



MARKETS FOR ECOSYSTEM SERVICES IN CHINA

AN EXPLORATION OF CHINA'S "ECO-COMPENSATION"
AND OTHER MARKET-BASED ENVIRONMENTAL POLICIES



MARKETS FOR ECOSYSTEM SERVICES IN CHINA: AN EXPLORATION OF CHINA'S "ECO-COMPENSATION" AND OTHER MARKET-BASED ENVIRONMENTAL POLICIES

**A Report from Phase I Work on an Inventory of Initiatives
for Payments and Markets for Ecosystem Services in China**

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Markets for Ecosystem Services in China: An Exploration of China's "Eco-compensation" and Other Market-Based Environmental Policies.

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COORDINATING INSTITUTIONS

Forest Trends (<http://www.forest-trends.org>): Forest Trends is a non-profit organization that advances sustainable forestry and forestry's contribution to community livelihoods worldwide. It aims to expand the focus of forestry beyond timber, and promotes markets for ecosystem services provided by forests such as watershed protection, biodiversity and carbon storage. Forest Trends analyzes strategic market and policy issues, catalyzes connections between forward-looking producers, communities, and investors, and develops new financial tools to help markets work for conservation and people. It was created in 1999 by an international group of leaders from forest industry, environmental NGOs and investment institutions.

The Katoomba Group (<http://www.katoombagroup.org>): The Katoomba Group seeks to address key challenges for developing markets for ecosystem services, from enabling legislation to establishment of new market institutions, to strategies of pricing and marketing, and performance monitoring. It seeks to achieve this goal through strategic partnerships for analysis, information sharing, investment, market services and policy advocacy. The Katoomba Group includes over 180 experts and practitioners from around the world representing a unique range of experience in business finance, policy, research and advocacy.

Peking University College of Environmental Sciences and Engineering (<http://cese.pku.edu.cn/index.asp>): The College of Environmental Sciences and Engineering consists of three departments — Environmental Sciences, Environmental Management and Environmental Engineering — with 63 faculty members and staff. Major research fields include air chemistry, atmospheric environmental and pollution control, water and sediment, environmental management and sustainable development, environment and health, environmental biological technologies, waste water treatment, and solid waste treatment. From 2001 to 2005, college faculty published more than 600 journal papers, and the College has been successfully competing for research funding, obtaining grants from China's National "973 program", National "863 program" and the National Natural Science Foundation, raising more than RMB 70 million (~US\$10.3 million) in research grants over this period.

Policy Research Center for Environment and Economy, Ministry of Environmental Protection, China (http://www.prcee.org/eng_index.htm): The Policy Research Center for Environment and Economy was founded in 1989, and is a national-level policy research institute for macro decision-making on environmental protection. Its main role is to, on the basis of the needs and strategic planning of China's Ministry of Environmental Protection, conduct research on environmental management and policy research to provide policy consultation and information services for national decision-making on environmental protection.

Natural Capital Project (<http://www.naturalcapitalproject.org>): Founded in 2006, the Natural Capital Project is a partnership among Stanford University, The Nature Conservancy, and World Wildlife Fund to align economic forces with conservation. The Natural Capital Project aims to: (1) develop tools for mapping and valuing natural capital and integrating outputs into policy and finance mechanisms; (2) to apply these tools in places worldwide where there are key opportunities to achieve policy change; and (3) to magnify what is learned to transform how businesses, government, and local people interact with nature. In China, the Project is currently using the InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) mapping tool with local Chinese partners to inform landuse and development planning at key pilot projects along the Yangtze River Basin.

The Environment for Development Initiative (<http://www.efdinitiative.org/>): The overall objective of the Efd initiative is to support poverty alleviation and sustainable development through the increased use of environmental economics in the policy-making process. The Efd initiative is a capacity building program in environmental economics, focusing on research, policy advice, and teaching in Central America, China, Ethiopia, Kenya, South Africa, and Tanzania. Efd's center in China, the Environmental Economics Program in China (EEPC), is headed by Dr. Jintao Xu and has three main tasks: building capacity of rigorous economic analysis into environmental policy in China, policy outreach, and graduate education that emphasizes systematic training in modern environmental economics.

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ABBREVIATIONS & ACRONYMS

4W	“Four Wastelands” policy
CCFG	Conversion of Cropland to Forests and Grassland Program (<i>tuigeng huanlin huancao gongcheng</i>)
CCICED	China Council for International Cooperation on Environment and Development
CDE	Carbon Dioxide Equivalent
CDM	Clean Development Mechanism of the Kyoto Protocol
CER	Certified Emissions Reductions of the CDM, Kyoto Protocol
CI	Conservation International
COD	Chemical Oxygen Demand
COFCC	China Organic Food Certification Center
CNAB	China National Accreditation Board
CNCA	Certification and Accreditation Administration of China
CNOPS	China National Organic Products Standard
CSR	Corporate Social Responsibility
DNA	Designated National Authority
FECF	Forest Ecosystem Compensation Fund (<i>senlin shengtai xiaoyi buchang jizhi</i>)
FEEM	Fondazione Eni Enrico Mattei
GDP	Gross Domestic Product
GRP	Gross Regional Product
ha	Hectare
IFOAM	International Federation of Organic Agricultural Movements
ISO	International Organization for Standardization
IPCC	Intergovernmental Panel on Climate Change
JAS	Japanese Agricultural Standard
m³	Cubic Meters
MEP	China Ministry of Environmental Protection (previously the State Environmental Protection Agency before being upgraded in 2007)
MES	Markets for Ecosystem/Environmental Services
MoA	China Ministry of Agriculture
MoF	China Ministry of Finance
MtCO₂e	Metric Tons of Carbon Dioxide equivalent
mu	A Chinese unit of area. 1 mu = 1/15 ha
MWR	China Ministry of Water Resources
NEPA	National Environmental Protection Agency of China (the original name of the Ministry of Environmental Protection)
NFPP	National Forest Protection Program
NGO	Non-Governmental Organization
NOF	US Department of Agriculture’s National Organic Program
PES	Payments for Ecosystem/Environmental Services
PRC	People’s Republic of China
RMB	Renminbi, China’s Unit of Currency
SEPA	China State Environmental Protection Agency (now the Ministry of Environmental Protection)
SFA	China State Forestry Administration
SO₂	Sulfur Dioxide
US EPA	United States Environmental Protection Agency
VER	Voluntary Emission Reduction credits

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PREFACE

Forest Trends has been involved in China for close to 10 years, witnessing firsthand the exciting and dramatic changes that have taken place in the country's evolving environmental policy framework. Indeed, our first event in China in Huangshan, China, in 2001 focused on emerging ecosystem service payments. These changes, and in particular the most recent developments that have occurred in market-based initiatives and Payments and Markets for Ecosystem Services (PES/MES) schemes, have remained relatively unknown both internationally and even domestically across different sectors and regions. This is surprising, given the country's increasingly important position in the world economic order and critical role for future international climate negotiations.

This report hopes to address this gap, by providing an overview of the development in payments and markets for ecosystem services in China, and to reveal the amazing breadth and scale of what is currently happening on the ground. The environment is an important area for engagement with China; the central government is eager to learn from outside experience and collaborate with international organizations to develop capacity, broaden and refine its policy toolkit, and better evaluate and improve its current programs. The world, as well, has much to learn from China; the sheer scale of the country's ongoing ecological payment programs and policy innovations suggests that a hidden wealth of untapped experience exists that could provide valuable lessons and insights to both domestic and international policymakers and practitioners of PES and MES schemes.

Already, the government is driving some of the largest public payment schemes and market-based programs for ecosystem services in the world, and has more than US\$90 billion in existing or planned programs. Local governments in China have been important contributors to this process, rapidly adapting centrally designed "eco-compensation" programs to their own needs, creating "hybrids" — programs that weave together and draw upon multiple central and provincial policies and funding sources — and creating their own distinct initiatives that often feed back into central government policy development.

The results of this report suggest that there are tremendous opportunities to draw lessons from the significant degree of local innovation that is occurring and to connect innovations from around the globe to inform developments in China. This needs to take the form of (1) greater documentation and analysis of existing programs, in terms of deepening the level of detail on the programs already documented here as a first step, and (2) developing cross-sectoral platforms for dialogue, information-sharing and cross-learning between policymakers, practitioners, stakeholders, experts and linking to global innovations.



Michael Jenkins, *President, Forest Trends & Katoomba Group*

EXECUTIVE SUMMARY

Policymakers in China have become increasingly interested in developing new approaches for environmental policy to address the country's multiplying conservation challenges and resource constraints in face of break-neck economic growth. This has led China's central and local governments in recent years to rapidly expand the range of policy and program innovations, many under the broad heading of "eco-compensation", that are laying the groundwork for the development of ecosystem services markets. Already, the government is driving some of the largest public payment schemes for ecosystem services in the world, and has more than US\$90 billion in existing or planned schemes and market-based programs.¹ Local governments in China have also been important contributors to this process, rapidly adapting centrally designed "eco-compensation" programs to their own needs, creating "hybrids" — programs that weave together and draw upon multiple central and provincial policies and funding sources — and creating their own distinct initiatives that often feed back into central government policy development. The result has been a highly diverse mosaic of initiatives and public programs that incorporate payments or market-based concepts into national, provincial and municipal levels. Almost all are being primarily developed and funded domestically, with relatively little involvement of international expertise or funding.

The range of programs is broad (see Table 1 below), covering watershed ecosystem services, carbon, timber, landscape amenities, biodiversity conservation and anti-desertification services. An increasing number of initiatives aim to protect watershed services and resolve conflicts over the rights and access to water resources. China has also actively embraced the Clean Development Mechanism (CDM) of the Kyoto Protocol as well as voluntary carbon markets as means to finance a transition to renewable, cleaner and more efficient energy systems, and as a result is host to 22 percent of registered Clean Development Mechanism (CDM) projects worldwide (Capoor & Ambrosi, 2008). Other programs include China's green and organic food certification system, the central government's green procurement program and green product label certification system, promotion of energy efficiency, central and local government subsidies and fees regarding the impacts of development and infrastructural projects on soil erosion and watersheds, as well as continuing experimentation with air and water pollution emissions trading. On-going interest in improving the effectiveness, efficiency and financial sustainability of these efforts has meant that policy circles have been abuzz with debate on how to improve these programs as well as how to explore and develop other market-based tools and regulatory innovations to better address China's environmental and development challenges.

This report documents a vast array of eco-compensation programs and market-based environmental policy instruments that are already in existence in China today, many of which are relatively unknown internationally or even within China across different regions and sectors. Based on the diversity of programs documented and their characteristics, this report reaches a number of key findings:

Domestically driven: Most of China's domestic eco-compensation policies and market-based environmental initiatives are domestically driven and funded. The exception to this found in this report is the Yunnan Province, Laishihai Nature Reserve — Lijiang City Eco-compensation Scheme, which has been funded and developed by, among others, Conservation International (CI) and the World Bank.

¹ This comes from the programs detailed in this report, presented in Tables 1 through 6, and is based on conservative estimates of total planned expenditures of programs, calculated via (1) information on planned program budgets (when available), or alternately from (2) program expenditures to date or (3) value of transactions/revenues under programs to date. Note that this is not an estimate of the value of ecosystem market transactions, since many programs contain both market-based instruments as well as more traditional command-and-control components, and in many cases budgetary numbers and/or value of transactions in terms of trades or subsidies paid were unavailable.

Geographically concentrated in the richer, coastal regions: Local and provincial-level eco-compensation policies are generally arising in the richest regions; key locales for provincial and local eco-compensation policies include Beijing (ranked 2nd out of 31 provinces/municipalities/autonomous regions in terms of 2006 per capita Gross Regional Product), Zhejiang (ranked 4th), Fujian (ranked 9th), Guangdong (ranked 6th), Liaoning (ranked 8th) and Shandong (ranked 7th).

Sectoral focus and innovation on water-related issues: Although existing eco-compensation and market-based initiatives cover a wide range of ecosystem services, the provision and protection of watershed ecosystem services is by far the biggest driver of eco-compensation policy in China, and is where most local innovation is occurring. Even forest-related programs have been initiated due to water-related problems: the spur to the launching of the Conversion of Cropland to Forests and Grassland program was large-scale flooding in Southwest and Northeast China in 1998, and according to the most recent survey of the Forest Ecosystem Compensation Fund, 80.1 percent of public benefit forest area encompassed by the program is located in headwaters, watersheds, wetlands or areas affected by severe soil erosion or desertification.

Involvement of private sector has been small but opportunities for growth exist: The majority of existing market-based initiatives in China found in this report are government-mediated, publicly administered programs that use public funds to pay land users for the stewardship of ecosystem services on their land. Although the public sector is clearly the dominant player in these ecosystem service provision programs, government ministries and provincial governments often emphasize in their policy documents the development of multi-jurisdictional and multi-sectoral policy frameworks that diversify funding sources (e.g. MEP, 2007; MoA, 2007g). This, combined with the ongoing challenges of funding conservation initiatives at all levels of government in China suggests that significant opportunities exist for greater involvement of the private sector.

High degree of local variation in design: Although central government policy has to date provided the main impetus and framework for the development of eco-compensation mechanisms locally, resource constraints and the need to find innovative new ways to improve resource management and resolve regional administrative and property rights issues over cross-boundary ecosystem service flows has resulted in a significant degree of local innovation. Local variations in eco-compensation policies in China appear to take three main forms:

(a) *Local de facto institutional arrangements governing implementation of central policies.* This comprises the majority of local diversity in eco-compensation and market-based mechanisms for environmental policy. Central-government policies often provide frameworks for local innovation by stipulating for local matching funds or administrative support, or delegating management authority and the development of standards and fee structures to provincial or local governments. Key examples of these types of central policies with evidence of local innovation include:

- the Conversion of Cropland to Forests and Grassland Program (CCFG),
- the Forest Ecosystem Compensation Fund (FECF),
- the “Four Wastelands” policy (4W),
- the variations in fee structure and management regimes engendered by China’s water and soil conservation law and regulations, and
- the policies governing the implementation and support of eco-agricultural programs at local levels.

(b) *Local innovations independent of central policies.* Significant local-level innovation is also occurring in the creation of eco-compensation schemes and market-based instruments for

environmental policy. The vast majority of these innovations concern resolving issues surrounding water resources and their effective, sustainable protection and equitable and efficient distribution. Examples include:

- Arrangements between Beijing and Hebei regarding the upper watershed of the Miyun reservoir;
- Water rights trading and water-based eco-compensation policies between various municipalities in Zhejiang Province;
- Water-rights trading between irrigation districts and industry in parts of Gansu, Ningxia, Inner Mongolia and Sichuan; and
- The developing inter- and intra-provincial frameworks of cost-sharing and integrated watershed management between various city governments in Fujian, Zhejiang, Jiangxi and Guangdong provinces.

(c) *Hybrids of central and provincial programs and funding sources*: Local governments are weaving together and drawing upon multiple central and provincial policies and funding sources to address local environmental concerns. An example of this can be seen in the Jinhua River Watershed, where in addition to local water rights trading and downstream development zone policies, governments also draw upon funding from State Forestry Administration policies such as the CCFG, FECF and “Closed-Mountain Forest Regeneration” measures (Zhang *et al*, 2006).

Benefits for Property and Equity Rights: The Chinese term “eco-compensation mechanisms” (*shengtai buchang jizhi*), it is important to note, encompasses both PES-like policies that involve direct payments from the government to individual and community-level suppliers of ecosystem/environmental services, as well as policies that develop frameworks of cooperation between various levels of government for the financing and sharing of costs of environmental protection and restoration. Thus, its growing use and importance within China’s developing environmental policy framework is indicative of greater emphasis on not only developing innovative market-based instruments for environmental policy, but also on resolving property rights and equity issues surrounding the use and protection of natural resources.

Developments on the ground in China have been rapid, and policymakers still face numerous challenges in creating effective and financially sustainable policies. Part of this is because many of China’s policymakers are still new to PES and market-based instruments in general. A number of reports have been produced recently to look at eco-compensation mechanisms in China. These includes a book produced in 2007 by the China Council for International Cooperation on Environment and Development - Taskforce on Eco-compensation (CCICED-TEMP), a book produced in 2008 by the Policy Research Center for Environment and Economy, MEP (Ren *et al*, 2008), a series of reports by IIED and China Agricultural University in 2006, and two World Bank reports (CCICED-TEMP, 2007; IIED & CHD-CAU, 2006; World Bank, 2007; Zheng & Zhang, 2006). However, though providing valuable information and insights, these reports have tended to either be sectoral in focus (often only looking at those policies of concern to a specific government ministry — with payments for watershed services being the most popular due to the major emphasis placed on it by the government) or limited to primarily documenting and discussing only those programs that are explicitly labeled as “eco-compensation” within the government’s policy classifications, despite the fact that many programs in China not explicitly labeled as such have PES/MES and market-based components and characteristics. This, combined with a dearth of platforms for dialogue and information-sharing in China between government ministries, academic institutions and the private sector has meant that, (1) a significant share of PES and MES-like programs, activities and initiatives might stand unrecognized as such and so remain undocumented and “off the radar”, and (2) existing summaries and sources of information are

generally sector-specific, with minimal cross-sectoral information, comparison and analysis.

Due to this, policymakers and practitioners in China and internationally have not been able to fully benefit from China's own growing wealth of experience in developing innovative market-based policies for conservation. With less than 10 years of experience in almost all programs, it is time to better assess their implementation and outcomes. This includes examining the relationships between local institutions, social capital, property rights, local environmental conditions, equity and poverty, and how these interact with different program designs to influence program efficiency and outcomes. It is also important to examine what potential complementarities and tradeoffs exist between the provision of different ecosystem services and between environmental and poverty alleviation goals. Thus, a clearer and more comprehensive picture of the status of markets for ecosystem/environmental services in China, the key actors, and the distribution of these activities and programs across ecosystem services and regions, could provide valuable insights for policymakers in terms where cross-learning and collaboration across government ministries could be most promising, where further research in this sector would be best targeted, and where the private sector could most easily and effectively be brought in as a key partner and stakeholder in environmental programs. Furthermore, assuming enough detailed information on current and past initiatives is available, it is likely that (i) the diversity of regional strategies for implementing centrally-initiated eco-compensation and PES/MES-like programs, and (ii) the range of local variations on central policy, including how local governments patch together different central-government policies and funding sources to address their particular resource and conservation needs, is already sufficient to provide valuable lessons learned and insights into how to develop effective and sustainable PES programs and market-based environmental policy instruments both in China and internationally.

The results of this first stage of work suggest that much can still be done to draw lessons from the significant degree of local innovation that is occurring in China. This needs to take the form of (1) greater documentation and analysis of existing programs, in terms of deepening the level of detail on the programs already documented here, and since this review is by no means exhaustive and likely only captures a portion of the wide diversity of initiatives occurring, and (2) developing cross-sectoral platforms for dialogue, information-sharing and cross-learning between policymakers, practitioners, stakeholders and experts.

Table 1 — Programs Involving Payments and Markets for Ecosystem Services in China

TARGET	PROGRAM / POLICY	SIZE
WATER QUALITY & QUANTITY	Watershed Eco-compensation Programs	Total budget of RMB 14.6+ billion, RMB 703+ million already spent, plus annual payments of RMB 288+ million.
	Water Use Rights Transfers	Total estimated project costs of RMB 2.777 billion, RMB 1.149+ billion invested so far.
FOREST-RELATED	Conversion of Cropland to Forests and Grassland Program (CCFG)	Total budget of RMB 337 billion (of which RMB 130.1 billion has been spent during 2000-2006). 139 million mu (9.27 million ha) of cropland enrolled and 205 million mu (13.67 million ha) of wasteland afforested.
	Central Government Forest Ecosystem Compensation Fund (FECF)	A total of 1.578 billion mu (105.2 million ha) of national-level key public benefit forest area enrolled by the end of 2007. Cumulative total investment of RMB 13.34 billion by the end of 2007 (RMB 3.34 billion in 2007 alone).
	Provincial-Level FECF (complementary to central government FECF)	Apart from national key public benefit forest area, 1.15 billion mu (76.7 million ha) of provincial-level public benefit forest area enrolled by the end of 2007. Subsidies of RMB 1.2 billion in 2006.
	Natural Forest Protection Program	Total targeted forest area of 1.023 billion mu (68.2 million ha), of which 846 million mu (56.4 million ha) is designated as natural forest area. Total budget for 2000-2010 is RMB 96.2 billion, of which the central government will provide RMB 78.4 billion.
	"Three-Norths" Shelterbelt Program	Completed afforesting 367 million mu (24.47 million ha), and is controlling desertification on over 450 million mu (30 million ha) and soil erosion on 300 million mu (20 million ha) of land. Total estimated budget for the current period of the program (2001-2010) is RMB 35 billion, of which RMB 25 billion will be from the central government.
	Beijing-Tianjin Sandstorm Source Control Program	Total program budget is RMB 50 billion, of which Beijing is to invest RMB 3.9 billion. By the end of 2007, 47 million mu (3.13 million ha) of land has been afforested, and total expenditures have been RMB 19.9 billion.
	Forest Vegetation Restoration Fee	RMB 8.044 billion during 2003-2005.
SOIL EROSION	"Four Wastelands" policy (4W)	Size of the program is likely to be huge both in terms of land area and revenue generated for local governments and participating farmers, as well as in terms of imputed labor costs of soil erosion prevention.

SOIL EROSION CONT.	Soil Erosion Control Fees and Soil and Water Conservation Installation Compensation Payments	No available information, though likely huge in terms of revenue generated and land area involved, since this policy encompasses all of China.
	Yangtze River Upper Watershed Water and Soil Conservation and Key Prevention Program	As of 2004, more than RMB 15.929 billion spent for management of soil erosion on over 8 million ha.
ECO- AGRICULTURAL	National Green and Organic Food Certification System	Large and growing, though exact numbers are not readily available.
	Dalian City, Liaoning Province, Green Agriculture Support Subsidy	Numbers on the program's total budget, or the number of farmers that have benefited from these subsidies, are not available.
	Shanghai Organic Fertilizer Subsidy	Size of the program has expanded from use of 15,000 tons of organic fertilizer on 100,000 mu (6,667 ha) in 2004, to 120,000 tons of organic fertilizer on 600,000 mu (40,000 ha) in 2006. From 2004-2006, total of RMB 56.25 million in subsidies spent.
	Beijing Organic Fertilizer Subsidy and Safe Pesticides Subsidy	RMB 20 million invested in 2007 for subsidizing the use of 75,000 tons of organic fertilizer used on 200,000 mu (13,333 ha) of grain fields in 13 counties in Beijing.
	National VAT Tax Exemption for Organic Fertilizer Use	Numbers on the size of total tax exemptions unavailable.
	Rural Biogas Development	Central government investments of RMB 12+ billion from 2003 through 2008. Provincial and local government investments of RMB 1.5 billion in 2006 alone. Program activities during 2004 through 2008 encompassed counties and 98,600 villages, with 10 provinces issuing complementary policies. A cumulative total of 26.23 million household biogas stoves installed by the end of 2007. The program aims to have a total of 40 million household stoves installed by the end of 2010.
	Promoting Conservation Tillage	Central government investment of RMB 170 million from 2002 through 2007, with matching local government investments of RMB 1.78 billion. Enrollment of 30.62 million mu (2.04 million ha) of conservation tillage area, and almost 100 million mu (6.67 million ha) of no-tillage area. Project encompasses 15 northern provinces.

CARBON	Clean Development Mechanism	China hosts 22 percent of registered CDM projects and supplied 73 percent of global CDM credits in 2007; 725 million tons CDE.
	Voluntary Carbon Market	The Asia-Pacific region (China data N/A) supplied 39 percent, or 16.4 MtCO ₂ e of global VERs.
	China Green Fund	RMB 300 million. 1.05 million mu (70,000 ha) of area for afforestation.
EMISSIONS TRADING	Ongoing Piloting of SO ₂ and COD Emissions Permit System and Emissions Trading	Transactions of 970 tons/year of COD, 28,500+ tons plus 1,007 tons/year of SO ₂ (contract lengths unknown). RMB 52.81+ million in transactions. More than RMB 9.3 million in government pilot support funding.
OTHER	Government Green Procurement	Huge potential market size. In 2006, total government procurement was estimated to be over RMB 300 billion.

CHAPTER I

PES/MES AND ECO-COMPENSATION POLICY IN CHINA

Policymakers in China have become increasingly interested in developing new approaches for environmental policy to address the country's multiplying conservation challenges and resource constraints in face of break-neck economic growth. This has led to a wide range of policy and program innovations, many under the broad heading of "eco-compensation". Some of these incorporate, to varying degrees, aspects of market-based approaches (Sterner, 2003). This includes a growing number of programs that, in line with international trends, are increasingly utilizing Payments for Ecosystem Services (PES) schemes. PES schemes consist of negotiated contractual arrangements involving direct payments between those who can provide, and those who benefit from ecosystem or environmental services. The flagship Conversion of Cropland to Forests and Grassland (CCFG - *tuigeng huanlin huancao*) program, for example, is arguably a PES program (Wunder, 2005; Pagiola and Plantais, 2007; Engel *et al.*, 2008; Bennett, 2008). While many of the programs and policies documented herein generally do not currently fit a narrow definition of PES, and indeed many fall short of being fully market-based instruments for environmental policy, the breadth and depth of existing programs suggest that the necessary policy frameworks for the development of PES and other market-based instruments in China are rapidly taking shape.

In the backdrop of PES is the broader vision of creating the institutional foundations necessary for engendering Markets for Ecosystem/Environmental Services (MES). According to economic theory, under the right conditions (e.g. appropriate institutional and legal frameworks, and sufficiently low transactions costs), markets can function more effectively than government command-and-control compliance-based regimes to identify and align the social costs and benefits of ecosystem services and thus more effectively achieve conservation outcomes. Growing interest in PES has meant that these direct payment schemes have been flourishing internationally, and have expanded beyond government-funded initiatives to real market transactions between beneficiaries and providers of services. In 2007, it is estimated that annual payments under all payment schemes and markets for ecosystem services totaled approximately US\$77 billion worldwide, and these total payments are expected to increase to approximately US\$300 billion by 2020 (Carroll *et al.*, 2008). Currently, the biodiversity and certified agriculture (i.e. eco-labeling) markets are the most active in terms of volumes of monetary transactions. In the foreseeable future, markets for carbon and certified agricultural products are expected to account for a significant proportion of the growth in payments and markets for ecosystem services.

In the case of China, the government is playing a central role in creating momentum towards the eventual development of MES. Already the Chinese government has made extraordinary efforts in driving some of the largest public payment schemes for ecosystem services in the world. Over RMB 130 billion has already been spent on the CCFG, and over 9 million ha of cropland has been afforested (SFA, 2007; Economic Daily, 2007). The government also spent RMB 3.34 billion in 2007, and a total of more than RMB 13.34 billion since 2001 on the Forest Ecosystem Compensation Fund (FECF - *senlin shengtai xiaoyi buchang jijin*), which currently covers 105.2 million ha of forest area across 30 provinces in China (SFA, 2008a). It could be argued that the Chinese government has been tentatively experimenting with PES programs for decades; in the early 1980s, the Ministry of Water Resources began to directly contract out fragile lands in some small watersheds to households for management, though with limited results (Liu, 2005). These experiments were formalized in the *Water and Soil Conservation Law of the P.R.C.* (1991), which allows some small watersheds to be auctioned or leased to farmers or other private investors for development, with the leaseholder in return being

obligated to protect against soil erosion and degradation (PRC, 1991). On-going interest in improving the effectiveness, efficiency and financial sustainability of these efforts has meant that policy circles have been abuzz with debate on how to improve these programs as well as how to explore and develop other market-based tools and regulatory innovations to better address China's environmental and development challenges.

Official Governmental Recognition of Eco-Compensation Programs: The government has made the development of "eco-compensation mechanisms" a priority. State Council release no.39 [2005] entitled *State Council Decision Regarding Using the Scientific Development View to Strengthen Environmental Protection* states that the government "...should improve eco-compensation policy, and develop eco-compensation mechanisms as quickly as possible" [Section 23, sentence 7] (State Council, 2005). China's *11th Five-year Guidelines* (2006-2010) calls for innovation in environmental policy, and the development of eco-compensation pilots, and for policymakers to quicken the pace of development of eco-compensation mechanisms, to develop intra-regional and watershed-related eco-compensation mechanisms, and to resolve funding issues regarding conservation.¹

In response to the *11th Five-year Guidelines*, China's Ministry of Environmental Protection (MEP) issued *Guiding Opinions on the Development of Eco-compensation Pilot Work* (MEP, 2007). In this, the MEP detailed four main areas of focus for the development of eco-compensation pilots: (i) nature reserves, (ii) key ecological function areas, (iii) mineral development areas, and (iv) watersheds. The MEP also set out five fundamental principals for the development of eco-compensation policies and mechanisms:

- (1) 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;
- (2) Responsibility, right and power are synonymous;
- (3) "Win-win" development should be achieved by jointly realizing public construction of the environment and public benefit;
- (4) Government guidance should be combined with market regulation, wherein funding source diversification and greater harnessing of market forces is encouraged; and
- (5) Adapt central policy to local conditions and energetically innovate.

