significant technical and financial resources into addressing its chronic water and environmental issues. It should now ensure a return on those investments by adopting a more comprehensive management system. Without such a system, it is unlikely that the condition of water resources and watershed ecosystem services on which millions of people and numerous regional economies depend will be improved.

The comprehensive management system that the PRC needs is one based, as much as possible, on complete hydrological units, rather than pieces of a whole that are managed separately due to the realities of administrative boundaries. Managing lakes and river catchments in their entirety enables the government to look after all the factors affecting the physical, chemical, and biological characteristics of a water system. This approach is often called integrated river basin management (IRBM) when referring to the management of complete river systems, although the same principles can be applied to the management of water systems at lower levels.

Managing lakes and river catchments in their entirety enables the government to look after all the factors affecting the physical, chemical, and biological characteristics of a water system

Eco-compensation can be an important aid to IRBM as it can help to create the economic incentives for effective implementation. The PRC has enough experience in experimenting with eco-compensation to know its potential and pitfalls. A clear national eco-compensation regulatory framework is now needed to advance the concept. Such a framework would clarify the institutional rights and responsibilities over watershed services in the context of IRBM.

The development of the Eco-Compensation Ordinance is an important step in the process. The PRC's institutional arrangement for governing the environment and water resources is complex. The first version of the ordinance is likely to be a compromise between the multiple agencies that have been traditionally tasked with environmental and water management. Negotiation will be required to balance these competing interests. As with any legislation, the ordinance can be refined over time, based on the lessons learned from experience.

Without developments in policy and practice, the PRC's already severe water challenges will only worsen. This ordinance, along with improved eco-compensation schemes, stronger environmental policy and regulations, and more holistic management of river systems and watersheds can help buffer the impact of the country's projected economic and population growth rates on its finite natural resources. We offer three recommendations for the ongoing work of developing the ordinance and designing an effective watershed eco-compensation policy framework.

Recommendation 1: Consider Eco-Compensation as a Potential Tool for Integrated River Basin Management

Much work still needs to be done in the PRC, as elsewhere, to develop effective, comprehensive frameworks for IBRM. While this presents a significant challenge, it also provides numerous opportunities for the application of eco-compensation mechanisms.

While the institutional labyrinth of water management in the PRC highlights the challenges ahead, a well-designed eco-compensation ordinance coupled with sufficient follow-up supporting regulations, funding, and activities could be an effective platform and focal point for the harmonization of the disparate water-related management responsibilities that are distributed across various ministries and regional government units.

As a useful tool for promoting IBRM principals, watershed eco-compensation schemes have the potential to (i) address financing shortfalls, (ii) identify management pitfalls, and (iii) convince key stakeholders to participate in water source protection.

First, eco-compensation could provide incentives for the investment in and sustainable financing of water infrastructure. In less-developed watersheds, investment plans for water infrastructure (e.g., the construction and operation of wastewater treatment plants and water filtration plants) can be developed side-by-side with eco-compensation mechanisms that would address both the incentives faced by key stakeholders in the watershed, and the sustainable financing of water infrastructure. Similarly, in more developed watersheds, eco-compensation could also provide a mechanism to address unresolved financing issues; for example, many existing wastewater treatment plants in the PRC are not operating as effectively as they should be due to a lack of funds. Low water tariffs and insufficient guarantees on revenue streams have been cited as key constraints hampering the development of more public–private partnerships for water treatment (endnote 7).

Secondly, the process of developing eco-compensation programs can also help identify key obstacles to achieving sustainable watershed management: What are the key sources of pollution and watershed degradation? What current institutional and legal issues give rise to these outcomes? Who are the key stakeholders (beneficiaries and providers)? These questions and answers are a fundamental part of designing the optimal eco-compensation program. As a part of this process, eco-compensation planning can also serve as valuable platforms for engagement and negotiation between the key stakeholders regarding watershed protection—helping address the underlying issues of rights and responsibilities, equity, and effectiveness.

Finally, eco-compensation may have a valuable role to play in addressing the growing challenge of nonpoint source (NPS) pollution from fertilizer runoff, pesticides, and discharges from intensive animal production facilities. NPS pollution, according to a recent national census, is now responsible for nearly two-thirds of total phosphorus discharges in the PRC, 57% of total nitrogen discharges, and 44% of organic pollutant discharges.[34] A larger social dimension to the issue of NPS pollution exists and has been frustrating the government's many thoughtful attempts to deal with the problem. Eco-compensation can help address these social dimensions by providing direct incentives to change farmers' preferences and behavior regarding fertilizer use, land management, and technological adoption.

Box 3 discusses opportunities for eco-compensation in the Chao Lake Basin where a lake management authority has recently

Eco-compensation can help address these social dimensions by providing direct incentives to change farmers' preferences and behavior regarding fertilizer use, land management, and technological adoption

Box 3 Chao Lake Integrated Management—Opportunities for Eco-Compensation

The fifth-largest freshwater lake in the People's Republic of China (PRC), Chao Lake has been one of the government's "Three Rivers, Three Lakes" priority watersheds since the 9th Five-Year Plan period (1996–2000) due to severe pollution caused by decades of population and economic growth pressures.[a] It has one of the most serious eutrophication problems of lakes in the PRC despite efforts by the provincial government since as far back as 1984, and a central government initiative during the 9th Five-Year Plan period. During the summer of 2010, an outbreak of green algae covering 13,000 square kilometers threatened the drinking water source of the 300,000 residents of eastern Chaohu City. It is estimated that nonpoint sources make up about 68% of the total discharged phosphorus, and around 74% of the total nitrogen within the lake, far exceeding the quantity from point sources. The most recent publicly available *China Water Resources Report* (2008) states that total surface water quality is worse than Class V (Class IV when not including total phosphorus and total nitrogen), with quality in the more developed western side of the lake significantly worse than the eastern side.[b]

