



An Eco-Compensation Policy Framework for the People's Republic of China

Challenges and Opportunities

Asian Development Bank



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Foreword

Eco-compensation, or payment for ecosystem services (PES), is a payment and incentive system that supports sustainable ecosystems, provides stable financing for conservation, and—when strategically designed—can address livelihood issues for the rural poor. It is an innovative and exciting step forward in how we think about the environment and ways to protect it and reverse damages already done to it. PES programs place an economic value on the natural services that different resources in our environment offer to our economies, standard of living, and future; for example, such services include those provided by clean and ecologically healthy rivers and forests, rich biodiversity, and scenic amenities. A PES program would figure an economic value and then design payments and incentives for individuals, groups, and local governments who live within the targeted resource area to protect that resource. Such protection usually involves farmers and industries adopting more environment-friendly practices.

In the People's Republic of China (PRC), policy makers have been experimenting with a wide array of policy and program innovations under the broad heading of eco-compensation. In fact, the PRC is driving some of the largest public PES schemes in the world. The current drive toward developing eco-compensation mechanisms started in 1999, when the government began the Conversion of Cropland to Forest and Grassland Program (also known as “Grain for Green”), which has spent more than CNY130 billion (\$19 billion) to date on payments and incentives for farmers to retire and afforest or plant grass on more than 9 million hectares (ha) of sloping or marginal cropland. The program now stretches to all corners of the country. Since 2001, the government has spent more than CNY13.34 billion (\$2 billion) on the Forest Ecosystem Compensation Fund, a program that pays households, communities, and local governments to protect about 44.53 million ha of key forest areas across 30 provinces. The variety of payment schemes for watershed services have escalated in recent years, from eight in 1999 to more than 47 in 2008, with an estimated transacted value of \$7.8 billion and covering about 290 million ha.

This paper provides a synthesis of the findings from the International Conference on Payments for Ecological Services, held on 6–7 September 2009 in Ningxia Hui Autonomous Region. This conference was hosted by the PRC National Development and Reform Commission, the Ministry of Environmental Protection, the Government of Ningxia Hui Autonomous Region, and the Asian Development Bank (ADB). About 500 provincial and central government representatives from more than 14 provinces and 7 central ministries, and a number of international experts attended the conference.¹

This paper credits the PRC with having gained a wealth of experience with eco-compensation, which should influence both domestic and international understanding of the role of government in sustainable ecosystem services. This paper discusses the evolution of eco-compensation policy within the PRC's environmental regulatory framework, summarizes important national and international developments, provides policy recommendations, and suggests further

¹ The 14 provinces are Anhui, Chongqing, Fujian, Gansu, Guangdong, Guizhou, Hainan, Jiangsu, Jiangxi, Liaoning, Ningxia Hui Autonomous Region, Qinghai, Shanxi, and Zhejiang. The seven ministries are the National Development and Reform Commission, the Ministry of Environmental Protection, the Ministry of Finance, the Ministry of Agriculture, the Ministry of Water Resources, the Ministry of Land and Resources, and the State Forestry Administration.

action. The paper concludes that the PRC government would benefit from greater understanding of other countries' experience with PES programs and other market-based environmental policy instruments as it continues to work on an eco-compensation policy framework, which would enable private sector participation.

ADB's Strategy 2020, the long-term strategic framework of the Asian Development Bank (2008–2020), focuses its support on three distinct but complementary development agendas for the region: inclusive economic growth, environmentally sustainable growth, and regional integration. Supporting PES schemes in the PRC will significantly contribute to all three of these strategic agendas.

The findings in this paper offer a good basis for further strategic policy dialogues between the PRC, ADB, and other development partners on instituting PES schemes. One solid step forward would come from having created a much-needed preliminary financing framework to guide development partnerships. Current and future policy dialogues are also an ideal opportunity to identify ways of designing effective PES schemes for the PRC.



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This knowledge product was prompted by the successful International Conference on Payments for Ecological Services held on 6–7 September 2009 in Ningxia Hui Autonomous Region. The Asian Development Bank's (ADB) Director General for the East Asia Department, Klaus Gerhaeusser, led the international team of experts and speakers at the conference. ADB's Director for Agriculture, Environment and Natural Resources Division of the East Asia Department, Kunhamboo Kannan, gave the inspiration and support for the preparation of this paper. ADB's Principal Water Resources Management Specialist, Qingfeng Zhang, designed the conference program and finalized this paper with contributions from Natural Resources Economist, Tun Lin. Consultants Michael T. Bennett and Leshan Jin participated in the conference and prepared the initial draft of this report and gave valuable comments for the final report. International experts Robert Crooks, Eva Abal, and Hasan Moinuddin also attended the conference and provided valuable comments on the product at various stages of its development. Melissa Alipalo, Anthony Victoria, and Joy Quitazol-Gonzalez helped edit, design, and produce this product.

This product has also benefited from the strong support of and close collaboration with the National Development and Reform Commission (NDRC), through whose successful organization and hosting of the conference made this report worthwhile. ADB is particularly grateful to Du Ying, the Vice Chairman of NDRC, for his leading role in cross-ministerial efforts on payment for ecosystem services in the PRC. ADB would also like to thank Qin Yucui, the Director of the Department of Western Regions Development of 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 Forest and Grassland
CRP	–	Conservation Reserve Program
ES	–	ecosystem service
EU	–	European Union
MEP	–	Ministry of Environmental Protection
NDRC	–	National Development and Reform Commission
NEPA	–	National Environmental Protection Agency
PES	–	payment for ecosystem services
PRC	–	People's Republic of China

Weights and Measures

ha – hectare

mu – a traditional Chinese unit of
land measurement (1 mu = 1/15 ha)

Currency Equivalents

(1 September 2010)

Currency Unit	–	yuan (CNY)
CNY1.00	=	\$0.14665
\$1.00	=	CNY6.79878

Note: \$ refers to United States dollars, unless otherwise specified.

Introduction: Ambition and Momentum for Eco-Compensation Policy

The People's Republic of China (PRC) is at an exciting phase in the development of its national environmental policy framework. The fast-paced economic growth of the past 3 decades has lifted hundreds of millions of rural dwellers out of poverty, but it also greatly multiplied the environmental challenges for policy makers at all levels of government, has increased the pressure on fragile ecosystems, created a range of new pollution and environmental safety issues, and further strained the country's already limited per capita natural resource base. The imbalanced economic growth between regions was partly due to the regional differences in environmental resources. Regions with relatively fast economic growth have exerted greater demand on natural resources for food, water supply, and energy consumption, much of which are provided by poorer regions. Policy makers are debating the extent to which the economically advanced regions should pay poor regions for the provision of these environmental services. "Eco-compensation," as it is known in the PRC, is important to sustainable use of natural resources and more balanced growth across regions.

Having experienced growth as it has, the PRC must now use its financial capacity to reverse environmental damage through closer monitoring, enforcing its environmental laws, and funding new initiatives and policies (Figure 1). The more prosperous regions now have the financial capacity to compensate poorer regions for the ecosystem services they provided during the rapid growth periods and will continue to provide for future growth.

In response to both the need and potential for addressing environmental damage, policy makers have been experimenting with new approaches to environmental management, resulting in a wide array of policy and program innovations under the broad heading of eco-compensation. Many of these incorporate or provide a policy framework for market-based approaches to payment for ecosystem services (PES).

PES attracts respectable government financing levels

Today, the PRC can be credited with driving some of the largest public PES schemes in the world. The government has

- spent more than CNY130 billion (\$19 billion) since 1999 on the Conversion of Cropland to Forest and Grassland Program (also known as "Grain for Green"), which has paid farmers to retire and afforest or plant grass on more than 9 million hectares (ha) of sloping or marginal cropland;

Today, the PRC can be credited with driving some of the largest public PES schemes in the world

- spent more than CNY13.34 billion (\$2 billion) since 2001 on the Forest Ecosystem Compensation Fund, a program that pays households, communities, and local governments to protect about 44.53 million ha of key forest areas across 30 provinces in the country;² and
- conducted a total estimated transaction value of \$7.8 billion on a variety of payment schemes for watershed services, which has escalated from eight in 1999 to more than 47 in 2008 and covering about 290 million ha.³
- Those who develop and exploit resources should also protect the environment, those who destroy the environment should repair it, those who benefit from it should subsidize it, and those who pollute should pay.
- Responsibility, right, and power are synonymous.
- Agreement on public construction of the environment and public benefit can help achieve “win-win” development.
- Government guidance and market regulation should encourage diversification of funding sources and harnessing of market forces.
- Adapt central policy to local conditions and energetically innovate.