No clear definition appears to exist for what comprises an "eco-compensation" program. However, the Chinese term "eco-compensation mechanisms" (*shengtai buchang jizhi*) appears to encompass both PES-like policies that involve direct payments from the government to individual and community-level suppliers of ecosystem/environmental services, as well as policies that develop frameworks of cooperation between various levels of government for the financing and sharing of costs of environmental protection and restoration. Thus, its growing use and importance within China's developing environmental policy framework is indicative of greater emphasis on not only developing innovative market-based instruments for environmental policy, but also on resolving property rights and equity issues surrounding the use and protection of natural resources.

In a speech to the 12th Green China Forum in 2007, Deputy Director Pan Yue of the MEP stated that eco-compensation policy is "...not only an environmental and economic, but also a political and strategic need. Eco-compensation policy that focuses primarily on instruments that transfer

² The plan also calls for greater utilization of international funds and NGO conservation expertise.

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, needs to be improved” (MEP, 2007).

The Rapid Rise of Eco-compensation Programs: Though the government has explored the use of economic instruments for environmental policy since the 1980s, the CCFG and FECF were important milestones in the government’s current drive towards developing eco-compensation mechanisms. These programs have represented major central government policy signals, and have generated a significant degree of momentum that has stimulated local capacity-building and a growing number of provincial and local innovations as well as collaborations with international organizations to develop various flavors of eco-compensation mechanisms.

A range of initiatives exist that are aimed at protecting watershed services and resolving conflicts over the rights and access to water resources, provincial and local variations on the FECF, green and organic food certification systems, the central government’s green procurement program and green product label certification system, promotion of energy efficiency, and central and local government subsidies and fees regarding the impacts of development and infrastructural projects on soil erosion and watersheds are all part of an expanding portfolio of developing programs and policies that cover a wide breadth of ecosystem services and products. China has actively embraced the Clean Development Mechanism (CDM) of the Kyoto Protocol as a means to finance a transition to renewable, cleaner and more efficient energy systems, and as a result is host to 22 percent of registered CDM projects worldwide, and accounts for almost 52 percent of the expected average annual certified emission reductions from registered CDM projects worldwide (UNFCCC CDM Website, 2008). Voluntary carbon markets look set to take off in China, and the government has been developing the policy framework and experience for air and water pollution rights emissions trading since the 1980s. Several new trading platforms have recently been announced for trading carbon credits, emissions rights, energy use allowances and green technology stocks.

Looking Ahead: Developments on the ground in China have been rapid, and policymakers still face numerous challenges in creating effective and financially sustainable policies. Part of this is because many of China’s policymakers are still new to PES and market-based instruments in general. Furthermore, a dearth of platforms for dialogue and information-sharing in China between government ministries, academic institutions and the private sector has meant that, (1) a significant share of PES and MES-like programs, activities and initiatives might stand unrecognized as such and so remain undocumented and “off the radar”, and (2) existing summaries and sources of information are generally sector-specific, with minimal cross-sectoral information, comparison and analysis. Due to this, policymakers and practitioners in China and internationally have not been able to fully benefit from China’s growing wealth of experience in developing innovative market-based policies for conservation. A clearer and more comprehensive picture of the status of markets for ecosystem/environmental services in China, the key actors, and the distribution of these activities and programs across ecosystem services and regions could thus provide valuable insights for policymakers in terms where cross-learning and collaboration across government ministries could be most promising, as well as where the private sector could most easily and effectively be brought in as a key partner and stakeholder in environmental programs. Furthermore, assuming enough detailed information on current and past initiatives is available, it is likely that the breadth and diversity of (i) regional strategies for implementing centrally-initiated PES/MES-like programs, (ii) local innovations independent of central programs, and (iii) “hybrid” policies in which local governments bundle together different central-government policies and funding sources to address their particular resource and conservation needs, is already sufficient to provide valuable lessons learned and insights into how

to develop effective and sustainable PES programs both in China and internationally.

This report is the result of Phase I exploratory work for an ongoing exhaustive documentation of PES/MES and other market-based environmental programs and policies in China. It is derived wholly from available secondary sources in Chinese and English, and has been produced with the collaborative input from the Policy Research Center for Environment and Economy (PRCEE), China Ministry of Environmental Protection (MEP). It documents those programs and initiatives found to date with sufficient detail in available sources, attempts to draw insights from the range, diversity, location and characteristics of these programs, and suggests next steps for the inventory work. This report is envisioned as a scoping exercise, and though these results already provide a range of valuable insights, much work still needs to be done to better document and detail these programs, since many of the available sources provided minimal information regarding their characteristics, mechanisms, management authorities, stakeholders and outcomes.

For the purposes of this report, programs have been organized into the following chapters: Watershed-Related Programs (Chapter II), Forest-Related Programs (Chapter III), Soil Conservation and Erosion Prevention (Chapter IV), Ecoagricultural Programs (Chapter V), Carbon Markets & Emissions Trading (Chapter VI) and Other Programs (Chapter VII). Though it is clear that these categories overlap in what ecosystem/environmental services they target, this organizational structure was adopted partially based on the key management authority involved. Watershed-Related Programs are almost exclusively local or provincial-level, while Forest-Related Programs are those managed primarily by the State Forestry Administration (SFA), provincial or local forestry bureaus. Soil Conservation and Erosion Prevention generally encompasses Ministry of Water Resources programs or those of the analogous provincial or local bureaus, Ecoagricultural Programs are those managed primarily by the Ministry of Agriculture (MoA) or the Ministry of Environmental Protection, while Carbon Markets & Emissions Trading are put into a separate chapter based on the common mechanisms used and policy framework developing around them in China.² This organizational structure was also adopted based on the limited available information. It is envisioned that ongoing work in developing this inventory in more detail will allow for further categorization of these and other programs along a range of different possible dimensions, such as administrative scale, type of mechanism, types of ecosystem services targeted and types of land use supported. Finally, estimates of program budgets, expenditures and payments were produced as best estimates from available (and sometimes contradictory) sources.

³ That said, many of these programs often involve the participation of a combination of local and/or central government water resources, forestry and environmental protection departments.

CHAPTER II

WATERSHED-RELATED PROGRAMS

That watershed-related programs have been a key focus of both national and local innovation is clearly due to the growing pressures that economic growth have been putting on China's already strained water resources. Though China ranks fifth in the world in terms of total freshwater resources, per-capita freshwater resources (2,258 m³) are less than a third of the world average (FAO, 2003). These resources, furthermore, are concentrated in the south; the area north of the Yangtze River basin has one-fourth the per-capita water endowment of the south, and one-tenth the world average (MWR, 2000). Throughout China, 400 of the country's 640 major cities face water shortages, and 700 million people lack access to safe water (Turner & Otsuka, 2006). According to the 2006 China Water Resources Quality Report, of 84,958 miles of monitored waterways 21.8 percent have water quality worse than level V, 19.9 percent are of Class IV to V, 27.5 percent are of Class III, and 30.8 percent are of water quality Class II or better (MWR, 2006a).³ These rates also vary significantly across key watersheds. For example, 55 percent of the Hai River watershed in Northeast China (which encompasses the Beijing area) has water quality listed as worse than level V, as well as 63 percent of Tai Lake near Shanghai, 35 percent of the Huai River watershed in central-east China (which joins the Yangtze at its mouth), 18 percent of the Pearl River in south China and 15 percent of the Yangtze River area.

With water a key concern for all levels of government in China, it is not surprising that this sector has seen a growing number of local innovations regarding cost-sharing for management and conservation, as well as PES-like programs and water rights transfers. Also important is the fact that while water resources are state owned according to both the current and previous *Water Law of the P.R.C.* (1988, 2002), with the state responsible for allocating resources through government orders and water quotas, this system has in reality resulted in poorly defined water use rights and artificially low water prices, resulting in a *de facto* open access system characterized by conflict and inefficient distribution of resources (PRC, 2002c; Zhang *et al.*, 2009). Thus, many of the developments in both watershed eco-compensation programs and water use rights transfer pilots discussed below fall within an evolving set of both the central and local government policy frameworks aimed, in part, at addressing the need to resolve these rights issues. These experiments have both the promise of influencing, and the risk of being adversely impacted by future reforms — or lack thereof — to China's legal foundations for water rights. This section divides programs into two main categories: Watershed eco-compensation, which consists of provincial and local-level eco-compensation schemes aimed at watershed ecosystem services and water quality and quantity assurance; and Water Rights Transfers, which captures a growing trend in which local upper and lower watershed governments directly negotiate contractual arrangements stipulating water use rights conditional on financial transfers and with associated obligations and criteria.

II.1 WATERSHED ECO-COMPENSATION

Much local innovation has been occurring in watershed eco-compensation in China. As is documented in Table 2.1 below, of those programs documented in this report, local governments are currently planning to invest at least RMB 14.6 billion in watershed eco-compensation programs, with this

⁴ In China's system of water quality classification, 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.

estimate a lower bound on what is a large and fast-growing sector in China's portfolio of environmental programs. Most of the programs documented here are concerned with ensuring municipal water supplies and water quality, and involve traditional command-and-control measures as well as cost-sharing arrangements and PES mechanisms. These programs can be viewed as part of a continuum of developing regional frameworks for watershed management in China, all of which are struggling with the challenges of resolving property rights issues and the equitable distribution of the costs and benefits of cross-jurisdictional ecosystem service flows.

Table 2.1 — China's Watershed Eco-compensation Programs

PROGRAM	SUMMARY	SIZE
ZHEJIANG PROVINCE, JINPAN DEVELOPMENT ZONE	Ex-situ development offset to allow the upstream county to move industrial development downstream, thus reducing potential sources of pollution to the upstream reservoir, a key source of drinking water.	15,660 mu (1044.2 ha) of zoning rights. 130 + enterprises. Revenue of US\$4.2 million in 2002, and US\$6.5 million in 2004, ~1/4 of Pan'an County's total.
FUJIAN PROVINCE, JIULONG RIVER WATERSHED	Jiulong River watershed management arrangements involving cross-district fiscal transfers for watershed management costs.	RMB 28 million annually.
BEIJING — HEBEI PROVINCE	Arrangements for managing water quality & quantity for Beijing's Miyun and Guanting Reservoirs, consisting of a framework for cooperation between Beijing & Hebei and including some PES elements.	RMB 100 million water resource management fund (2005-2009), RMB 22 million (2006), RMB 2 million (2007), 76,000 mu (5067 ha) rice paddies (103,000 mu planned), 20,000 mu (1333 ha) water saving technology.
FUJIAN PROVINCE, MIN RIVER WATERSHED	Management arrangements for the Min River Watershed, involving cross-district fiscal transfers for watershed management costs.	RMB 35 million annually.
FUJIAN PROVINCE, JIN RIVER WATERSHED	Jin River watershed management arrangements involving cross-district fiscal transfers for watershed management costs.	RMB 20 million annually.
JIANGXI PROVINCE, DONG RIVER HEADWATERS	Management arrangements for the headwaters of the Dong River watershed — a key source of drinking water for Hong Kong — involving cross-provincial fiscal transfers for watershed management costs, and including some PES-like components involving direct payments to farmers or communities.	RMB 14.2 billion earmarked for program (of which RMB 390 million already spent), + RMB 150 million annually.

ZHEJIANG PROVINCE, DONGTOU COUNTY WATER CONSERVATION AREA	PES scheme to pay farmers to cease land use activities that have a detrimental impact on two key reservoirs.	RMB 330,000+ annually (2006 numbers).
ZHEJIANG PROVINCE, DEQING COUNTY	Watershed management arrangements involving a range of projects, including PES.	~ RMB 10 million annually.
ZHEJIANG PROVINCE, HANGZHOU CITY	Qiantang River watershed management arrangements involving a range of projects, including PES.	RMB 200 million invested in the total project.
SHANDONG PROVINCE, HUIHAI AND XIAOQING RIVER WATERSHEDS ECO-COMPENSATION	PES scheme for farmers to convert riverside aquacultural and cropland operations to wetlands area, as well as financial incentives for industries to reduce pollution via better management and technological upgrades.	Involving 12 cities and 69 counties. No available information on financial dimensions.
LIAONING PROVINCE CROSS-DISTRICT WATERSHED ECO- COMPENSATION	Watershed management arrangements that involve cross-district transfers based on measured changes in cross-border pollution flows.	No information yet available on fiscal transfers.
SHAANXI PROVINCE, SOUTH-NORTH WATER TRANSFER PROJECT ECO- COMPENSATION	Planned PES scheme involving payments to farmers to change land-use practices which have a detrimental effect on watershed water quality.	Not yet being implemented.
ANHUI-ZHEJIANG PROVINCE, XIN'AN RIVER BASIN ECOLOGICAL PUBLIC BENEFIT MECHANISM	Planned PES scheme. Zhejiang Province and Hangzhou City will providing funding to Anhui Province's Huangshan City to better manage the upper watershed of the Xin'An River Reservoir, a key source of drinking water for Zhejiang and Hangzhou.	Not yet being implemented.
LASHIHAI WATERSHED	A planned watershed management PES consisting of a tourism eco-tax for management of the upper watershed, developed in cooperation with Conservation International (CI) and the World Bank.	Not yet being implemented. Could potentially involve annual payments of around RMB 3 million.

Zhejiang Province, Jinpan Development Zone (Jinhua City – Pan’an County)

Initiated in 1996 on the urgings of the central government, downstream Jinhua City provided upstream Pan’an County with 660 mu (40 ha) of land for the Jin-Pan Economic and Technology Development Zone, to offset impacts on the up-stream watershed via “ex-situ” development opportunities downstream. The headwaters in Pan’an County feed the important upstream Nanjiang and Hengjin Reservoirs. More than 99 percent of these upstream rivers have a water quality of Class I perennially, and come from hilly and mountainous areas in the county with forest coverage ratios reaching 74.6 percent in the headwaters. During the first stage of this program, 1,130 enterprises were allowed to set up in the zone. Stage 2 began in 2004, wherein 15,000 mu (1,000 ha) were added to the zone. At the same time, Pan’an is required to reduce the number of polluting enterprises, and to close enterprises that do not meet pollution standards. All revenues from the Zone go back to Pan’an County. The zone’s revenue was US\$4.2 million in 2002, and US\$6.5 million in 2004, almost 1/4 of Pan’an’s total.

SOURCE: Zheng *et al*, 2006.

Fujian Province, Jiulong River Watershed Eco-compensation

The Jiulong River is Fujian’s second largest. In 2003, the Jiulong watershed became the location of Fujian Province’s first watershed eco-compensation pilot. From 2003–2007, each year Xiamen city has contributed RMB 10 million and Zhangzhou and Longyan contributed RMB 5 million for joint management of the watershed. Beginning in 2005, Fujian’s environmental protection bureau has earmarked RMB 8 million for special use in integrated management of the watershed in Zhangzhou and Jiuyan. From 2003–2005, funds for eco-compensation were 12.3 percent the size of funds invested in water pollution management in Longyan, and 15.1 percent of those invested in Zhangzhou.

SOURCE: Zhen & Jin, 2006; Cong & Xu, 2006; Liu *et al*, 2005.

Beijing City – Hebei Province

Due to concerns about ensuring the quality and quantity of Beijing’s water supply, a framework of cooperation has been developing between Beijing and Hebei Province regarding water quality and quantity in the Miyun and, eventually, the Guanting reservoirs. As part of this, Beijing and Hebei initiated the “Paddy to Dryland” (*dao gai ban*) program in 2005.⁴ Under this program, the two parties will over two periods (2005-2008 & 2008-2010) convert 183,000 mu (12,200 ha) of rice paddies to corn and other low water-use dryland crops in Chengde and Zhangjiakou Municipalities of the upper watersheds of the Miyun and Guanting Reservoirs, respectively. The original plan calls for Hebei to convert 103,000 mu (6867 ha) of paddy fields in the upper watershed of the Miyun reservoir before 2008, and 80,000 mu (5333 ha) of paddy fields in the upper watershed of the Guanting reservoir after 2008, based on the results of Phase I. Recent news indicates that in reality 71,000 mu (4733 ha) of paddy fields had been enrolled in the upper watershed of the Miyun reservoir by the end of 2007, while Zhangjiakou city in Chicheng County in the Black River drainage area, located in the upper watershed of the Guanting Reservoir, converted 14,400 mu (960 ha) of paddy fields ahead of schedule by 2007. As part of this arrangement, Beijing Municipality provided annual “income loss” subsidies to farmers for this at the rate of RMB 450/mu (RMB 6,750/ha). This has since been increased in 2008 to RMB 550/mu (RMB 8,250/ha). The responsible departments of both parties have promised to improve verification of the area converted from rice paddies to dryland crops in the upper watershed of the

⁵ Some news sources suggest that this could have started as early as 2003.

two reservoirs and to establish a concrete plan. The department of water resources is also helping farmers to improve production conditions, develop water-saving agriculture, and implement controls on agricultural water use. Available sources do not provide information on subsidy lengths.

Beijing Municipality has earmarked RMB 100 million in water resource environmental management funds for the period 2005–2010 to support water pollution management and water-saving industries in the upper watersheds of the Miyun and Guanting reservoirs. Of this, RMB 22 million was earmarked for 2006, and an additional 2 million for 2007. Projects include water-saving irrigation on 10,000 mu (666.7 ha) in the watershed of the Bai River in Zhangjiakou's Chicheng County, Hei River headwaters management in Chicheng County, water-saving and seepage prevention on 10,000 mu (666.7 ha) in the Sanggan River watershed in Yangyuan County, management of pollution water from sheep slaughterhouses in Xuanhua Area, Jiulong Collective integrated pollution management project in Chengde's Fengning County, a rural village domestic garbage landfill project, the conversion of 10,000 mu (666.7 ha) of paddy fields to dryland and water-saving irrigation projects in the Han River watershed in Chengde City, Luanping County, and the implementation of 7 water pollution management projects in Yangfang, Xuanhua Area. According to available reports, Hebei Province's implementation of the program has so far realized water savings of 19.5 million m³ and increased cross-border water flow by 13 million cubic meters annually.

Beijing and Hebei have also jointly called upon the central government to provide greater support of aspects related to the set-up of emergency projects. These two parties have coordinated activities to accompany project legal entities to accelerate the construction of the South-North Water Transfer Project, Beijing section of the emergency water-supply project, to ensure running water by April, 2008. Hebei also continued to improve the plan for water distribution between Gangnan, Huangbizhuang, Wangkuai and Xidayang reservoirs, to ensure the maximum outflow of high quality water during the flood season so as to create the conditions for the emergency supply of 400 million m³ of water for the 2008 Olympics. Determination of water distribution and eco-compensation has been up to the responsible departments of the two parties, in line with central government guidance.

These arrangements also involve the continuation of the Beijing-Tianjin Sandstorm Source Control Program, the "Three Norths" Shelterbelt Forests Program, and the Taihang Mountain Afforestation Program. Both parties will jointly apply to the central government to increase Hebei Province's area for public benefit forests under the Forest Ecosystem Compensation Fund (FECF), and to increase support of state-owned forest farms. Both parties will lay out the program for developing Miyun and Guanting upper watershed water resource protective forests, and while striving for central government support, during the period of the *11th Five-year Guidelines* Beijing will provide a portion of construction funds, with emphasis on supporting the construction of ecological water resource protection forests in Fengning, Luanping, Chicheng and Huailai Counties of Hebei Province, and based on implementation results, support Hebei's gradual expansion of protective forest area. Both parties will also strengthen cooperation on protection of forests in Beijing and Hebei, on development of a mechanism for unified activity and protection of forests, while Beijing will at the same time support Hebei's investment and development of the groundwork for fire prevention in current forests. Both parties will also jointly strengthen their abilities of monitoring, early warning and recovery from sandstorms.

SOURCE: Xinhua News Agency, 2007a; Hebei Daily, 2007 & 2006; BJLYJ, 2003; Zhen & Jin, 2006; BMBLF, 2003a & 2003b; SFA-DIC, 2005.

Fujian Province, Min River Watershed Eco-compensation

The Min River is Fujian Province's largest. To manage the river, the Fujian provincial Environmental Protection Bureau and the provincial Finance Bureau drafted Min River Watershed Protection Special Fund Management Measures, which was initiated in 2005 and under its current form is for the duration of the 11th Five-year Guidelines period (2006–2010). The management plan covers the 36 counties, cities and municipalities in the Min River watershed. The government is currently in the process of determining the relevant upper and lower watershed jurisdictions to include in the management framework, and the method of monetary transfers, following the principle "The polluter pays, the beneficiary compensates." As it currently stands, cities in the lower watershed of the Min River provide the upper watershed cities of Nanping and Sanming with a RMB 10 million annual special-purpose ecological environment protection fund. The upper watershed Sanming and Nanping cities each pay RMB 5 million annually, under the plan's principle of local matching funds. If these upper watershed areas create pollution for lower watershed areas, the upper watershed areas are responsible for compensation. In addition, Fujian Province's Development and Reform Commission and Environmental Protection Bureau will also earmark RMB 15 million annually for integrated management over the whole watershed. Pollutive industries will also have to pay compensatory environmental protection fees, in accordance with damages. The plan includes 104 projects, such as to move and manage the pollution from aquaculture, poultry and husbandry operations, the Fuzhou City Hongmiaoling Garbage Incinerator Electrical Power Plant, and township and city environmental protection key water source protection projects. This plan also formally adds watershed protection and water pollution prevention targets into the performance evaluations of government officials, and will set up a system for environmental performance evaluations for municipal and county government officials, as well as a system for monitoring and investigating watershed protection and responsibility, so as to pursue and establish responsibility regarding problematic implementation of policy or illegal activities.

SOURCE: Zhen & Jin, 2006; Straits Capital News, 2005; Hu & Li, 2006; Li & Hu, 2007; China Environmental Report, 2005; Cong & Xu, 2006.

Fujian Province, Jin River Watershed Eco-compensation

Each year during the 11th 5-year plan period (2006–2010) Quanzhou City will contribute RMB 5 million, and the 8 counties and municipalities in the Jin River lower watershed will contribute a total of RMB 15 million, with the specific contributions of each based on relative water usage. The money will primarily be used in the upper watershed Nan'an City, Anxi County, Yongchun County, Shuichun County, and Dehua County, as well as in water resource protection and conservation projects in the upper watershed of the Luoyang river, including building treatment facilities for households wastewater and garbage, as well as projects for management of non-point-source pollution.

SOURCE: Zhen & Jin, 2006; Wang *et al*, 2006.

Jiangxi Province, Dong River Headwaters Eco-compensation

Jiangxi Province will invest RMB 14.2 billion during 2005–2010 in projects surrounding ecological protection of the Dong River source areas. This will be invested in 9 large programs:

- Investment in ecological forests,
- Prevention and control of soil erosion,

- Restoration of mines,
- Eco-friendly agriculture,
- Flood prevention and protection of drinking water supplies,
- Integrated management of agricultural run-off pollution,
- Eco-tourism,
- Eco-migration (i.e. compensated resettlement of rural households away from fragile ecosystems), and
- Establishment of a system of protective monitoring and information management.

These 9 big projects aim to improve water quality to surpass the national standard Class II, increase forest coverage rate in the Dong River headwaters area to 85 percent, increase integrated soil erosion management area to 14.55 million mu (970,000 ha), and establish an integrated system of soil erosion prevention and monitoring to effectively combat human-induced soil erosion.

The program was initiated in Anyuan County, Jiangxi Province. Currently RMB 390 million has already been spent, and the first phase of the project completed. This encompasses on-going integrated management of the 33 waterways in the watershed, a garbage processing yard, a wastewater process yard, management of mining waste and management of animal waste. The near-term project will develop 1.737 million mu (115,800 ha) of “closed mountain reforestation”, 240,000 mu (16,000 ha) of CCFG area, establish 6 different nature reserves and establish 8 areas for the rehabilitation and management of water-protection ecosystems. In all mining areas establish the “three abolishments” management and reclamation plan will be established to return 45,000 mu (3,000 ha) of mining area to cultivation. In the headwater region, the plan will enroll 30,000 households in a standardized “Pigs, wetlands and horticulture” model, will reinforce and remove from danger at-risk reservoirs, rebuild and newly build 10 reservoirs, use man-made wetlands to clean pollution, develop the environmental protection industry, develop 5 pilot projects to manage organic waste resources from husbandry, poultry and aquaculture, and assist in the migration of 330,000 households out of the headwaters regions, establish an integrated informational network management system for the development and improvement of ecosystem functionality and environmental, natural resource and disaster management.

As part of this process, an eco-compensation mechanism will be set-up to help offset the losses to communities in Xunyu, Anyuan and Dingnan Counties, where in order to improve the effectiveness of control measures, 330+ family-run mining operations will be closed, thus slowing regional economic development. This eco-compensation mechanism will be in place from 2005–2025. Funding sources will come from central, provincial, municipal and county sources according to a set formula, in accordance with the central government’s establishment of a coordinated upper-lower watershed eco-compensation system. In total, Guangdong Province will pay Guangxi Province RMB 150 million annually for environmental protection in the headwater area of the Dong River.

SOURCE: Southern Daily, 2005. Zhang *et al*, 2007; Zhen & Jin, 2006; MWR, 2005.

Zhejiang Province, Dongtou County Water Resource Conservation Area Eco-compensation

This program was initiated in 2005, and revised in 2007, and as currently formulated is to last through 2009. More than 1,000 households were participating in the program in 2006, with total funding of RMB 330,000. Under the policy, entitled “Dongtou County Water Resource Protected Area Eco-compensation Implementation Measures (Try out)”, all households in the water resource protection zones of Bei’ao and Damen Townships, which are in the upper watersheds of the Changkeng, Longtankeng and

Fengshukeng Reservoirs, are subsidized for ceasing activities that have a detrimental impact on watershed water quality. These include cropping, horticulture, husbandry, husbandry waste management and mining. The subsidy standards are as follows (unfortunately, available sources did not give information on subsidy period lengths):

- For ceasing cropping activity: RMB 700/mu/year (RMB 10,500/ha/year) under the 2005 plan, and RMB 650/mu/year (RMB 9,750/ha/year) under the 2007 plan. After subsidies are completed, this land must be enrolled in the Sloping Land Conversion Program as public benefit forest land.
- For ceasing horticultural activities involving orchard crops: RMB 15/tree/year under the 2005 plan, and RMB 8/tree/year under the 2007 plan. The 2007 plan also gives a subsidy for RMB 0.3/tree/year for Kuding Tea Trees. After subsidies end, use of manure fertilizer and spray pesticides will be strictly banned on this land area.
- For ceasing husbandry activities: RMB 300/pig, RMB 450/cow, RMB 100/sheep and RMB 6/chicken under the 2005 plan. After subsidies end, husbandry activities remain banned.
- For ceasing all mining activity: RMB 5,000/mine under the 2005 plan. Mining activity will remain banned after subsidies end.
- Displaced construction activities: Will be compensated according to “Dongtou County Key Construction Project Policy Management Regulations” (Dongtou Government Issue (2005) No. 15. Within this, RMB 100/sq. meter to remove open-air manure pits, with the stipulation that these cannot be reinstalled after subsidies end.

Funding for the program comes from a County Financial Bureau special fund of RMB 200,000, 50 percent of basic water fees that are centralized for use by the county financial bureau, 10 percent of county water resource fees, and RMB 0.3/ton of water pollution management fees [2005 plan] or 30 percent of per ton water pollution management fees [2007 plan]. All eco-compensation funds will be specially managed by the County Finance Bureau. Relevant townships and villages will be responsible for distributing funding and using appropriate measures for implementing the program. The County Environmental Protection Bureau, jointly with the County Financial Bureau, Rural Forestry and Water Resources Bureau, and the central government’s Ministry of Land and Resources, will verify and supervise implementation.

SOURCE: Dongtou County Government, 2007; Dongtou County Government, 2005; ZPDRC, 2005; Wenzhou Daily, 2006.

Zhejiang Province, Deqing County

According to available sources, this is the earliest document regarding “eco-compensation” in Zhejiang Province. Though the county has been investing RMB 10 million annually since 2003 in environmental protection and restoration, this program was formally launched in 2005, and involves the collection of an “eco-compensation fund” via diversification of funding sources into six channels: (1) RMB 1 million annually earmarked from county finances; (2) 10 percent of the total county water resource fees; (3) Funds generated from an increase in water resource fees of RMB 0.1/ton for water originating from reservoirs and river mouths; (4) 1 percent of the county portion of land transfer money; (5) 10 percent of water pollution fees; (6) 5 percent of the agricultural development fund. In 2005, this totaled RMB 10 million. The domain of these funds includes the following:

- Subsidies and management for ecological public benefit forests (likely FECF). Available sources indicate that Deqing county currently has 115,000 mu (7,666.7 ha) of national and provincial, and 290,000 mu (19,333.3 ha) of county-level public benefit forest area;
- Priority investments in daily garbage management;

- Basic investment in the county's western areas, which supply many of the ecosystem services related to watersheds;
- Protection of river mouth water resources;
- Subsidies to close or move enterprises to protect the environment of the county's western region;
- Other county-government-approved subsidies for western region ecological environment protection work.