In the face of these challenges, policy makers continue to search for effective policies and mechanisms to better manage the Chao Lake watershed. The Anhui Provincial Development and Reform Commission (APDRC) led the development of the Comprehensive Plan for Chao Lake Watershed Integrated Environmental Management in 2007, with investments estimated to exceed CNY50 billion, covering several large projects concerning watershed management, township and village household waste management, agricultural nonpoint source pollution control, and industrial waste management. In 2009, Hefei, Chaohu, Huainan, and Liuan municipalities jointly drafted the *"9 + 4" Chao Lake Watershed Environmental Protection and Ecological Construction Cooperation Agreement*. However, much work still needs to be done to develop a more integrated and effective framework for addressing watershed degradation. In response to this, the State Council decided in August 2011 to establish the Chao Lake Management Authority whose mandates cover all of the lake's water-related matters, including land use planning, water quality and quantity issues, fisheries, navigation, and tourism. The APDRC and the Asian Development Bank (ADB) technical assistance team are now working together to (i) design a component for the ADB's financing to build the capacity of the newly established Chao Lake Management Authority; (ii) pilot a water quality trading scheme; and (iii) introduce eco-compensation mechanisms to assist in clarifying rights and responsibilities, and provide mechanisms for sustainably financing watershed infrastructural investments. This includes a planned pilot eco-compensation fund to subsidize livestock operations to produce organic fertilizer and to pay farmers to use commercial organic fertilizers. The fund will be paid for from water user fees and government-earmarked funds.

[a] This also includes Tai Lake; Dianchi Lake; and the Huai, Hai, and Liao rivers.

[b] Under the PRC's water quality classification system, Class I is the highest quality, suitable for headwaters and national protected areas. Class III is the lowest quality still considered suitable for drinking water. Classes IV and V are considered to be suitable for agricultural use or for normal landscape needs. Worse than Class V is considered to be highly polluted, in which water system functionality has been severely degraded.

Source: Shang, Guangping and Jincheng Shang. 2005. *Chinese Geographical Science*. 15(4). pp. 348–354; Hong, Jin et al. 2007. Analysis of Water Pollution and Ecosystem Health in the Chao Lake Basin. In L. Oxley and D. Kulasiri, eds. *MODSIM 2007 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand.* December 2007. pp. 74–80; *China Daily*. 2011. China Environment Strategy Report Says the Drinking Water for 190 million Chinese Does Not Meet Pollution Standards. April 22; Le, C. et al. 2010. *Environmental Management*. 45(4). pp. 662–668; Government of the People's Republic of China, Ministry of Water Resources. 2008. *2007–2008 Annual Report*. Beijing.

been established. The creation of the Chao Lake Management Authority is an example of how the groundwork for true IRBM can be laid. The management system there provides the opportunity to develop and test new ideas and approaches for various forms of eco-compensation, including water quality trading, payment for watershed services, and many other ideas. Well-designed pilot projects in the Chao Lake catchment could greatly inform the PRC's refinement of the ordinance, the application of IRBM principals, as well as improve the country's various strategies for improving and managing water quality.

Recommendation 2: Balance Firmness with Flexibility—Focus on Outcomes

To develop an effective regulation for ecological services protection, policy makers need to retain a healthy respect for the complexity, interconnectivity, and multiplicity of ecological functions and services. In the case of watershed ecological services, in particular, the complexity of service flows and the interconnectedness of ecosystems and ecological functions make the formulation of outcomes and the development of appropriate policy tools to achieve these outcomes a challenge. Watersheds and water systems are complex multifunctional entities that overlap regional and administrative boundaries and provide a range of ecological services (e.g., flood control, seasonal water flow regulation, water quality and temperature regulation, and water quantity) to multiple beneficiaries (e.g., the general public, agriculture, industry, energy, transport, and construction). Such services are provided by multifunction landscapes that include both natural and human ecosystems (e.g., forestry, agriculture, wetlands, urban areas, industrial zones, residential areas, grasslands, and coastal ecosystems).

As watershed ecological services significantly depend on scale and location, policy makers need to strike a balance between creating a strong regulatory framework to ensure compliance, while also allowing for flexibility in how outcomes are achieved so as to allow for and catalyze local-level innovation and adaptation of central policies to fit local needs and constraints.

To remain productive, future discussions on the development of an eco-compensation regulatory framework should focus on principles and desired outcomes rather than operational details. Eco-compensation will be driven, at least in the near term, by direct negotiations between downstream and upstream entities, and the level of payments and fiscal transfer rates should be determined by the negotiating processes, not by objective formulas in a policy.

Currently, however, the development of the needed framework on fundamental issues and basic components of policy has been, to some degree, sidelined by discussions on operational-level details—namely, the development of criteria and formulas for calculating eco-compensation subsidies and fiscal transfer rates.[35] Many stipulations in the draft ordinance are implementation notes—such as specification of a common formula for subsidy rates, contract structures, land use measures, etc.—but these elements should not overshadow the broader function of policy, which is to guide planning toward certain outcomes. More basic and fundamental questions for potential eco-compensation still need to be worked out, such as whether the benefits of eco-compensation outweigh the costs (Box 4).

At this stage, the development of an ecosystem policy would benefit most from discussions that bring agreement on principles and goals of eco-compensation, namely who has rights to do what, what outcomes

To develop an effective regulation for ecological services protection, policy makers need to retain a healthy respect for the complexity, interconnectivity, and multiplicity of ecological functions and services

Box 4 Eco-Compensation Subsidy Rates—Revisiting the Logic behind Payments for Ecological Services

Currently, the formula for eco-compensation subsidies under the Eco-Compensation Ordinance is being developed along the lines of

[Eco-Compensation Subsidy]

$\approx$

[Conservation Cost] + [Development Opportunity Cost] + [Value of Ecological Services Provided]

where the [Conservation Cost] refers to the on-site cost of conducting targeted land use activities, and the [Development Opportunity Cost] refers to the average net return of the most profitable alternative land use (in the case of an individual land user) or average economic gain from provincial development in the absence of development restrictions. Much of this discussion is to inform eco-compensation's role as a government subsidy program, to some extent as part of the national function-based land zoning plan, via development of administrative rules and regulations governing fiscal transfer rates. However, overemphasis on subsidy formulas risks missing the underlying logic behind a payments for ecological services (PES) scheme: "Do the benefits outweigh their costs?"