PES policy gains momentum

In 2005, the fifth Plenary Session of the 16th Central Committee of the Chinese Communist Party issued, for the first time, the principles for developing eco-compensation mechanisms. As a result, the State Council released Document No. 39, *State Council Decision Regarding Using the Scientific Development View to Strengthen Environmental Protection*, which states that the government “...should improve eco-compensation policy, and develop eco-compensation mechanisms as quickly as possible” (State Council 2005).⁴ The PRC’s Ministry of Environmental Protection (MEP) has also issued its own *Guiding Opinions on the Development of Eco-compensation Pilot Work*, which targets four pilot areas: western PRC; key ecological function reserves (e.g., nature reserves and restricted construction zones); natural resource use (e.g., forests, grasslands, wetlands, and mineral resources); and watershed services. MEP also set out five fundamental principles for developing eco-compensation policies and mechanisms (MEP 2007a):

The ambition and momentum of these initiatives is evident in the 11th Five-Year Plan (2006–2010), which calls for policy makers to innovate in environmental policy, develop eco-compensation pilot projects and accelerate the development of eco-compensation mechanisms (especially intraregional and watershed-related eco-compensation mechanisms), and resolve issues over funding conservation.

As part of implementing the 11th Five-Year Plan, the 2007 State Council workplan called for “...deepening product pricing and emissions fee reforms for key natural resources, perfecting a resource taxation system, and improving a paid mineral resource use system; quickening the development of eco-compensation mechanisms.” The PRC’s revised water pollution control law now states that “the PRC will, via such means as financial transfers and payments, develop sound environmental protection compensation mechanisms for regions located in drinking water source protection areas, and river, lake, and reservoir upper watershed conservation and ecological protection areas.”⁵

² State Forestry Administration (SFA) 2008, SFA 2007, *Economic Daily* 2007.

³ Stanton, Tracy et al. 2010. State of Watershed Payments: An Emerging Marketplace. Ecosystem Marketplace. Available online 23 June 2010.

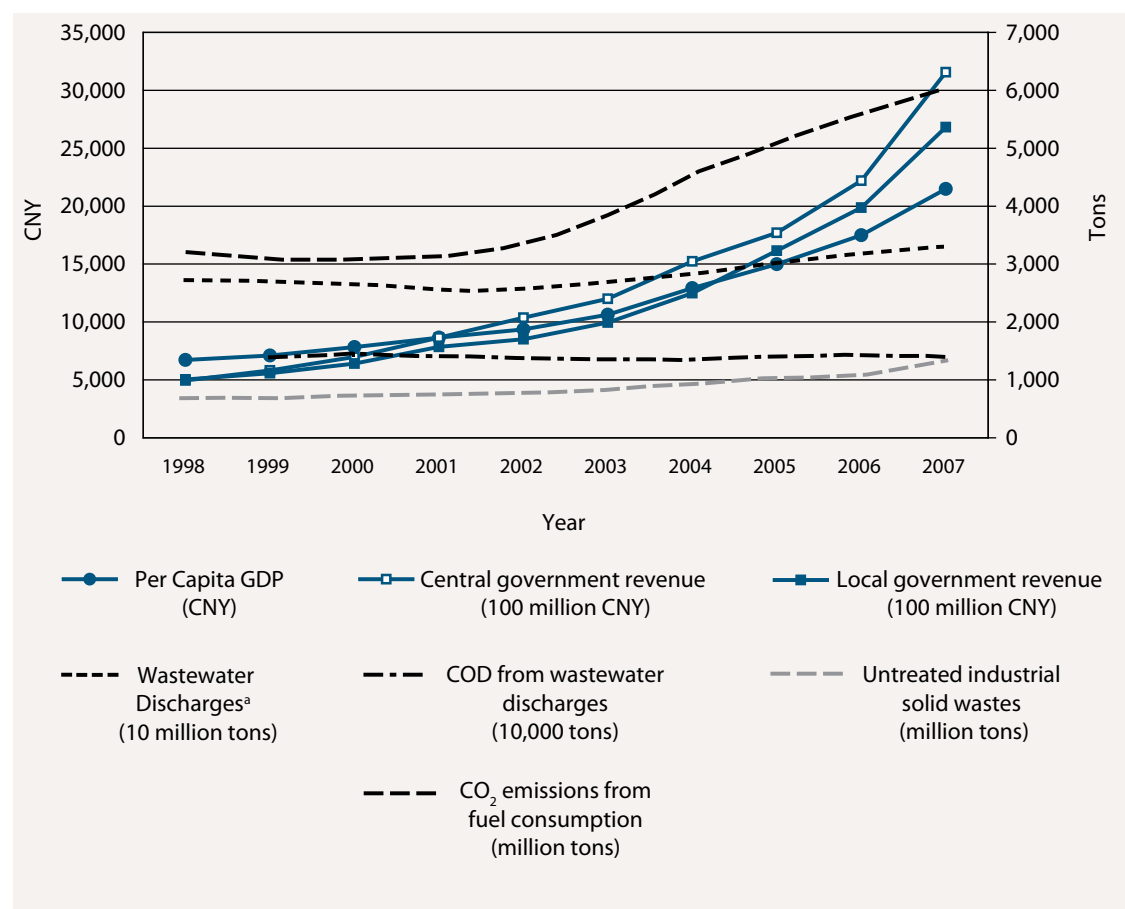
⁴ [Section 23, sentence 7].

⁵ National People’s Congress 2002 Law of the People’s Republic of China on the Prevention and Control of Water Pollution (Amendment of 1988 Law) Section 1 Article 7.

In 2009, both President Hu Jintao and Premier Wen Jiabao also made clear statements reiterating that the PRC will develop a “sound system of paid use of (mineral and natural) resources” and “eco-compensation mechanisms” (Jin and Zuo 2010; Wang et al.

2010).⁶ Against this backdrop, the central government is developing a national eco-compensation policy framework, and possibly a law, in preparation for the drafting of its 12th Five-Year Plan (2011–2015).

Figure 1 Government Revenue versus Selected Pollution Indicators, People’s Republic of China, 1998–2007



CNY = yuan, CO₂ = carbon dioxide, COD = chemical oxygen demand, GDP = gross domestic product.

^a Wastewater discharges are calculated as discharges from consumption plus untreated industrial wastewater discharges.

Source: National Bureau of Statistics of China, various years. CO₂ emissions data are from the International Energy Agency (2009).

⁶ In March 2009, at the 2nd session of the 11th National People’s Congress, Premier Wen Jiabao stated the need to “accelerate the development of a sound system of paid use of mineral resources and eco-compensation mechanisms.” In October 2009, at the 17th National Congress of the Communist Party of China, President Hu Jintao stated that the PRC “will develop a sound system of paid use of resources and eco-compensation mechanisms”.

Local government innovation influences central policies

The contribution of local governments to building momentum and innovation in this PES frontier deserves recognition and study. They are adapting centrally designed eco-compensation programs to meet their own needs, drawing upon multiple central and provincial policies and funding sources. The result is a diverse catalogue of initiatives and public programs that incorporate both direct payments for ecological services renders and incentive-based elements

at all government levels. These hybrid programs often feed back into central government policy development, stirring a healthy debate on how to improve these programs while exploring more market tools and regulatory innovations (Bennett 2009). For example, current experiment and experiences with emission trading in Jiangsu and Zhejiang provinces, particularly in the Tai Lake Basin, suggest that such a system may soon be replicated in various locations across the country, and will provide valuable insights into the types of institutional and legal reforms that the country will need to develop this system.

The Policy Debate: What is Meant by “Eco-Compensation”?

The People’s Republic of China (PRC) tends to use the term “eco-compensation,” rather than payment for ecosystem services (PES), which is the predominant term used internationally. The real issue, however, is the many interpretations within the PRC over the use of its own term, “eco-compensation.” The various definitions are topic in academic and policy discourse in the country and in provincial case studies presented at the conference. While the Chinese term “eco-compensation mechanisms” has often been paired or used interchangeably with the term PES—especially in comparisons between the PRC and the rest of world—these two concepts are very different.

Defining Payment for Ecosystem Services

PES schemes generally refer to contractual arrangements involving direct payments between those who provide and those who benefit from ecosystem services. A classic definition comes from Wunder (2005), who characterizes PES as

- (i) a *voluntary* transaction in which
- (ii) a *well-defined* ecosystem service (ES), or a form of land use likely to

secure that service (iii) is bought by at least one *ES buyer* (iv) from a minimum of one *ES provider* (v) if and only if the provider continues to supply that service (*conditionality*).