SOURCE: MEP, 2006; Zhejiang Provincial Government, 2005; Zhang *et al*, 2007; Zhen and Jin, 2006; Zhuan, 2005.

Zhejiang Province, Hangzhou City Eco-compensation

The Hangzhou City Eco-compensation Program, initiated in 2005, aims to develop an ecological city as well as to set the foundation for eco-compensation mechanisms and a system of financial distribution linking Hangzhou City, the county and districts where the program is being implemented. Cities and counties will be given higher or lower subsidies for better or worse environmental management records, respectively, taxes will be reduced or remitted for underdeveloped townships in headwater regions, areas that conserve drinking water, nature reserves and forest and biodiversity reserves, and policies and institutions will be developed to ensure financial support and specific subsidies for ecological protection. The program encompasses integrated management of urban atmospheric pollution, comprehensive management of pollution on the Qiantang River and Tai Lake Basin (e.g. Tiao River, the canal water system) and the Shaoxi and Yun River System, 7 key environmental inspection and control areas and 8 important industrial pollutants (called the "1278 projects"). Special care will be placed on city and township building, running and use of drinking water resource projects, and development of a self-monitoring system of key pollution sources. The program will also strongly promote the "1250" ecological demonstration projects, which involve tree planting and ecological public benefit forests. The program will also incorporate more environmental targets (and measures of local satisfaction with environmental quality) into examination criteria of local officials.

Funds for the program include RMB 800 million remitted to Hangzhou City from provincial and central government finance bureaus to encourage the development of the program, a special fund earmarked by Hangzhou City of RMB 160 million to fund 10 eco-compensation policies as well as a newly added RMB 56 million, from which RMB 16 million will be used for upper watershed eco-compensation. Local governments will also earmark special funds for the projects. Components of the program include subsidies for industrial technology upgrades, improved rural household sewage installations and water resource management installations.

SOURCE: Youth Daily, 2005; MEP, 2006; Zhejiang People's Government, 2005; Zhen & Jin, 2006.

Shandong Province, Huaihai and Xiaoqing River Watersheds Eco-compensation

An eco-compensation pilot project in the lower section of the South-North Water Transfer Project and the Huaihai River and Xiaoqing River watersheds began in July, 2007, and will be implemented until 2010. A key goal of the program is to improve water quality for the South-North Water Transfer Project. Currently, 28.6 percent of the section of the Huai River watershed in Shandong Province does not satisfy environmental protection targets, and 95.8 percent of the portion of South-North Water Transfer Project running through Shandong fails to meet the project's water quality demands, and only 4 percent of the Xiaoqing River meets these demands. The Xiaoqing River is a key component of the South-North Water Transfer Project and Shandong Province's "Two Lakes One River" (Nansi Lake,

Dongping Lake and Xiaoqing River) Watershed. As such, the pilot involves 12 cities and 69 counties along the Xiaoqing River watershed. Funding will be jointly raised from the participating cities and counties. Each city will contribute funds according to their total amount of sewage emissions, and the MEP's publically available pollutant management cost calculations, with the amounts in principle calculated based on the previous year's chemical oxygen demand, with the contribution calculated as being 20 percent of Ammonium Nitrate management costs. At the same time, Shandong provincial-level contributions are to be in principle no less than city/county-level contributions. Provincial finances will deal with non-point source pollution and soil and water conservation, and will use loans from the World Bank and foreign governments, with the emphasis on the pilot areas and improving eco-compensation efficiency. Pilot areas will, according to each environmental protection component and the extra costs of implementing national and provincial environmental protection plans and sewage reduction plans, rationally set eco-compensation recipients and their corresponding targets and implementation measures.

As part of the project, direct payments will be made to farmers to convert key areas of farmland and aquaculture operations back to wetland along the river. Farmers who participate in this "Conversion of Farmland/Aquaculture to Wetland" (*tui geng/ yu huan shi*) program will be paid for two years. For years one and two, farmers will be reimbursed for 100 percent and 60 percent, respectively, of their lost net income of the year just before participation in the program. For industries that satisfy government pollution standards and participating in the government's "Deep Management" Program, 50 percent of the water pollution management fees will be reimbursed. For participants in the "Further Improve Industry" project, 50 percent of the industry's pollution cost reductions will be given back to them. Available information sources found to date do not indicate the ongoing status of the program.

SOURCE: Jinan Daily, 2007; Xinhua News Agency, 2007b; Shandong People's Government, 2007.

Liaoning Province Cross-District Watershed Eco-compensation

Entitled the *Liaoning Province Cross-District River Water Quality Target Examination and Subsidy Measures for River Sections Exiting Cities*, the policy is currently under discussion in draft form, which was issued in April, 2008. It will require upper watershed districts to pay a fee to lower watershed districts if the water quality of the sections of rivers exiting upper watershed city administrative boundaries is on average below set targets. Inspection stations will be responsible for monitoring water quality, with at minimum two inspections per month. Cities just above river mouths where they enter the ocean will be required to pay fees to the provincial Finance Bureau if the river mouth water quality is below set targets. These fees will be incorporated into environmental protection guidance funds or pollution prevention and management funds, for use exclusively for water pollution prevention and ecological restoration.

Interim pollution targets will be chemical oxygen demand (COD), based on water pollution prevention and management costs. The interim subsidy standard is as follows: For the main channel of a river, RMB 500,000 times the multiple that the pollution level exceeds the target; for a tributary of the river, RMB 200,000 times the multiple. Environmental protection departments at each administrative level are required at a set date to publish a name list of pollution-emitting companies/units that have an impact on water quality, to encourage them to do the utmost possible to reduce their emissions. Those who have administrative responsibility over sections of river exiting cities that do not achieve the standard over the long term, or that are found to be significantly under standard on numerous occasions, will be pursued via the relevant regulations. For districts and cities that do not submit fees on time, the provincial environmental bureau's administrative management branch will implement MEP's policy on revoking administrative district EIA approval, while also pursuing via the relevant

regulations those administratively responsible.

According to available news, this policy was implemented beginning June 1, 2008, for Tieling City on the upper watershed section of the Liao River, Fuxun City on the upper watershed of the Hun River, Benxi City on the upper watershed of the Taizi River, Shenyang, Liaoyang and Anshan cities on the upper watershed of the Daliao River Chaoyang and Fuxin cities on the upper watershed of the Daling River, whereby the upper watershed city will pay the fee rates to the lower watershed area if water flowing out of cities does not meet environmental standards. This will also be implemented on the coastal cities of Dandong, Dalian, Yingkou, Panjin, Jinzhou and Huludao. Currently, pollution content in river sections exiting cities along main river channels in Liaoning Province are currently up to 1.5 times the standard, while those along tributaries are up to 3 times the standard. At the time of this report, available sources did not indicate whether or not fees have been assessed under this program.

SOURCE: Liaoning Environmental Protection Bureau, 2008.

Shaanxi Province, South-North Water Transfer Project Eco-compensation Pilot Project

This is currently under consideration as a national eco-compensation mechanism pilot project. Xunyang County in the South of Shaanxi Province is designated as a water source conservation area of the South-North Water Transfer Project, Central Channel. The Han River flows through the county into the Dan River Mouth Reservoir, where the South-North Central Channel begins. Ensuring stable water quality is thus a major concern. As such, policymakers have been considering eco-compensation policies within a package of measures aimed at ensuring water quality for the reservoir, and Xunyang County has invited China Agricultural University and the Policy Research Center for Environment and Economy (PRCEE), Ministry of Environmental Protection, to develop a plan for the management of water quality. A meeting to comment on the "South-North Water Transfer Project Central Channel Water Resource Conservation Area Xunyang Eco-compensation Plan Research Report" was held on July 12, 2008, attended by key representatives and researchers from PRCEE, the Ministry of Finance, and various provincial and local government leaders and policymakers.

SOURCE: MEP-PRCEE, 2006; Shanxi Provincial Government, 2008; Xinhua News Agency, 2007c; MEP, 2008a; Ankang City Government, 2008.

Anhui-Zhejiang Province Xin'an River Watershed Eco-compensation

Anhui Province is exploring eco-compensation mechanisms for the An River basin to control pollution and improve the protection of the watershed, and has entered the China Ministry of Environmental Protection's program of eco-compensation pilot projects. Anhui wishes to set-up an eco-compensation mechanism paid for by Zhejiang Province and Hangzhou City, to help Anhui to make a transition to low or no-pollution industry. Huangshan City in Anhui Province, located in the upper watershed of the Xin'an River Reservoir, a key source of drinking water for Hangzhou City and Zhejiang Province, will take the lead together with the provincial Environmental Protection Bureau and the Water Resources Office, to organize survey research work and evaluate the costs of construction and implementation, the laws, regulations and policies related to eco-compensation, and the form that eco-compensation will take, for the purpose of providing a report to the provincial government regarding how to self-manage watershed pollution.

Both Anhui and Zhejiang Province are very interested in eco-compensation, but apparently have

differing views. Huangshan City hopes that Zhejiang Province can help provide subsidies to support investment in reducing water pollution and improving water quality. However, Zhejiang Province and Hangzhou City reason that upper watershed water quality cannot be ensured. Nitrogen and Phosphorous content is already very high, so that the water is national level V quality. If the upper watershed cannot achieve up-to-standard water quality, then the lower watershed should have no obligation to continue subsidies. Secondly, Huangshan City wants to set up a reservoir with a capacity of 800 million m³, so that it can stabilize seasonal irrigation capacity. Zhejiang Province is opposed to this, raising the concern that this will negatively impact lower watershed water quality and quantity. Thirdly, Zhejiang Province has expressed the view that further subsidies are unfair, since it already sends 50 percent of its annual RMB 200 billion in revenue to the central government, which includes funds for environmental management. Finally, hydroelectricity from a new reservoir in Anhui Province on the Xin'an River will benefit the nation in general, and should therefore receive subsidies from the central government.

SOURCE: China Anhui Net, 2005; SEPA, 2005; Zhejiang Provincial Government, 2005; Zhang *et al*, 2006; Zhen and Jin, 2006; Water Information Net, 2007. Shen, 2004.

Yunnan Province, Lashihai Nature Reserve – Lijiang City Eco-compensation

This is a pilot research project for the development of a PES scheme in Lijiang Municipality, Yunnan Province, targeting both watershed ecosystem services and biodiversity. According to available information, it has to date not yet been launched. This project stands apart from the majority of those documented in the report for the fact that it has been driven primarily by international funding and expertise, and in particular funding from Conservation International (CI) and the World Bank, with the joint participation of the Nature Conservancy and FEEM. A detailed description of the research work and development of this project can be found in CI, TNC and FEEM (2007). This pilot PES scheme is to consist of special fees charged to tourists for visiting Lijiang old city and the Laishihai Nature Reserve, to be used to compensate upper watershed farmers adjacent to or near Laishi Lake for changing their land use practices. Laishi Lake is a key part of the Lijiang Basin, from which flow the various rivers and streams that run through and around Lijiang old city, which are an important part of the city's charm as a tourist destination. The Laishihai Nature Reserve was established in 1998 to preserve the Laishihai wetland, an important destination for migratory birds. Land-use practices adjacent to and near Laishi Lake thus have important impacts on both watershed ecosystem services as well as biodiversity, key beneficiaries of which are the tourists to the area. In 2005 alone, some 4 million tourists visited Lijiang old city, the vast majority of these being domestic tourists, while around 50,000 domestic and 15,000 international tourists visited the Laishihai Nature Reserve.

Based on the research work for the pilot, which examined both farmer costs of different land-use scenarios as well as the willingness-to-pay of tourists for the local watershed and biodiversity services, a preliminary recommendation was made for an entrance fee to the Laishihai Nature Reserve of RMB 8 for domestic tourists and RMB 40 for international tourists, and an addition to the entrance fee to Lijiang old city of RMB 0.4 for domestic tourists and RMB 2 for foreign tourists. These funds would be used to offset farmer losses associated with land-use changes to reduce their impact on the Laishi Lake watershed as well as on its migratory birds, and to help them to shift to longer-term and sustainable alternative livelihood strategies, including organic farming and mixed systems of cropping, horticulture and husbandry. As part of the pilot work, a committee consisting of the key governmental units and local stakeholders was created, and a special fund was established along with an independent foundation to manage it.

SOURCE: CI, TNC & FEEM, 2007.

II.2 WATER USE RIGHTS TRANSFERS

A growing number of water rights transactions between municipal governments and between the power industry and agricultural irrigation districts are occurring across China. This trend started with the Dongyang-Yiwu City water rights transfer in 2000, which is a local-level program that generated significant interest and discussion amongst central and local government policy circles, and sparked policy emulation and innovation. Since then, the central government has been developing the regulatory framework to facilitate water rights transactions, particularly for the Yellow River watershed, where such transfers are seen as a means to rationalize water use and generate investment into water-saving agricultural irrigation infrastructure and technology. As detailed in Table 2.2 below, documented projects found to date involve estimated total project costs of almost RMB 2.8 billion, of which RMB 1.15 billion has already been spent.

Table 2.2 — China’s Water Use Rights Transfers

PROGRAM	SUMMARY	SIZE
ZHEJIANG PROVINCE, DONGYANG CITY — YIWU CITY WATER RIGHTS TRANSFER	Negotiated purchase of water use rights involving both direct payments and longer-term investments in and management responsibilities over infrastructure.	One-time payment of RMB 200 million, plus estimated total project costs of RMB 500–660 million.
GANSU PROVINCE, ZHANGYE WATER RIGHTS TRANSFER	Development of a framework of rational water use, including a platform for negotiating water use rights transactions and for greater adoption of water-saving technology.	No program cost information available.
NINGXIA AUTONOMOUS REGION, WATER-SAVING SOCIETY EXPERIMENT	Policy framework and program to facilitate negotiated purchases of water use rights between agricultural irrigation districts and power plants.	RMB 15 million invested so far. Total costs estimated to be RMB 550.16 million.
SICHUAN PROVINCE, LUSHAN BRANCH CANAL MANAGEMENT OFFICE — GAOYU COLLECTIVE COMPANY LTD	Negotiated purchase of water use rights between an irrigation district and a factory.	One-time payment of RMB 170,000.
INNER MONGOLIA, ERDOS ELECTRICITY AND JOINT STOCK COMPANY	Negotiated purchase of water use rights between agricultural irrigation districts and Erdos Electricity and Joint Stock Company.	RMB 80.44 million invested.
ZHEJIANG PROVINCE, CIXI CITY — SHAOXING CITY	Negotiated purchase of water use rights involving both direct payments and longer-term investments in and management responsibilities over infrastructure.	One-time payment of ~RMB 700 million, plus a one-time reservoir maintenance fee of RMB 153.3 million and additional estimated total project costs of RMB 514 million.

GANSU PROVINCE, JINGYUAN NO. 2 ELECTRIC POWER CO. WATER RIGHTS TRANSFER	Negotiated purchase of water use rights between agricultural irrigation districts and Jingyuan No. 2 Electric Power Company.	No information available.
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Zhejiang Province, Dongyang City — Yiwu City Water Rights Transfer

This is the first case of a water rights transfer occurring in China, and has been responsible for stimulating significant discussion and policy innovation towards using market mechanisms to help resolve the many water resource conflicts in China arising from ambiguous delineation of use rights and management responsibilities. The agreement, signed November 24, 2000, has the following stipulations: (1) Yiwu City makes a one-time payment of RMB 200 million to purchase the use rights to 49.999 million m³ of water annually from the Hengjin Reservoir; (2) After the transfer of use rights, the rights of the Hengjin Reservoir over the water source do not change, and management of the reservoir remains the responsibility of Dongyang City. Based on the current year’s actual use, Yiwu will pay a management and water resource fee of RMB 0.1 per m³ of water consumed. (3) Investment for the construction of the pipeline between Yiwu and Dongyang will come from Yiwu, and while Dongyang City will be responsible for the policies and management of the portion of pipeline in Dongyang’s administrative purview, Yiwu City will cover the management costs. It is estimated that Yiwu will use 150,000 tons of water daily, and that the approximately 50km of pipeline needed will require RMB 350-510 million in investment, and that a new water management enterprise for this endeavor will require roughly RMB 150 million to set up.

SOURCE: China Water Resource Report, 2001; Zhen & Jin, 2006.

Gansu Province, Zhangye Water Rights Transfer

This is the first project in China to set up a water use rights system with tradable water use quotas. It was launched in the beginning of 2002 in Zhangye City, Ganzhou District, Gansu Province, by the Ministry of Water Resources as a national water saving society pilot project. The pilot project work was completed during 2002–2004. In general, this pilot is to clarify water use rights and to develop platforms of dialogue between the various stakeholders to more rationally distribute water use rights and to improve water saving for the watershed of the Hei River in central Gansu Province. At the beginning of the pilot in 2002, water use in the pilot area was readjusted based on local ecological and social conditions, with high-efficiency water users given preference for distribution of use rights, and per capita water use being determined based on proximity to water resources. Water use rights certificates were distributed to counties and irrigation districts, down to townships, villages and then households. In Minle County, each irrigation district distributed water rights certificates to households based on land area and a water resource deployment scheme which was checked, ratified and strictly enforced. Water used for irrigation was significantly reduced, with each mu of land using 100-120 m³/year (1,500–1,800 m³/ha/year), significantly lower than the previous year. In March 2004, a rural household water user consortium was established in Minle County, Sanbao Township, Renguan village. As of 2006, it has 223 members and 9 irrigation small-groups. Members are able to negotiate water use and irrigation channel arrangements, and the redistribution and consolidation of agricultural land to improve irrigation efficiency. At present, before each irrigation period, this consortium convenes a meeting of representatives and publishes a seasonal report of household water use and fee payment information.

In 2000, the State Council decided to expand crises management for the Hei River, to create a more rational system of water resource distribution between the upper, lower and middle sections of the river. News articles indicate that as a result of the water user consortium established for the pilot, water management and collection of water fees have improved, water costs decreased and in Taihe Village, Jinminlian Township, water use has been reduced by 860,000 m³/year and water costs have dropped by RMB 260,000/year in comparison to 2001–2002.

SOURCE: Zhen & Jin, 2006; China.com.cn, 2007; Xinhua News Agency, 2007d; Xinhua News Agency, 2006c; Zhang *et al*, 2009; China Daily, 2007.

Ningxia Autonomous Region, Water-Saving Society Experiment

Initiated in 2004, this program will be in effect for at least 10 years with the aim to restructure water use and distribution. As with north China in general, Ningxia Province has limited water resources. According to national data, the use rate of the Yellow River is around 70 percent, much higher than the internationally recommended rate of 40 percent for rivers. The central government allows Ningxia the rights to 400 million m³ of water from the Yellow River. Ningxia Yinhuang Irrigation Area has less than 200 mm of rainfall annually, while having an evaporation rate over 2,600 mm/year, 93 percent of the area's water resources are used by agriculture, creating a severe impediment to industrial and urban development. Thus, to facilitate more efficient use of water resources and alleviate these resource bottlenecks, three projects have currently been approved for the transfer of the water rights for 53.8–64 million m³ for the sum of approximately RMB 15.1–64 million, to be used for the improvement of irrigation infrastructure and to promote water-saving.⁵

These projects are (1) water rights transfer from Tanglai Channel Irrigation Area to Lingwu Power Plant, (2) water rights transfer from Huinong Channel Irrigation Area to Maliantai Power Plant, and (3) water rights transfer from Hanyan Channel Irrigation Area to the 3-period expansion project of the Main Dam Power Plant. According to available information, the Huinong Channel Irrigation Area project will invest a total of RMB 56.96 million, with the Maliantai Power Plant providing two-thirds of this. After completion, it is estimated to reduce water use in the channel by 57 million m³, and inefficient use of Yellow River water by 21.5 million m³. The Hanyan Channel Irrigation Area water-saving reconstruction project has an estimated budget of RMB 493.2 million, with the Main Dam Power Plant investing two-thirds of this. When completed, it is estimated to reduce water use in the Yinhuang channel by 50 million m³, and will reduce inefficient use of Yellow River water by 18 million m³. As part of the overall program, Yaofu Township of Pingluo County was designated in 2004 as a demonstration Township to expand an agricultural water use consortium system. After 1 year, the project has helped to resolve important water-use conflicts, and water-use decreased by 120 m³ per mu (1,800 m³/ha) on the previous year. As of 2006, there were 905 water-use consortiums in Ningxia, controlling 83 percent of the irrigation area. Rainfall in 2004 was 60 percent less than the year before, while water use increased by 25.5 million m³. However, during this time, the average fee for water management units dropped by RMB 0.3/mu (RMB 4.5/ha). Currently, 3 million mu (200,000 ha), which is over 50 percent of the irrigated area, are now under water-saving irrigation management.

The vice-manager of the Ningxia Water Service Company, Ltd., which appears to be the key management authority for these projects, says that investment of RMB 10 billion into eastern Ningxia's Energy & Chemical Industrial Base is a key hope for development of the region, but a critical prerequisite for that is development of the region's water resources. The completion of water-related

⁶ Different articles gave different numbers. This is possibly due to the evolving parameters of the project.

projects will bring an estimated 360.2 million m³ of water, with agriculture and natural ecosystems ecosystems using around 42 million m³, and industry using 318.2 million m³.

SOURCE: Ningxia Daily, 2006 & 2004.

Sichuan Province, Lushan Branch Canal Management Office — Gaoyu Collective Company Ltd.

News sources provide little information regarding this, but call it an “embryonic” form of water rights transfers for Sichuan province. In 2004, Lushan Branch Canal Management Office sold 11,577,600 m³ of water for 95 days to Gaoyu Collective Company Ltd. for RMB 170,000.

SOURCE: Gao *et al*, 2005.

Inner Mongolia, Erdos Electricity and Joint Stock Company

This is the first project of a program formally entitled “Erodos City Water Rights Transfer Water-Saving Transformation Project”. According to limited news sources, this agreement is between Erodos Township’s electricity company, whose Eronggui Electric United Power Plant has faced water shortages despite using other water-saving techniques, and the Inner Mongolia Yellow River South Bank Irrigation Area in Otoq Qi and Hangjin Qi. The proposal for this was tentatively approved in 2004. As per the agreement, Erdos Electricity and Joint Stock Company has invested RMB 80.44 million to build a 42 km water-saving pipeline and other water installations, and now has the rights to a maximum 18.8 million m³/year of water.

SOURCE: People’s Daily, 2006c.

Zhejiang Province, Cixi City — Shaoxing City

This is Zhejiang Province’s third example of a water rights transfer. Though Cixi City is economically strong, it is short of water supplies, and particularly of good quality water. Though Cixi signed an agreement in 1999 with Yuyao City in the next county for Yuyao’s Lianghui Reservoir to supply it with water for 20 years, at an investment of RMB 4 billion to develop the back-bone river network, without additional water supply the city, whose water use has increased by 20 percent annually in recent years, will face severe development bottlenecks. At the same time, Shaoxing City, Shaoxing County and Shangyu City jointly invested RMB 1 billion into the Tangpu Reservoir, which has a storage capacity of 235 million m³, an annual recharge rate of 360 million m³, has Class I drinking water, and can provide 1 million m³ daily, with only 40 percent of this capacity currently being used.

The contract, signed by both municipal governments, is in effect from January 1, 2005, to December 31, 2040. For the first 18 years of the contract (phase I: 2005–2022), Cixi City will pay Shaoxing City more than RMB 700 million to obtain water supplies of 1.2 billion m³, and a daily supply of 200,000 m³ of water. Cixi City’s water management companies will provide all of the investment and management of the pipeline, while Shaoxing City will set prices, which will be the same for both cities. The total cost of the pipeline project is to be RMB 514 million. Cixi City is also required to make a one-time compensation for reservoir maintenance to Shaoxing City of RMB 153.3 million. The project will be divided into two stages. In the first stage (covering 18 years), Cixi City will invest RMB 514 million to build more than 50 km of pipeline and storage tanks (as well as the above-mentioned one-time investment into the Tangpu Reservoir). The water will be paid for separately, according to the

same price that Shaoxing City pays, which at present is RMB 0.4/m³. The price for the second period will be determined separately. According to the provincial water department's chief, Zhang Jinru, this was a pioneering initiative due to the cross-district resource use arrangement it entails.

SOURCE: China News Service, 2003; China Water Resource Report, 2003; Ningbo Daily, 2003; Zhen & Jin, 2006.

Gansu Province, Jingyuan No. 2 Electric Power Company Water Rights Transfer

Initiated in 2006, this is Gansu Province's first cross-sectoral water rights transfer project. Gansu Province Water Resources Department has drawn up a tentative draft agreement wherein Baiyin City will provide water resources for the Jingyuan No. 2 Electrical Power Company Ltd. The project will allow for the removal of a key bottleneck to the electrical industry — guaranteed water supply — while also providing finances to improve agricultural irrigation (via expanding the irrigation network) and water-saving. As per the agreement, Jingyuan No. 2 Electrical Power Company Ltd. paid the first installment of RMB 14 million, out of a total of RMB 37.77 million, for the one-time purchase of the use rights to 9.96 million m³/year of water for 20 years.

SOURCE: People's Daily, 2006a & 2006b.

CHAPTER III

FOREST-RELATED PROGRAMS

The forestry sector has seen the most dramatic and large-scale developments in market-based initiatives in China, currently boasting two of the largest ecological payments programs in the world: the Conversion of Cropland to Forests and Grassland Program (CCFG) and the Forest Ecosystem Compensation Fund (FECF). China's other major forestry initiatives also currently have or are in the process of developing incentive-based components targeting households and communities, as the overall strategy of the State Forest Administration (SFA) has seen a gradual shift towards greater utilization of market-based instruments over more traditional campaign-style approaches. These programs — which, similar to the CCFG and FECF, are concerned with a range of ecosystem services, including carbon sequestration, landscape amenities, timber, biodiversity, watershed ecosystem services and combating desertification — have planned expenditures of more than RMB 181 billion and encompass 100+ million ha of forest area. Overall, the SFA has emerged as a key driver and innovator in the development of ecosystem services markets in China over the past decade. The CCFG and FECF, by themselves, have been instrumental in generating significant momentum at local levels in terms of capacity building, policy innovation and development regarding the environment, with this then feeding into and reinforcing the overall development of eco-compensation policy across the country. And the SFA continues to explore other market-based approaches, including (as discussed in Chapter VI) developing instruments to tap into the private sector and international carbon markets to fund its ongoing afforestation and forest rejuvenation work.

Table 3 — China's Forest-Related Programs

PROGRAM	SUMMARY	SIZE
CONVERSION OF CROPLAND TO FORESTS AND GRASSLAND PROGRAM (CCFG)	PES scheme involving direct payments to farmers to retire and afforest or plant grasses on sloping or marginal cropland.	Total budget of RMB 337 billion (of which RMB 130.1 billion has been spent during 2000-2006). 139 million mu (9.27 million ha) of cropland enrolled and 205 million mu (13.67 million ha) of wasteland afforested.
CENTRAL GOVERNMENT FOREST ECOSYSTEM COMPENSATION FUND (FECF)	Payments to farmers, communities or local governments to manage standing forest area deemed as "key public benefit forests".	A total of 1.578 billion mu (105.2 million ha) of national-level key public benefit forest area enrolled by the end of 2007. Cumulative total investment of RMB 13.34 billion by the end of 2007 (RMB 3.34 billion in 2007 alone).
PROVINCIAL-LEVEL FECF (COMPLEMENTARY TO CENTRAL GOVERNMENT FECF)	Provincial-level policies that are complementary to the National FECF, which add provincial level forest area with subsidies, and/or provide additional, complementary subsidies on top of national subsidies.	Apart from national key public benefit forest area, 1.15 billion mu (76.7 million ha) of provincial-level public benefit forest area enrolled by the end of 2007. Subsidies of RMB 1.2 billion in 2006.

NATURAL FOREST PROTECTION PROGRAM	Program to facilitate restructuring of the State Forest Sector so as to put greater emphasis on longer-term ecological and economic sustainability, reduce over-harvesting of forests, and recover forest stock. Involves some PES elements.	Total targeted forest area of 1.203 billion mu (68.2 million ha), of which 846 million mu (56.4 million ha) is designated as natural forest area. Total budget for 2000-2010 is RMB 96.2 billion, of which the central government will provide RMB 78.4 billion.
"THREE-NORTHS" SHELTERBELT PROGRAM	Long-term afforestation program to halt desertification in central China via creation of a large transitional forest zone. Involves payments to individuals or communities for afforestation work, as well as some agroforestry extension.	Completed afforesting 367 million mu (24.47 million ha), and is controlling desertification on over 450 million mu (30 million ha) and soil erosion on 300 million mu (20 million ha) of land. Total estimated budget for the current period of the program (2001-2010) is RMB 35 billion, of which RMB 25 billion will be from the central government.
BEIJING-TIANJIN SANDSTORM SOURCE CONTROL PROGRAM	Program to reduce source of sandstorms to Beijing and Tianjin via afforestation and planting of grasses and vegetation on barren land in surrounding provinces and regions. Has a range of different components, including PES schemes.	Total program budget is RMB 50 billion, of which Beijing is to invest RMB 3.9 billion. By the end of 2007, 47 million mu (3.13 million ha) of land has been afforested, and total expenditures have been RMB 19.9 billion.
FOREST VEGETATION RESTORATION FEE	A fee levied on developers who impact forest area managed by the SFA, for use in forest restoration and rehabilitation work.	RMB 8.044 billion during 2003-2005.