In the case of the provider, this is a simple calculation of whether subsidy payments for targeted land uses are sufficient to make participation in the PES scheme attractive in comparison to the next best alternative. Thus, the baseline payment should be slightly larger than [Conservation Cost] + [Development Opportunity Cost]. In comparison, the beneficiary will only find it worthwhile to pay subsidies for service provision if the value of received services is equal to or greater than the cost, i.e., [Eco-Compensation Subsidy] $\leq$ [Value of Ecological Services Provided]. Thus, simply speaking, a PES scheme only makes economic sense if the following holds:

[Value of Ecological Services Provided]

$\geq$

[Conservation Cost] + [Development Opportunity Cost]

PES schemes serve to incentivize both the provision of ecological services and the financing of provision. Without this type of "win–win" outcome, either or both parties will not have incentives to participate. As is the case of many national policies in the People's Republic of China, if proper incentives do not exist then actual implementation of eco-compensation programs, even if participation is stipulated by law, will likely significantly depart from what is intended; conservation outcomes would not achieve targets, or funding sources would dry up or be misappropriated. This has occurred under the Conversion of Cropland to Forests and Grassland program, for example.

Source: Xu, Jintao, et al. 2010. China's Sloping Land Conversion Program: Does Expansion Equal Success? *Land Economics*. 86(2). pp. 219–244.

are expected to be achieved, and what type of indicators can be used to measure progress, etc. Policy discussions should also focus on developing the right incentives and building demand for watershed eco-compensation schemes. An output of the policy formulation, and a subject of discussion and consensus, should be broad outcome-based

An outcome-oriented rather than standardization-based policy also encourages the consideration of other complimentary approaches and tools

frameworks that guide the implementation of eco-compensation yet are flexible enough to encourage local and regional variations in the design and subsidy structures of eco-compensation programs.

Formulating a policy that is flexible and focused on general outcomes has strong inherent benefits. Leaving some level of detail up to local designers and implementers engenders innovations that can ultimately lower program costs. The regional variations in eco-compensation programs could also help to reveal the regional "costs" and "benefits" of ecological services provision, which could guide better use of limited funds to achieve maximum conservation outcomes.

An outcome-oriented rather than standardization-based policy also encourages the consideration of other complimentary approaches and tools. Eco-compensation is only one of a number of potentially useful policy tools. Context determines which regulatory approach is most able to achieve particular outcomes; and as contexts change over time with economic growth, so should the approaches.[36] In many cases, eco-compensation may be best used as a tertiary strategy to support effective regulatory controls, such as land use regulations, agricultural best management practices, regulation on protected areas and endangered fish and wildlife, support to fair and clear assignment of land use rights, including who has the right to pollute and who has the right to be protected from pollution, fair allocation of use rights. Eco-compensation may also be an input to other economic policies, such as removal of harmful subsidies for industrialized agriculture and destructive infrastructure and energy projects (like big dams and new coal mines) and eco-taxes on pollutants. For watersheds, eco-compensation policies that call for developing detailed assessments to determine "desired future conditions" that reflect ecological, social, and economic aspects would help local planners understand the potential for eco-compensation and compare it to other tools and options available to them.

Recommendation 3: Take Account of the Scale of Actors

One of the goals of the Eco-Compensation Ordinance is to include all levels of potential buyers and providers of ecological services—from central government to individual land user—within a common framework. Complicating this are various institutional and legal issues associated with particular eco-compensation schemes and the institutional scale of the parties involved. The ordinance should give distinct treatment to these different scales.

The feasibility of eco-compensation depends on how clear are the property rights and responsibilities over specific ecological service flows. In general, the legal framework for eco-compensation will need to address two fundamental issues (endnote 35):

(i) **Property rights and responsibilities on the protection of ecological services.** The legal framework should clarify the rights and responsibilities over water resources, detailing who is responsible for ensuring the provision of the related ecosystem services. Rights determine the key actors and stakeholders of ecosystem services markets and provide the foundation for successful eco-compensation programs.

(ii) **Coordination of watershed management across different regional and administrative jurisdictions.** Because watershed ecological services often cross administrative and regional government

boundaries, the management of these services requires cross-sector, cross-jurisdiction, and cross-agency coordination, cooperation, and information sharing in land use planning and environmental management. While various initiatives are being developed within provinces to create frameworks for cross-district programs, the central government has an important role in developing the legal and regulatory frameworks necessary to allow and encourage cross-provincial coordination and cooperation.

Property rights are more clearly defined for some actors than others in the PRC regulatory system—it depends on the "size" of the actor. In the case of "large" buyers and suppliers (e.g., provincial governments), the most challenging environmental management issues relate to watershed services that spill across multiple administrative and regional boundaries, such as from watershed ecosystems.[37] The legal frameworks need to be stronger and clearer on water use rights, and the relationships between the multiple government-level stakeholders of watershed ecological services. The absence of a strong legal foundation for property rights can have unforeseen consequences and produce counterproductive outcomes. An obvious result from this scenario is that upstream water users will take advantage of available water while downstream water users can only utilize whatever is left from upstream. But, to a large degree, most of the work on strengthening property rights to water resources should be done outside the eco-compensation regulatory framework. The ordinance should anticipate this and be structured to help facilitate and influence the transition to a watershed management regime wherein regional and administrative rights and responsibilities are more clearly delineated.