More simply put, PES refers to voluntary transactions where a service provider is paid by or on behalf of service beneficiaries for land, coastal, or marine management practices that are expected to result in continued or improved service provision.⁷

When successful, PES creates economic incentives for landholders to conserve or even improve the function of their lands for services as varied as watershed protection, carbon sequestration, and biodiversity conservation. Landholder awareness of the true value of their property also increases as part of the process.

PES schemes generally refer to contractual arrangements involving direct payments between those who provide and those who benefit from ecosystem services

⁷ Given that a number of PES approaches exists, a variety of terms have been used to describe PES, including “market mechanisms for environmental services” (Landell-Mills and Porras 2002; Pagiola, Landell-Mills, and Bishop 2002; and Wunder 2005), “compensations for environmental services” (Rosa, Kandel, and Dimas 2003), “rewards for environmental services” (Pro-Poor Rewards for Environmental Services in Africa [PRESA]), and “agri-environmental payments” (OECD 2009).

PES is becoming more popular internationally as a valuable new policy tool for achieving conservation more effectively and efficiently (in certain contexts) than traditional command-and-control measures. PES schemes may introduce new resources and new incentives for conservation, which is important where funding for conservation is scarce.

Defining Eco-Compensation

Eco-compensation is a system of incentives and disincentives by both users and producers of ecological services. Incentives refer to a reward or compensation for a right that is foregone to maintain a certain ecosystem service. Disincentives refer to charges for the loss of or damage to ecosystems and natural resources (China Council for International Cooperation on Environment and Development 2006). The Jiangxi Province Forest Ecological Compensation Fund, for example, has a CNY20-million (\$2.9 million) fund to reward 10 counties that demonstrate sound forest ecosystems, a clear increase in forest resources, and reduced rates in harvesting. Similarly, Hangzhou City's eco-compensation fund increases or decreases subsidy rates to the various counties and cities in the municipality depending on their environmental management performance (Bennett 2009). River basin eco-compensation programs in Liaoning and Jiangsu provinces also include a range of financial rewards and penalties.

In a speech to the 12th Green China Forum in 2007, Vice Minister Pan Yue of the Ministry of Environmental Protection (MEP) said

Eco-compensation policy is not only an environmental and economic, but also a political and strategic need. Eco-compensation policy needs to

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be improved to focus primarily on instruments that transfer implementation and financial costs between developed and undeveloped regions, between urban and rural areas, between rich and poor, between lower and upper watershed areas, between those benefiting from the environment and those suffering from environmental degradation, and between high-polluting, high-energy industries and 'green' industries. (MEP 2007b)

Eco-compensation in the PRC was initiated as a means for environmental agencies to both strengthen their administrative power and better finance environmental rehabilitation and protection. In 1993, the National Environmental Protection Agency (NEPA) issued the Notice Regarding the Confirmation of NEPA's Ecological Environment Compensation Fee Pilots (NEPA 1993). When the fee was levied (1993–2002), only government environmental agencies and the environmental community called for the development of eco-compensation policy. As the concept of PES became more widely known in the PRC, beginning around 2003, enthusiasm for eco-compensation gradually spread—both horizontally to the different sectors (e.g., water, finance) and vertically to the different levels of government (e.g., central government, local government in upper watersheds). Each of these sectors and governments develop their own definition of eco-compensation.

The provincial case studies presented at the International Conference on Payments for Ecological Services in Ningxia Hui Autonomous Region suggest that the term “eco-compensation” now includes programs that:

- involve direct payments from the government to individual and community-level suppliers of ecosystem services to ensure and improve ecosystem service provision;
- compensate households, communities, or regional governments for regulatory undertakings 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);
- create clear, fair, lateral cooperation and financial transfers between regional or administrative levels of government to ensure and improve ecosystem services;
- adjust or introduce fees, levies, taxes, tax breaks, or subsidies on resource uses to increase funding and/or incentives for conservation, environmental management, and/or restoration;
- increase financial transfers from upper- to lower-level government to better fund environmental management; and
- compensate regions, especially in the PRC's less-developed western region, for past and current extractive and environmentally damaging resource uses.

Many eco-compensation initiatives contain more than one of the above elements as they can serve multiple objectives. Overall, much of the discourse states that the main purpose of eco-compensation is to raise the value of ecosystem services in economic activities, so as to balance economic growth with conservation and environmental protection. Li Wenhua, a prominent Chinese expert who

headed the China Council for International Cooperation on Environment and Development Task Force on Eco-compensation, argued that it is a form of public regulation. It adjusts the relationship between the different stakeholders who affect ecosystem services and the environment. It does this by introducing—through government and the market—values for ecosystem services and costs for ecological conservation. Ultimately, it protects and sustains ecosystem services.

Usage in this Report

In a discussion about PES in the PRC, as what this report attempts to generate, it is difficult to not use both terms, i.e., PES and eco-compensation. They are not used interchangeably in this report. This report uses “PES” to refer to programs that involve actual financial transactions or relate to a market. The report uses the term “eco-compensation” when referring to the broader inputs for developing PES schemes and building a PES market, such as the policies, laws, capacity building, and institutional coordination that is also a part of both enabling environments to perform their natural services and enabling PES schemes to succeed.

Current Status of Eco-Compensation in the People's Republic of China

The People's Republic of China (PRC) has a long history of developing policies to better incorporate the costs of environmental protection in economic activities, enough so to say that the country has long been experimenting with payment for ecosystem services (PES) through its various eco-compensation programs. As early as 1983, Yunnan Province's Phosphorous Mine Environmental Restoration Levy served as the starting point for similar mining fee pilot projects in numerous provinces in the 1980s and 1990s (Li and Liu 2010; Jin and Zuo 2010). In 1994, these were later formalized with some regions using these fees for environmental protection and post-mining restoration. Such work is ongoing, with Fujian and Guangdong provinces recently introducing or revising mining environmental management methods (Jin and Zuo 2010). And in 1991, the Water and Soil Conservation Law of the PRC began allowing some small watersheds to be auctioned or leased to farmers or other private investors for development, with the leaseholder permitted to keep any economic gains of forestry or agricultural activities on the land in return for preventing soil erosion and degradation.

The launch of the Conversion of Cropland to Forest and Grassland Program in 1999 was the starting point for the current drive toward developing eco-compensation mechanisms. Its sheer scale has signaled an important central government policy, generated significant momentum and local capacity building, and has catalyzed a vigorous discourse among policy

makers, experts, and officials regarding the use of innovative payment methods to achieve conservation objectives.⁸ Since its launch, numerous eco-compensation and environmental policy and program innovations have taken shape across the country.

Watershed ecosystem services are clearly the most important targets for these programs. Most of the provincial eco-compensation programs presented at the conference directly target these services, with the remainder having important watershed co-benefits. This is hardly surprising. Although the PRC ranks fifth worldwide in terms of total freshwater resources, its per capita freshwater resources

The People's Republic of China has a long history of developing policies to better incorporate the costs of environmental protection in economic activities, enough so to say that the country has long been experimenting with payment for ecosystem services through its various eco-compensation programs

⁸ Though not officially labeled as an eco-compensation program, numerous academic and policy documents categorize it as such.

of 2,258 cubic meters account for less than one-third of the world average (Food and Agriculture Organization of the United Nations 2003). In the area north of the Yangtze River Basin, per capita freshwater resources is only one-tenth of the world average (Ministry of Water Resources 2000). On 26 July 2010, the Ministry of Environmental Protection reported that 43.2% of state-monitored rivers were classified as Class IV or worse, meaning the water was unsuitable for human use. Last year, as a whole, it was 42.7% (*The Economist* 5 August 2010).⁹ About 400 of the country's 640 major cities face water shortages, and 700 million people lack access to safe water (Turner and Otsuka 2006).

Provincial eco-compensation programs that directly target watershed ecosystem services can be categorized into two general groups: (i) those grappling with ways to better coordinate watershed management across jurisdictional boundaries and (ii) 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 development of cross-jurisdictional management frameworks that map out responsibilities, rights, and targets, and include a range of different financial transfer mechanisms. Fujian's eco-compensation programs to manage the Jiulong, Min, and Jin river watersheds, for example, use cost-sharing arrangements and lower-to-upper watershed financial transfers to improve funding for upper watershed water quality management. Conversely, Liaoning, Jiangsu, and Anhui provinces each have eco-compensation programs—either active or in the design stage—that involve financial penalties for cities or counties along designated rivers when monitored water quality in their respective river sections is less than stipulated targets. Levied charges are deposited to general funds to defray needed water treatment and management costs to cities in the lower watershed. Between January and April 2009, Liaoning Province had

collected CNY7.75 million (\$1.1 million) in levied penalty fees using this mechanism.¹⁰

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 services providers (local governments, communities, and households), with compensation being linked with the implementation of upper watershed zoning restrictions and land-use requirements. One of the earliest of these types, the Jinpan Development Zone in Jinhua City, Zhejiang Province, restricts industrial development in upstream Pan'an County while compensating for this by offering off-site development options downstream. Other programs in Guangdong, Fujian, Zhejiang, and Jiangxi provinces (and programs under development in Anhui Province) involve direct financial transfers to upper watershed governments and communities to pay for improved land management practices and to compensate for foregone agricultural income caused by land-use restrictions. These programs often also include "ecological migration" components, which consist of financial incentives to induce households living in ecologically fragile upland regions to resettle in downstream urban areas. Chongqing Municipality, for example, provides both housing and employment benefits in a program of this type.