III.1 CONVERSION OF CROPLAND TO FORESTS AND GRASSLAND PROGRAM (CCFG)⁶

This has been the government's largest and most prominent eco-compensation policy, involving direct compensation to individual farmers. At present, the program has enrolled 139 million mu (9.27 million ha) of cropland for afforestation and 205 million mu (13.67 million ha) of wasteland, encompasses 25 provinces, 2279 counties and 32.5 million rural households. From 2000-2006, the program has spent a total of RMB 130.1 billion (~one-third of the total budget). The total budget of the program is RMB 337 billion, and the original target for retirement of cropland was 220 million mu (14.67 million ha). A State Council notice in 2007 has extended subsidy lengths for already enrolled land by the original subsidy amounts (e.g. 5 years + 5 years, or 8 years + 8 years), and has set a floor on subsidies as follows: an annual living expense of RMB 20/mu (RMB 300/ha), plus a subsidy of RMB 105/mu (RMB 1575/ha) for the Yangtze River watershed and south China, and RMB 70/mu (RMB 1050/ha) for the Yellow River watershed and north China. Subsidy lengths are 8 years for ecological forests (timber

⁷ This program is also known in the English-language literature as "Grain for Green" or the "Sloping Land Conversion Program". The title "Conversion of Cropland to Forests and Grassland" was adopted for this report since it is a direct translation from the official program title in Chinese.

crops), 5 years for economic forests (orchards or trees with medicinal value), and 2 years for grasses. Due to concerns of encroachment onto national base grain-growing area, the State Council notice calls for a halt on expansion of the program and places emphasis on consolidating the gains already made (State Council, 2007). The policy itself has had a large impact on policy circles in China, and is arguably the starting point of the government's drive towards developing eco-compensation mechanisms. In fact, the names of many subsequent policies have followed the same rubric of "Conversion of A to B Policy" (e.g. Conversion of Husbandry to Grassland, Conversion of Aquaculture to Wetlands, Conversion of Cropland to Lake Area, etc.).

SOURCE: SFA, 2007; Economic Daily, 2007; State Council, 2007; Bennett, 2008.

III.2 FOREST ECOSYSTEM COMPENSATION FUND (FECF)

This program is aimed at conserving and improving management of what is deemed by the government to be "public benefit" forest area, and has expanded significantly in recent years. The legal foundations for this program were set down in Article 6, Chapter 1 of the revised *Forest Law of the PRC* (1998), which called for the establishment of a "Forest Ecosystem Benefit Compensation Fund" (which is the full name of the FECF), for exclusive use for the construction, fostering and protection of "public benefit" forests (PRC, 1998). Section 3, Article 15 of the *Forest Law Implementation Regulations* (2000) further states that those who manage and protect "public benefit" forests have the right to receive compensation (State Council, 2000b). The pilot phase of the FECF was launched in 2001, whereby the national government earmarked RMB 1 billion for use in pilot implementation in 200 million mu (13.33 million ha) in 685 counties (or enterprises) and 24 national-level reserves across 11 provinces and autonomous regions. Formal implementation began in late 2004, with total funds increased to RMB 2 billion and implemented on 400 million mu (26.67 million ha) (Zuo *et al*, 2005). By 2007, it has encompassed 1.578 billion mu (105.2 million ha) of key public benefit forest area across 30 provinces. Of this forest area, 59.52 percent is state-owned public benefit forest area, 34.06 percent is collective public benefit forest area, and 6.42 percent is individual or other public benefit forest area. In terms of regional distribution, 72 percent of total public benefit forest area is in the western region. Watershed protection appears to be a key goal behind the program, since some 80.1 percent of total public benefit forest is watershed or soil-conservation related (headwater forests make up 4.8 percent, forests along watersheds make up 23.6 percent, wetlands and reservoirs make up 5.1 percent, desertified areas suffering from sever soil erosion make up 46.6 percent).⁷ Around 44 percent of public benefit forest is in the Yangtze River watershed, 29.4 percent in the Yellow River watershed, 11.3 percent is in Heilong River watershed, 6.7 percent is in the Pearl River watershed, 1.6 percent is in the Huai River watershed, 1.55 percent is in the Liao River watershed and 3.77 percent is in the Min River and Tai Lake water system in southeast China (SFA, 2008a).

In 2007, annual expenditures were RMB 3.34 billion, for a cumulative total investment of RMB 13.34 billion. This encompasses 30 provinces, as well as a total of 35 other entities, including Inner Mongolia's and Heilongjiang Province's forest worker collectives, Daxinganling Forestry Company, the People's Liberation Army Logistics Department and Xinjiang Province's Production and Construction Corps. The central program has also called for the development of provincial programs. By the end of 2006, a total of 25

⁸ Nature reserves and natural heritage forests make up 8.5 percent, national borderland area makes up 4.7 percent, high-altitude protective forest belts, redwood forests and forests in the western straights made up 0.9 percent, 2001 pilot area that does not accord with document no. 94 but which has continued to receive subsidies makes up 4.3 percent, and the People's Liberation Army Logistics Department forest area makes up 1.5 percent.

provinces had set up local forest ecosystem compensation systems, and in 2006 these contributed RMB 1.2 billion in complementary subsidies. Apart from national public benefit forests, the area of current provincial-level public benefit forests is 1.150 billion mu (76.7 million ha). Available examples of provincial programs are presented below.

Guangdong Province, Provincial FECF

Initiated in 1998–1999, available reports indicate that Guangdong’s FECF was the first provincial-level FECF in the country. In 2003, the Guangdong began the “ecological counties” campaign, and in 2004 started building an “ecological province”, meaning it continued to be a leading case study in forestry initiatives nationally. In 1998, the subsidy rate for provincial public benefit forest was RMB 2.5/mu (RMB 37.5/ha). In 2000, this was increased to RMB 4/mu (RMB 60/ha), and in 2003 was further increased to RMB 8/mu (RMB 120/ha). Annual provincial payments have increased from the original RMB 127 million, to RMB 413.98 million in 2005, of which RMB 310.485 million has been paid directly to the 5.3597 million participating forest households. At present (these are likely 2005 numbers), provincial public benefit forest area enrolled in the program stands at 51.75 million mu (3.45 million ha). In addition, 11.3255 million mu (755,033.3 ha) of (national) key public benefit forest area is also provincial public benefit forest area, and so is enrolled in both the national and provincial FECFs and thus receives a subsidy rate of RMB 13/mu (RMB 195/ha) (national rate of RMB 5/mu + provincial rate of RMB 8/mu). According to available news, beginning in 2008 the subsidy rate will increase to RMB 12–15/mu (RMB 150–225/ha), and a “natural increase mechanism” has also been set-up which adds RMB 1/mu (RMB 15/ha), and will likely increase RMB 2/mu (RMB 30/ha) every two years. Reports also exist of a Shenzhen City “Municipal Forest Ecological Compensation Program”, which has a subsidy rate of RMB 24/mu (RMB 360/ha), though available information in Chinese news and government reports is very limited.

SOURCE: Li *et al*, 2006; SFA, 2008d; Guangdong Provincial Finance Bureau, 2008.

Zhejiang Province, Provincial FECF

In 2001, the national FECF enrolled 30 million mu (2 million ha) of public benefit forest in the province. In the same year, Zhejiang Province also designated this area as provincial-level public benefit forest area, and earmarked RMB 50 million for subsidies. Since 2003, the province has invested RMB 3.3 billion and up annually to support lesser developed regions in the province, with a significant share of this going towards ecological construction. Up to October of 2005, RMB 240 million in provincial subsidy funds had already been distributed down to locales to fund subsidies for 30 million mu (2 million ha) of public benefit forest. The province plans to spend a total of RMB 968 million by the end of the 11th 5-year plan (2010).

The original subsidy structure was +RMB 3/mu (RMB 45/ha) for a total subsidy of RMB 8/mu (RMB 120/ha), with these funds coming from local finances. Key headwaters support areas, including those for the Qiantang and Ou Rivers receive RMB 2/mu (RMB 30/ha) from provincial finances and RMB 1/mu (RMB 15/ha) from county and city finances. Secondary support areas receive +RMB 1/mu (RMB 15/ha) from provincial finances and RMB 2/mu (RMB 30/ha) from county and city finances. More recently, subsidies have been increased to a minimum total subsidy of RMB 12/mu (RMB 180/ha), with some areas receiving as much as RMB 25/mu (RMB 375/ha).

SOURCE: China Green Times, 2005; Zhejiang Provincial Forestry Office, 2004; Zhejiang Provincial Government, 2005; Xinhua News Agency, 2005a; SFA, 2008f; SFA, 2008g.

Shandong Provincial FECF

In 2004, the province initiated a pilot for this provincial FECF. The budget was initially set at RMB 12 million. This increased to RMB 52 million by the end of 2004, and by mid-2005 further increased to RMB 60 million. In 2004, 2.4 million mu (160,000 ha) of provincial forests were enrolled. By the beginning of 2005, this increased to 10.40 million mu (693,333 ha), and by mid-2005 this again increased to 12 million mu (800,000 ha), within 9 cities and 28 counties. Based on the available numbers, it would appear to have the same subsidy rate as the national program, which is RMB 5/mu (RMB 75/ha). About 80 percent of subsidies are paid directly to more than 30,000 forest managers via individual bank accounts accessible by bankcard, so as to reduce leakage of funds through intermediaries.

SOURCE: Guangxi Financial Office, 2005.

Jiangxi Province, Provincial FECF

This program was initiated in 2005. On top of the RMB 10 million earmarked by the provincial financial department in 2005 for starting local ecological public benefit forest protection, RMB 40 million were added in 2006 for a total of RMB 50 million in specially marked funds for local ecological public benefit forest protection and to support the development of forestry eco-compensation mechanisms. In 2007, this was increased to RMB 178 million, and in 2008 was further increased to RMB 278 million. Out of the subsidy standard of RMB 5/mu (RMB 75/ha) for the 10 million mu (666,667 ha) of public benefit forest, RMB 4.5 is for compensation to those holding forest rights, while RMB 0.5 is for the public costs of forest fire prevention and pest and disease management. The program also calls for program district, city and county financial departments to set up ecological public benefit forest eco-compensation institutions. By close to the end of 2006, 6 program districts and cities had started work on city-level ecological public benefit forest subsidies, and 40 counties had started work on county-level subsidies. By 2007, 49 cities and counties had started their own public benefit forest schemes, with a total retired area of 8.26 million mu (550,667 ha) and total annual subsidies of RMB 24.56 million. Subsidy standards at program onset were RMB 2-5/mu (RMB 30-75/ha), but increased first to RMB 6.5/mu (RMB 97.5/ha) and then to RMB 8.5/mu (RMB 127.5/ha)

The land area in 2007 that received both central and provincial level subsidies was 51 million mu (3.4 million ha), of which 30.62 million mu (2.0413 million ha) is (national) key public benefit forest and 20.83 million mu (1.389 million ha) is local or provincial level public benefit forest. To encourage and promote local governments to improve their capacity for forest resource protection, and to improve the quality of forest resources, the provincial ministry of finance will provide RMB 10 million, and the provincial forestry office will provide RMB 10 million, to reward those 10 counties with good forest ecosystems, with a definite increase in forest resources and whose levels of harvesting have decreased. In addition to this, three major subsidy supports will be provided to support forest rights reform: (1) The RMB 164 million in special products tax (e.g. for bamboo, etc.) that has now been cancelled as part of the forest rights reform, will be supplied by the provincial office of finance; (2) The RMB 41.85 million in cancelled municipal, county, township and village-levied timber and bamboo fees will now be supplied by the provincial office of finance to the 70 major forestry counties; (3) All operating and administrative costs for forestry management authorities and their business units will be entered into and managed within a common (within each level) budget, so that the long history of relying on forestry resources for paying operating and social expenses will be ended and the situation of grass-roots forestry teams will be stabilized. In order to support forest rights reform and to guarantee the smooth operation of this work, the provincial office of finance will also earmark RMB 30,000 in

outlays for special use as subsidies to forestry public safety bureaus.

SOURCE: Nanchang Daily, 2006; SFA, 2008e; MoF-AO, 2008;

Henan Provincial FECF

In 2005, the provincial financial bureau invested RMB 1 million to establish a pilot of 200,000 mu (13,333 ha) of provincial level public benefit forest area in Ruyang County. The annual subsidy fund will be at least RMB 900,000, and could increase if the program is implemented well. In 2006, the budget was RMB 6 million. In 2006, the province had 18.9112 million mu (1.261 million ha) of (national) key public benefit forest area, of which 7.7978 million mu (518,853 ha) is under the NFPP. Of the remaining 11.1134 million mu (740,893 ha), 8.7065 million mu (580,433 ha) are receiving subsidies from the central government.

SOURCE: Henan Forestry Information Net, 2006; Luoyang Radio Net, 2006; Yiwu City Agricultural Net, 2006; Xinhua News Agency, 2006a-2006b.

Hainan Province, Provincial FECF

Beginning in 2006, Hainan Province will annually appropriate RMB 19.52 million in provincial finances in order to pay subsidies for the protection of 3,905,300 mu (260,353.3 ha) of (national) key public benefit forest in the province that is not enrolled in the national FECF or NFPP. Hainan has 13.4578 million mu (897,187 ha) of (national) key public benefit forest. The subsidy rate for this is identical to the national rate of RMB 5/mu (RMB 75/ha). For the 1500 km of coastal-defense forest-belt forests, an additional RMB 15/mu (RMB 225/ha) subsidy is to be added. The provincial government will hire 2000 new forest staff responsible for forest management and protection, for a total of almost 6000 staff. Program subsidies will go towards paying these forest protection staff, for a monthly salary of approximately RMB 600-700/month. Around 81 percent of key public benefit forest area in the province is in central poor areas, encompassing 11 counties and cities.

SOURCE: Hainan Daily, 2006a-2006c; Hainan Xingnong Net, 2007.

Guangxi Provincial FECF

Since 2001, the national FECF has been implemented in Guangxi, whereby the national government delineated 35 million mu (2.33 million ha) of Guangxi forest area as (national) key public benefit forests, with a total subsidy fund of RMB 175 million. This area has recently been increased by 8.6045 million mu (573,640 ha), for total (national) key public benefit forest area of 43.6045 million mu (2.907 million ha), and total national subsidy funds of RMB 196.22 million. The Guangxi Provincial FECF was initiated in 2006, with the same subsidy rate as the national FECF, which is RMB 5/mu (RMB 75/ha). A total of 4 million mu (266,667 ha) of provincial level public benefit forest area outside of the (national) key public benefit forest area is enrolled in the program. Thus, total public benefit forest area in the province (national + provincial) is now 47.6045 million mu (3.174 million ha). Total budget for the program in 2006 was RMB 20 million (as calculated from the subsidy rates and area enrolled).

SOURCE: Guangxi Daily, 2006.

Fujian Province, Provincial FECF

Initiated in 2007, Fujian Province formulated the "Fujian Province Lower Watershed-to-Upper

Watershed Forest Ecosystem Compensation” scheme. According to the scheme, Fujian Province will annually earmark RMB 85.90 million. Subsidies will come from local governmental financial commitments, not from industry and domestic water use fees, and will be transferred to the provincial government. The 42.9 million mu (2.86 million ha) of area enrolled in the program will all be compensated at the same standard. Program subsidies will be paid directly to households based on public benefit forest area. The subsidy will augment the FECF subsidies of RMB 5/mu (RMB 75/ha) with an additional RMB 2/mu (RMB 30/ha), for a total subsidy of RMB 7/mu (RMB 105/ha).

SOURCE: Fujian Forestry Office, 2007a.

Fujian Province, Sha County FECF

Initiated in 2007, this policy provides subsidies in addition to national FECF subsidies, and stipulates how funds are to be raised and used for county-level Public Benefit Forests. Funds will be raised from the following sources: (1) RMB 200,000 will be earmarked from the County budget; (2) 5 percent of the increase in the “two fees” (afforestation and regeneration) for timber harvesting will be raised, for more than RMB 400,000; (3) budgetary water source conservation funds of RMB 200,000 from beneficiaries such as the county-administered Changshui Reservoir Management Area and county water companies. A separate report indicates that funds will be raised from a RMB 0.01/ton added charge on local water fees, RMB 10/m³ from forest harvest fees, 8 percent of entrance fees to scenic areas, and an added RMB 0.005/kilowatt charge to hydropower fees. With these, the county can annually raise RMB 800,000 for subsidies for public benefit forests. The subsidy rates in addition to the national rates area as follows: Level-1 protected area will receive an additional RMB 2.5/mu (RMB 37.5/ha) on top of the national subsidy. Level-2 protected area will receive an additional RMB 1.5/mu (RMB 22.5/ha), and Level-3 protected area will receive an additional RMB 1/mu (RMB 15/ha).

SOURCE: Fujian Forestry Office, 2007b; Guangdong Forestry, 2007.

Sichuan Province, Provincial FECF

The full details of this program are scarce. Available sources indicate, however, that the pilot phase is 2008, with full implementation set to begin in 2009. In 2008, the provincial financial bureau earmarked RMB 10 million for this program and selected 6 counties for pilot implementation. In 2009, the 30.67 million mu (2.045 million ha) of provincial-level public benefit forest will be entered into the program. Within the policy framework of the provincial-level FECF, local-level activities are also occurring. Eco-tourism areas such as Aba County’s Jiuzhaigou, Siguniang Mountain and Huanglong National Key Scenic Area have contributed more than RMB 10 million to give subsidies to local people within and on the borders of these scenic areas. The goal of this program is to protect the upper Yangtze River watershed, which have impacts not only for areas within the province, but also for the Three Gorges Dam area and downstream. Because of the critical importance of its location, restrictions on development and stipulations for protection exist for all key abundant forests, grasslands, wetlands and watersheds in the province that fall within the program area. The program also hopes to include the 36 million mu (2.4 million ha) of land in the province that is suffering from soil erosion or that is denuded mountain areas that are appropriate for forests.

SOURCE: Sichuan Forestry Office, 2008a–2008b.

Sichuan Province, Deyang City, Zhongjiang County FECF

Started in 2008, this is the first county-level FECF in Sichuan Province. Zhongjiang County financial office will earmark at minimum RMB 100,000 annually for this program. In 2008, it has already procured RMB 200,000. In addition to this, all state-owned medium and small sized reservoirs will contribute 3–5 percent of their annual revenue to the county-level forest ecological benefit fund, to be given as eco-compensation to those who have ownership over the forests (in the backdrop of this program is ongoing collective forestry sector reform). The subsidy rate will be RMB 5/mu (RMB 75/ha).

SOURCE: Sichuan Forestry Office, 2008c; China Green Times, 2008a.

III.3 ANTI-DESERTIFICATION

In addition to soil erosion, desertification is a serious concern in north China. World Bank (2001) reports that out of 331 million hectares of land prone to desertification (roughly a third of China's total area) about 262 million are actually affected, with this actual-to-potential ratio believed to be the highest in the world. In response to this long-term problem, the central government has actively combated desertification of cropland in north China since the late 1970s via the SFA's mass-scale afforestation program, the "Three-Norths' Shelterbelt Program". More recently, the SFA has initiated the "Beijing-Tianjin Sandstorm Source Control Program", and has begun to gradually shift its approach away from large-scale labor mobilization to greater use of market-based instruments targeted at households and communities to encourage afforestation, forest management and land reclamation. In 2002, it passed the *PRC Anti-Desertification Law*, which allows for local governments to provide subsidies or tax incentives to governmental units, private organizations and individuals that engage in activities that help to control or reverse desertification, and stipulates that reasonable compensation should be provided to those who have effectively managed desertification on land area that is subsequently enrolled into national or provincial conservation area (PRC, 2002a). The *State Council Decision Regarding Strengthening Anti-Desertification Work*, issued in 2005, reinforces this approach by stating that the central government should provide tax breaks for organizations, individuals and government departments involved in anti-desertification work (State Council, 2005).

"Three Norths" Shelterbelt Program

This is the government's preeminent afforestation program. Launched in 1978, the "Three Norths" program (a.k.a. "The Great Green Wall") aims to control desertification in north China (i.e. northwest, north-central and northeast China, thus the "three norths") via a large-scale, long-term afforestation drive to create a protective forest belt. The program is operational until 2050, with 8 plan periods distributed across three phases: Phase I (period 1: 1978–1985; period 2: 1986–1995; period 3: 1996–2000), Phase II (period 4: 2001–2010; period 5: 2011–2020) and Phase III (period 6: 2021–2030; period 7: 2031–2040; period 8: 2041–2050). Its goal is to successfully afforest 526.24 million mu (35.083 million ha) by 2050 (including a forest belt and a transitional forest zone), of which 395.56 million mu (26.371 million ha) is to be manual afforestation, 16.71 million mu (1.114 million ha) is aerial afforestation, and 113.97 million mu (7.598 million ha) is "closed mountain reforestation". The program will also plant 5.25 billion trees on the borders of household agricultural plots, and aims to increase the forest coverage rate in program areas from the original 5.05 percent to 14.95 percent.⁸

⁹ These are termed "four-sided trees" in China forestry statistics.

According to SFA reports, over the last 30 years the program has successfully afforested 367 million mu (24.47 million ha), controlled desertification on more than 450 million mu (30 million ha) of land area, controlled soil erosion on more than 300 million mu (20 million ha) of land area, developed a forest zone on 58.64 percent of agricultural land in program areas and increased forest coverage rates from 5.05 percent to 6.62 percent. More than 5 billion labor days have been invested in the program by local farmers over the past 30 years, valued at more than RMB 4.7 billion.

The program currently encompasses 551 counties/districts/cities in 13 provinces, with total plan area of 6.103 billion mu (406.9 million ha), some 42 percent of China's total land area. The current plan period (2001-2010) aims to afforest an additional 142.5 million mu (9.5 million ha), of which 94.53 million mu (6.302 million ha) is manually afforested area, 29.05 million mu (1.937 million ha) is "closed-mountain reforestation," and 18.91 million mu (1.261 million ha) is aerial seeding afforestation. The goal is also to increase the forest coverage rates in the new program areas from 8.63 percent to 10.47 percent. According to the government plan, the total estimated budget for the current plan period is RMB 35.412 billion, of which RMB 25.159 billion will be from the central government (RMB 13.757 billion of which is for afforestation work).

The current plan also aims to develop a stable mechanism of investment, create tax benefits and credit support, to provide support to all individuals and organizations involved in anti-desertification and sandstorm prevention, to ensure the legal rights and interests of those involved in this work, and to rationally develop and use the resources of sandstorm source regions. As part of this, the central government will provide three types of financial incentives for anti-desertification and sandstorm prevention: (1) Regarding investment, to make national investment the primary source of funding, with each subsequent level of government continuing to invest in anti-desertification and sandstorm prevention, and to continue to focus on anti-desertification and sandstorm prevention in the formulation of capital construction funds in the national debt and central budget; (2) In terms of tax revenue, bodies and individuals investing in anti-desertification and sandstorm prevention will be completely tax exempt during the investment phase, and will be given some tax exemptions and reductions upon realizing clear, positive results; (3) In terms of credit, the government will continue to provide reductions of interest for loans that are in accordance with regulations relating to anti-desertification and sandstorm prevention, will appropriately loosen the conditions for anti-desertification and sandstorm prevention loans, and will increase small loans to individual farmers and rural group loans, to support the welfare of those involved in this work.

Evidence suggests that these financial incentives are successfully encouraging some private sector investment into anti-desertification work. An example of this, described as a "first effort" by Chinese business leaders to halt desertification in the Gobi Desert, is Society Entrepreneur Ecology (SEE), a private sector environmental NGO in China which began a number of projects in 2004 in the Arlarshan Plateau of Inner Mongolia.⁹ These projects are addressing various dimensions of anti-desertification work, including technical capacity building and improving options for local livelihoods.

SOURCE: China Green Times, 2008b & 2008c; State Council, 2005; SFA, 2006; Zhou, 2005. SFA, 2001.

Beijing-Tianjin Sandstorm Source Control Program

This afforestation/forest management program was initiated in 2000 to combat worsening sandstorms in northeast China due to desertification caused by human encroachment onto fragile ecosystems. The current plan from 2000–2010 has a budget of RMB 50 billion, with the Beijing city government

¹⁰ Their website: <http://see.sina.com.cn/en/index.shtml>

planning to invest RMB 3.9 billion of this. The scope of the program encompasses 75 counties/districts in the 5 provinces of Beijing, Tianjin, Hebei, Shanxi and Inner Mongolia. In Beijing, the program involves the six counties/districts of Mentougou, Changping, Yanqing, Huairou, Miyun and Pinggu. In addition to afforestation activities, the program also involves the mandatory resettlement of households living in areas near fragile ecosystems, with resettlement subsidies of RMB 10,000/person, 50 percent of which is from the central government, and 50 percent of which is from city and regional governments. In 2005, this was increased to RMB 14,500/person. It would appear that various local governments are developing PES initiatives within the framework of this program. For example, Beijing established a mountain-area afforestation/reforestation eco-compensation mechanism in 2004, with annual expenditures of RMB 190 million, and involving the hiring of 40,000 rural workers in soil erosion, afforestation and forest management work.

According to SFA data sources, by the end of 2007 the program has in total afforested 47 million mu (3.13 million ha) of land and spent RMB 19.89 billion. By the end of 2004, Beijing had already invested RMB 884.07 million, afforested more than 3.83 million mu (255,333 ha), planted grass on 200,000 mu (13,333 ha), established 3832 water-resource-saving offices, and conducted integrated small-watershed management on 482.5 km². In 2005, Beijing completed afforestation on 170,000 mu (11,333 ha), established 882 water resource saving offices, and conducted integrated small-watershed management on 290 km². A total of 2000 people had been resettled by the end of 2004, with an additional 2000 added to the plan in 2005.

SOURCE: SFA, 2005 & 2008h; Xinhua News Service, 2005b; Beijing Modern Business News, 2005.

III.4 NATURAL FOREST PROTECTION PROGRAM (NFPP)

This program was initiated in 1998 in response to major floods in the upper and middle Yangtze River watershed and the Songhua and Nen Rivers in Northeast China, which were attributed to, or exacerbated by, over-logging in state forest areas. The pilot phase of the program was during 1998–2000, while full implementation is during 2000–2010. The NFPP encompasses key forest areas in 163 public forestry departments, 734 counties and 17 provinces in the upper Yangtze River watershed, upper and middle Yellow River watershed, and in northeast China and Inner Mongolia. Upper Yangtze River watershed areas are those above the Three Gorges Dam reservoir, which includes the provinces of Yunnan, Sichuan, Guizhou, Chongqing, Hubei and Tibet. Yellow River upper and middle watershed areas are those affecting the Xiaolangdi Reservoir, including the provinces of Shaanxi, Gansu, Qinghai, Ningxia, Inner Mongolia, Shanxi and Henan. Other targeted key state forest areas are in the provinces of Inner Mongolia, Jilin, Heilongjiang, Hainan, and Xinjiang. Total forest area targeted is 1.023 billion mu (68.2 million ha), 846 million mu (56.4 million ha) of which are natural forests, 53 percent of China's natural forest area.

The current plan, for 2000–2010, has the ultimate aim of restructuring the state forest sector so as to place greater emphasis on the economic and environmental sustainability of forest resource management, both for timber production and ecological conservation. For the upper Yangtze River watershed and the upper and middle Yellow River watershed, tasks/goals include the following; effectively protect 918 million mu (61.2 million ha) of current forests; reduce consumption of forest resources by 61.08 million m³/year; reduce commercial harvests by 12.39 million m³/year; increase forest cover rate in program areas by 3.72 percentage points; and reposition and/or lay off with settlement 25,600 redundant workers. For northeast China and Inner Mongolia, key tasks/goals include the following: reduce harvests by 75.15 million m³/year; implement effective protection and management of 495 million mu (33 million ha) of forest area; appropriately reposition or lay off with

settlement 48,400 redundant forestry workers; shift the production structure for forestry enterprises to make them more environmentally and economically sustainable.

To implement these goals, the NFPP stipulates the payment of subsidies by the central government to participating bureaus and local forest authorities for various environmental and social tasks. For all program areas, RMB 10,000/person/5,700 mu (380 ha)/year is paid for forest management. For the Yangtze River upper watershed and the Yellow River upper and middle watershed, subsidies for afforestation/reforestation tasks will be paid as follows: Reforestation via mountain closure — RMB 70/mu (RMB 4.67/ha), disbursed as RMB 14/mu/year (RMB 0.934/ha/year) for 5 years; Aerial Seeding Afforestation — RMB 120/mu (RMB 8/ha) for near mountain areas, RMB 50/mu (RMB 3.3/ha) for remote mountain areas; Manual Afforestation — RMB 200/mu (RMB 13.3/ha) for the upper Yangtze River watershed, RMB 300/mu (RMB 20/ha) for the upper and middle Yellow River watershed. Regarding social expenditures, in all program areas, central government fees of RMB 12,000/person/year will be paid for educational expenses, RMB 15,000/person/year will be paid for public security, and for health expenditures (i) RMB 6,000/person/year and (ii) RMB 2,500/person/year will be paid for (i) upper Yangtze River watershed and upper and middle Yellow River watershed program areas and (ii) northeast China and Inner Mongolia program areas, respectively. In all program areas, one-time settlements for layoffs will be 300 percent of the previous year's average salary. Other subsidies are also stipulated for forest nursery establishment, elderly care, to offset reductions in local revenues, forest fire prevention, and technical support.