Property rights are more clearly defined for some actors than others in the PRC regulatory system—it depends on the "size" of the actor

In contrast, land rights in the PRC are *de jure* already strong enough to support the development of an eco-compensation program targeting individual land users. The Rural Land Contract Law of the PRC clearly stipulates tenure lengths of 30 years for arable land, 30–50 years for grassland, and 30–70 years for forestland.[38] Land users thus arguably have legal protection for a sufficiently long period to be able to provide a flow of ecological services from the land over a medium- to longer-term eco-compensation scheme.[39] Furthermore, in cases where de facto tenure is short and less stable than that stipulated by law, eco-compensation programs targeting individual land uses can often help strengthen tenure by providing additional guarantees over land enrolled in programs, and by creating legal precedence. This has already occurred under the Conversion of Cropland to Forests and Grassland program.

While it is understood that the organization of the Eco-Compensation Ordinance into specific environmental sectors (e.g., forestry, wetlands, watersheds, ocean) reflects the administrative divisions within the government regarding environmental management, too strict an adherence to these divisions will fail to address many of the underlying drivers of ecological service degradation. For example, the agricultural sector was not included in the initial Eco-Compensation Ordinance. However, this sector is one of the easiest and most important to target for achieving watershed service outcomes. Ongoing population and economic growth, and the social changes associated with rising affluence will only increase pressure on arable land. The growth in land-intensive grain production and husbandry will cause farmers to depend more on intensive fertilizer use to boost productivity, with consequent impacts on water quality. Direct payment mechanisms, such as eco-compensation, can flexibly address these challenges.[40] In regulating eco-compensation programs that target individual land users, policy makers need not be so concerned

about the delineation of property rights, but rather could spend more effort on developing guarantees to protect the rights and welfare of individual land users that participate in these schemes.

Conclusion: Watershed Eco-Compensation for the Greater Social Good

In formulating the ordinance, policy makers should remember, and be inspired by, the value of watershed eco-compensation as a strategic focus to effectively advance key sustainable development goals, such as providing clean, reliable drinking water supplies to the 300 million people in the PRC currently without them. Eco-compensation can compliment programs to alleviate rural poverty, water poverty, and other development challenges, when specifically designed for poverty alleviation.[41]

The International Conference on Payment for Watershed Services and Eco-Compensation Legislation, held on 23–24 October 2010 in Ya'an, Sichuan Province concluded that while the challenges and constraints to watershed eco-compensation schemes are still significant and will require all stakeholders to continue to strive for better solutions, there is at the same time already a strong foundation of experience, commitment, and capacity to build upon as the policy makers develop the national Eco-Compensation Ordinance.

Table A1 Laws Related to Eco-Compensation in the People's Republic of China

Name		Issuing Agency	Date of Issue	
English	Chinese		Issued	Revised
National Construction and Land Acquisition Law	《国家建设征用土地办法》	National People's Congress Standing Committee	6 January 1958	
National Construction and Land Acquisition Ordinance	《国家建设征用土地条例》	National People's Congress Standing Committee	4 May 1982	
Marine Environment Protection Law of the PRC	《中华人民共和国海洋环境保护法》	National People's Congress Standing Committee	23 August 1982	25 December 1999
Forest Law of the PRC	《中华人民共和国森林法》	National People's Congress Standing Committee	20 September 1984	29 April 1998
Ethnic Regional Autonomy Law of the PRC	《中华人民共和国民族区域自治法》	National People's Congress Standing Committee	1 October 1984	28 February 2001
Grassland Law of the PRC	《中华人民共和国草原法》	National People's Congress Standing Committee	18 June 1985	28 December 2002
Aquacultural Law of the PRC	《中华人民共和国渔业法》	National People's Congress Standing Committee	20 January 1986	31 October 2000
Mineral Resources Law of the PRC	《中华人民共和国矿产资源法》	National People's Congress Standing Committee	19 March 1986	29 August 1996
General Principals of the Civic Law of the PRC	《中华人民共和国民法通则》	National People's Congress	12 April 1986	
Land Management Law of the PRC	《中华人民共和国土地管理法》	National People's Congress Standing Committee	25 June 1986	
Atmospheric Pollution Control Law of the PRC	《中华人民共和国大气污染防治法》	National People's Congress Standing Committee	5 September 1987	29 April 2000
Water Law of the PRC	《中华人民共和国水法》	National People's Congress Standing Committee	21 January 1988	29 August 2002
Wildlife Protection Law of the PRC	《中华人民共和国野生动物保护法》	National People's Congress Standing Committee	8 November 1988	
Environmental Protection Law of the PRC	《中华人民共和国环境保护法》	National People's Congress Standing Committee	29 December 1989	
Water and Soil Conservation Law of the PRC	《中华人民共和国水土保持法》	National People's Congress Standing Committee	29 June 1991	
Agriculture Law of the PRC	《中华人民共和国农业法》	National People's Congress Standing Committee	2 July 1993	28 December 2002
Law of the PRC for the Prevention and Control of Solid Waste Environmental Pollution	《中华人民共和国固体废物污染环境防治法》	National People's Congress Standing Committee	30 October 1995	
Coal Law of the PRC	《中华人民共和国煤炭法》	National People's Congress Standing Committee	29 August 1996	
Energy Saving Law of the PRC	《中华人民共和国节约能源法》	National People's Congress Standing Committee	1 November 1997	
Outline of the Tenth 5-Year Plan for National Economic and Social Development of the PRC	《中华人民共和国国民经济和社会发展第十个五年计划纲要》	National People's Congress	15 March 2001	
Desertification Prevention and Control Law of the PRC	《中华人民共和国防沙治沙法》	National People's Congress Standing Committee	31 August 2001	

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Table A1 *continued*

Name		Issuing Agency	Date of Issue	
English	Chinese		Issued	Revised
Law of the PRC for the Promotion of Clean Production	《中华人民共和国清洁生产促进法》	National People's Congress Standing Committee	29 June 2002	
Rural Land Contract Law of the PRC	《中华人民共和国农村土地承包法》	National People's Congress Standing Committee	29 August 2002	
Water Pollution Prevention and Control Law of the PRC	《中华人民共和国水污染防治法》	National People's Congress Standing Committee		28 February 2008
Management Measures for the Collection and Use of Charges for the Use of Uninhabited Islands	《无居民海岛使用金征收使用管理办法》	Ministry of Finance, State Oceanic Administration	7 June 2010	

PRC = People's Republic of China.