Both groups of watershed eco-compensation programs are also trying to improve financial sustainability by diversifying funding sources to include earmarked funds from various government departments and/or by requiring local matching funds. Alternatively, financial sustainability of these programs can also be improved by better linking 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.

⁹ In the PRC's system of water quality classification, Class I is the highest quality, suitable for headwaters and national protected areas. Class III is the lowest water quality still considered suitable for drinking. 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.

¹⁰ Payments are received by the Cross-Administrative-District Municipal Section River Discharge Water Quality Target Assessment Program.

The diversity of provincial programs reveal that while the national government has ostensibly been leading the charge to develop eco-compensation mechanisms and other innovative environmental policies, the provincial and local governments have been key contributors to and, in some cases, have initiated this process. For example, Yiwu and Dongyang cities in Zhejiang Province developed the first water-use rights trading scheme of its kind in the PRC in 2000, and the scheme developed relatively independently from the central government. The program has since stimulated a range of related schemes in other provinces and catalyzed the development of national guidelines and regulations for

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trading water use rights. Similarly, Guangdong Province was first to institute a provincial forest ecosystem compensation fund program ahead of the national program.

Jiangsu and Zhejiang provinces also started to design a system in 2008 to trade emissions between point sources and between point and non-point sources. Their practices suggest that cap-and-trade systems for emissions and effluents could be a valuable future policy option, so long as there would be better monitoring and enforcement. Establishment of a pollution permit trading platform may soon debut in various locations across the country.

Table 1 displays the diversity of eco-compensation programs in the different provinces, varying from forest ecological compensation fund to an emission trading program.

As seen in the provincial case studies, and illustrated in Figure 2, eco-compensation program activities and innovations closely track provincial per capita gross regional product (Bennett 2009). The richer provinces of Zhejiang, Jiangsu, Guangdong, Liaoning, and Fujian have developed a much larger number and array of policies than, for example, Qinghai or Gansu.¹¹ This suggests that the central government has a more important role to play in the less developed regions of the PRC, where financial resources are scarcer. The wealthier coastal regions, conversely, look promising as staging grounds to encourage the development of private sector PES and eco-compensation schemes.

¹¹ Zhejiang, Jiangsu, Guangdong, Liaoning, and Fujian rank 4th, 5th, 6th, 8th and 9th, respectively, in terms of 2006 per capita gross regional product, while Qinghai and Gansu rank 23rd and 30th (ZGTJNJ 2007).

Table 1 Comparison of Provincial-level Diversity of Eco-compensation Programs from the Case Studies

PROGRAM TYPES PROVINCES	ECO-COMPENSATION TYPES											
	Forest and Grassland Services					Watershed Services				Mining Deposit Funds	Ecological Function Zones	
	NFPP	CCFG	Central Government FECF	Provincial FECF	CGG	Inter-provincial Payments	Intra-provincial Payments	Emission Trading	Water Use Rights Trading			Ex-situ Development Zones
Eastern												
Fujian			✓	✓			✓					
Guangdong			✓	✓			✓				✓	
Hainan	✓		✓	✓								✓
Jiangsu		✓	✓	✓			✓				✓	✓
Liaoning		✓	✓	✓			✓				✓	
Zhejiang			✓	✓			✓		✓		✓	
Inland												
Anhui		✓	✓	✓			✓				✓	
Jiangxi		✓	✓	✓			✓					✓
Shanxi	✓	✓	✓	✓			✓				✓	
Western												
Chongqing	✓	✓	✓	✓			✓				✓	✓
Gansu	✓	✓	✓	✓	✓				✓			
Ningxia	✓	✓	✓	✓	✓							
Qinghai	✓	✓	✓	✓	✓			✓				✓

CCFG = Conversion of Cropland to Forest and Grassland Program, CGG = Conversion of Grazing to Grassland Program, FECF = Forest Ecological Compensation Fund Program, NFPP = Natural Forest Protection Program.

Source: Compiled from the Proceedings of the 2009 International Conference on Payments for Ecological Services.

Figure 2 Provincial Gross Domestic Product and Eco-Compensation Programs



FECF = Forest Ecological Compensation Fund.

Source: Bennett 2009.

The Reality Check: Challenges in Designing Payments for Ecosystem Services

Efforts to identify and calculate the economic value of ecosystem services for social welfare are surprisingly recent, but indicate extremely high costs of replacing many of these services if they were to fail.¹² Markets to capitalize on the commercial value of these services, however, are relatively new and face a number of challenges mainly related to the actual valuation of ecosystem services and coordination between the buyers and sellers. Even more fundamental to valuation and coordination is the difficulty of clearly defining service providers and beneficiaries, exactly what kinds of services are provided, and what role government should play.

Uncertainty and Risks

To design policy instruments that efficiently provide ecosystem services, policy analysts must be able to identify services on a local ecological scale—detailing how they are generated and how they are delivered. In many cases, the biophysical relationships between land management changes and ecosystem service provision are unknown or uncertain. Such lack of knowledge or uncertainty makes designing payment for ecosystem services (PES) contracts difficult since it creates challenges in determining who should bear general risks as well as those events or outcomes that are beyond the knowledge or control of the parties involved.

An example of one general risk to *buyers* is having to accept *inputs* (land management activities) as a sufficiently close proxy to service provision, which would then justify payments. In this case, sellers (service providers) manage their ecosystem according to the terms of the PES contract and are paid whether or not adequate services are provided. Buyers' willingness to pay under these circumstances could be low, because they cannot be certain that the quality and/or quantity of those actual service inputs will induce the intended natural ecosystem service.

Conversely, *sellers* assume a general risk when PES is linked with the service *outputs* (the intended environmental benefits from the inputs described above) because of the uncertainty level of efforts needed to deliver the output or intended environmental outcome. In this case,

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¹² In a highly publicized 1997 article in *Nature* (Costanza et al.), for example, a group of economists and ecologists estimated the value of nature's services at approximately \$16 trillion to \$54 trillion per year and the global gross product at \$18 trillion.

sellers are accepting the risk of “innocent loss” — i.e., even if all the required inputs have been duly provided for, there will be factors outside the seller’s control that could disrupt the provision of service outputs or intended outcomes.¹³

Market Failures

Markets play an essential role in discovering the values of goods and services through information exchanged between buyers and sellers. Markets generally do not exist for many ecosystem services because these services—which range from flood control to climate stability—are considered public goods. With no market price attached to public goods, these services often appear to be free and thus are taken for granted—until their importance is belatedly realized after their loss. Given that landholders generally are not paid for the ecosystem services their land provides to others, they have little incentive to conserve, take service provision into account when making land use decisions, or enhance these services beyond what is immediately economically or financially beneficial to them.

The fundamental objective of PES is to overcome these incentive problems by requiring service beneficiaries (buyers, which are typically government) to pay service providers (sellers, which are typically farmers and land users or other local governments), in a sense, to convert “public goods” into “private goods” and thereby “create” the market. Unfortunately, as with markets in general, PES can be subject to information issues that can adversely affect outcomes. Buyers and sellers often have access to different sources and amounts of information regarding ecosystem service provision, resulting in informational asymmetries, which can be exploited in the negotiation of prices.

For example, potential ecosystem service sellers (e.g., farmers) often know better than the buyer (e.g., a government program manager) the characteristics and quality of their own land and the opportunity costs of specific land

use changes. Since this information is often private to them, it can allow them to overstate the opportunity cost of program participation, thereby increasing prices and decreasing program cost effectiveness.

Another related problem is that of “free riding.” This occurs when individuals understate their willingness to pay (e.g., as elicited in government-implemented surveys to estimate the public’s willingness to increase taxes or surcharges to pay for service provision), assuming they will still receive the desired level of service provision because others will pay for it. This often arises with ecosystem services that are “non-rival” (i.e., one’s use will not change the level available to others, such as a scenic view) and “non-excludable” (i.e., services cannot feasibly be ring-fenced to exclude those who do not pay for them, such as clean air). Effective coordination of the relevant information among beneficiaries and effective management of transactions between beneficiaries and providers are both necessary to address these issues.