The Total program budget for 2000–2010 is RMB 96.2 billion, of which the central government will provide RMB 78.4 billion. Of this, investments to the Yangtze River upper watershed and the Yellow River upper and middle watershed are to be RMB 53.3 billion in total, of which RMB 42.6 billion is from the central government. Investments to key forest areas in northeast China and Inner Mongolia are to be RMB 42.9 billion total, of which RMB 35.8 billion is from the central government. Apart from this, the central government invested RMB 11.48 billion during the pilot stage (1998–1999), and central finances also have added a special fund of RMB 17.08 billion. According to available sources, problems in forest enterprise financial institution debt have also been resolved as part of the program. To the end of 2007, RMB 66.67 billion has already been invested in total, with RMB 61.778 billion coming from the central government and RMB 488.8 million from local matching funds. From 1998 to the end of 2008, cumulative central government investment stands at RMB 90.885 billion.

According to available plan reports, by the end of 2007 the 13 participating provinces in the upper Yangtze River watershed and the upper and middle Yellow River watershed had completely halted all commercial harvesting of natural forests, and other key state forest area (e.g. Inner Mongolia and Northeast China) reduced timber harvesting from 18.54 million m³/year in 1997 to 12.13 million m³/year. In addition, 1.43 billion mu (95.3 million ha) of forest area is being effectively protected and managed, and in total 243 million mu (16.2 million ha) of "public benefit" forest area has been established, of which 77.9 million mu (5.19 million ha) is area afforested via aerial-seeding and 164.97 million mu (10.998 million ha) is area reforested via mountain closure. Also, 67,500 redundant workers have so far been repositioned or laid off with settlement (not including the pilot period). Based on inspections of 35 forest enterprises, forest bureaus and forest farms have made a gradual shift in structure from a 42 percent/38 percent/20 percent tertiary/secondary/primary industry mix in 2003, to 51 percent/27 percent/22 percent currently.

In terms of ecological impacts, plan reports indicate that the forest ecology in program areas has clearly improved, forest resource consumption has been reduced by a cumulative total of 426 million m³ since the program began, while forest volume has seen a net increase in 460 million m³. Waterborne siltation in Hubei Province's Yichang section of the Yangtze River has been reduced by 30

percent in comparison to 10 years ago, with a rapid decrease of 10 percent annually. Inspections by the Shanxi Provincial Water Bureau have found that flow-through siltation load in the Yellow River has been reduced by 200 million tons/year. In upper watershed of the Yangtze River, which constitute important repositories of biodiversity, Giant Panda numbers have increased by 1000 since the 1980s, to more than 1590. In northeast forest areas, the northeast tiger has been spotted after many years of no sightings. Populations of Golden Monkeys and other national level-one protected species are also continuously increasing.

SOURCE: SFA, 2008b; SFA, 2008c.

III.5 OTHER FOREST-RELATED PROGRAMS/POLICIES

Forest Vegetation Restoration Fee

Article 18, Chapter 2, of the *Forest Law of the P.R.C.* (1998) stipulates that developers (e.g. mining, infrastructure and other construction projects) who must conduct their operations on land zoned as forest area (i.e. after first following the principal of avoiding operations if possible and minimizing their use and impact on forest area), pending approval from county or higher level forest management authorities and in accordance with the relevant land management laws, are to be levied a “Forest Vegetation Restoration Fee”, to be used by the relevant forest management authorities for afforestation and forest vegetation recovery for an area no less than that taken up by the developer’s operations. The *Forest Vegetation Restoration Fee Levy, Use and Management Provisional Measures*, established in 2002, as well as providing various other stipulations detail the following fee structure based on the SFA’s forestland zoning system: timber forestland, economic forestland (for orchard crops and trees of medicinal value), firewood and charcoal forestland and sapling nursery forestland — RMB 6/m²; non-mature plantation forests — RMB 4/ m²; protected or special-use forestland — RMB 8/m²; National key protected or special-use forestland — RMB 10/m²; sparsely forested land or scrubland — RMB 3/m²; land suitable for forest, harvested forestland or land affected by forest fire — RMB 2/m²; city-level and municipal zoned land can levy double the above fees. The SFA has indicated that the fee, through which a total of RMB 8.044 billion was collected during 2003–2005, is an important source of finance for its afforestation and conservation work. Furthermore, though the policy stipulates a common fee structure, the general structure of the central policy allows for local-level innovations on how the unavoidable impacts of development activities on ecosystems can be “offset”. This suggests that a policy framework already exists in China for the potential future development of biodiversity offsets or similar market-based mechanisms.

SOURCE: PRC, 1998; MoF, SFA, 2002.

CHAPTER IV

SOIL CONSERVATION AND EROSION PREVENTION

Soil erosion control and prevention remains an important goal of the government. It is estimated that soil erosion affects 360 million hectares of land in China, some 38 percent its total area, more than three times the world average (SFA, 2003; Huang, 2000). Around 8 percent of the country's cultivated land is estimated to be affected by "intensive" water erosion, and another 26 percent is affected by "light to medium" erosion (Yang, 1994). Southwest China (containing the upper watershed of the Yangtze River) and the Loess Plateau (containing the upper watershed of the Yellow River) alone are estimated to contain 25 percent and 22 percent, respectively, of China's eroded cropland, and fully 39 percent and 19 percent, respectively, of China's cultivated area affected by "intensive" erosion. The benefits of erosion control in China (calculated in terms of the reduced costs of cleaning irrigation canals and reservoirs and the higher yields due to better water management) have been calculated to be as high as RMB 3.9 billion per year, with the net present value of reducing soil erosion to be RMB 50 billion (Mackinnon and Xie, 2001; Ning and Chang, 2002; Xu *et al*, 2005). In general, the Ministry of Water Resources that has been the key management authority for much of the soil erosion control and prevention work, including a long-standing focus on "integrated small-watershed management."

As detailed in Table 4, further work needs to be done to quantify estimated expenditures of such work, but they are likely to be huge, since most of these policies (e.g. The "four wastelands" policy and soil erosion control fees and soil and water conservation installation compensation payments) are being implemented throughout China on a large scale.

Table 4 — China's Soil Conservation and Erosion Prevention Programs

PROGRAM	SUMMARY	SIZE
"FOUR WASTELANDS" POLICY (4W)	Policy stipulating that "wasteland" may be contracted to farmers for use in agriculture or horticulture, whereby farmers are given rights to the economic gain of crops, trees or grasses planted, but with the stipulation that the contractee control soil erosion and conserve soil and water on the contracted land.	Size of the program is likely to be huge both in terms of land area and revenue generated for local governments and participating farmers, as well as in terms of imputed labor costs of soil erosion prevention.
SOIL EROSION CONTROL FEES AND SOIL AND WATER CONSERVATION INSTALLATION COMPENSATION PAYMENTS	Policy framework detailing the rights and responsibilities of developers regarding the impact of projects on soil erosion and local watersheds, and stipulating fees to be levied at national and local level for soil erosion prevention and soil and water conservation work.	No available information, though likely huge in terms of revenue generated and land area involved, since this policy encompasses all of China.

**YANGTZE RIVER UPPER
WATERSHED WATER AND
SOIL CONSERVATION AND
KEY PREVENTION
PROGRAM**

Long-term Yangtze River Upper Watershed management policy framework. Some PES or PES-like components.

As of 2004, more than RMB 15.929 billion spent for management of soil erosion on over 8 million ha.

IV.1 THE WASTELAND DEVELOPMENT POLICY ("FOUR WASTELANDS" POLICY)

Although the government's emphasis on "eco-compensation" most likely stems from the Conversion of Cropland to Forests and Grassland Program (CCFG) and the Forest Ecosystem Compensation Fund (FECF), in reality an earlier policy is most likely the first "PES-like" policy regarding land use in China. This is the government's wasteland development policy. Also known as the "Four Wastelands" policy (*sibuang zhengce* — the four wastelands are waste flatland, waste mountains/hills, waste gullies and sandy wastes), the roots of this began in the 1980s, when as part of the household responsibility system reforms regarding agricultural land rights, villages began to informally contract out wasteland for development by farmers (Ho, 2005). The Water and Soil Conservation Law of the P.R.C. (1991) formalized the contracting and development of wasteland and added stipulations that the contractor is responsible for reducing soil erosion on the contracted wasteland, and that reclamation of land with slopes over 25° for cultivation of crops is prohibited. The law also states that all trees planted as part of land rehabilitation, as well as the fruits there from, belong to the contractor (PRC, 1991). In response to rapid proliferation of local wasteland auctions, which had first begun in various locales in the early 1980s, the central government issued the Notice on the Strengthening Soil and Water Conservation through the Control and Development of Rural 'Four Wastelands' in 1996 (State Council, 1996a). Though some claim that the policy has been a failure, due to unequal access to land resources due to wealth and the village political economy, the inventory work has found a number of articles that have referred to examples of "Four Wastelands" auctions as a means to address soil erosion. It would thus appear that the government's eco-compensation drive is potentially breathing new life into this policy. It is also interesting to note the striking similarities between this policy and the CCFG, especially given that policymakers are currently considering how to conduct auctions for CCFG.

IV.2 SOIL EROSION CONTROL FEES AND SOIL AND WATER CONSERVATION INSTALLATION COMPENSATION PAYMENTS

China's central government water and soil conservation regulations have provided a framework from which provincial and local governments have developed a plethora of regulations governing the levy of fees from developers whose activities impact soil erosion, and the use of these fees for soil erosion prevention and control measures. In particular, Article 27, Section 1, of the *Water and Soil Conservation Law of the PRC*, stipulates that enterprises and business units are responsible for adopting measures to prevent soil erosion during their construction and production activities, and that all erosion created by these activities are the responsibility of these units to control. If they do not have the capacity to control this soil erosion, then the relevant water management authority will take responsibility, with the soil erosion control expenses being the responsibility of the enterprise or business unit that created the erosion (PRC, 1991). In addition to this, Article 19 of the *Water and Soil Conservation Law of the PRC Implementation Regulations* states that soil erosion control fee levy and use standards are to be set by provincial-level and above finance bureaus, pricing authorities and

water management authorities. Article 21, furthermore, states that enterprises and business units that damage or destroy water and soil conservation facilities during construction or production activities must pay compensation (State Council, 1993). These, taken together, have provided a framework from which provincial governments have developed local stipulations for the levy and use of “Soil Erosion Control Fees” and “Water and Soil Conservation Installation Compensation Payments.”

IV.3 OTHER SOIL CONSERVATION AND EROSION PREVENTION PROGRAMS

Yangtze River Upper Watershed Water and Soil Conservation and Key Prevention Program

Launched in 1989, as the name indicates the key concern of this large-scale Ministry of Water Resources (MWR) program is the control and prevention of soil erosion in the upper Yangtze River watershed. When first launched, the program encompassed 61 counties/cities/areas in the 7 provinces/municipalities of Sichuan, Yunnan, Guizhou, Gansu, Shaanxi, Hubei and Chongqing. It has since been expanded to 183 counties/cities/areas and the 3 additional provinces/municipalities of Hunan, Jiangxi and Henan. Program components include the development of integrated management frameworks, such as the State-Council-approved establishment of the *Yangtze River Upper Watershed Water and Soil Commission* — consisting of the MWR, State-Council-related ministries and commissions, the relevant provincial and local government representatives, and the *Yangtze River Water Resources Commission* — as well as developing local-level measures to improve land-use practices and control soil erosion, which suggest that possible PES-like elements exist in local-level implementation. These elements could include contracting afforestation and work preventing soil erosion on sloping land to rural households as part of the MWR’s ongoing “Small-Watershed Integrated Management” work. Other local measures involve improved livestock management practices, conservation tillage, improved sloping land water systems to ensure better water use for agricultural production, and integrated management of “mountains, water, forests, fields and roads.” Overall, the program has been implemented under the guidelines of “Interconnected protection, adaptation to local conditions, integrated management, key breakthroughs and enthusiastic promotion, with prevention being the focus”. The program also calls for “ceaseless” innovation of management models and investment mechanisms, allowing for social (private sector) funding for soil and water conservation. At present, it is recommended that an eco-compensation mechanism between lower and upper watershed areas of the Yangtze River be established as part of this program. According to government reports, as of 2004 the program has spent more than RMB 15.929 billion, and is controlling soil erosion on more than 8 million ha of land, as well as providing benefits to the hundreds of millions of households that depend on the Yangtze River.

SOURCE: Xinhua News Agency, 2004; MWR, 2006b; Yangtze Water Resource Net, 2008 & 2004.

CHAPTER V

ECOAGRICULTURAL PROGRAMS

China's 11th 5-year plan (2006–2010) emphasizes reducing the environmental impact of agriculture, which includes control of non-point source pollution, development of rural renewable energy sources and a “circular economy”, development of the production base for green and organic foods, greater adoption of water-saving and conservation agriculture and the promotion of “ecological agriculture” (*shengtai nongye*), which denotes a combination of adoption of environmentally-beneficial integrated traditional and modern scientific techniques, rural economic development and environmental improvement. China's Ministry of Agriculture (MoA) has responded with a number of programs that include either direct subsidies to rural households or contain the basis for the development of markets for ecosystem services. The wording of policy documents also suggests that MoA officials are cognizant of, and interested in taking advantage of, international market trends in organic agriculture as well as post-2012 climate change agreement opportunities regarding ‘agricultural landscape carbon’. As documented in Table 5 (below), current total expenditures in these programs are at least, and likely much greater than, RMB 56 billion, with these potentially affecting hundreds of millions of rural households.

Table 5 — China's Ecoagricultural Programs

PROGRAM	SUMMARY	SIZE
NATIONAL GREEN AND ORGANIC FOOD CERTIFICATION SYSTEM	Developing framework for certifying low-pesticide and fertilizer use and organically grown agricultural goods.	Large and growing, though exact numbers are not readily available.
DALIAN CITY, LIAONING PROVINCE, GREEN AGRICULTURE SUPPORT SUBSIDY	A range of subsidies to encourage the development of a local green and organic agricultural production capacity.	Numbers on the program's total budget, or the number of farmers that have benefited from these subsidies, are not available.
SHANGHAI ORGANIC FERTILIZER SUBSIDY	Subsidy to encourage greater use of organic fertilizers.	Size of the program has expanded from use of 15,000 tons of organic fertilizer on 100,000 mu (6,667 ha) in 2004, to 120,000 tons of organic fertilizer on 600,000 mu (13,333 ha) in 2006. From 2004-2006, total of RMB 56.25 million in subsidies spent.
BEIJING ORGANIC FERTILIZER SUBSIDY AND SAFE PESTICIDES SUBSIDY	Subsidies to encourage greater use of organic fertilizers and safe pesticides.	RMB 20 million invested in 2007 for subsidizing the use of 75,000 tons of organic fertilizer used on 200,000 mu (13,333 ha) of grain fields in 13 counties in Beijing.

NATIONAL VAT TAX EXEMPTION FOR ORGANIC FERTILIZER USE	VAT tax exemption for organic fertilizer production.	Numbers on the size of total tax exemptions unavailable.
RURAL BIOGAS DEVELOPMENT	A central policy framework involving both central and local-government subsidies to encourage households to install and utilize biogas generators.	Central government investments of RMB 12+ billion from 2003 through 2008. Provincial and local government investments of RMB 1.5 billion in 2006 alone. Program activities during 2004 through 2008 encompassed counties and 98,600 villages, with 10 provinces issuing complementary policies. A cumulative total of 26.23 million household biogas stoves installed by the end of 2007. The program aims to have a total of 40 million household stoves installed by the end of 2010.
PROMOTING CONSERVATION TILLAGE	Subsidies to promote conservation tillage and no-tillage farming practices to conserve water, reduce soil erosion and reduce agricultural emissions.	Central government investment of RMB 170 million from 2002 through 2007, with matching local government investments of RMB 1.78 billion. Enrollment of 30.62 million mu (2.04 million ha) of conservation tillage area, and almost 100 million mu (6.67 million ha) of no-tillage area. Project encompasses 15 northern provinces.

V.1 NATIONAL GREEN AND ORGANIC FOODS CERTIFICATION SYSTEM

China's green and organic food movement has developed rapidly in recent years, with a number of competing standards managed by different ministries, most notable the Ministry of Agriculture (MoA) and the Ministry of Environmental Protection (MEP). China's movement towards developing organic agricultural systems began in 1989 when the Rural Ecology Sector of the Nanjing Institute of Environment Sciences of the State Environment Protection Administration joined the International Federation of Organic Agricultural Movements (IFOAM) as the first member from China. The following year, the MoA established its "green foods" certification system, with the following three years devoted to developing the standards, certification regime, the establishment of the Green Foods Development Center and the *Green Foods Label* in 1992. Information on the MoA's certification system can be found on the Green Foods website (<http://www.greenfood.org.cn/sites/MainSite/>). Contrary to what is implied by its name, the MoA's *Green Foods Label* is not strictly organic, but rather signifies food that is produced with low use of chemical fertilizer and pesticide. Below *Green Foods* is the less restrictive *Non-Public-Harm* agricultural products certification, which indicates that food has been grown in healthy environmental conditions with acceptable levels of chemical pesticide and fertilizer use.

In competition with these standards, the Ministry of Environmental Protection launched its own "organic food" certification system in 1994, which was IFOAM accredited and was in line with what would be recognized as "organic" internationally. The Organic Foods Development Center (<http://www.ofdc.org.cn/>) was also launched as part of this process. In response to the MEP's standard, the MoA differentiated its *Green Foods Label* into "A" and "AA" classes in 1996, with the "AA"

class generally denoting what would be as accepted as “organic” internationally, and in 2003 the MoA launched the China Organic Food Certification Center (COFCC) (<http://www.ofcc.org.cn/sites/ofcc/>) which certifies its own organic standard. In the most recent stage of this process, the Certification and Accreditation Administration of China (CNCA) was authorized by the State Council in 2002 to be responsible for the administration of all organic certification and accreditation in China.

The CNCA organized the establishment of the China National Organic Products Standard (CNOPS) (which includes both an *Organic* and a *Conversion to Organic* standard), which was officially issued and implemented in 2005 as China’s main organic standard. The Standard is based on the IFOAM Basic Standard. It introduces requirements based on the ISO 90012000 Quality Management System, is compatible with Codex Alimentarius, EU Regulation 2092/91, the US Department of Agriculture’s National Organic Program (NOP) and the Japanese Agricultural Standard (JAS). The national standard and regulations now have the main role of regulation and supervising the organic sector, including certification, consultation, and operational practices. According to the IFOAM website, the CNOPS is among the most stringent organic standards in the world, since it complies with many foreign standards. Currently, the China National Accreditation Board (CNAB) is in the process of evaluating and accrediting all institutions involved in organic certification in China, and has approved 29 control bodies as of 2006. Most foreign CBs are starting different cooperation methods with Chinese partners so as to get approval from CNCA (IFOAM, 2008). In the backdrop of this has been the fast growth of the organic food sector in China, primarily for export but also increasingly for domestic consumption. In response to this, both the central and local governments have been developing a range of policies, including subsidies and other financial incentives, to facilitate the development of green and organic agricultural good industries. A selection of these is presented below.

V.2 SUPPORT PROGRAMS FOR GREEN AND ORGANIC AGRICULTURE

Dalian City, Liaoning Province, Green Agriculture Support Subsidy

In 2003, Dalian City in Liaoning Province implemented this subsidy policy to support the establishment of “ecological” and high-efficiency agriculture in Shunkou District. Between 2003 and 2005, the following subsidy structure was implemented:

- A one-time subsidy of RMB 5,000/mu (RMB 75,000/ha) for newly developed high efficiency flower and plant garden contiguous greenhouse facilities of “common plan and matching high-efficiency production standard” of area 50 mu (3.33 ha) and up;
- A one-time subsidy of RMB 4,000/mu (RMB 60,000/ha) for newly developed contiguous greenhouse facilities with area 50 mu (3.33 ha) and up in “green vegetable” agricultural zones;
- A subsidy of RMB 180/mu (RMB 2,700/ha) for 3 years for just-developed centralized or contiguous “high-quality” fruit orchards with area 200 mu (13.33 ha) and up;
- A one-time subsidy of RMB 2,000/mu (RMB 30,000/ha) for just-being-developed area converted from “protected vegetable land” to flower and plant gardens with area 20 mu (1.33 ha) and up;
- A one-time subsidy of RMB 200/mu (RMB 3,000/ha) for water-saving irrigation areas that mainly use sprinkler or drop irrigation with area of 100 mu (6.67 ha); and
- A one-time subsidy of RMB 20,000–100,000 (depending on the specific case) for special agricultural products that have been successfully enrolled in and have received the right to use “non-public harm”, “green food” or “organic food” agricultural goods labels, or that have obtained the title of provincial-level or national-level high-quality agricultural good and have received the provincial “Famous Brand” or national “Becoming Famous” mark.

SOURCE: China Environmental Report, 2003.

Shanghai Organic Fertilizer Subsidy

To reduce the local watershed, public health and ecosystem impacts of chemical fertilizer use, Shanghai City initiated a policy in 2004 promote greater use of organic fertilizer in its peri-urban agricultural zones. The policy provides a subsidy of RMB 250/ton for organic fertilizers, so that farmers pay only RMB 150/ton (as of the time of the article, in 2006). In 2004, Shanghai promoted the use of 15,000 tons of organic fertilizer for use on less than 100,000 mu (6,667 ha) of agricultural land in Shanghai's peri-urban area. In 2005, this increased more than sixfold, to 90,000 tons of organic fertilizer used on 500,000 mu (33,333 ha) of paddy rice fields and 100,000 mu (66,667 ha) of vegetable fields across 103 villages and township in Shanghai's periphery. In 2006, this increased to 120,000 tons of organic fertilizer on 600,000 mu (40,000 ha) of paddy rice fields and 200,000 mu (13,333 ha) of vegetable fields. Moreover, there are now around 40 enterprises in the city that each produces at least 1,000 tons of organic fertilizer annually, for a total annual production of 300,000 tons. In 2005, the Shanghai Municipal Finance Bureau invested RMB 22.50 million in the program. In 1950, chemical fertilizers made up only 3 percent of total fertilizer used in Shanghai's peri-urban agricultural sector. By 1988 this increased to 8 percent, with subsequent impacts on the watershed and greater pest resistance.

SOURCE: Eastern Rural-Urban Report, 2006.

Beijing Organic Fertilizer and Safe Pesticide Subsidies

Beginning in 2007, Beijing has begun to promote greater use of safe pesticides and organic fertilizers in its agricultural regions. The "Pesticide Use Subsidy" and the "Empty Bottle (Bag) Recovery" stipulate that as long as farmers in Beijing use safe pesticides and organic fertilizers recommended by the relevant departments, the city government will give them a corresponding subsidy. The program's current round encompasses 13 types of biological pesticides, 4 types of bionic-pesticide, and 8 types of organic fertilizer. In 2007, the Beijing city government earmarked RMB 20 million for subsidizing the use of 75,000 tons of organic fertilizer. The subsidy is RMB 250/ton, so that farmers need only pay around RMB 150/ton (there was some confusion in different news articles, since one claimed that the subsidy rate was RMB 250/mu (RMB 3,750/ha) for organic fertilizers). For safe pesticides, the subsidy is not in cash, but rather as a refund sent to a bank account with an account card (a virtual-money IC card). Upon returning the empty bottle or bag to the original sales location, farmers are given 70 percent-80 percent of the cost of the pesticide via a direct transfer to their IC-card account. According to news reports, the subsidy can be at maximum RMB 120/mu (RMB 1,800/ha) for safe pesticides.

The program is currently being implemented on 200,000 mu (13,333 ha) of grain fields in 13 counties, 104 townships (including Pinggu, Miyun and Daxing), and 483 villages in Beijing Municipality. The program covers 10 important vegetable production townships, 21 key vegetable production bases, 5736 rural households, and has already involved sales of around RMB 700,000, with the bottle/bag return rate of 95 percent, and total subsidies received by rural households of RMB 632,000. The program also provides technical support, with a service staff of 30 people. This program is available to the 200,000 farmers in Beijing and its surrounding areas. Pesticide residue and use of chemical fertilizers is a major factor affecting the safety of farm produce in China. Use of chemical fertilizers is also reducing soil fertility and creating soil nutrient imbalances. A land survey in 2005 of the peri-urban agricultural areas found that land was often lacking in potassium, which was attributed to the heavy nitrogen and phosphorous fertilizer use and light organic and potassium fertilizer use resulting from continued emphasis on increasing yields.

SOURCE: Beijing Urban-Rural Economic Information Net, 2007b; Liu, 2007; BJMBA, 2007.

National VAT Tax Exemption for Organic Fertilizer Use

In 2008, the Ministry of Finance and the State Administration of Taxation jointly issued *Notice Regarding VAT Tax Exemption for Organic Fertilizer Products*. Effective June 1, 2008, this policy makes retail and wholesale organic fertilizer and non-organic compound fertilizer products in China exempt from the VAT tax. The Ministry of Agriculture and the relevant local level agriculture authorities will be responsible for measurement and verification for the exemption. No information is provided in available sources regarding the environmental goals of this program.

SOURCE: MoF & STA, 2008; STA, 2008.

V.3 OTHER ECOAGRICULTURAL PROGRAMS

Rural Biogas Development

Although China has invested in biogas development since 1979, the pace of development has accelerated rapidly in recent years as part of the government's drive to transition to cleaner and more sustainable sources of energy. During the 10th 5-year plan period (2001–2005), a total of 9.59 million rural household biogas generators were installed in China, 5.1 times the total number installed during the period of 1979–2000 (MoA, 2007a). Currently, China's 11th 5-year plan and both the Renewable Energy Law and the Clean Energy Law of the People's Republic of China (PRC) emphasize the development of renewable energies such as biogas and solar power in rural China. The current government program raises funds via government treasury bonds to finance rural household biogas development, via the National Debt Program. Households that participate in “one biogas generator, three reforms” arrangement, which consist of restructuring the kitchen and household sanitation in addition to installing a biogas generator to create a circular system of resource use, receive a one-time subsidy from the central government. Central government one-time subsidies to households are set at RMB 1,200 in north China, RMB 1,000 in southwest China and RMB 800 elsewhere (MoA, 2003).

The National Debt Program expanded the scope of and sped up the popularization of biogas. From 2003 to the end of 2005, the government spent RMB 5.5 billion raised via sales of these government treasury bonds to install 5.73 million household biogas generators in 48,000 villages, and raised RMB 93.85 million to install 98 large and medium-scale biogas generator programs. From 2004 to mid-2008, the government invested RMB 10.5 billion from government treasury bond sales. In 2007, program investments were RMB 7.93 billion, of which RMB 2.4 billion was from the central government, RMB 0.85 billion was from local government, and RMB 4.68 billion was from rural households. In 2008, the government invested RMB 2.52 billion.

The plan also calls for accompanying local funds and support. In response, more than 10 provinces have issued policies and opinions on how to accelerate the development of rural biogas, and along with various local governments have added their own supporting policies and subsidies for biogas development. Examples include (MoA, 2007b-f):

- A Heilongjiang Province subsidy of RMB 1,200;
- A Guizhou Province subsidy of RMB 300;
- A RMB 1,200 county subsidy and RMB 500 township subsidy in Anxi County, Taozhou Township, Fujian Province;
- A county subsidy of RMB 1,000 in Linyi County, Shandong Province;
- A RMB 500 county subsidy in Zezhou County, Shanxi Province.

According to statistics, financial support from localities in developing rural biogas exceeded RMB 1.5 billion in 2006. Of this, Shanxi, Heilongjiang, Hubei, Hunan, Guangxi, Yunnan and Guizhou provincial-level investment exceeded RMB 80 million.

By the end of 2006, around 22.6 million household biogas generators have been installed, and by the end of 2007 26.23 million had been installed, accounting for more than 15 percent and 18.3 percent, respectively, of all rural households for which biogas generation is deemed viable by the government (MoA, 2007a; Xinhua News Agency, 2008a). From 2004 through 2008, program activities have encompassed 6,417 counties and 98,600 villages, with benefits accruing to 10.64 million rural households. In addition to national funds, the government is also utilizing over US\$150 million in Asian Development Bank loans in over 270 medium and large-scale projects in 7 provinces for developing rural energy and improving the environment. The current biogas development plan is also using a US\$120 million loan from the World Bank for linking household economic development and biogas utilization in 5 provinces and municipalities, which will benefit more than 500,000 rural households.