Source: Wang, Jinnan et al. 2010. Considerations Regarding a National Legal Framework for Eco-Environmental Compensation. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

Table A2 Administrative Laws, Regulations, Standards, and Rules Related to Eco-Compensation in the People's Republic of China

Name		Issuing Agency	Date of Issue
English	Chinese		
National People's Congress and State Council Decision on Several Issues Regarding Forest Protection and Forestry Development	《中共中央、国务院关于保护森林发展林业若干问题的决定》	State Council	8 March 1981
Ordinance of the PRC for Environmental Protection and Management of Ocean Petroleum Exploration and Development	《中华人民共和国海洋石油勘探开发环境保护管理条例》	State Council	30 January 1982 (Issued) 23 September 2001 (revised)
State Council Implementation Measures Regarding Promotion of the Civic Duty of Tree Planting	《国务院关于开展全民义务植树运动的实施办法》	State Council	27 February 1982
Ordinance of the PRC for Environmental Protection and Management of Ocean Petroleum Exploration and Development	《中华人民共和国海洋石油勘探开发环境保护管理条例》	State Council	29 December 1983
Natural Resource Tax Provisional Ordinance of the PRC	《中华人民共和国资源税暂行条例》	State Council	18 September 1984
Forest and Wildlife Category Protected Area Management Measures	《森林和野生动物类型自然保护区管理办法》	State Council	6 July 1985
Mineral Resource Exploration Licensing and Management Provisional Measures	《矿产资源勘查登记管理暂行办法》	State Council	29 April 1987
Mineral Resource Supervision and Management Provisional Measures	《矿产资源监督管理暂行办法》	State Council	29 April 1987
Petroleum and Natural Gas Exploration and Development Licensing and Management Provisional Measures	《石油及天然气勘查、开采登记管理暂行办法》	State Council	16 December 1987
Forest Fire Prevention Ordinance	《森林防火条例》	State Council	16 January 1988
River Management Ordinance	《河道管理条例》	State Council	10 June 1988
Township Land Use Tax Provisional Ordinance of the PRC	《中华人民共和国城镇土地使用税暂行条例》	State Council	27 September 1988
Regulation on Returning Land to Cultivation	《土地复垦规定》	General Office of the State Council	8 November 1988
Management Ordinance of the PRC for the Prevention and Control of Terrigenous Pollution and Pollution Damage to the Marine Environment	《中华人民共和国防治陆源污染物污染损害海洋环境管理条例》	State Council	25 May 1990

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Table A2 *continued*

Name		Issuing Agency	Date of Issue
English	Chinese		
Provisional Measures for the Mining Licensing and Management of Nationally Owned Mining Enterprises	《全民所有制矿山企业采矿登记管理暂行办法》	State Council	22 November 1990
State Council General Office Transmission of National Greening Commission and Ministry of Forestry Notice Regarding Several Opinions on Policy Measures for Anti-Desertification Work	《国务院办公厅转发全国绿化委员会，林业部关于治沙工作若干政策措施意见的通知》	State Council	29 August 1991
Urban Greenification Ordinance	《城市绿化条例》	State Council	22 June 1992
Water and Soil Conservation Law of the PRC Implementation Ordinance	《中华人民共和国水土保持法实施条例》	State Council	1 August 1993
Water Extraction Permit System Provisional Measures	《取水许可制度实施办法》	State Council	1 August 1993
Land VAT Provisional Ordinance of the PRC	《中华人民共和国土地增值税暂行条例》	State Council	13 December 1993
Township and Village Coal Mining Management Ordinance	《乡镇煤矿管理条例》	State Council	20 December 1994
Mineral Resource Compensation Fee Collection Management Regulations	《矿产资源补偿费征收管理规定》	State Council	27 February 1994
Detailed Implementation Rules for the Mineral Resource Law of the PRC	《中华人民共和国矿产资源法实施细则》	State Council	26 March 1994
Nature Reserve Ordinance of the PRC	《中华人民共和国自然保护区条例》	State Council	1 December 1994
Provisional Ordinance for the Prevension and Control of Water Pollution in the Huai River Watershed	《淮河流域水污染防治暂行条例》	State Council	8 August 1995
State Council Decision Regarding Several Environmental Protection Issues	《国务院关于环境保护若干问题的决定》	State Council	3 August 1996
State Council Notice Regarding National Ecological Construction Plan	《国务院关于印发全国生态环境建设规划的通知》	National People's Congress, State Council	7 November 1998
Base Farmland Protection Ordinance	《基本农田保护条例》	State Council	24 December 1998
National Land Management Law of the PRC Implementation Ordinance	《中华人民共和国土地管理法实施条例》	State Council	27 December 1998
Detailed Implementation Rules for the Water Pollution Prevention and Control Law of the PRC	《中华人民共和国水污染防治法实施细则》	State Council	20 March 2000
Provisional Measures for Compensation for Use of Flood Retention Areas	《蓄滞洪区运用补偿暂行办法》	State Council	23 May 2000