Institutional Coordination

Political jurisdictions rarely align ecologically, such as within a watershed boundary. Instead, authority is exercised within areas defined by state, provincial, or municipal borders—artificial boundaries rather than natural ones. Not surprisingly, environmental problems do not track political boundaries, rendering it difficult for political actors to agree on a course of action. More challenging, the costs and benefits of conserving ecosystem services vary across jurisdictions. For example, upstream and downstream jurisdictions will have very different views about the value of upstream forest conservation on water quality. As a result, consistent efforts to manage landscapes that ensure service provision are easily confounded by collective adverse activities. Seeking to overcome this obstacle, New Zealand and a number of Australian states have, in the last decade, created catchment management

¹³ To buffer unexpected losses, service providers could rely on a form of self-insurance, such as planting more trees than necessary for carbon offsets or fencing off additional riparian areas to prevent erosion.

bodies that exercise land use planning authority throughout an entire watershed—but these remain a rare exception (Salzman and Ruhl 2001).

Land property rights, land use regulations, and the perceived responsibility of the different stakeholders are all critical to defining the value of ecosystem services, and therefore to determining the feasibility of PES. Different institutions and perceptions will affect service providers' willingness to participate in the PES market. For example, a recent Asian Development Bank survey asked the residents of Fuzhou, a downstream city on the Min River in the People's Republic of China, whether they would be willing to pay a higher water tariff in exchange for better pollution control in the upstream communities of the Min River. Among the 326 survey respondents (out of a total of 757) who replied "no," half of them cited reasons related to low income and high existing water tariff, while the other half quoted institutional reasons such as (i) the responsibility of pollution control should fall upon governments, upstream communities, and/or water supply companies;

and (ii) the quality of PES governance should be improved (Jiang et al. 2010).

On the providers' side, land use regulations are critical for defining the opportunity cost of ecosystem service provision. Opportunity cost is the value of the most profitable alternative land use that is allowed by regulations, and which is forgone as a result of providing the ecosystem service in question. As such, opportunity cost represents a minimum "price" that sellers would be willing to accept for land use changes. In some cases, when potential providers of ecosystem services face no actual land use restrictions (e.g., where land use regulations are incomplete or absent), alternative land uses are highly profitable; and/or when buyers' willingness to pay is low, a PES scheme may be infeasible. In other cases, however, these various factors converge (e.g., combination of land use regulations and cost realities) making PES a feasible and cost-effective choice for securing ecosystem service provision. An example of this is the Catskills Watershed's role in supplying water for New York City (Box 1).

Box 1 New York City and the Catskills Watershed—Opportunity Costs Depend on Regulations

In the early 1990s, a combination of federal regulation and cost realities drove New York City to reconsider its strategy for securing water supplies. New York City's water system provides about 1.5 billion tons of drinking water to almost 9 million New Yorkers every day. Around 90% of the water is drawn from the Catskill/Delaware watershed, which extends 125 miles north and west of the city. Under amendments to the federal Safe Drinking Water Act, municipal and other water suppliers were required to filter their surface water supplies unless they could demonstrate that they had taken other steps, including watershed protection measures, to protect their customers from harmful water contamination.

Presented with a choice between building a filtration plant and managing the watershed to provide clean water, New York City easily concluded that an ecosystem services approach was more cost effective. A filtration plant would cost between \$6 billion and \$8 billion to build. By contrast, watershed protection efforts, which would include not only the acquisition of critical watershed lands but also a variety of other programs designed to reduce contamination sources in the watershed, would cost only about \$1.5 billion. After 2 years of more than 150 meetings with stakeholders, a memorandum of agreement was signed by 60 towns, 10 villages, 7 counties, and various environmental groups.

New York City is not alone in choosing watershed protection activities, rather than invest in the construction of a filtration plant. Many municipalities around the world use watershed conservation as a means of ensuring high drinking water quality.

Source: Daily and Ellison 2002.

International Experience and the Role of Government in Ecosystem Service Markets

The People's Republic of China's (PRC) debate over eco-compensation highlights an important point often overlooked in the international discourse on ecosystem service markets and payment for ecosystem services (PES): the role of government. International experience tends to emphasize the private sector and voluntary aspects of PES schemes, since PES promises to broaden and deepen sources of conservation finance by directly engaging a wider range of economic actors as buyers of ecosystem services. In contrast, policy circles in the PRC are focused on combining market mechanisms with government guidance, indicating a predominantly public sector-driven approach.

At first glance, the PRC's situation thus appears to be unique, but it is not. The public sector is still very much the dominant player in ecosystem service markets worldwide. Internationally, the government plays three key roles as buyer, regulator, and enabler.

Role 1 – Buyer

The public sector has always been the largest purchaser of ecosystem services, presently contributing about 70% of annual ecosystem services payments internationally by value (Food and Agriculture Organization of the United Nations 2007; Milder et al. 2009). Government-created programs for ecosystem services have been important catalysts for ecosystem services markets, and there are many examples: Costa Rica, Mexico, South Africa, the United States, and the European Union (EU) (Natural Resources Conservation Service 2008; EU 2008; Forest

Trends et al. 2008). For example, biodiversity conservation services, where public and quasi-public agencies are the largest buyers, have payments totaling at least \$3 billion annually under the agri-environmental payment schemes of the United States and the EU (Scherr et al. 2007). In the case of the PRC, the sheer scale of the Conversion of Cropland to Forest and Grassland (CCFG) Program has helped to stimulate significant local capacity building and momentum. This can be built upon in the development of ecosystem service markets. Many provincial governments are already considering ways to reallocate portions of their CCFG land area into other programs that tap into more sustainable sources of funding.

Role 2 – Regulator

This common role for government involves both “setting the rules of the game” and using legislation and regulation to mobilize demand for ecosystem services. Perhaps the best and most recognized example of this role is when

The public sector is still very much the dominant player in ecosystem service markets worldwide. Internationally, the government plays three key roles as buyer, regulator, and enabler

government sets emissions control criteria for industrial enterprises. The government defines the rules of the game (which is to protect an ecosystem service in the form of, for example, maintaining adequate water quality), while enterprises respond by installing and operating pollution control equipment.

Some of the earliest programs under this heading can be termed “regulation-driven markets”—whereby the government creates market demand via regulatory requirements to, for example, offset the impacts of development activities on important ecosystems and watersheds. In many cases, an environmental impact assessment for a project or investment may require the development of biodiversity offsets to compensate for unavoidable biodiversity damage by the project. The government-run eco-certification regimes are another more recent type of instrument that falls under this heading. In fact, the markets for biodiversity and certified agriculture (i.e., eco-labeling) show the highest volume of monetary transactions (Carroll and Jenkins 2008). In developing a national eco-compensation policy framework, this will also be a central role for the PRC government.

Role 3—Enabler

This is a relatively new, but increasingly important role. Internationally, various governments are beginning to develop tools and mechanisms to link private sector actors and facilitate the PES schemes. These include services to help these actors buy and sell ecosystem services, and provide new legal and policy frameworks to encourage market development. Swallow et al. (2007), for example, identify three important links between flexible and regulatory approaches to environmental governance. First, new environmental regulations that allow flexibility in the approach to compliance help create institutional freedom for public utilities, local governments, and private firms to innovate in their PES activities. Second, firms or industry groups may promote PES schemes as a way of demonstrating commitment to the environment

to stall environmental regulations. Finally, firms may seek to establish or illustrate best practice in environmental management as a way of influencing the shape of future environmental regulation. In the case of the PRC, huge potential exist for bringing in a wider range of economic actors to invest in the environment. Along these lines, in drafting a national policy framework for eco-compensation, policy makers should consider how the government’s role can slowly evolve from buyer to enabler, and what supporting policies and regulations would need to be in place for this to happen.