The government's current rural biogas development policy's goal is to have 40 million rural household biogas generators (~30 percent of all rural households for which biogas is viable) and 4,700 medium and large-scale manure biogas generators (to be present in 39 percent of all cattle/pig/poultry yards/facilities nationally) by 2010. In addition to improving rural energy efficiency and adoption of clean energy, the biogas program also aims to reduce the impact of farm and household waste on key watersheds and aquifers. This can be seen in the program's focus on developing biogas in CCFG program areas, water resource protection areas along the South-North Water Transfer Project and reservoir areas.¹⁰ It is estimated that when program targets are reached, some 15.4 billion m³ of biogas will be produced annually, equivalent to the consumption of 24.2 million tons of standard coal or 140 million mu (9.3 million ha) of forestland. It is estimated that by generating biogas from waste, rural households will reduce by 20 percent or more the use of pesticides and fertilizers and reduce fuel, electricity, pesticide and fertilizer costs by around RMB 500, which would mean an overall estimated savings of RMB 20 billion annually (MoA, 2007a; MoA, 2007b).

Promoting Conservation Tillage

China has been researching conservation tillage since the early 1990s. In 2002, the central government initiated the "Conservation Tillage Demonstration County Development" project. From 2002 to the end of 2007, the central government has invested RMB 170 million in the project for the enrollment of 30.62 million mu (2.04 million ha) of conservation tillage area and almost 100 million mu (6.67 million ha) of no-tillage seeding area. The project currently encompasses 15 northern provinces, 173 national-level and 328 provincial-level demonstration counties. Government reports claim that conservation tillage land has increased annual grain harvests by 400,000–1.2 million tons, and has annually reduced provincial use of water for irrigation by 1.2 to 1.8 billion m³, reduced dust from farmland by 600,000–1.2 million tons, reduced soil erosion by 30–60 million tons, and reduced greenhouse gas emissions by 1.24–2.59 million tons of CDE. In *The Ministry of Agriculture's Views on Enthusiastically Developing Conservation Tillage*, the MoA stresses greater investment at all levels of government in promoting conservation tillage through current agricultural machine subsidy policies and other related funds, in order to guide and support rural households in purchasing advanced conservation tillage machines and farm implements, and to bring into play central government, local government, private sector and rural household actors to build multi-channel, multi-level and multi-source funding mechanisms for this work. In response, various local governments have created policies which provide subsidies to farmers to encourage the development of conservation tillage. One example is a recent policy in Beijing that provides annual subsidies of RMB 2/mu

¹¹ The program also supports biogas development in key grain production areas, key husbandry areas, historical revolutionary areas, ethnic minority areas, Shistosomiasis areas and Fluorosis epidemic areas.

(RMB 30/ha) to rural households that practice non-tillage cropping and purchase the requisite machinery. Apart from this, reports indicate that some RMB 1.728 billion in matching funds have to date been invested in the program from local government finances, extension service organizations and rural households.

SOURCE: Agricultural Daily, 2008a–2008b; MoA, 2007g. China New Countryside Development Net, 2008. Beijing Urban-Rural Economic Information Net, 2007a.

CHAPTER VI

CARBON MARKETS & EMISSIONS TRADING

In addition to the range of other market-based environmental instruments in play, China's leaders have also been developing the policy frameworks and practical experience for carbon markets, air and water pollution emission rights trading, in large part spurred by the challenges of addressing the country's severe levels of air and water pollution and growing carbon footprint. China is currently the world's top emitter of SO₂ and CO₂, surpassing the US and EU-27 (China Daily, 2006a & 2006b; Reuters News Service, 2007b; New York Times, 2008). Acid rain has been a serious problem since the first decade of China's economic boom, and felt most acutely in China's southwestern regions. Since the 1980s, it has continually spread along the Yangtze River basin to the eastern coastal regions, and currently more than a third of the country and more than 50 percent of the 696 cities and counties in the country that carry out monitoring are affected by acid rain (Wang *et al.*, 2001; China Daily, 2006a & 2006b). Emissions of SO₂ in the first six months of 2007 were about 12.6 million tons (Reuters News Service, 2007a). China has some of the most polluted cities in the world, with more than a million deaths annually from respiratory diseases due to severe air pollution (Lü *et al.*, 2006). As discussed in Chapter II, water pollution in China is also a serious and pressing issue, with upwards of 700 million people lacking access to safe water (Turner & Otsuka, 2006).

In face of such challenges, over the past few decades a broad policy framework for the development of trading mechanisms has been evolving in China that encompasses pollution emissions and, more recently, carbon credits and energy use allowances. At its present stage, the country is at the cusp of formalizing some of these mechanisms, and a number of trading platforms have been launched. The earliest of these is the Jiaxing City Emissions Quota Reserve Trading Center in Zhejiang Province, which has already successfully completed 41 emissions rights transactions since its establishment in 2007 (China Environmental Report, 2008). In mid-2008, the Tianjin Property Rights Trading Center, China National Petroleum Corporation's Resource Management Co. Ltd, and the Chicago Climate Exchange jointly prepared to establish the Tianjin Emission Rights Exchange (Wang *et al.*, 2008). Conducting its first trade in December, 2008, this exchange is the first of its kind in China to allow online bidding for emission credits for the major pollutants. The Exchange will trade domestic excess SO₂ and COD emissions permits, international carbon credits and environmental technology stocks (Tianjin Daily, 2008; Wang *et al.*, 2008). In June, 2008, the Chinese Academy for Environmental Planning, MEP, launched the opening of a thermal power sector SO₂ emissions trading management platform (Wang *et al.*, 2008). On August 5, 2008, Beijing and Shanghai simultaneously announced the establishment of the Beijing Environmental Exchange and the Shanghai Environmental Energy Exchange. In addition to COD and SO₂ permits, these exchanges plan to trade energy use permits under China's energy-saving and renewable energy laws, green technology stocks and China-based international carbon credits (China Future Association, 2008; People's Net, 2008). Following this, in September, 2008, Heilongjiang Province launched its own SO₂ emissions trading platform (Wang *et al.*, 2008).

Table 6 — China’s Carbon Markets & Emissions Trading

PROGRAM	SUMMARY	SIZE
CLEAN DEVELOPMENT MECHANISM	Mechanism of the Kyoto Protocol allowing Industrialized countries (Annex B countries) to invest in projects in order to generate Certified Emission Reduction (CER) carbon credits and meet their commitments under the Kyoto Protocol.	China hosts 22 percent of registered CDM projects and supplied 73 percent of global CDM credits in 2007; 725 million tons CDE.
VOLUNTARY CARBON MARKET	Due to a backlog of approval for CDM credits with Chinese and CDM authorities, Voluntary Emission Reduction credits (VERs) are traded as pre-CDM credits, because they take less time to generate and are not subject to the strict standards of CERs.	The Asia-Pacific region (China data N/A) supplied 39 percent, or 16.4 MtCO ₂ e of global VERs.
CHINA GREEN FUND	Innovative new SFA program to encourage both institutional and private buyers to purchase carbon credits, to be used for funding the government’s on-going afforestation projects.	RMB 300 million. 1.05 million mu (70,000 ha) of area for afforestation.
SHANGHAI MUNICIPALITY, MINHANG DISTRICT WATER EMISSIONS TRADING	First trade was conducted in 1987, with trades continuing to the present. Paid transfers of COD emissions permits.	37 water pollution emissions trades, total of RMB 13.91 million for rights to 1031 kg/day of COD.
NATIONAL WATER POLLUTION EMISSION PERMIT SYSTEM PILOTS	Pilot program launched by NEPA in 1988 in 18 cities for water pollution emissions permit system.	18 cities. No available information on the value of the emissions permit transfers.
NATIONAL AIR POLLUTION EMISSION PERMIT SYSTEM PILOTS	Pilot program launched by NEPA and the State Council in 1994 in 16 cities, including Baotou in Inner Mongolia, Liuzhou in Guangxi Province, Tiayuan in Shanxi Province, Pingdingshan in Henan Province and Guiyang in Guizhou Province. Focus on SO ₂ and soot dust emissions, and taking various forms (e.g. allowance transfers within an enterprise, environmental compensation fees to obtain additional emission rights, investments in non-point source pollution control to obtain additional emission rights, and allowance transfers from sources with surplus allowances to new or existing sources with insufficient	16 cities. No available information on the value of the emissions permit transfers.

<p>NATIONAL AIR POLLUTION EMISSION PERMIT SYSTEM PILOTS (CONT.)</p>	<p>allowances). Implementation often motivated by political considerations and conducted as part of new, expansion or technical innovations projects.</p>	
<p>NATIONAL AIR POLLUTION EMISSIONS TRADING PILOTS</p>	<p>Pilot program implemented over 2001-2003, with emissions trade contracts lasting until 2010 in some cases. Launched by SEPA with the help of the Environmental Defense Fund and the US EPA. Implemented in Shandong, Shanxi, Jiangsu and Henan provinces, Liuzhou City in Guangxi Province and in Shanghai and Tianjin municipalities.</p>	<p>RMB 3+ million for 28,500+ tons of SO₂ emissions.</p>
<p>EMISSIONS QUOTA RESERVES TRADING CENTER</p>	<p>Pilot SO₂ and COD emission rights trading platform established in Jiaying City, Zhejiang Province, in November, 2007. The trading platform eventually hopes to expand the range of pollutant emissions trading, including Ammonia-Nitrogen and Total Phosphorous.</p>	<p>32 sales totaling RMB 35.90+ million for 315 tons/year of COD, 777 tons/year of SO₂ allowances; 9 purchases of 278 tons/year of COD, 230 tons/year of SO₂ allowances. This pilot received RMB 300,000 in national pilot support funding in 2007, and RMB 9 million in 2008.</p>
<p>HONG KONG SAR AND GUANGDONG PROVINCE SO₂ EMISSIONS TRADING MECHANISM</p>	<p>In 2002, both parties jointly pledged to reduce SO₂ emissions 30 percent by 2010, with the use of an emissions trading mechanism given priority. In 2007, Guangdong Province and Hong Kong SAR publically issued the Pearl River Delta Zhouhuoli Power Plant Emissions Trading Trial Plan. Though SO₂ is the main target, the plan also covers NO_x and PM10.</p>	<p>Currently under development.</p>
<p>TAI LAKE WATERSHED EMISSIONS TRADING PILOT</p>	<p>Involving collaboration between the MoF and MEP, this pilot will target SO₂, COD and Ammonia Nitrogen emissions. During 2008-2010, a real-time digital emissions trading platform will be developed. The pilot will involve major cities in the Tai Lake Basin, including Suzhou, Wuxi, Changzhou, and parts of Nanjing and Zhenjiang.</p>	<p>Currently under development.</p>
<p>WEIFANG CITY, SHANDONG PROVINCE, EMISSIONS TRADING PILOT</p>	<p>No details currently available.</p>	<p>Currently under development.</p>

<p>CHONGQING MUNICIPALITY EMISSIONS TRADING PILOT</p>	<p>No details currently available.</p>	<p>Currently under development.</p>
<p>SHAOXING CITY, ZHEJIANG PROVINCE, EMISSIONS TRADING PILOT</p>	<p>No details currently available.</p>	<p>Currently under development.</p>
<p>WUHAN CITY, HUBEI PROVINCE, EMISSIONS TRADING PILOT</p>	<p>According to available information, Wuhan City conducted its first SO₂ emission rights trade in 2007, and in 2008 the city's Guanggu Property Rights Exchange drafted the establishment of an emission rights trading platform, bringing emission rights into the property rights market.</p>	<p>Currently under development. No available information on the value of trades to date.</p>
<p>THERMAL POWER SECTOR SO₂ EMISSIONS TRADING MANAGEMENT PLATFORM</p>	<p>Launched in June, 2008, by the Chinese Academy of Environmental Planning, MEP. No details currently available.</p>	<p>Currently under development.</p>
<p>TIANJIN EMISSIONS RIGHTS EXCHANGE</p>	<p>Jointly launched in mid-2008 by the Tianjin Property Rights Trading Center, China National Petroleum Corporation's Resource Management Co. Ltd, and the Chicago Climate Exchange. Conducted its first trade in December, 2008. This exchange is the first of its kind in China to allow online bidding for emission credits for the major pollutants. The Exchange will trade domestic excess SO₂ and COD emissions permits, international carbon credits and environmental technology stocks.</p>	<p>Currently under development.</p>
<p>BEIJING ENVIRONMENTAL EXCHANGE</p>	<p>Launched in August, 2008. This exchange plans to trade SO₂ and COD emissions permits, as well as energy use permits under China's energy efficiency and renewable energy laws, as well as green technology stocks and China-based international carbon credits.</p>	<p>Currently under development.</p>

SHANGHAI ENVIRONMENTAL ENERGY EXCHANGE

Launched in August, 2008. Similar to Beijing, this Exchange plans to trade SO₂ and COD emissions permits, energy use permits under China's energy efficiency and renewable energy laws, green technology stocks and China-based international carbon credits.

Currently under development.

VI.1 CARBON MARKETS

Clean Development Mechanism (CDM)

China has embraced international carbon markets as a means to attract foreign investment in improving energy efficiency and switching to renewable energy products. Since the launch of the Kyoto Protocol's first compliance period in 2005, China has dominated the Clean Development Mechanism (CDM) of the Kyoto Protocol. It is the host of 22 percent of registered CDM projects and supplied 73 percent of the CDM credits transacted in 2007 (Capoor & Ambrosi, 2008). This amounted to a volume of 725 million tons of carbon dioxide equivalent (MtCO₂e). According to the World Bank's State and Trends of the Carbon Market 2008 report, China was the 'destination of choice' of certified emission reduction Certified Emission Reduction (CER) buyers and project developers alike in 2007 because of its economies of scale in credit origination and favorable investment climate (Capoor & Ambrosi, 2008).

A recent report by WWF notes, furthermore, an increasing diversity in the CDM project pipeline in China, with the market expanding beyond projects involving destroying Hydrofluorocarbons (now only 1 percent of pipeline projects) to bring carbon finance to a range of new technology sectors, and in particular renewable energy. Of projects in the pipeline in China, 48 percent are hydropower, 16 percent are energy efficiency for own generation and 16 percent are wind power. This compares with 20 percent hydropower, 13 percent energy efficiency for own generation and 9.8 percent fossil fuel switch (and 26.7 percent Hydrofluorocarbons) in the overall pipeline (WWF, 2008).

The same WWF report estimates that carbon revenue can account for anywhere from 10 percent to 240 percent of renewable energy project capital costs, and thus is proving particularly valuable to technologies such as biogas and energy from landfill gas, as well as important secondary benefits such as increasing transparency in sectors such as wind power, and giving investors more confidence and improving the technical quality of projects. Of the most recent list of projects approved by the Designated National Authority (DNA) of China, 16 percent are "energy saving and energy efficiency", 73 percent are "renewable energy", 6 percent are "methane recovery & utilization", 1.4 percent are "fuel substitutes" and 1.6 percent are "N₂O decomposition" (NDRC-ONCCCC, 2008).

China also boasts the first registered afforestation/reforestation CDM project in the world (the Pearl River reforestation project in Guangxi Province), with two other Chinese-DNA-approved afforestation and reforestation projects in Liaoning and Sichuan provinces. Though the forward sale of these credits was made to the World Bank's BioCarbon Fund in 2007, no credits have yet been delivered. Furthermore, reforestation projects make up less than 1 percent of the pipeline projects (according to the WWF report) and a mere 0.07 percent of the CDM projects approved by the DNA of China. The contribution of the forestry sector to China's CDM portfolio is sure to remain small for the remainder of this second Kyoto Compliance Period (2008–2012), with afforestation and reforestation-sourced credits projected to supply less than 1 percent of the total Chinese CDM portfolio in 2012 (Sinton, 2004).

Based on the trends in 2005 through 2007, it is expected that interest in China-sourced Certified Emissions Reductions (CERs) will have remained strong for most of 2008, though the reduced interest in CER credit origination brought on by the drop in price spread between CERs and EU emissions allowances in the final months of 2008 and early 2009 will slow the development of new CER projects in China in 2009, as it will across the world. However, the number of Chinese CERs reaching the market are likely to remain high, as the Chinese Designated Operational Entities (DOEs) are already overwhelmed with projects approved by the DNA but which are still awaiting submission for registration to the CDM Executive Board. As of July 2008, 1,443 projects had received Letters of Approval from the Chinese Government, but fewer than 400 had been submitted for registration with the CDM Executive Board (Moasheng, 2008). Thus, a more pressing issue for China in increasing its supply of issued CERs than the global drop in CER prices in late 2008 and early 2009 is increasing the capacity of DOEs to submit Government-approved projects to the Executive Board for validation and credit issuance.

SOURCE: Capoor & Ambrosi, 2008; Maosheng, 2008; Sinton *et al.*, 2004.

Voluntary Carbon Market

Increasingly over the past two years, as the project approval backlog at the Chinese DNA level and the international CDM Executive Board, developers of Chinese CO₂ emissions reduction projects have turned to the voluntary market for several reasons: as a source of demand for pre-CDM credits; for faster credit issuance (despite the typically lower prices earned by voluntary credits versus credits used toward compliance obligations¹¹); and for what has until recently been perceived as less stringent project requirements of voluntary market verification standards. The launch of the Asia Carbon Exchange for Voluntary Emissions Reductions (VERs) in mid-2007 further demonstrates the growth of Chinese interest in the voluntary carbon market.

A detailed analysis of the voluntary carbon market at the country level has not been done for 2007, although it can be roughly assumed that, given the dominance of China in the regional market, many of the trends seen in the regional voluntary carbon market mirror trends in China (Forest Trends is expecting to analyze the 2008 country level with a report to be released in mid 2009). In 2007, the Asia-Pacific region supplied 39 percent, or 16.4 MtCO₂e, of the transaction volume of the voluntary “over-the-counter” (i.e. not traded over an exchange) carbon market. This volume is more than any other region supplied to the voluntary market in 2007 (Hamilton *et. al.*, 2008). Such a large volume of VERs coming from Asia, in particular China and India, mirrors the large number of CDM projects coming from the region, where awareness of compliant and voluntary project methodologies is high and carbon finance is seen as a driving force behind several industries in China, in particular renewable wind and hydropower, and to a smaller degree, biomass energy (Maosheng, 2008).

Asia’s VER breakdown by project type in 2007 closely resembles that of China in the CDM market in 2007. Of the VERs supplied by Asia in 2007 (annual global data on the voluntary market for 2008 is not yet available), the majority (47 percent) were sourced from renewable energy projects, followed by energy efficiency projects (24 percent) as the second most common credit source. Land-use projects, including forestry, supplied 0.5 MtCO₂e (4 percent) of Asia’s VERs in 2007. It is anticipated that this volume of credits sourced from Chinese land-use projects into the voluntary markets will increase in 2010-2012 and successive years as a result of the China Green Carbon Fund, which has been launched to spur private sector investment in the voluntary forest carbon market.

SOURCE: Hamilton *et. al.*, 2008; Maosheng, 2008.

¹² The average credit price of a VER sourced from the Asia region in 2007 was US\$5.80/tCO₂e, versus an average primary forward sale price of 8-11 euro (US\$10.8 - \$14.8) for Chinese CERs the same year.

China Green Carbon Fund

Launched in mid-2007 by the State Forest Administration, this is the first instrument developed by the government that is designed to tap into private sector funding for afforestation work, and is pioneering for its goal of stimulating the development of a voluntary forest carbon market in China. When initiated, the fund received RMB 300 million in initial funds from the China National Petroleum Corporation (CNPC) to reforest 1.05 million mu (70,000 ha) of what is considered “barren” land mainly located in poor regions. These projects included both carbon sequestration afforestation, as well as a project for the development of forest biofuel plantations. Informal discussions with SFA officials suggest that CNPC’s investment in the fund stems from its interest in not only developing forest biofuels, but also developing a portfolio of domestic carbon credits with beneficial local livelihoods impacts, likely in anticipation of future government regulation and/or international climate obligations. The program already has 10 regulatory documents, including fund administration and technical documents, and has set up a China Green Carbon Special Foundation to oversee management of funds. The Fund also has a range of innovative elements designed to stimulate public interest, including direct purchase of credits online via the fund’s website (<http://www.fcarbonsinks.gov.cn/>), a range of innovative methods to generate public interest and participation, including a series of China Green Carbon Fund gifts (e.g. birthday gifts, wedding anniversary gifts, gifts for new-borns, memorial forest plantings), and a car sticker for purchases of credits in the amount RMB 1,000 and up. In addition, there is a 25 percent tax reduction on money used to purchase fund credits.

Regarding technical aspects, the Fund plans to develop Chinese-specific afforestation standards adapted from IPCC standards. The baseline for afforestation will be land that has been barren since 2000, and its afforestation work will prioritize the planting of ecological forests, developing plantation structure to capture biodiversity benefits, and reforestation activities in poor regions to enhance local livelihoods. Once afforestation work has been systematically developed, the planned next step will be to develop some Fund credit trading pilots.

SOURCE: Li, 2008; China Green Foundation, 2007.

VI.2 EMISSIONS TRADING

China has been developing the foundations for emissions trading since the early 1980s. This has occurred parallel to country’s pollution levy system, which has been one of the key economic instruments used to control pollution in China up to the present.¹² The foundations for emissions trading — a total emissions control regime and the legal basis for paid emissions permit transfers — were first explored by the National Environmental Protection Agency (NEPA)¹³ during the 6th Five-Year Plan period (1981–1985), while late in the 1980s the emphasis of pollution control policy first began to shift from one based on emissions concentrations to total emissions control (Wang *et al.*, 2001; Wang *et al.*, 2004). In 1988, NEPA issued and began enforcing the *Water Pollutant Emissions Permit Management Provisional Measures*, which stipulates in Article 21, Chapter IV, that “the total

¹² The levy system was first launched in 1978 followed by the introduction of pollution levy regulations in 1982, whereby polluters pay levies against the level of concentration exceeding standards (Wang *et al.*, 2001). Within this system, the SO₂ levy has become a central component, though the SO₂ levy was not strictly imposed until 1992, when NEPA issued Notice Regarding the Pilot Program for the Development of Industrial Combustion of Coal SO₂ Emission Levies (Wang *et al.*, 2001; NEPA, 1992).

¹³ The original name for the Ministry of Environmental (MEP) was the National Environmental Protection Agency (NEPA). After 1998 it was upgraded to State Environmental Protection Agency (SEPA), and in 2008 was upgraded to the ministerial-level MEP.

emission allowances for water pollutants may be flexibly distributed among the emission entities in the same region” (NEPA, 1988). In the following year the *Water Pollution Prevention Law Detailed Implementation Measures* was issued, and stipulated in Article IV that “Corporations and enterprises that emit water pollution will put into practice emission permits management” (Wang *et al*, 2008).

The late 1980s also saw the beginning of emission permits and emissions trading pilots. The first emissions trade in China occurred in Shanghai’s Minhang District in 1987, and was for water pollution emissions permits. At present, Minhang District has implemented 37 water pollution emissions trades, with total emission rights transfers of 1031 kg/day of COD, and total payments of RMB 13.91 million. The first two trades were as follows:

- The Shanghai Haiyong Color Picture Tube Co. Ltd. purchased the rights to emit 395 kg/day of COD from the Shanghai Hongwen Paper Mill.
- Shanghai Steel Factor No. 10 purchases water pollution emissions rights (presumably COD) from Tangwan Electroplating Factor, paying RMB 40,000/year to compensate for economic losses.

The next year, NEPA selected 18 cities — including Shanghai, Beijing, Tianjin, Shenyang in Liaoning Province, and Xuzhou and Changzhou in Jiangsu Province — to pilot water pollutant emission permits (Wang *et al*, 2008).

Air pollution emissions permit pilots followed soon afterwards, when in 1990 the *State Council’s Decision Concerning the Progress of Strengthening Environmental Protection Work* required the “gradual advancement of the total emissions control system and emissions permit system” (Wang *et al*, 2001; State Council, 1990). During 1990-1991, the State Council and NEPA selected sixteen cities for the air emissions permit pilot work, including Baotou in Inner Mongolia, Liuzhou in Guangxi Province, Tiayuan in Shanxi Province, Pingdingshan in Henan Province and Guiyang in Guizhou Province (Wang *et al*, 2001). As part of this process, both Kaiyuan and Taiyuan put into place provisional regulations governing emissions trading in 1993. Yunnan Province’s Kaiyuan City government issued *Kaiyuan City Atmospheric Pollution Emissions Permit Management Provisional Measures*, and the city environmental bureau issued *Kaiyuan City Atmospheric Emissions Trading Management Measures*, which detailed the implementation of total emissions levies and emissions trading for SO₂, soot and dust pollution (Wang *et al.*, 2008). Taiyuan City government issued *Rules on Environmental Offsets for Air Pollutants*, which started the pilot of emissions trading in Taiyuan (Morgenstern *et al.*, 2004).

These policy experiments were launched in 1994, and took various forms, including allowance transfers within an enterprise, environmental compensation fees to obtain additional emission rights, investments in non-point source pollution control to obtain additional emission rights, and allowance transfers from sources with surplus allowances to new or existing sources with insufficient allowances (Yang & Schreifels, 2003). Unfortunately, the emissions trading that occurred in these pilots — in the form of offsets — were not strictly market-driven, were heavily influenced by institutional and political considerations and were conducted in combination with new, expansion, and technical innovation projects arranged by local environmental protection bureaus (Morgenstern *et al*, 2004). By the end of 1994, SEPA announced that air emissions permit pilot work was completed, and began to push for an emissions permit system in all cities. As a result of this pilot work, Taiyuan City passed *Taiyuan City Air Pollution Total Emission Control Management Methods* in 1998, which was China’s first local law on total emissions control that contained provisions on emissions trading (Wang *et al*, 2008).

During this time, Liaoning Province put into practice emissions permit management for all polluting entities in 1993, and in 1995 the State Council issued *Huai River Water Pollution Prevention Regulations*, with clause 9 stipulating that "Huai River watershed....entities possessing emissions

permits should guarantee that their total emissions do not exceed the total emissions target stipulated in the emissions permit regulations” (Wang *et al.*, 2008). The official inclusion of total emissions control policy of the major pollutants into the environmental protection appraisal projects and nationwide implementation of a emission permit system in Chinese cities occurred when the State Council approved the *9th Five-Year Plan Period (1995–2000) National Plan for Total Emissions Control of Major Pollutants*, submitted by NEPA in 1996 (Wang *et al.*, 2008). In the same year, the *State Council’s Decision Concerning Several Problems of Environmental Protection* further stated that “there is a need to implement the total emissions control system, quickly building a system of national standards and within a fixed period publicizing those standards” (State Council, 1996b). In 1997, the environmental protection, price management, and finance bureaus in Xiuzhou District of Jiaying City, Zhejiang Province, jointly issued *Provisional Measures for Total Emission Control and Paid Use of Emission Rights for Water Pollutants*. Among other things, this stipulated that Xiuzhou District Wastewater Treatment Co., Ltd., is to be responsible for collecting operating charges for paid use of the emission rights and all the revenues shall be used in construction of township domestic wastewater treatment plants for the whole district (Wang *et al.*, 2008).

In the late 1990s, China began a range of collaborations with the US to further develop its policy framework and practical experience in SO₂ emissions trading. In 1997, the Beijing Institute of Environment and Development and Environmental Defense Fund launched an emission trading research project, with Benxi City in Liaoning Province, and Nantong City in Jiangsu Province selected to conduct case studies in city-level emission trading for the first stage of the work. This work was continued with the joint signing by the newly upgraded State Environmental Protection Agency (SEPA) and the US EPA of "Research on the Feasibility of Using Market Mechanisms in China to Reduce SO₂ Emissions" cooperation agreement in 1999. In the same year, SEPA and the Environmental Defense Fund signed a memorandum of cooperation to "Research How to Use Market Mechanisms, Help Local Governments and Enterprises and Achieve the Total Emissions Quotas Set by the State Council", and SEPA and the US EPA jointly convene the "International Workshop on the Feasibility of SO₂ Emissions Trading in China" in November. In October, 2000, a 15 member group from SEPA, the State Planning Commission, the Chinese Research Academy of Environmental Sciences and Bexi and Nantong Municipal Environmental Bureaus went to the US to review SO₂ trading, and to host with the US EPA the "Sino-US Workshop on Utilizing Market Mechanisms to Control SO₂ Emissions (Session 2)" (Wang *et al.*, 2008).

An important step for air pollution control was also made during this time, when the State Council in 1998 ratified a plan designating “Two Control Zones” — an Acid Rain Control Zone and an SO₂ Pollution Control Zone — and approved new regulatory standards and measures in line with this. These zones are key areas for controlling acid rain and SO₂ emissions in China and receive priority for investment and management to control emissions (Wang *et al.*, 2001; Wang *et al.*, 2004).¹⁴ The transition to a total emission control regime was then formalized for both air and water pollution emissions, first in revisions to pollution laws, and then in the 10th Five-Year Plan. For air emissions, a revised *Atmospheric Pollution Prevention and Control Law* (2000) stipulated that levies be imposed based on total emissions, and correspondingly defined the legal status of the emission permit system. Regulation 15 stated that “In areas that have not yet achieved air quality standards or that have not yet received State Council authorization within the Two Control Zones, implementation of air pollution total emissions control and air pollution emissions permit systems will use total emission control policy to provide the legal basis” (Wang *et al.*, 2001; Wang *et al.*, 2008; PRC, 2000).