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Table A2 *continued*

Name		Issuing Agency	Date of Issue
English	Chinese		
State Council Notice Regarding Work to Strengthen Urban Water Supplies, Water-Saving and Water Pollution Control	《国务院关于加强城市供水节水和水污染防治工作的通知》	State Council	7 November 2000
Ordinance for Three Gorges Dam Project Resettlement	《长江三峡工程建设移民条例》	State Council	21 February 2001
Several Opinions Regarding Improving Policy Measures for the Conversion of Cropland to Forests and Grassland Program	《关于进一步完善退耕还林政策措施的若干意见》	State Council	11 April 2002
Several Opinions of the State Council Regarding the Strengthening of Grassland Protection and Revitalization	《国务院关于加强草原保护与建设的若干意见》	State Council	16 September 2002
Conversion of Cropland to Forests and Grasslands Program Ordinance	《退耕还林条例》	State Council	14 December 2002
State Council Decision Regarding Implementation of the Scientific Development View to Strengthen Environmental Protection	《国务院关于落实科学发展观加强环境保护的决定》	State Council	3 December 2005
State Council Views on the Zoning of National Core Function Regions	《国务院关于编制全国主体功能区规划的意见》	State Council	26 July 2007
Several Views of the State Council Regarding the Promotion of Sustainable Resource-Based Urban Development	《国务院关于促进资源型城市可持续发展的若干意见》	State Council	18 December 2007
Guiding Opinions of the State Council Regarding Further Promoting the Opening Up and Socio-Economic Development of the Yangtze River Delta	《国务院关于进一步推进长江三角洲地区改革开放和经济社会发展的指导意见》	State Council	7 September 2008
State Council Endorcement of NDRC Notice Regarding 2009 Work on Deepening Economic Reforms	《国务院批转发展改革委关于 2009年深化经济体制改革工作意见的通知》	State Council	19 May 2009

NDRC = National Development and Reform Commission, PRC = People's Republic of China.

Source: Wang, Jinnan et al. 2010. Considerations Regarding a National Legal Framework for Eco-Environmental Compensation. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

Table A3 Eco-Compensation-Related Ministerial and Departmental Rules and Regulations Issued by Agencies under the State Council of the People's Republic of China

Name		Issuing Agency	Date of Issue
English	Chinese		
Detailed Implementation Rules for the Forest Law of the PRC	《中华人民共和国森林法实施细则》	Ministry of Forestry	10 May 1986
Detailed Implementation Rules for the Fisheries Law of the PRC	《中华人民共和国渔业法实施细则》	Ministry of Agriculture, Animal Husbandry and Fisheries	20 October 1987
Fisheries Resource Breeding Protection Fee Collection and Use Measures	《渔业资源增殖保护费征收使用办法》	Bureau of Tourism, MoF, Bureau of Pricing	31 October 1988
Provisional Measures for Mining Zone Utilization Fee Remittance for Sino-Foreign Cooperative Land-Based Petroleum Exploration and Development	《中外合作开采陆上石油资源缴纳矿区使用费暂行规定》	MoF	15 January 1990
Terrestrial Wildlife Protection Implementation Ordinance of the PRC	《中华人民共和国陆生野生动物保护实施条例》	Ministry of Forestry	1 March 1992
Terrestrial Wildlife Resource Protection and Management Fee Collection Measures	《陆生野生动物资源保护管理费收费办法》	Ministry of Forestry, MoF, State Bureau of Commodity Prices	17 December 1992
Aquatic Wildlife Protection Implementation Ordinance of the PRC	《中华人民共和国水生野生动物保护实施条例》	Ministry of Agriculture	5 October 1993
Detailed Implementation Rules for the Vegetation Quarantine Ordinance (Section on Forestry)	《植物检疫条例实施细则 (林业部分)》	Ministry of Forestry	26 July 1994
Regulations for the Management of Yellow River Lower Watershed River-Based Irrigation	《黄河下游引黄灌溉管理规定》	MWR	1 December 1994
Provisional Measures for Use and Management of Especially Large Flood and Drought Prevention Subsidies	《特大防汛抗旱补助费使用管理暂行办法》	MoF, MWR	29 December 1994
Agricultural Irrigation Water Resource Use and Irrigation Project Facility Compensation Measures	《占用农业灌溉水源、灌排工程设施补偿办法》	MWR, MoF, State Planning Commission	13 November 1995
Several Opinions of SEPA Regarding Strengthening the Environmental Management and Protection of Western Development Program Construction Projects	《国家环保总局关于西部大开发中加强建设项目环境保护管理的若干意见》	SEPA	10 January 2001
Animal Husbandry Pollution Control Management Measures	《畜禽养殖污染防治管理办法》	SEPA	20 March 2001

continued on next page

Table A3 *continued*

Name		Issuing Agency	Date of Issue
English	Chinese		
Forest Ecological Benefit Compensation Fund Management Measures (Provisional)	《森林生态效益补助资金管理办法) (暂行》	SFA, MoF	26 November 2001
Notice Regarding the "Conversion of Grazing to Grassland Program and the Banning of Grazing through the Promotion of the Livestock Pen-Raising Program and Grain Supply Monitoring Provisional Measures"	《<退牧还草和禁牧舍饲陈化粮供应监管暂行办法>的通知》	NDRC, State Grain Bureau, et al.	1 July 2003
Notice Regarding the Promulgation of the "Motorcycle Pollution Emissions Control Technology Policy"	《关于发布 (摩托车排放污染防治技术政策) 的通知》	SEPA	15 January 2003
Emissions Fee Collection Standard and Management Measures	《排污费征收标准管理办法》	State Development Planning Commission, et al.	28 February 2003
Central Government Forest Ecological Benefit Compensation Fund Management Measures	《中央森林生态效益补偿基金管理办法》	MoF, SFA	11 October 2004 (issued), 15 March 2007 (revised)
Guiding Opinions of the Ministry of Finance, MLR and SEPA Regarding Progressive Development of a Mine Environmental Management and Ecological Restoration Liability System	《财政部国土资源部环保总局关于逐步建立矿山环境治理和生态恢复责任机制的指导意见》	MoF, MLR, SEPA	10 February 2006
Central Government Village Environmental Protection Special Fund Management Provincial Measures	《中央农村环境保护专项资金管理暂行办法》	MoF, SEPA	21 April 2009
National Key Ecological Function Zone Financial Transfer Payment Measures (Pilot)	《国家重点生态功能区转移支付 (试点) 办法》	MoF	11 December 2009

MLR = Ministry of Land and Resources, MoF = Ministry of Finance, MWR = Ministry of Water Resources, NDRC = National Development and Reform Commission, SEPA = State Environmental Protection Administration, SFA = State Forestry Administration.