Which of these government roles will most effectively ensure service provision depends on which ecosystem service is being targeted for PES. In the case of watershed ecosystem services, which depend on scale and location, the government generally needs to take a central role to ensure that key communities participate and at the necessary scale, level of aggregation, and coordination in land-use changes. Of course, once such broad planning authorities are established and integrated watershed management frameworks developed, private PES schemes can also become one of many policy instruments. In comparison, a lighter public sector role is possible for forest carbon sequestration. This type of service does not depend on a particular location (i.e., the same amount of carbon can be sequestered from trees grown in many different areas) nor on scale (i.e., the amount of carbon an individual tree sequesters generally does not depend on how many other trees exist in the same forest, nor how much total land is enrolled in the PES program). A unit of carbon in one area is equal to a unit of carbon in another. This makes a common market possible in which a variety of buyers and sellers can transact, suggesting that policy makers can more efficiently and cost-effectively secure services by establishing a market and developing the regulatory frameworks, policies, and incentives that enable or even require private sector participation. Examples of this include the Kyoto Protocol’s Clean Development Mechanism and the Reduced Emissions from Deforestation and Forest Degradation mechanism.¹⁴

¹⁴ The 13th Conference of Parties under the United Nations Framework Convention on Climate Change, held in Bali, Indonesia on 3–14 December 2007.

International Experience in Choosing More Cost-Effective Payment Mechanism

The various types of payment for ecosystem services (PES) mechanisms fit into three basic categories: direct payments, mitigation and offset payments, and certification.¹⁵ Direct payments include general subsidy, scored subsidy, negotiation, and reverse auction. Mitigation and offset payments include the Clean Development Mechanism, wetland mitigation banking, and biodiversity offsets. Certifications include eco-labels and forest certification.

Determining the best mechanism depends on a number of factors, including the type of service, the legal setting, whether the parties are public or private, the difficulty and cost of obtaining information, the availability of funds, and the supporting institutions.

Direct Payment – General Subsidy

A general subsidy is the simplest form of payment. The funding agency determines the maximum amount each farmer can receive, identifies the types of qualifying land use measures that will increase service provision, and then settles on the funding protocol. This may simply be on a first-come, first-served basis and until the fund is depleted. The mechanism entails low information and administrative costs, and also allows for a period of experimentation to determine which type of land management changes provide the most benefit. The Sloping Land Conversion

Program of the People's Republic of China discussed earlier provides general subsidies.

General subsidies, however, may not ensure maximum value for money for two reasons. First, they cannot meaningfully distinguish between those parties who will provide high-value services and those who will provide low-value services. As a result, a landholder is eligible for payment simply if the land is located in a qualifying area and the landholder commits to a particular land use practice. This could entice landholders to propose changing the management of their least productive land, regardless of whether this increases or decreases the level of service provision. Secondly, general subsidies can also face the issue of additionality: some landholders may already be providing the targeted ecosystem service via their chosen land uses, so in these instances PES provides nothing in addition to the existing situation.

The various types of payment for ecosystem services mechanisms fit into three basic categories: direct payments, mitigation and offset payments, and certification

¹⁵ This section has benefited from the thematic paper prepared by James Salzman, et al. (unpublished) on Designing Payments for Ecosystem Services in the People's Republic of China.

Direct Payment—Negotiation

Another common mechanism involves public or private parties directly negotiating with providers. This approach assumes that different landholders provide different levels of service and should be compensated accordingly. Thus, direct negotiation has the advantage of allowing individually crafted agreements. Direct negotiation may be preferable when there are few market participants or significant uncertainties or doubts between the buyer and provider.

Transaction costs can be comparatively higher, especially if negotiations need to be conducted with many landholders. This mechanism dampens competition among providers and also assumes buyers have the capacity to accurately assess the provider's willingness to accept the conditions and changes in land management. In the context of water quality, for example, developing a subcatchment-wide strategy for service provision would be quite daunting if negotiations were conducted with individual farms. A third party, either local government or a specially created funding body, could negotiate directly with the landholders. This is the general approach followed in New York's Catskills case (Box 1, page 15).

Direct Payment—Scored Subsidy

To reduce the potentially huge transaction costs of direct negotiations with many individual landholders, many subsidy programs rely on scoring strategies, whereby indexes or other assessment methodologies are used to provide scores for various land attributes, such as presence of biodiversity or proximity to a stream. These scores are meant to identify the service providers who can offer the greatest level of services. The Conservation Reserve Program

(CRP) in the United States takes this approach (Box 2). Unlike general subsidies, scoring systems can maximize the benefits per dollar of subsidy. The scoring system, however, is more expensive to administer. The system's accuracy is also highly dependent on the chosen proxies for service provision.

Direct Payment—Reverse Auction

This increasingly popular approach relies on landholders providing the government sealed bids on how much they are willing to accept for changes in land use management. The bids that offer the greatest service provision at the lowest cost are funded first, and so on until the funds have been exhausted. Reverse auctions are well suited to a monopsony market, where there is only one buyer and many sellers. In a scenario where there are only few sellers, though, collusion is a potential problem. While the CRP described in Box 2 has features of a reverse auction, the most successful example is the BushTender¹⁶ program in Australia.

The reverse auction approach can significantly lower the costs of collecting seller infor-

Determining the best mechanism depends on a number of factors, including the type of service, the legal setting, whether the parties are public or private, the difficulty and cost of obtaining information, the availability of funds, and the supporting institutions

¹⁶ BushTender is a pilot program developed by the State of Victoria's Department of Natural Resources and Environment in Australia. The aim is to conserve native vegetation remnants on private property. In exchange for payments from the state government, landholders commit to fencing off and managing an agreed amount of their native vegetation for a set period of time.

Box 2 Conservation Reserve Program in the United States

Created in 1985, the Conservation Reserve Program (CRP) is one of the largest ecosystem service payment schemes in the world, providing farms with annual rental payments and sharing the cost of conservation practices on farmland. First created to address soil erosion and support farm incomes at a time of plummeting crop prices, the program has grown over the years to include payments for land changes that promote water quality and wildlife habitat. Its annual payments exceed \$1.6 billion for activities on over 34 million acres (13.8 million hectares). The topsoil loss has been reduced on CRP lands by about 21% and pesticide and nutrient runoff has been greatly reduced as well.

To be eligible for the CRP, the farmland must have been planted in two of the five most recent crop years and meet requirements ensuring it can provide services. Interested farmers apply for the program by submitting a bid. To increase their chances, farmers can stipulate that they would accept a lower rental rate than the local market price. Government field officers rank and select applicant farmers according to an environmental benefits index.

This index renders a composite score, with points for

- wildlife habitat benefits resulting from coverage of the contract acreage;
- water quality benefits from reduced erosion, runoff, and leaching;
- on-farm benefits of reduced erosion;
- benefits that will likely endure beyond the contract period (10–15 years);
- air quality benefits from reduced wind erosion;
- benefits of enrollment in conservation priority areas that would improve adverse water quality, wildlife habitat, or air quality; and
- cost of conservation practices on farmland.

If farmers are willing to enter into permanent conservation easements, the CRP offers 100% of the restoration costs and legal fees.

Source: United States Department of Agriculture Farm Service Agency 2003.

mation, thereby addressing the issue of information asymmetry mentioned previously. Since others are also competitively bidding to enter the program, individual landholders have an incentive to accurately reveal to the government how much they would be willing to accept in payments to institute the targeted land use changes. The government, for its part, decides which land use changes are most effective in meeting its overall service goal. Reverse bidding also helps transform how landholders think about the ecological benefits their land produces.

Overall, to achieve these benefits, the bidding process must thoroughly inform potential participants. Without such information sharing, the government is at risk of overpaying,

and landholders have little sense of the relative value of alternative land uses or how to optimize service provision.

Mitigation and Offset Payments

Mitigation and offset markets (also referred to as compliance markets) are based on regulations that require developers and other economic actors to mitigate and/or offset the impacts of their development activities in important species habitats or ecosystems. These types of instruments typically require developers to first design onsite mitigation activities for as many potential ecosystem impacts as

Box 3 Wetland Mitigation Banking

On the face of it, the basic law on conserving wetlands in the United States—the 1972 Clean Water Act (with major amendments in 1977 and 1987)—seems to prevent the filling of most wetlands. The act provides a limited exception, however, through a permit system, for many routine land development activities before they can proceed. When applying for a permit, a developer must convince the government that: (i) no reasonable alternatives exist to the development of the wetlands; (ii) the design of the development minimizes harm to the wetlands; and (iii) other wetlands have been restored to compensate for the wetlands destroyed (known as “compensatory mitigation”).

The government has traditionally preferred on-site to off-site locations for compensatory mitigation. Over time, however, compensatory activities have been allowed, paving the way for wetland mitigation banking. This program allows a developer, who has created a wetland “bank” somewhere else in advance of the development, to draw from the resulting bank of mitigation “credits” as the development is implemented and wetlands are filled. Wetland mitigation banking now resembles a commodity market, with wetland banks offering for sale closed, off-site wetlands as credits to anyone who is in need of mitigation for their development permits. There were between 370 and 400 such commercial mitigation banks operating in the United States as of January 2000.^a

^a A 2005 inventory by the Corps’ Institute for Water Resources estimates a total of 450 approved mitigation banks (59 of which have sold out of credits) and an additional 198 banks in the proposal stage. Since this survey counted umbrella banks as a single bank, the number of bank sites is likely considerably larger than this estimate. See web link: www.epa.gov/owow/wetlands/facts/fact16.html

Source: Salzman and Ruhl 2001.

possible. Developers are then required to offset any unavoidable damage by either directly conducting offsetting conservation and/or restoration activities off-site, contracting a third party, or by purchasing “credits” of conserved habitat elsewhere created precisely for this purpose.