¹⁵ The Acid Rain Control Zone consists of areas with average annual pH values for precipitation less than or equal to 4.5, sulphate deposition greater than the critical load, and high SO₂ emissions. The SO₂ Pollution Control Zone consists of areas with annual average ambient SO₂ concentrations exceeding Class II standards, daily average concentrations exceeding Class III standards, and high SO₂ emissions (Wang *et al.*, 2004).

For water emissions, Article 10 of the revised *Water Pollution Prevention and Control Law Implementation Rules*, issued by the State Council, stipulated that local environmental protection authorities shall issue water pollutant emission permits based on the total emission control implementation plan (State Council, 2000a). Following this, the 10th Five-Year Plan (2001-2005) mapped out a total emissions control system and encouraged the development of emissions trading pilots, thus beginning a period, lasting to the present, of significant activity in developing and implementing emissions trading. In 2002, the State Council approved and implemented the *10th Five-Year Two Control Zones Acid Rain and SO₂ Emissions Prevention Plan*, which stipulates that SO₂ total emissions control and emissions permit systems are to be put into practice in the Two Control Zones (Wang *et al.*, 2008).

The largest scale emissions trading pilot work took place during 2001–2003. In 2001, SEPA signed a joint project with the US EPA entitled “Research Promoting Policy Implementation of SO₂ Total Emissions Control and Emission Rights Trading”, issued the *Notice Regarding Developing the Demonstration Work for “Research Program for Promoting SO₂ Total Emissions Control and Emissions Trading Policy Implementation in China”*, and with the help of the Environmental Defense Fund started developing SO₂ total emissions control and emissions trading pilots in Shandong, Shanxi, Jiangsu and Henan provinces, Liuzhou City in Guangxi Province and in Shanghai and Tianjin municipalities (Wang *et al.*, 2008; China Environment Net, 2007; Yang & Schreifels, 2003). As part of this work SEPA, Chinese power companies and the Environmental Defense Fund held several workshops on SO₂ emissions trading in 2001. The Asian Development Bank and the Shanxi Provincial Government also jointly launched the “SO₂ Emissions Trading Mechanisms” Program, with Taiyuan City serving as a case study, and 26 large-scale enterprises in the city participating. In 2002 — with the assistance of Resources for the Future and the Environmental Planning Research Institute, Chinese Academy of Environmental Sciences — Taiyuan City issued *Taiyuan City SO₂ Emissions Trading Management Measures (Try Out)*, China’s first local government regulations regarding SO₂ emissions trading. In the same year, Jiangsu Provincial Environmental Office and Jiangsu Provincial Economic & Trade Office jointly set down the *Jiangsu Province Power Sector SO₂ Emissions Rights Trading Management Provisional Measures*. Following up on the pilot work SEPA and the Environmental Defense Fund cooperated in national-scope SO₂ total emissions control and emissions trading training work during April, 2003 (Wang *et al.*, 2008).

Beginning in 2001, these pilots began conducting trades (Wang *et al.*, 2008):

- In 2001, Nantong City’s Tianshenggang Electric Company Ltd. sells the rights to 1,800 tons/year of SO₂ emissions to Nantong Cellulose Acetate Plant, with a contract length of six years.
- In 2001, Nantong City’s Taicang Environmental Electrical Co. Ltd. purchases emissions rights to 1,700 tons/year of SO₂ emissions for 2003-2005 from Nantong Xiaguang Electrical Plant.
- In 2003, under the Henan Provincial Environmental Bureau, Yima Coal Gas Company of Sanmenxia City purchases emissions quotas for 900 tons/year of SO₂ emissions from Zhongyuan Gold Smelting Plants.
- In 2003, the China State Power Corp.’s Changzhou Power Co. Ltd. in Jiangsu Province uses annual fees of RMB 3 million to buy emissions rights to 2,000 tons/year of SO₂ emissions for 2006–2010 from Tongzhenjiang Jianbi Power Plant.
- In July, 2003, Jiangsu Taicenggang Environmental Power Company Ltd. purchases emissions rights for 1,700 tons/year of SO₂ emissions from Xiaguan Power Plant, to be used within 2 years time.

Other schemes were also being developed during this time. In 2002, Hong Kong SAR Government and Guangdong Provincial Government issued *Joint Pronouncement to Improve the Air Quality of the Pearl*

River Delta Area, wherein each pledged to reduce SO₂ emissions 30 percent by 2010, with a strong focus on developing an emissions trading mechanism (Wang et al, 2008). In the same year, water emissions trading work picked up when Jiaying City, Xiuzhou District in Zhejiang Province began promoting water emissions trading pilots by requiring all emitting enterprises to purchase "original" emissions use rights, while also introducing emissions rights into the market for trading. Late in the same year, 11 enterprises in Xiuzhou District's Honghe Township and Wangdiang Township from the dyed wool sweater collective participated in the first batch of emissions rights transactions, with payments for the contract for emissions rights totaling RMB 1.4359 million (Wang et al, 2008).

In December, 2005, the State Council issued the *Decision on Carrying Out the Scientific Development View to Strengthen Environmental Protection*, which stated "A system of total emissions control will be put into practice, an emissions permit system promoted, and emissions trading pilots developed." (Wang et al, 2008). Since then, there has been a flurry of activity to develop water pollution emissions rights trading pilots, as well as emissions rights trading platforms for both water and air pollution emissions rights. The most prominent of these has been collaboration between MEP and MoF to develop an emission rights trading pilot for the Tai Lake Watershed. This pilot will target SO₂, COD and Ammonia Nitrogen emissions, as well as the national power sector, and will encompass four main components:

- (1) Improve pollution rights pricing structure using pollution control costs and scientific research as the basis for determining the initial price of emission rights, implement an initial fee to sell emission rights, and promote the establishment of a long-term mechanism to reduce emissions of pollution;
- (2) Establish a market for emission rights. In 2008, Tai Lake took the lead in launching the first sales of COD emissions rights. This year the Tai Lake basin plans to quickly promote an ammonium-nitrogen and total phosphorous emissions rights trading pilot;
- (3) Establish an emission rights trading platform. During 2008–2010, a real-time digital emissions rights trading platform for Tai Lake watershed will be gradually built, engendering a market for emissions rights trading;
- (4) Strengthen emissions rights trading market supervision. This will involve establishing and improving relevant institutions and researching and developing emissions control technology and advanced management systems to control total emissions (Shanghai Securities Report, 2008).

The pilot will involve the major cities in and around the Tai Lake Watershed: Suzhou City, Wuxi City, Changzhou City and parts of Nanjing and Zhenjiang (China Environmental Report, 2008; Wang et al, 2008).

In November 2007, Jiaying City (also in the Tai Lake watershed) established the Emissions Quota Reserves Trading Center, the first platform in China for trading COD and SO₂ emissions quotas. According to news reports, the Center and has already developed a set of fairly complete trading mechanisms for SO₂ and COD and has carried out transactions between enterprises. So far, the center has successfully completed 41 emissions rights transactions. Of these, it has made 32 sales of emission allowances — totaling 315 tons/year of COD and 777 tons/year of SO₂, for total revenue of more than RMB 35.90 million — and 9 purchases, totaling 278 tons/year of COD and 230 tons/year of SO₂ allowances. This pilot received RMB 300,000 in national pilot support funding in 2007, and RMB 9 million in 2008. Director Weng Jianrong of the Jiaying Municipal Environmental Protection Bureau has said that next steps will be to expand the range of pollutants traded at the center. For example, agricultural non-point source pollution is generally a bigger source of water pollution than COD in

Jiaying City, and so permits for Ammonia-Nitrogen and total Phosphorous is planned to be brought into the trading system (China Environmental Report, 2008).

In addition to this major piloting work, a number of other initiatives have also been taking shape. Weifang City in Shandong Province, Chongqing Municipality, Shaoxing City in Zhejiang Province, and Wuhan City in Hubei Province have also all announced their intention to quickly develop emissions trading pilots. (MEP, 2008b; Qilu Evening News, 2008; Times News, 2008; People's Daily, 2007). According to available information, Wuhan City conducted its first SO₂ emission rights trade in 2007, and in 2008 the city's Guanggu Property Rights Exchange drafted the establishment of an emission rights trading platform, bringing emission rights into the property rights market (Wang et al, 2008). In August, 2007, Zhuji City of Zhejiang Province issued the Provisional Regulations for Zhuji City Total Pollution Emissions Quota Compensated Use, followed by the Detailed Implementation Rules for Zhuji City Total Pollution Emissions Quota Compensated Use with these targeting COD and SO₂ emissions. Also in 2007, Guangdong Province and Hong Kong SAR publically issued the Pearl River Delta Zhouhuoli Power Plant Emissions Trading Trial Plan. Though SO₂ is the main target, the plan also covers NO_x and PM₁₀. In 2008, Taiyuan City begun implementing the Taiyuan City SO₂ Emissions Trading Management Measures (Wang *et al.*, 2008).

CHAPTER VII

OTHER PROGRAMS

VII.1 CHINA ENVIRONMENTAL LABEL CERTIFICATION SYSTEM AND GOVERNMENT GREEN PROCUREMENT

The State Environmental Protection Agency (SEPA) instituted the China Environmental Label (*huanjing biaozhi*) certification system for non-food products in 1993, and the first enterprise passed certification in July, 1994. In October, 2003, the China Environmental United Certification Center Co., Ltd., (<http://www.sepacec.com/cecen/>) was established in Beijing to manage certification and authentication of international and Chinese environmental labels, including China Environmental Label Type I and II and the Hong Kong Green Label. In 2006, the Chinese government instituted the government “green” procurement policy in order to stimulate the development of environmental products. The basis for this is Article 9, Section 1, of the *China Government Procurement Law*, which states that “Government procurement should be conducive to the implementation of current national economic and social development policy goals, including environmental protection, supporting underdeveloped and ethnic minority regions, and promoting the development of small and medium-size industry” (PRC, 2002b).

The subsequent *Views Regarding Government Implementation of Environmental Label Products Procurement* issued jointly by the Ministry of Finance and the State Environmental Protection Administration in 2006, provides the policy framework for this: all levels of government are to place precedence on purchasing environmental-label products, and are forbidden to purchase goods harmful to the environment or public health; environmental products include those that promote the adoption of “green” technologies, protect the environment and public health, save energy, promote circular use of resources and realize sustainable economic and social development; the Ministry of Finance and the State Environmental Protection Administration (now MEP) are responsible for creating and managing the environmental label certification system and the associated list of products and companies that pass certification, and the China Green Purchasing Network (<http://www.cgpn.cn/>) and the China Green Procurement Network (<http://www.cgpn.cn>) have been established for the public dissemination of this information; central and provincial government budgetary bodies are, according to the document, to put this policy into effect as of January 1, 2007, and all governmental units are to adopt these measures as of January 1, 2008 (MoF, 2006).

At present, more than 1500 enterprises and more than 30,000 products in 65 categories — ranging from automotive products, construction materials, textiles, electronics, furniture and packaging — have received certification under the system. The government’s green procurement list currently includes 444 enterprises. The China Environmental Label system has also signed joint cooperation and assistance agreements with Germany, North European countries, Japan, Korea, Australia, New Zealand and Thailand (Xinhua News Agency, 2008b). This will represent a huge market for environmental goods. Total estimated government procurement in 2006, for example, was more than RMB 300 billion (Li, 2006).

CHAPTER VIII

CONCLUSIONS

The pace of on-the-ground developments in China has been brisk, and interest in “eco-compensation mechanisms” and “environmental economic policies” has grown significantly in recent years at many levels of government. New policies are being developed and existing ones refined and improved. Many local governments are in the process of developing their own eco-compensation and market-based environmental initiatives, with policy documents and reports as yet not publically available.¹⁵ This report is thus by no means exhaustive. However, the breadth of the policies and programs documented herein is more than sufficient to provide valuable insights.

FINDINGS

(1) The majority of programs are domestically-driven: It is clear from these results that most of China’s eco-compensation policies and market-based environmental initiatives are domestically driven and funded. An exception to this is the Yunnan Province, Laishihai Nature Reserve — Lijiang City Eco-compensation Scheme, which has been primarily funded and developed by, among others, Conservation International (CI) and the World Bank.

(2) The government is the key driver: The majority of existing eco-compensation initiatives in China are government-mediated, publicly administered programs that use public funds to pay landusers for the stewardship of ecosystem services on their land. Private sector initiatives found during the inventory work, though not documented in the report, are generally all occurring within government policy frameworks. Examples of this include Carrefour and Walmart contracting with local farmers and producers for the supply of organic-labeled agriculture and environmental-label products, as well as the anti-desertification work of the Society Entrepreneur Ecology (SEE) in the Gobi desert, which falls under the “Three-Norths” policy.

(3) Water is the most common target: The vast majority of eco-compensation policies and mechanisms in China have to do with water-related ecosystem services:

- Conversion of Cropland to Forests and Grassland Program (CCFG): The spur for initiation of this policy was severe flooding in the upper and middle Yangtze River watershed and in northeast China, and a historic dry-out of the Yellow River.
- Forest Ecosystem Compensation Fund (FECF): According to the most recent survey of this program, 80.1 percent of public benefit forest area encompassed by the program is located in headwaters, watersheds, wetlands or areas affected by severe soil erosion or desertification.
- Local initiatives in Fujian, Zhejiang, Guangdong, Jiangxi, Hong Kong, and Liaoning are in large part focused on watershed eco-compensation and management.
- The challenge of controlling water pollution has been a key impetus behind the central government’s ongoing experimentation with and development of emissions trading pilots.

(4) Local innovation is occurring more often in China’s wealthier, coastal regions: As seen in Figure 1 below, the three most important provinces in terms of diversity of local programs, Beijing, Zhejiang and Fujian, are ranked 2nd, 4th and 9th, respectively, in terms of 2006 per-capita GRP. Other

¹⁶ Various government policymakers have suggested, in informal discussions, that this is because risk-averse local governments often wish first to obtain and consolidate some positive outcomes before making public the details of their programs.

important provinces in terms of local programs include Guangdong, Liaoning and Shandong, which are ranked 6th, 8th and 7th, respectively (ZGTGNJ, 2007).

Figure 1 — Provincial GDP and PES/MES Programs



(5) High degree of local variation: There is a high degree of local variation in policy design and implementation, suggesting that a wealth of untapped policy experiments and lessons learned exists across China. Although central government policy has to date provided the main impetus and framework for the development of eco-compensation mechanisms locally, resource constraints and the need to find innovative new ways to improve resource management and resolve regional administrative and property rights issues over cross-boundary ecosystem service flows has resulted in a significant degree of local innovation. Local variations in eco-compensation policies in China appear to take three main forms:

(a) Local de facto institutional arrangements governing implementation of central policies. This comprises the majority of local diversity in eco-compensation and market-based mechanisms for environmental policy. Central-government policies often provide frameworks for local innovation by stipulating for local matching funds or administrative support, or delegating management authority and the development of standards and fee structures to provincial or local governments. Key examples of these types of central policies with evidence of local innovation include:

- the Conversion of Cropland to Forests and Grassland Program (CCFG),
- the Forest Ecosystem Compensation Fund (FECF),
- the “Four Wastelands” policy (4W),

- the variations in fee structure and management regimes engendered by China's water and soil conservation law and regulations, and
- the policies governing the implementation and promotion of eco-agricultural programs at local levels.

(b) Local innovations independent of central policies. Significant local-level innovation is also occurring in the creation of eco-compensation schemes and market-based instruments for environmental policy. The vast majority of these innovations concern resolving issues surrounding water resources and their effective sustainable protection and equitable and efficient distribution. Examples include:

- Arrangements between Beijing and Hebei regarding the upper watershed of the Miyun reservoir;
- Water rights trading and water-based eco-compensation policies between various municipalities in Zhejiang Province;
- Water-rights trading between irrigation districts and industry in parts of Gansu, Ningxia, Inner Mongolia and Sichuan; and
- The developing inter- and intra-provincial frameworks of cost-sharing and integrated watershed management between various city governments in Fujian, Zhejiang, Jiangxi and Guangdong provinces.

(c) Hybrids of central and provincial programs and funding sources: Local governments are weaving together and drawing upon multiple central and provincial policies and funding sources to address local environmental concerns. An example of this can be seen in the Jinhua River Watershed, where in addition to local water rights trading and downstream development zone policies, governments also draw upon funding from State Forestry Administration (SFA) policies such as the Conversion of Cropland to Forests and Grassland Program (CCFG), Forest Ecosystem Compensation Fund (FECF) and "Closed-Mountain Forest Regeneration" measures (Zhang *et al*, 2006).

(6) Significant program overlap: A significant degree of overlap exists in programs in terms of the ecosystem services targeted and the administrative purviews of their key management authorities. For the control of soil erosion, for example, both the MWR and the SFA have policies that similarly involve payments to farmers or local governments for the management and rehabilitation of marginal and sloping land so as to prevent and control adverse impacts on the local watershed. Similarly, both the MoA and MEP are promoting their own certification system for organic agriculture.

(7) Continuing Predominance of Top-Down, Project-Centric Approaches: Though the programs documented herein suggest a significant degree of innovation in financing arrangements, they also continue to be predominantly top-down and project-centric in their approaches to obtaining ecosystem service delivery, with no apparent instances of truly conditional, open-ended payments for service delivery, including for programs that actually involve direct subsidies to individual households or communities.¹⁶

INSIGHTS

These findings, taken together, provide a range of important insights for policymakers in China. First, while the government is the main driver of eco-compensation and market-based environmental

¹⁷ Though the CCFG has some conditionality in terms of linking subsidy delivery to sufficient survival rates of planted trees and grasses, evidence of implementation on the ground raises questions about the degree to which this is actually adhered to (Bennett, 2008).

initiatives, the development of eco-compensation policy in China is also strongly motivated by local resource scarcity — a form of induced institutional innovation — since the greatest degree of innovation and activity appears to be occurring regarding ecosystem services with relatively high value (water quality and quantity) in locales with higher beneficiary willingness-to-pay (i.e. wealthier regions). This suggests that significant potential exists for greater private sector participation in and funding of PES/MES initiatives, and in particular regarding watershed ecosystem services in China's wealthier regions.

Given this, in developing its regional strategy for environmental investment, the government could create a strategic framework through which its role in current and future ecosystem markets can be slowly shifted from designer and central manager to a provider of services to foster innovation, link buyers and sellers, enable the flow of information and expertise, reduce financial risk and enforce laws and contracts. This could not only help to foster greater private sector investment and free-up government budgetary resources for use in lesser developed regions, but would also reduce the risk that the government's prominent and driving role in PES is crowding out private investment in ecosystem services markets. Policymakers would also do well to consider how current eco-compensation policies that involve direct subsidies to households and communities can be transitioned into programs with truly conditional, open-ended payments for the delivery of more clearly defined and targeted ecosystem services. The long-term sustainability and effectiveness of current and future PES programs in China and elsewhere hinge on these types of considerations.

China's structure of environmental governance also raises a number of important concerns. First of all, the significant overlap seen in the structure of and ecosystem services targeted by some of these major programs suggests cost inefficiencies. On the other hand, such overlap might be helping to improve outcomes by giving local governments a menu of programs and funding sources to draw from to more flexibly address their particular conservation needs in face of weak institutional capacity. Also of concern, and related to this, is the degree to which the development of eco-compensation programs at both central and local government levels has been motivated in part by the desire to capture rents. Successful local programs selected as national pilots can expect generous central-government grants and status, while ministries appear to be battling over similar environmental "turf" to expand their administrative purviews and corresponding budgets. A common paradigm utilized by the central government is to create a broad policy framework that allows the flexibility for local innovation, thus allowing the center to pick and choose from successful local variations to scale up at the national level. This structure of governance likely has its benefits, by creating a "market" for effective environmental policy that, through competition, engenders experimentation and policy innovation. However, it also has potentially huge costs, in terms of the barriers it creates to cross-sectoral and cross-administrative information sharing and collaboration.

NEXT STEPS

The range and scale of the programs documented so far reveal that many opportunities exist for fruitful, high-impact future work in China. The environment is a key area of engagement; the *11th Five-year Guidelines* call for greater utilization of international expertise and funding regarding the environment, and indeed the government is increasingly eager to learn from international experience and form collaborative relationships to improve and expand its policy toolkit. Policymakers are still new to the concepts of PES, MES and market-based environmental policy instruments in general, but at the same time are intrigued and willing to learn, especially given the central government's call to further explore and develop such policies and mechanisms.

Future work on this can take a wide variety of forms. This includes: continuing to develop an ongoing general “inventory” of China’s eco-compensation programs and market-based policies, with the goal of estimating the potential size of future ecosystem services markets in China; documenting in much greater detail the interactions between and hybrids arising from local and central eco-compensation programs and market-based environmental policy innovations at a sub-regional scale, for example by focusing on a few key locales such as Zhejiang and Fujian provinces; or developing detailed case studies and evaluations of particularly interesting local or national programs. With less than 10 years of experience in almost all programs, it is a good time to better assess program implementation and outcomes. This includes examining the relationships between local institutions, social capital, property rights, local environmental conditions, equity and poverty, and how these interact with different program designs to influence program efficiency and outcomes. As with the international experience with PES, Chinese policymakers are intrigued by the potential of eco-compensation mechanisms to achieve “win-win” outcomes of conservation and poverty alleviation, especially given that many of the beneficiaries of watershed ecosystem services are in China’s richer coastal regions, while those providing such services tend to be in poorer inland regions. Given this, it is also important to examine what potential complementarities and tradeoffs exist between the provision of different ecosystem services and between environmental and poverty alleviation goals.

An additional important direction for future work is to develop platforms for dialogue and information-sharing between the various experts, policymakers, practitioners and stakeholders identified through the process of creating this inventory. In addition to the factors mentioned above, the successful future development of PES programs in China also depends whether the country’s growing experience and lessons from ongoing policy experiments can be effectively shared, fed into the government’s evolving policy frameworks, and developed into private sector initiatives and public-private partnerships.

While China has much to learn from the rest of the world, the findings of this report indicate that China also has a range of untapped lessons learned and policy experiments of potentially great importance for policymakers internationally. Developing a clearer and more comprehensive picture of the status of markets for ecosystem/environmental services in China, including a more detailed documentation of the variety of local implementation strategies and outcomes, will help to capture the value of China’s ongoing, large-scale experiments in PES and other environmental policy innovations, and help to identify where cross-learning and collaboration across government ministries could be most promising, where further research in this sector would be best targeted and where the private sector could most easily and effectively be brought in as a key partner and stakeholder in environmental programs.

REFERENCES

- Agricultural Daily. 2008a. "My Country's Implemented Conservation Tillage Land Area Tops 30.62 Million Mu." <http://ac.agri.gov.cn/ac/ViewContent.do?id=4affaa20197f2afb01198313125f0117&year=2008&month=4&right=!ENCODEOn4HQIuBOIITHu7&sysid=4028817608b273d40108b273e12b1000>.
- Agricultural Daily. 2008b. "Central Government Invests RMB 170 Million to Implemented Conservation Tillage on More Than 30 Million Mu." http://ac.agri.gov.cn/ac/ViewContent.do?id=4affaa201984dc95011914e7f1500d4&year=2008&month=5&right=!ENCODEm_iCo0kXm007CkP&sysid=4028817608b273d40108b273e12b1000
- Ankang City Government. 2008. "National South-North Water Transfer Project Research Work Report on Each Initial County-Level Eco-compensation Plan Smoothly Passes Through Appraisal in Xunyang." <http://www.ankang.gov.cn/zwgk/nsl/200807/20080716073119.shtml>.
- BJMBA (Beijing Municipal Bureau of Agriculture). 2007. "Beijing City's Daxing District "Empty Bottle Recovery" Program Proceeds Smoothly." [http://www.bjagri.gov.cn/detail?model=00000000000000000005135&documentid=26282](http://www.bjagri.gov.cn/detail?model=000000000000000005135&documentid=26282).
- Beijing Modern Business News. 2005. "Beijing-Tianjin Sandstorm Source Control Program Construction Projects Will Develop Social Capital." June 21, 2005. <http://gov.finance.sina.com.cn/zsy/2005-06-21/62803.html>
- Beijing Urban-Rural Economic Information Net. 2007a. "Beijing City Daxing Area's Courteous and Virtuous Rural Households Who Practice Non-Tillage Agriculture Are Given a Subsidy." http://www.agri.gov.cn/dfxxlb/bjxxlb/t20070517_817521.htm.
- Beijing Urban-Rural Economic Information Net. 2007b. "Beijing City Government Encourages the Use of Organic Fertilizer." http://www.agri.gov.cn/dfxxlb/bjxxlb/t20070416_803000.htm.
- Bennett, Michael T. 2008. "China's Sloping Land Conversion Program: Institutional Innovation or Business as Usual?" *Ecological Economics* 65(2): 699-711.
- BMBLF (Beijing Municipal Bureau of Landscapes and Forestry). 2003a. "Third Phase of the Project *Protection and Management of Miyun Reservoir Drainage Area* is Already Confirmed." http://www.bjnw.gov.cn/jqdt/nchjjsyz/nclhnh/200607/t20060706_8465.html
- BMBLF. 2003b. "Sino-German Project *Protection and Management of the Miyun Reservoir Drainage Area* Has Achieved Phase Results." http://www.bjnw.gov.cn/jqdt/ncescy/wjwm/200607/t20060706_11084.html.
- Capoor, K. and Ambrosi, P. 2008. *State and Trends of the Carbon Market 2008*. Washington, DC: World Bank Institute. http://wbcarbonfinance.org/docs/State_Trends_FINAL.pdf.
- Carroll, N. and Michael Jenkins. 2008. *Payments for Ecosystem Services (PES) Markets: The PES Matrix Chart*. Washington, D.C.: Ecosystem Marketplace. http://ecosystemmarketplace.com/pages/article.news.php?component_id=5917&component_version_id=8762&language_id=12
- CCICED-TEMP (China Council for International Cooperation on Environment and Development — Taskforce on Eco-compensation Mechanisms and Policies). 2007. *Eco-compensation Mechanisms*

and Policies in China. Beijing: Science Press.

- China Anhui Net. 2005. "Anhui Province Plan Will Establish an Eco-compensation Mechanism in the Xin'an River Watershed." <http://ah.anhuinews.com/system/2005/06/09/001279865.shtml>.
- China Daily. 2006a. "Acid Rain Hampers Well-Off Society Goal." Aug. 3, 2006.
- China Daily. 2006b. "One-Third of China Hurt by Acid Rain." Aug. 27, 2006.
- China Daily. 2007. "A Struggle to Conserve the Elixir of Life for Our Children." Jan. 5, 2007. http://english.people.com.cn/200701/05/eng20070105_338503.html
- China Environment Net. 2007. "Policy Analysis: In-Depth Analysis of Emission Rights Trading and Other Environmental Economic Policies" <http://www.chinaenvironment.com/view/ViewNews.aspx?k=20070928092555234>.
- China Environmental Report. 2008. "Jiaying City Emission Trading is at the National Vanguard. It has Now Successfully Made 41 Trades for a Total of RMB 35.90 Million." http://www.mep.gov.cn/hjyw08/200806/t20080624_124452.htm.
- China Environmental Report. 2005. "Fujian Province Tries Out Min River Water Eco-compensation Mechanism".
- China Environmental Report. 2003. "Dalian Implements Shunkou Subsidy Payments for Green Agriculture". http://www.cenews.com.cn/lxw/200802/t20080214_211147.html.
- China Futures Association. 2008. "Beijing and Shanghai Announce on the Same Day the Establishment of Environmental Exchanges — A Domestic Market System for Carbon and Emissions Rights Will Hopefully Take Shape." <http://www.cfachina.org/news.php?id=39190>.
- China Green Foundation. 2007. "China Green Carbon Fund Established in Beijing" <http://www.cgf.org.cn/gzdt/content.asp?id=24>.
- China Green Times. 2005. "Zhejiang Invests RMB 968 million to Compensate Forest Ecosystem Benefits."
- China Green Times. 2008a. "Zhongjiang Establishes a Forest Ecosystem Benefit Compensation Fund" http://www.greentimes.com/green/news/zhuanli/lingai/content/200809/23/content_15215.htm
- China Green Times. 2008b. "The Three Norths Program Has Successfully Afforested 390 Million Mu of Land Area in Total." <http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=13996>
- China Green Times. 2008c. "A Towering Great Green Wall, Casting an Historical Monument — A Summary of the 30 Years of Successes of the Three Norths Shelterbelt Program" <http://www.forestry.gov.cn/distribution/2008/11/18/lyyw-2008-11-18-22816.html>
- China News Service. 2003. "Zhejiang's Cixi Spends RMB 700 million to Purchase Water from Shaoxing."
- China Water Resource Report. 2001. "Zhejiang Province's Dongyang Sells Water Rights to 50 million m³ to Yiwu."
- China Water Resource Report. 2003. "Zhejiang Province's Shanxing Will Sell Water Rights for 200,000 Tons/Day to Cixi."