Source: Wang, Jinnan et al. 2010. Considerations Regarding a National Legal Framework for Eco-Environmental Compensation. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

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2 Xie, Jian et al. 2009. *Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues*. Washington, DC: World Bank.

3 *China Daily*. 2011. China Environment Strategy Report Says the Drinking Water for 190 Million Chinese Does Not Meet Pollution Standards. 22 April.

4 Endnote 2; World Bank. 2007. *Cost of Pollution in China: Economic Estimates of Physical Damages*. Washington, DC.

5 Endnotes 1 and 2; ADB. Forthcoming. *Flood Risk Management Proposed for the People's Republic of China: Learning to Live with Flood Risk*. Manila.

6 Bennett, Michael T. 2009. *Markets for Ecosystem Services in China: An Exploration of China's "Eco-compensation" and Other Market-Based Environmental Policies*. Washington, DC: Forest Trends. www.forest-trends.org/publication_details.php?publicationID=2317; for a more detailed discussion of the various definitions of and innovations in eco-compensation, please refer to Zhang, Qingfeng et al. 2010a. *An Eco-Compensation Policy Framework for the People's Republic of China: Challenges and Opportunities*. Manila: ADB; and Zhang, Qingfeng et al., eds. 2010b. *Payments for Ecological Services and Eco-Compensation: Practices and Innovations in the People's Republic of China*. Manila: ADB.

7 ADB. 2011b. *Market-Based Instruments for Water Pollution Control in the People's Republic of China*. Manila.

8 Endnote 3; Government of the People's Republic of China, State Council. 2010. *State Council Notice Regarding Promulgation of the National Key Function Regional Zoning Plan*. National Issue [2010] No. 46; Government of the People's Republic of China, Ministry of Environmental Protection, and Chinese Academy of Sciences. 2008. *National Ecological Function Zoning Plan*. Beijing.

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12 One example is the severe Beijing dust storms in 2001 and 2006, caused by both intensification and extensification of agriculture in Loess Plateau regions.

13 Economy, Elizabeth. 2011. China's Growing Water Crisis. *World Policies Review*. 9 August. www.worldpoliticsreview.com/articles/print/9684

14 Such pressures have, furthermore, forced growing dependence and exploitation of groundwater resources, resulting in a dramatic drop in groundwater tables throughout the PRC.

15 The Beijing–Tianjin Sandstorm Source Control Program is another example, but in many ways it is very similar to the CCFG program.

[16] Bennett, Michael T. 2008. China's Sloping Land Conversion Program: Institutional Innovation, or Business as Usual? *Ecological Economics.* 65. pp. 699–711.

[17] Government of the People's Republic of China, State Council. 2010. *State Council Notice Regarding Promulgation of the National Key Function Regional Zoning Plan*. National Issue [2010] No. 46.

[18] To be precise, the 436 county-level administrative districts are Key Ecological Function Areas that are in Restricted Development Zones. An additional number of counties deemed as Key Ecological Function Area also exist in Banned Development Zones.

[19] Government of the People's Republic of China, Chinese Communist Party Central Committee. 2010. 2011 Central Government No. 1 Document: State Council Decision Regarding the Acceleration of Water Conservation Reforms and Development. December 31; *Xinhua News Agency*. 2011. Authoritative Interpretation of the Central Government No. 1 Document: The Government Will Invest CNY4 Trillion Over 10 Years in Water Conservancy. 29 January.

[20] Government of the People's Republic of China, Ministry of Finance. 2009. *National Key Ecological Function Zone Transfer Payment Measures (Provisional)*; Du, Ying. 2010. Vigorously Building a Regulatory System of Safeguards, Accelerating the Development of Sound Eco-Compensation Mechanisms. Address from the Vice Chairman of the National Development and Reform Commission at the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October; Given that only 436 county-level administrative areas are designed as "National Key Ecological Function Zones," it is likely that the additional counties beyond this number are in protected areas.

[21] Bennett, Michael T. 2009. *Markets for Ecosystem Services in China: An Exploration of China's "Eco-compensation" and Other Market-Based Environmental Policies*. Washington, DC: Forest Trends. www.forest-trends.org/publication_details.php?publicationID=2317

[22] Zhang, Qingfeng et al. 2010a. *An Eco-Compensation Policy Framework for the People's Republic of China: Challenges and Opportunities.* Manila: ADB.

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[24] Endnote 16; Xu, Jintao et al. 2006. China's Ecological Rehabilitation: Unprecedented Efforts, Dramatic Impacts, and Requisite Policies. *Ecological Economics*. 57. pp. 595–607; Government of the People's Republic of China, State Forestry Administration. Various years. *China Forestry Development Report*. Beijing: China Forestry Press.