The government plays a central role in setting the rules for these trades: what types of ecosystems qualify, the ratio of land area created to land area destroyed, and units of measurement for the trade (e.g., hectares, ecosystem functions, rates of endemism, and species diversity and mix). Only when these requirements have been satisfied may a permit for development be issued. The Wetland Mitigation Banking is the earliest example of

these types of market (Box 3). The challenge for such markets lies in comparability between different ecosystems.¹⁷

Offset markets also exist in the context of climate change, where some regulatory markets permit those emitting greenhouse gases to offset their emissions by purchasing credits for sequestered carbon. The Clean Development Mechanism and Reduced Emissions from Deforestation and Forest Degradation mechanism are examples.

Developing smoothly functioning offset and mitigation markets is not simple. There must be a sufficient and well-defined marketplace, a community of market participants, and strong regulatory capacity. There also must be a refined currency of trade that is fungible and reflects the

¹⁷ The Business and Biodiversity Offsets Program (<http://bbop.forest-trends.org/>), for example, is specializing in the development of methodologies and guidelines to compare different ecosystems, so as to facilitate the development of biodiversity offset regulations and markets.

desired environmental quality to enable these trading programs to increase the efficiency and flexibility of prescriptive instruments.

In mitigation and offset markets, the responsibility for ensuring the quality of the ecosystem services falls on the regulator, who does not have a stake in the transaction. The buyer in a wetland mitigation market, for example, does not care about the quality of the mitigated wetland as long as the regulator issues a development permit. Thus adequate governance and oversight are essential for effective offset and mitigation markets. For this reason, most compliance markets operate in developed countries, particularly Australia and the United States, rather than in developing countries that have weaker administrative, legal, and enforcement capacities.

Certification

Growing in importance since the 1990s, certification schemes focus on the impacts

of consumption on ecosystem services. Lack of information is a significant barrier to environmental protection. Consumers and corporations who wish to promote environmental responsibility through their purchasing behavior cannot do so unless they have adequate information on the environmental attributes of the products they wish to buy or the behavior of their suppliers. Certification and eco-labels attempt to provide this information.

Eco-labels and certification schemes have grown rapidly over the past 2 decades and across a range of sectors, including sustainably harvested timber, fisheries, agricultural produce, and even financial companies and eco-tourism. The goal of these schemes is to provide consumers with an objective basis for selecting environmentally responsible products. The most significant market development has taken place through major wholesale buyers, such as Wal-Mart and professionals such as architects and builders, not by persuading individual consumers to buy green products and services (Salzman 1997).

Towards a More Effective Eco-Compensation Policy Framework

The growth of the People's Republic of China's (PRC) eco-compensation policies is encouraging for a number of reasons.

First, it is indicative of the government's commitment to increasing investment in environmental protection and management. Environmental spending within the 11th Five-Year Plan period is projected to top CNY1,530 billion (\$225 billion)—a 70% increase from the 10th Five-Year Plan, although still short. In the future, outcomes will improve if funding amounts correlate with the scale responsibilities assigned to the various central and local actors involved in environmental management (ADB 2007).

Second, developing and refining both central and provincial government eco-compensation programs and policies is improving the basic implementation of core components to effective environmental management. These include clarifying rights and responsibilities over ecosystem services and natural resources, resolving equity issues, improving strategic environmental planning, clarifying and prioritizing goals and targets, and strengthening monitoring and enforcement capacity.

In the future, outcomes will improve if funding amounts correlate with the scale responsibilities assigned to the various central and local actors involved in environmental management

Finally, eco-compensation policy is also stimulating innovation in environmental policy, including the development of more incentive-based management regimes, and greater adoption of and innovation in market-based instruments such as payment for ecosystem services (PES). Such innovations stand a good chance of improving the environment and the sustainability of funding for conservation. This brings together a wider range of economic actors and stakeholders, and better internalizes environmental management costs as well as the benefits of ecosystem services into economic activities.

As the government continues to develop a national eco-compensation policy framework, it should keep in mind the following recommendations.

Legal and Regulatory Grounds for Eco-compensation

The general legal framework for eco-compensation should address two fundamental issues: property rights over ecosystem services, and coordination between jurisdictions and institutions.

Clarifying property rights would protect ecosystem services. The government should continue to clarify and strengthen laws about rights and responsibilities over natural resources, which would point to who are responsible for ensuring the related ecosystem services. Rights determine the key actors and stakeholders of

ecosystem services markets and will provide the foundation for successful eco-compensation programs. For example, the state owns water resources and is responsible for allocating resources through government orders and water quotas. But the state has not defined who has rights to use that water. The state also tends to maintain artificially low water prices—prices that do not reflect the real cost of protecting, treating, distributing, managing, or maintaining water systems. As a result, an open access system has developed—one that is characterized by conflict and inefficient distribution of resources (National People's Congress 2002; Zhang et al. 2009).

In the case of land resources, unclear property rights can have unforeseen consequences and produce counterproductive outcomes, such as “elite capture,” whereby powerful local individuals or groups take control over valuable resources that have ambiguous property rights. As a result, the intended beneficiaries—farmers, who are the original providers of the program's targeted ecosystem services—not only miss out on the payments but also lose access to their land and income. The implications of this scenario become even more important in eco-compensation programs that target poverty alleviation.

Policy, regulation, and incentives would trigger coordination between jurisdictions. Because ecosystem services (such as water resources) often cross administrative boundaries, the management of these services requires the coordinated involvement of different sectors, agencies, and levels of government. Various initiatives are being developed within provinces to create frameworks for cross-district programs. However, given the range of central and provincial government ministries

Rights determine the key actors and stakeholders of ecosystem services markets and will provide the foundation for successful eco-compensation programs

Incentives could encourage cross-boundary cooperation for PES schemes within the PRC

and departments with different and sometimes overlapping responsibilities for natural resource management, the central government must develop the legal and regulatory frameworks for cross-provincial coordination and cooperation (Wang et al. 2010). While assigning the National Development and Reform Commission as the leading agency in the development of eco-compensation policy is a good first step, mechanisms for coordination and cooperation between other key ministries will also need to be developed.

Incentives could encourage cross-boundary cooperation for PES schemes within the PRC. For example, the government could financially reward those ministries that partner together and, as a result, demonstrate the kind of interagency cooperation that enables cross-boundary eco-compensation programs.

Keys to Making Eco-Compensation More Effective

If eco-compensation is going to achieve its potential on the PRC's agenda for environmental management, the very term “eco-compensation” needs to be better understood, as does its role in the overall environmental policy framework. Beyond these basics, focus should shift toward market development and in two ways: (i) allow basic market-based, economic processes to determine the rates of environmental service payments; and (ii) legislate and regulate to attract private sector participation.

A policy framework requires a clear definition of eco-compensation. Clarifying the meaning of eco-compensation is important for creating an effective national eco-compensation policy framework. While the creation of the term and the outgoing discourse regarding its function

and meaning have stimulated a valuable debate about the PRC's environment policy in general, provincial governments have expressed the need for a clearer definition. The provincial case studies presented at the conference, however, highlight the challenges that the central government will face in doing this—the country has a wide range of socioeconomic conditions and environmental challenges and varying priorities. A clearer definition of eco-compensation will consolidate understanding and allow priorities and targets to emerge more clearly in the process of developing the policy framework. The provincial case studies provide guidance on how to approach this, since they reveal the range of concerns and issues faced by the key regional stakeholders and actors in environmental management, which will need to be taken into account in developing the national policy.

Incentives can improve fiscal efficiency and environmental effectiveness. National policy should encourage, even emphasize, the development and use of incentive-based eco-compensation programs. Because eco-compensation programs are systems of fiscal transfers from central to provincial governments, the development and inclusion of incentives in PES programs (such as outcome-based, performance-based eco-compensation contracts) should improve both the environment and financial efficiency. Numerous provincial programs have already begun to experiment with such mechanisms.

The widely-applied general subsidy approach in the PRC, though the simplest payment mechanism, does not account for the various types and values of land use and potential eco-services. Instead, all land within a program area is given the same value and amount of payments, which is neither fiscally efficient nor environmentally effective. More sophisticated designs, such as scored subsidy and reverse auction, should be experimented with at the local level and their experiences shared.