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[26] Shaanxi Provincial Development and Reform Commission. 2010. Shaanxi Province: Situation Regarding Developing Eco-Compensation Work. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

[27] The idea of "green insurance" was first put forward by the Ministry of Environmental Protection and the China Insurance Regulatory Commission. A well-designed insurance and environmental liability scheme can protect enterprises from bankruptcy due to environmental accidents, while also pushing them to continuously improve environmental performance with punitive premiums for high-risk enterprises. It can facilitate timely compensation for those who suffer from accidents while alleviating the government's financial burden on environmental restoration, and also engender greater corporate social responsibility. Such schemes are being developed in a growing number of provinces and locales across the PRC, including Hunan, Hebei, and Jiangsu provinces, and Kunming municipality in Yunnan Province. In the case of Fujian's pilot scheme, annual payments

by enterprises range from CNY70,000 to CNY240,000, depending on the size of the enterprise and the degree to which it poses a pollution risk, with the limit for total payouts ranging from CNY3.5 million to CNY30 million, again depending on similar considerations as well as the severity of the accident. Of these payouts, 35% are given to the lower watershed government for cleanup costs for "large" pollution occurrences and 50% are given for "extremely severe" pollution occurrences. Once all payments and compensations are completed in a given year, 70% of the remainder is paid into the provincial eco-compensation special fund, for use the following year. (Fujian Provincial Development and Reform Commission. 2010. Fujian Province: Reflections on the Exploring of Green Insurance and the Refinement of Eco-Compensation Mechanisms. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October).

28 Government of the People's Republic of China, Ministry of Agriculture, Research Center for Rural Economy. 2010. Reflections on the Design of Grassland Eco-Compensation Mechanisms. Paper for the International Conference on Payment for Watershed Services and Eco-Compensation Legislation. Ya'an, Sichuan Province, PRC. 23–24 October.

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30 Endnotes 2 and 9; Feng, Yan, Daming He, and Beth Kinne. 2006. Water Resources Administration Institution in China. *Water Policy*. 8(4). pp. 291–301.

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33 Many of the earlier established river basin or lake authorities are only at the same administrative level as other sector agencies. One example is the Dianchi Lake Management Bureau, which was created at the same administrative level as the other line agencies and has apparently not been very effective as a result.

34 It is noted that agriculture will not be covered in the initial Eco-Compensation Ordinance. Nevertheless, eco-compensation principles have the potential to play an important role in dealing with the NPS pollution problem as discussed further in this section.

35 Endnote 22; Zhang, Qingfeng et al., eds. 2010b. *Payments for Ecological Services and Eco-Compensation: Practices and Innovations in the People's Republic of China*. Manila: ADB.

36 Jin, Leshan and Wenjuan Zuo. 2010. Eco-Compensation in the Environmental Policy Toolkit. In Zhang, Qingfeng et al., eds. *Payments for Ecological Services and Eco-Compensation: Practices and Innovations in the People's Republic of China*. Manila: ADB.

37 An even more challenging example is climate regulation services, such as carbon sequestration.

38 Government of the People's Republic of China, National People's Congress. 2002b. *Law of the People's Republic of China on Land Contract in Rural Areas.* Article 20. Beijing.

39 Note that this observation is tempered by evidence on the ground that de facto land tenure length and security vary significantly by locale across the PRC (see Liu, Shouying, Michael Carter, and Yang Yao. 1998. Dimensions and Diversity of Property Rights in Rural China: Dilemmas on the Road to Further Reform. *World Development*. 26(10). pp. 1,789–1,806; and Brandt, Loren, Scott Rozelle, and Matthew Turner. 2004. Local Government Behavior and Property Rights Formation in Rural China. *Journal of Institutional and Theoretical Economics*. 160(4). pp. 627–662).

40 One example of such a "low-hanging fruit" is eco-compensation programs targeting agricultural nonpoint source pollution. In the

PRC, agricultural nonpoint source pollution is estimated to have contributed 44% of the chemical oxygen demand, 55% of the nitrogen, and 67% of the phosphorus pollution in recent years (endnote 1). Since both service providers (i.e., upstream agricultural land users) and beneficiaries (i.e., downstream water users) are easily identifiable and sufficiently localized groups, and targeted land use practices have measurable impacts on the watershed, an effective eco-compensation mechanism involving direct payments between beneficiaries and suppliers would be relatively easy to set up to achieve improvements in water quality above and beyond what is required by law. Note that other PES approaches could also be used. Agricultural eco-labeling is one example, though this would be less direct in targeting specific watersheds and services. Another is water quality trading (also known as "nutrient trading") schemes whereby total pollution load limits are stipulated for a watershed, pollution credits are distributed among all point sources, and a mechanism is established where point sources (e.g., industries) can "offset" their impacts by paying for agricultural nonpoint sources (e.g., farmers) to reduce theirs.

41 Standard designs for eco-compensation programs should not assume that they will inherently reduce poverty. For eco-compensation programs to genuinely reduce poverty, schemes need to be specially designed and monitored for poverty reduction. Poor households may lack the necessary skills and education to be able to effectively participate and benefit from eco-compensation schemes in terms of learning and implementing new land use practices, negotiating contracts, etc. Research on the CCFG program found, for example, that the program's poverty alleviation goal has often been used as an "exit option" for local officials if the environmental targets are too difficult to achieve.

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———, eds. 2010b. *Payments for Ecological Services and Eco-Compensation: Practices and Innovations in the People's Republic of China*. Manila: ADB.

Eco-Compensation for Watershed Services in the People's Republic of China

The People's Republic of China (PRC) is seeking new approaches to improve water management outcomes in the face of a growing water crisis caused by ongoing pollution control and watershed management challenges. This has included numerous experiments in "eco-compensation" (which shares characteristics with payments for ecological services). This paper details progress in creating a national eco-compensation ordinance and discusses the ongoing institutional challenges in its effective development. Water is possibly the single most-pressing resource bottleneck of economic growth for the PRC over the medium term. As such, the degree to which such initiatives are ultimately successful is not only critical for the PRC but also has major ramifications for global food, fuel, and commodity markets and production chains.

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