Rely more on market-oriented tools for setting compensation rates. Subsidy rates should be negotiated by ongoing contractual

arrangements between beneficiaries (or the government on behalf of beneficiaries) and providers of ecosystem services, rather than based on exhaustive methodologies and formulas. This will help ensure that the PRC's eco-compensation schemes can improve incentives, lower costs, and provide the economy with greater flexibility in adapting to changing environmental challenges.

To date, though, as indicated in the case studies provided at the conference and in numerous academic papers in the PRC, research to inform the development of eco-compensation mechanisms focuses too heavily on methods to calculate subsidy levels. Calculating a starting price, value, or willingness-to-pay for the provision of ecosystem services is often a necessary first step for launching a PES mechanism. However, the emphasis on the methodology risks missing the point of market-based programs. Economic theory states that those best able to calculate the opportunity cost of ecosystem service provision are the providers themselves. As such, gains in program efficiency and cost are achieved by allowing for subsidies to be negotiated by the various potential participants and stakeholders, since this means that those who provide services at lower opportunity costs (and therefore lower price) will more often be the participants in PES. If providers and buyers of ecosystem services cannot agree on an acceptable price, then PES is probably not the appropriate policy instrument to address the problem in question.

In general, markets also provide a number of important benefits for the provision of goods and services, and these should carry over into ecosystem services markets. One benefit already mentioned is price discovery, wherein the socially optimal value of goods or services is revealed via the competitive bidding of numerous buyers and sellers. Another is the effective signaling, via the relative resource values represented in market prices, of where technological innovation will be most profitable (i.e., which resource bottlenecks are most critical). A third is the ability of markets to flexibly induce changes in the economy's structure of production and resource use that are more appropriate for relative and changing resource scarcities, as signaled through market prices.

Legislate and regulate to develop environmental service markets that attract the private sector.

Gains made by the large-scale provincial eco-compensation programs will be unable to mature without the central government's further development of legal and regulatory frameworks that target the private sector. The large-scale central government payment programs for forest area management and land conversion have provided powerful boosts to provincial experimentation and innovation in market-based environmental policy instruments in recent years. At the same time, an overly large public sector presence as buyer risks crowding out the private sector. This is an important concern, given that one of the promising attributes of PES schemes is their ability to tap private sector funding for conservation.

In developing a national eco-compensation policy framework, the government needs to think carefully about how its role can evolve from being the main buyer of ecosystem services to more of an “enabler.” It can make this transition by providing a range of new PES-support programs, such as information services that link private buyers and sellers, research services for program development, legal and regulatory frameworks to ensure that contracts are enforced and to encourage private sector participation, and regulatory requirements that can create markets (such as having to offset the impacts of projects on biodiversity or watershed services).

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Leveraging Existing Sector Policies and Measures

The conference also discussed the PRC's environmental policy “tool kit.” It has done so to emphasize the many parts that make up a whole. A healthy and sustainable environment requires the attention of many sectors and tools. Some of the required laws, policies, regulations, programs, and incentives to address rebuilding the environment and natural resource base already exist in other sectors. These can be used, improved upon, or replaced with more relevant, advanced ideas. Eco-compensation—and more specifically, PES schemes—is only one tool in the tool kit and should be explored and used alongside other complementary tools.

Eco-compensation is not a substitute for institutional, administrative measures. Eco-compensation is not a substitute for better monitoring and enforcement capacity and, in fact, will fail without these qualities of good governance. Although eco-compensation, or specifically PES scheme, is one solution for conservation and environmental restoration beyond what is required under current regulatory structures, it should not be seen as a low-cost alternative to basic improvements in the environmental management regime. *It is actually only one of many tools in a policy toolkit.* Tai Lake is a good example of this.¹⁸ Despite strong political leadership, the government still faces numerous challenges to improving water quality in the lake watershed, which has suffered various effects of development over the past 50 years, particularly over the past decade (ADB 2008). Without measures to correct pollution in the lake, including the lack of a strong, integrated management framework backed by a sufficiently strong legal authority, PES-like eco-compensation programs or other market-based instruments, such as the emissions rights trading currently being piloted in the watershed, will not achieve what other policies have tried and failed.

¹⁸ Tai Lake is the third largest freshwater lake in the PRC, and its catchment is located in three provinces (Jiangsu, Zhejiang, and Anhui) and a provincial level municipality (Shanghai).

Adjusting other sector policies might be more effective sometimes. A national eco-compensation policy framework will need to take account of the range of policies across all sectors that already support, as well as those that undermine, good resource use and environmental protection. Otherwise, sector-specific piecemeal environmental policies risk creating countervailing incentives, or simply being made irrelevant by policies affecting other sectors. For example, farmers are offered only CNY5 (\$0.7) per mu by programs to protect the Sanjiang Plains wetland, compared to earning CNY320 (\$47) per mu from agricultural revenue, of which CNY130 (\$19) per mu comes from direct agricultural subsidies (Ma 2009).¹⁹

Adjusting policies in other sectors might be more effective in achieving targeted environmental outcomes than through separate eco-compensation programs. Existing policies that could be modified to improve environmental outcomes include those that (i) encourage rural–urban migration; (ii) discriminate against rural development; or (iii) increase investment in public services, access to credit, information, health services, and education (Crooks 2010).

Eco-compensation to reduce poverty requires highly strategic thinking. Using PES schemes to alleviate poverty is difficult to achieve, and designers should be especially strategic about incorporating such goals into a program. PRC

policy makers, along with their international peers, are clearly energized by the prospects of using PES and eco-compensation policy to achieve the win–win outcome of poverty alleviation and environmental improvements. Related goals should also be approached with caution. Research on PES often finds that poverty does not always closely correlate to the quality of the local environment or the value of ecosystem services. Poor households may also lack the skills and education to effectively participate in PES schemes in terms of learning and implementing new land use practices and negotiating contracts.

Giving programs multiple goals, such as poverty alleviation, also risks their effectiveness. For example, research on the Conversion of Cropland to Forest and Grassland Program found that the program’s poverty alleviation goal has often been used as an “exit option”—if the environmental targets prove too difficult to achieve, local officials shift to the poverty alleviation goal, resulting in poor environmental outcomes.

Policy makers should strategically build poverty alleviation goals into eco-compensation programs, perhaps by legislating guarantees that protect rural households that participate in these programs. In some cases, however, separate but complementary policies specifically targeting poverty alleviation might be more effective.

¹⁹ A mu is a traditional Chinese unit of land measurement (1 mu = 1/15 hectare).

Conclusion

The International Conference on Payments for Ecological Services, held on 6–7 September 2009 in Ningxia Hui Autonomous Region concluded that the development of an eco-compensation policy framework in the People’s Republic of China (PRC) can be improved by incorporating more ideas from other countries’ experience with payment for ecosystem services (PES) programs and market-based environmental policy instruments. The conference also acknowledged the PRC’s own wealth of experience with eco-compensation that should be shared with other countries.

The majority of provincial case studies presented at the conference focused on compensation for watershed services. This not only suggests the significant potential for payment for watershed services in the PRC, but also the need to clarify and strengthen the PRC’s laws governing rights and responsibilities over watershed services in the context of integrated river basin management. The sheer scale of the Conversion of Cropland to Forest and Grassland Program— which now extends to

all corners of the PRC— suggests a wide variety of local de facto implementation regimes which, if better documented, could provide valuable lessons and innovative examples. Thus, the PRC government has a real opportunity to provide leading examples of public sector PES programs and policies that catalyze the development of ecosystem services markets. Such opportunities will only be realized, however, with better documentation, research, and evaluation of PRC’s ongoing eco-compensation programs.

The PRC government has a real opportunity to provide leading examples of public sector PES programs and policies that catalyze the development of ecosystem services markets

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An Eco-Compensation Policy Framework for the People's Republic of China Challenges and Opportunities

Economic growth has multiplied the environmental challenges faced by the People's Republic of China but has also created opportunities, by increasing available funding for environmental management and conservation. At the nexus of these countervailing trends, policy makers have been experimenting with new approaches to environmental management under the broad heading of "eco-compensation". Many of these are market-based, particularly payments for ecosystem services; an emerging policy debate is regarding the extent to which beneficiaries should pay, and the providers should be compensated, for the provision of natural resources and environmental services to promote sustainable, balanced growth. This paper synthesizes the findings of the International Conference on Payments for Ecological Services convened in Ningxia Hui Autonomous Region in September 2009 to support eco-compensation programs in the country.

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