- China.com.cn. 2007. "The Exploration and Practice of Water Rights Trading in China."
http://www.china.com.cn/info/2006zghjzb/2007-04/27/content_8179760.htm.
- China New Countryside Development Net. 2008. "2008 China Conservation Tillage Workshop
 Convened in Beijing" http://www.bjnw.gov.cn/jqdt/shzyxncjs/dxsl/200804/t20080425_177623.html.
- CI, TNC & FEEM (Conservation International, the Nature Conservancy and Fondazione Eni Enrico
 Mattei). 2007. *Towards More Sustainable and Market-based Ecological Compensation Mechanism
 — A Pilot Project of Payments for Ecological and Environmental Services in Lijiang, China. Study
 Report and Implementation Guideline.*
- Cong, Lan, Wei Xu. 2006. "Practice and Thoughts on Fujian Province Establishing Watershed Eco-
 compensation Mechanisms" *Environmental Protection* 2006 (19).
- Dongtou County Government. 2007. *Notice Regarding Distribution of Dongtou County Water Resource
 Protection Area Eco-compensation Implementation Measures.* Dongtou County Government Issue
 [2007] No. 86. http://www.dongtou.gov.cn/zwgk/fgwj/xfwj/20071229/7200_1.htm
- Dongtou County Government. 2005. *Notice Regarding Distribution of Dongtou County Water Resource
 Protection Area Eco-compensation Implementation Measures.* Dongtou County Government Issues
 [2005] No. 23. http://www.dongtou.gov.cn/main/dzzc/zcfg/zfwj/csjs/t20050516_8351.jsp
- Eastern Rural-Urban Report. 2006. "Farmers in Shanghai City's Periphery that Use Organic Fertilizer
 Will Receive a Subsidy."
- Economic Daily. 2007. "The State Forest Bureau Issues *Report on the Comprehensive Development of
 the Conversion of Cropland to Forests and Grassland Policy.*" http://www.gov.cn/jrzg/2007-02/04/content_517272.htm
- Engel, Stefanie, Stefano Pagiola and Sven Wunder. 2008. "Designing Payments for Environmental
 Services in Theory and Practice: An Overview of Issues." *Ecological Economics* 65(4): 663-674.
- FAO. 2003. *Review of World Water Resources by Country.* Water Reports 23.
- Fujian Forestry Office. 2007a. "Fujian Sets up a Lower Watershed Area to Upper Watershed Area Forest
 Ecological Benefit Compensation Mechanism"
http://www.forestry.gov.cn/subpage/content.asp?lm_Tname=lyyw&lmdm=3010&f_lmname=&id=15184
- Fujian Forestry Office. 2007b. "Yongan City, Sha County, Establishes a County-Level Forest Ecosystem
 Benefit Mechanism" <http://www.fjforestry.gov.cn/document.asp?docid=19294>
- Gao, Bin, Chunhong Zhang, Jian Liu and Yongqing Liu. 2005. "Thoughts on Lushan Channel Water
 Rights Transfer." *Sichuan Water Resources* 2005(03).
- Guangdong Forestry. 2007. "The Innovative Ecological Public Benefit Forest Compensation Mechanism
 Pilot of Yongan City, Fujian Province, Makes a New Breakthrough" <http://www.gdf.gov.cn/index.php?controller=front&action=view&id=10000538>
- Guangdong Provincial Finance Bureau. 2008. "Research of Guangdong Province's Forest Ecological
 Compensation Mechanism" http://www.gdczt.gov.cn/cz_news_nr.jsp?news_id=7504
- Guangxi Daily. 2006. "Guangxi Starts a Provincial-Level Forest Ecology Benefit Compensation Fund
 System" <http://www.gxdy.gov.cn/news/shownews.asp?newsid=3405>

- Guangxi Financial Office. 2005. "Shandong Provincial Forest Ecology Benefit Compensation Fully Being Implemented" <http://www.gxcz.gov.cn/newsinfo.asp?id=2854&CataID=24>
- Hainan Daily. 2006a. "Hainan Uses Forest Ecosystem Benefit Compensation Fund to Newly Hire More than 2000 Forest Protection Staff" http://www.gov.cn/gzdt/2006-08/06/content_355672.htm
- Hainan Daily. 2006b. "Provincial-Level Forest Ecosystem Benefit Compensation is Implemented This Year" <http://news.sina.com.cn/c/2006-08-06/07459669639s.shtml>
- Hainan Daily. 2006c. "My Province Establishes a Provincial-Level Forest Ecosystem Benefit Compensation System" <http://www.hainan.gov.cn/data/news/2006/07/15969/>
- Hainan Xingnong Net. 2007. "Hainan Province Implements a Forest Ecosystem Benefit Compensation System, Preventing Over-Harvesting" <http://nc.mofcom.gov.cn/news/2109910.html>
- Hamilton, K., Sjardin, M., Marcello, T. and Xu, G. 2008. *Forging a Frontier: State of the Voluntary Carbon Markets 2008*. Washington, DC: Ecosystem Marketplace and New Carbon Finance. http://ecosystemmarketplace.com/documents/cms_documents/2008_StateofVoluntaryCarbonMarket2.pdf
- Hebei Daily. 2007. "Hebei's Chengde City Will Convert 71,000 mu of Paddy Rice Fields to Dryland Agriculture in 2007 According to Beijing's Water-Supply Plan."
- Hebei Daily. 2006. "Beijing and Hebei Memorandum to Strengthen Cooperation on Social and Economic Development Resolved." http://www.he.xinhuanet.com/test/2006-10/26/content_8357510.htm
- Henan Forestry Information Net. 2006. "Excellent Start for Forest Ecology Benefit Compensation Work" <http://www.hnly.gov.cn/hnly/asp/detail.jsp?id=0154C7E2-B1D1-4B43-A3F3-E675ADBAEB4E&typeid=2c90819c0ee3db3d010ee4247719001e>
- Ho, Peter. 2005. "Going, Going, Gone! The Four Wastelands Auction Policy." Chapter 5 in Ho, Peter, *Institutions in Transition: Land Ownership, Property Rights and Social Conflict in China*. Oxford, UK: Oxford University Press.
- Hu, Yi, Yuansheng Li. 2006. "Determining the Building of Eco-compensation Mechanisms Inside Watersheds — Case Study of the Min River Watershed." *Fujian Teacher's Training University Journal (Philosophy and Social Sciences Edition)* 2006 (06).
- Huang, Jikun, 2000. "Land Degradation in China: Erosion and Salinity." A Report Submitted to the World Bank. Center for Chinese Agricultural Policy, Beijing.
- IFOAM (International Federation of Organic Agricultural Movements). 2008. "Regulatory Framework and Policies for Organic Agriculture in China." http://www.ifoam.org/growing_organic/2_policy/case_studies/china_regulations_policies.php.
- Jinan Daily. 2007. "Shandong Starts an Eco-compensation Pilot"
- Li, Ling. 2006. "Chinese Government to Start 'Buying Green'." Nov. 30, 2006. Worldwatch Institute. <http://www.worldwatch.org/node/4760>.
- Li, Nuyun. 2008. "Establishment and Operation of the China Green Carbon Fund" Presentation at the *International Workshop on the Development of Forestry Carbon Sequestration and Bio-energy*, Dec. 16-18, 2008, Beijing.

- Li, Yuansheng, Yi Hu. 2007. "Exploratory Analysis of Min River Watershed Area Ecological Benefit Compensation Standards" *Modern Agriculture Research* 2007 (03).
- Liaoning Environmental Protection Bureau. 2008. "Liaoning Brings Out *River Section Water Quality Target Assessment and Compensation Measures*, if Water that Passes Section Boundaries is Below Standard, the Upper Watershed Compensates the Lower Watershed." <http://www.lnepb.gov.cn/hbj/web/html/100103/2008429/1209434486600.shtml>.
- Liu Jianchang, Weiqi Chen, Luoping Zhang & Huasheng Hong. 2005. "Research on the Developing Environmental Economics Instruments for Controlling Agricultural Nonpoint Source Watershed Pollution." *China Ecoagricultural Journal* 2005(03).
- Liu, Feifei. 2007. "Beijing City's Daxing District Farmers Can Purchase Safe Pesticides at a Low Price." http://www.agri.gov.cn/dfxxlb/bjxxlb/t20070704_846428.htm.
- Liu, Zhen. 2005. "The retrospect and prospects of China's soil and water conservation and integrated small watershed management." *China Water Resources* 19: 17-20.
- Lü, Zhi, Michael Totten, and Philip Chou. 2006. "Spurring Innovation for Clean Energy and Water Protection in China: An Opportunity to Advance Security and Harmonious Development" *China Environmental Series* 8: 61-81.
- Luoyang Radio Net. 2006. "Ruyang County Establishes Province-Level Forest Ecology Benefit Compensation Fund Pilot Province." <http://www.radioluoyang.com/xwvp/online/200606/2593.html>.
- Mackinnon, J., Xie, Y., 2001. *Restoring China's Degraded Environment-The Role of Natural Vegetation*. China Forestry Press, Beijing, China.
- Maosheng, Duan. 2008. "The CDM Market in China: Developments and Challenges." Published in International Emissions Trading Agency, *Greenhouse Gas Market 2008: Piecing Together a Comprehensive International Agreement for a Truly Global Carbon Market*, 24-28.
- MEP (China Ministry of Environmental Protection). 2006. "Eco-compensation: The Immediate Need for Sustainable Development — The Search and Practice of Zhejiang and Anhui Establishing an Eco-compensation Mechanism." http://www.zhb.gov.cn/hjyw/200606/t20060629_77851.htm
- MEP. 2007. "Pan Yue: Environmental Economics Policy is the Institutional Support to the Scientific Development View." http://www.sepa.gov.cn/zxbd/2007lvrw/tpbd/200709/t20070910_108942.htm (last accessed May 29, 2008).
- MEP. 2008a. "Shanxi: *Research Report on the Xunyang South-North Water Transfer Project Eco-compensation Plan* Undergoes Expert Appraisal and Review." http://www.sepa.gov.cn/info/gxdt/200807/t20080718_125899.htm.
- MEP. 2008b. "Hubei Province Wuhan City Group Ecological Environment Plan is Released." http://www.mep.gov.cn/info/gxdt/200811/t20081117_131307.htm
- MEP-PRCEE (Policy Research Center for Environment and Economy — Ministry of Environmental Protection). 2006. "Research Report on Issues Regarding South-North Water Transfer Project Central Channel Water Resource Conservation Area Eco-compensation."
- MoA (China Ministry of Agriculture). 2007a. "The China Ministry of Agriculture Issues 'National Rural

- Biogas Project Development Plan', which will have 40 million rural households using biogas by 2010." http://www.agri.gov.cn/xxlb/t20070410_800366.htm.
- MoA. 2007b. "National Development and Reform Commission Opinion on Strengthening the Management of Rural Biogas Development."
http://www.agri.gov.cn/zcfg/bmgz/t20070930_898899.htm.
- MoA. 2007c. "A New Type of Energy Source Enters the Average Home in Hulin City."
http://www.agri.gov.cn/dfxxlb/hljxxlb/t20070629_844225.htm.
- MoA. 2007d. "The Jin City, Zezhou County Progressive Biogas Development Project."
http://www.agri.gov.cn/dfxxlb/sxsxxlb/t20070622_839676.htm.
- MoA. 2007e. "New Energy Sources Such as Solar and Biogas Enter Villages and Homes in Dezhou."
http://www.agri.gov.cn/dfxxlb/sdxxlb/t20070618_836711.htm.
- MoA. 2007f. "Taozhou Township of Anxi County Energetically Develops Rural Biogas, Protecting the Ecological Environment of the Jin River Headwaters."
http://www.agri.gov.cn/dfxxlb/fjxxlb/t20070429_811285.htm.
- MoA. 2007g. *The Ministry of Agriculture's Views on Enthusiastically Developing Conservation Tillage*. MoA Issue [2007] no. 10.
<http://www.amic.agri.gov.cn/DesktopModules/Infos11/Infos/ThisInfo.aspx?c=1& itemid=27336>
- MoA. 2003. *Rural Biogas Development National Debt Program Management Measures (Try-out)*.
http://www.china.com.cn/policy/txt/2003-10/08/content_5417438.htm.
- MoF (China Ministry of Finance) & STA (State Taxation Administration). 2008. *Notice Regarding /VAT Tax Exemption for Agricultural Fertilizer Products* MoF and STA Joint Issue [2008] no. 56
<http://www.chinatax.gov.cn/n480462/n480513/n480902/7915158.html>.
- MoF (China Ministry of Finance). 2006. "Ministry of Finance, State Environmental Protection Agency Jointly Printed and Disseminated [Views on Implementing Government Procurement of Environmental Label Products]". <http://www.ccgp.gov.cn/purgjlaw/hongtou.jsp?condition=822>
- MoF-AO (Agriculture Office — China Ministry of Finance). 2008. "Fully Bringing Into Play Financial Functions and Actions to Support Collective Forest Tenure Reform"
http://www.mof.gov.cn/nongyesi/zhengfuxinxi/bgtDiaoCheYanJiu_1_1_1_2/200807/t20080718_57940.html
- MoF, SFA. 2002. *Forest Vegetation Restoration Fee Levy, Use and Management Provisional Measures*. MoF Joint Issue [2002] no. 73.
- Morgenstern, Richard D., et al. 2004. "Emissions Trading to Improve Air Quality in an Industrial City in the People's Republic of China." Resources for the Future Discussion Paper 04-16.
<http://www.rff.org/rff/News/Features/Improving-Air-Quality-in-China.cfm>
- MWR. 2000. *China Water Resources Bulletin*.
- MWR. 2005. "Jiangxi Province's Anyuan County: Implementing Ecological Restoration Program, Promoting Harmonious Development between Man and Nature."
<http://www.mwr.gov.cn/ztpd/2005ztpd/ stbcgzh/tpbd/2005032200000049234.aspx>.

- MWR. 2006a. *2006 Annual Water Resource Quality Report*.
- MWR. 2006b. "Existing Issues and Views Regarding the Successes and Experience of the Yangtze River Upper Watershed Water and Soil Conservation and Key Prevention Program" *18th Scientific Investigation Briefing (6th, 2006)*
<http://www.mwr.gov.cn/ztpd/tszt/sbkkzt/jb/20060424000000070849.aspx>
- Nanchang Daily. 2006. "Jiangxi Province Invests RMB 50 million in 2006 to Support the Establishment of a Forest Ecosystem Compensation Mechanism".
- NDRC-ONCCCC (China National Development and Reform Commission, Office of National Coordination Committee on Climate Change). 2008. *Projects Approved by DNA of China (Total: 1444) (up to July 18, 2008)*. <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1905.doc>
- NEPA (National Environmental Protection Agency of China). 1988. *Water Pollutant Emissions Permit Management Provisional Measures*. March 20, 1988.
- NEPA. 1992. *Notice Regarding the Pilot Program for the Development of Industrial Combustion of Coal SO₂ Emission Levies*. NEPA Issue [1992] no. 361. Sept. 14, 1992.
- New York Times. 2008. "China Increases Lead as Biggest Carbon Dioxide Emitter" June 14, 2008.
- Ning, Datong, Chang, Y., 2002. "An assessment of the economic loss resulting from the degradation of agricultural land in China." Consulting Report, ADB TA-3548 PRC.
- Ningbo Daily. 2003. "Ningbo City Signs First Extraterritorial Water Supply Project: Cixi People Can Drink Shaoxing Water in 2005."
- Ningxia Daily. 2006. "Ningxia Agricultural Sector Transfers 64 Million Cubic Meters of Water to Industry" *Aug. 25, 2006*.
- Ningxia Daily. 2004. "Ningxia Increases Water Use Efficiency via Compensated Transfer of Water Rights." *April 22, 2004*.
- Pagiola, Stefano and Gunars Platais. 2007. *Payments for Environmental Services: From Theory to Practice*. Washington DC: World Bank.
- People's Daily. 2006a. "Gansu Province Jingyuan No. 2 Electrical Power Company Ltd. and Baiyin City Water Rights Transfer Enters Full Implementation Stage."
- People's Daily. 2006b. "Gansu Initiates First Case of Cross-Sectoral Water Rights Transfer."
- People's Daily. 2006c. "Inner Mongolia Erdos Electricity and Joint Stock Company Obtains Water Supplies via Water Rights Transfer."
- People's Daily. 2007. "First Domestic Emissions Rights Reserve Trading Center Sets Up Shop — Can One Now Pay Money to Emit Pollution?"
- People's Net. 2008. "Shanghai's and Beijing's Two Environmental Exchanges Formally Set Up Shop on the Same Day." <http://www.caep.org.cn/ReadNews.asp?NewsID=1714>.
- PRC (People's Republic of China). 1991. *Water and Soil Conservation Law of the P.R.C.*
<http://www.mwr.gov.cn/zcfg/fl/19910629000000314204.aspx>.

- PRC. 1998. *Forest Law of the P.R.C.* http://www.gov.cn/flfg/2005-09/27/content_70626.htm.
- PRC. 2000. *Atmospheric Pollution Prevention and Control Law*. April 29, 2000.
- PRC. 2002a. *PRC Anti-Desertification Law*. http://www.gov.cn/ziliao/flfg/2005-09/27/content_70629.htm
- PRC. 2002b. *China Government Procurement Law*.
<http://www.people.com.cn/GB/jinji/31/179/20020629/764316.html>
- PRC. 2002c. *Water Law of the P.R.C.* <http://www.mwr.gov.cn/zcfg/fl/20021001000000914234.aspx>
- Qilu Evening News. 2008. "Shandong Weifang City Will Implement a Pollution Rights Trading Pilot" http://www.sd.xinhuanet.com/wq/2008-03/06/content_12629665.htm.
- Ren, Yong, Dongfang Feng and Hai Yu. 2008. *Chinese Eco-compensation Theory and Policy Framework Design*. Beijing: China Environmental Sciences Press.
- Reuters News Service. 2007a. "China's Emissions Drop but Situation Grim: Report." Aug. 21, 2007.
- Reuters News Service. 2007b. "China Overtakes U.S. as Top CO₂ Emitter: Dutch Agency" June 20, 2007.
- Southern Daily. 2005. "Jiangxi Invests RMB 1.42 billion to Initiated the Dong River Eco-compensation Program. Guangdong Will Provide RMB 150 million in Subsidies Annually."
- State Council (China State Council). 1990. *State Council Decision Concerning the Progress of Strengthening Environmental Protection Work*. Dec. 5, 1990.
- State Council. 1993. *Water and Soil Conservation Law of the P.R.C. Implementation Regulations* <http://www.mwr.gov.cn/zcfg/xzfg/19930801000000613837.aspx>.
- State Council. 1996a. *State Council Notice on Strengthening Soil and Water Conservation through the Control and Development of the Rural 'Four Wastelands'*. State Council Issue [1996] no. 23.
- State Council. 1996b. *State Council Decision Concerning Several Problems of Environmental Protection*. State Council Issue [1996] no. 31. Aug. 3, 1996.
- State Council. 2000a. *Water Pollution Prevention and Control Law Implementation Rules* March 20, 2000.
- State Council. 2000b. *PRC Forest Law Implementation Regulations*. State Council Issue [2000] no. 278, Jan. 29, 2000.
- State Council. 2005. *State Council Decision Regarding Strengthening Anti-Desertification Work*. State Council Issue [2005] no. 29.
- State Council. 2007. *State Council Notice Regarding the Improvement of the Conversion of Cropland to Forests Policy*. State Council Issue [2007] no. 25.
- STA (State Taxation Administration). 2008. "Two Ministries Issue Notice That Organic Fertilizer Products Will be VAT Tax Exempt Starting June 1." http://www.gov.cn/gzdt/2008-05/26/content_993885.htm.
- SEPA (China State Environmental Protection Agency). 2005. "Eco-compensation: Sustainable Development's Pressing Need — The Search for and Implementation of an Eco-compensation Mechanism Between Zhejiang and Anhui."

- http://www.zhb.gov.cn/hjyw/200606/t20060629_77851.htm.
- SFA (State Forest Administration). 2001. *Three Norths Shelterbelt Forest System Construction 4th-Period Program Plan*.
- SFA. 2003. *Sloping Land Conversion Program Plan (2001–2010)*.
- SFA. 2005. “Beijing-Tianjin Sandstorm Source Control Program”
http://www.forestry.gov.cn/all_zl/swhm/ldgc/03.asp
- SFA. 2006. “The General Situation of the Three Norths Shelterbelt Forest Program”
<http://www.forestry.gov.cn/sub/FstArticle.aspx?id=zllh.1350>
- SFA. 2007a. “The Overall Situation of the Conversion of Cropland to Forests and Grassland Program is Excellent and the Results Significant.” http://www.gov.cn/jrzg/2007-02/03/content_517012.htm.
- SFA. 2008a. “Survey Research Report on Regional Forest Ecosystem Compensation Policies”
<http://www.forestry.gov.cn/sub/FstArticle.aspx?id=kjyj.275>.
- SFA. 2008b. “Status of the Natural Forest Protection Program.”
<http://www.forestry.gov.cn/distribution/2008/11/28/lyyw-2008-11-28-23538.html>.
- SFA. 2008c. “The Natural Forest Protection Program’s Implementation Status and Main Outcomes.”
<http://www.forestry.gov.cn/sub/FstArticle.aspx?id=lyyw.8237>.
- SFA. 2008d. “Guangdong Province Local Finance Establishes a Forest Ecological Benefit Compensation Fund.”
<http://www.forestry.gov.cn/distribution/2008/10/30/lyjj-2008-10-30-245.html>.
- SFA. 2008e. “Jiangxi Province Local Finance Establishes Forest Ecological Benefit Compensation Fund.”
<http://www.forestry.gov.cn/distribution/2008/11/03/lyjj-2008-11-03-253.html>.
- SFA. 2008f. “Public Report of Survey Research of Regional Forest Ecological Benefit Compensation Policies” <http://www.forestry.gov.cn/sub/FstArticle.aspx?id=kjyj.275>.
- SFA. 2008g. “Most Provinces Are Moving Quickly, Forest Tenure Reform Has Entered A Critical Stage — Highlights from the National Forest Tenure Reform Management Meeting”
<http://www.forestry.gov.cn/distribution/2008/04/01/lqgg-2008-04-01-2759.html>.
- SFA. 2008h. “Building an Eco-Barrier, Welcoming a Green Olympics — Beijing City’s Record to Date of Construction for the Beijing-Tianjin Sandstorm Source Control Program” May 27, 2008.
<http://www.forestry.gov.cn/distribution/2008/05/27/fszs-2008-05-27-199.html>
- SFA-DIC (State Forestry Administration, Department of International Cooperation). 2005. “Sino-German Forestry Technical Cooperation Miyun Reservoir Protection and Management Project Phase III Agreement Signed in Beijing.”
http://www.forestry.gov.cn/subpage/content.asp?lm_Tname=lyyw_2005d&lmdm=1055&f_lmname=&id=11225.
- Shandong People’s Government. 2007. “Opinions Regarding the Development of Eco-compensation Pilot Work on the South-North Water Transfer Project, Yellow River South Section, and Provincially-Administered Projects on the Huai River and Xiaoqing River Watersheds.”
http://www.shandong.gov.cn/art/2007/7/16/art_956_1203.html.
- Shanghai Securities Report. 2008. “Jiangsu Starts a Tai Lake Emissions Rights Trading Pilot”

- <http://www.p5w.net/news/gncj/200808/t1836555.htm>.
- Shanxi Provincial Government. 2008. "South-North Water Transfer Project Central Channel Water Conservation Area Eco-compensation Mechanism Plan Appraisal Meeting is Convened in Xunyang." <http://www.shaanxi.gov.cn/0/1/9/42/53689.htm>
- Shen, Manhong. 2004. "Views on Implementing an Eco-compensation Mechanism in the Thousand Island Lake Channel Program." *Hangzhou Technology* 2004(02).
- Sichuan Forestry Office. 2008a. "Sichuan Decides to Establish a Province-level Forest Ecology Benefit Compensation Mechanism" <http://www.scly.gov.cn/article342580.html>.
- Sichuan Forestry Office. 2008b. "Sichuan Provincial Forestry Office Convenes Workshop on Province-Level Forest Ecology Benefit Compensation Pilot Work" <http://www.scly.gov.cn/article352103.html>
- Sichuan Forestry Office. 2008c. "Deyang City, Zhongjiang County, Takes the Lead in Establishing a County-Level Forest Ecosystem Benefit Subsidy Fund" <http://www.scly.gov.cn/article342539.html>.
- Sinton et. al. 2004. *China Energy Databook*. Lawrence Berkeley National Laboratory, Table 2-1. Cited in Joanna Lewis, "The Evolving Role of Carbon Finance in Promoting Wind Power Development in China." Published at the conference proceedings of the China Wind Power 2008 conference, 29 — 31, October 2008.
- State Council (of the PRC). 2005. *State Council Decision Regarding Strengthening Anti-Desertification Work*. State Council Issue [2005] no. 29. http://www.gov.cn/gongbao/content/2005/content_91640.htm
- Sterner, Thomas. 2003. *Policy Instruments for Environmental and Natural Resource Management*. Washington: Resources for the Future.
- Straits Capital News. 2005. "Fujian Min River Implements Compensation Mechanism for Environmental Protection." <http://www.jxsl.gov.cn/article.jsp?articleid=601>.
- Tianjin Daily. 2008. "Comprehensive Pilot for Major Pollutant Emission Rights Trading Launched in Binhaxin District" Dec. 24, 2008. http://www.mep.gov.cn/hjyw08/200812/t20081224_132807.htm
- Times News. 2008. "Chongqing Drafts Application for Pollution Rights Trading Pilot: Enterprises Can Purchase Pollution Targets" http://www.cq.xinhuanet.com/business/2008-04/02/content_12856352.htm.
- Turner, Jennifer and Kenji Otsuka. 2006. *Reaching Across the Water: International Cooperation Promoting Sustainable River Basin Governance in China*. China Environment Forum, Woodrow Wilson Center for Scholars.
- UNFCCC CDM Website. 2008. <http://cdm.unfccc.int/index.html>.
- Wang, Jinnan, Yang Jintian, Stephanie Benkovic Grant & Jeremy Schreifels. 2001. "SO₂ Emissions Trading Program: A Feasibility Study for China." Beijing: China Environmental Science Press.
- Wang, Jinnan, Zhanfeng Dong, Jintian Yang, Yunsheng Li and Gang Yan. 2008. "Emissions Trading Programs: The Updated Progress and Its Development for China." Chinese Academy for Environmental Planning. <http://www.caep.org.cn/english/paper/The-Updated-Progress-of-Emission-Trading-Programs-in-China.pdf>

- Wang, Jinnan, Jintian Wang, Chazhong Ge, Dao Cao and Jeremy Schreifels. 2004. "Sulfure Dioxide Emission Trading in China: Piloting Programs and Its Perspective."
<http://www.caep.org.cn/english/paper/A-Framework-of-SO2-Emission-Trading-Program-in-China-2001.pdf>.
- Wang, Zhongjing, Youxing Lu, Dajun Shen, Xuefeng Wang and Hang Zheng. 2006. "Thoughts on the Construction of Quanzhou City's Jin River Watershed Water Rights Institution" *China Water* 2006 (21).
- Water Information Net. 2007. "Anhui: Xin'an River Enters the National Eco-compensation Mechanism Pilot Program." <http://www.hwcc.com.cn/newsdisplay/newsdisplay.asp?Id=174021>.
- Wenzhou Daily. 2006. "Dongtou: The Government Gives a 'Bonus' to Rural Households That Do Not Cultivate Their Land or Raise Pigs." <http://county.aweb.com.cn/2006/11/27/8030982.htm>.
- WWF (World Wildlife Fund). 2008. *The Value of Carbon in China: Carbon Finance and China's Sustainable Energy Transition*. A report for WWF Hong Kong/Beijing Office prepared by Ecofys-Azure.
http://wwf.org.hk/eng/pdf/references/pressreleases_hongkong/WWFcarbon_report_FINAL_20080630_ENG.pdf
- World Bank. 2007. *Promoting Market-Oriented Ecological Compensation Mechanisms: Payment for Ecosystem Services in China*. World Bank Analytical and Advisory Assistance (AAA) Program Policy Note
- World Bank, 2001. *China: Air, Land and Water, Environmental Priorities for a New Millennium*. World Bank, Washington, DC.
- Wunder, Sven. 2005. *Payments for Environmental Services: Some Nuts and Bolts*. Center for International Forestry Research Occasional Paper No. 42. Bogor, Indonesia: CIFOR.
- Xinhua News Agency. 2008a. "My country has invested RMB 10.5 billion to develop rural biogas."
<http://ac.agri.gov.cn/ac/ViewContent.do?id=4affaa201b3ec603011b78222f4c02cc&year=2008&month=7&right=!ENCODEo5PZTxDUoxxBZDX&sysid=4028817608b273d40108b273e12b1000>.
- Xinhua News Agency. 2008b. "My Country's Environmental Label Already Consists of a Complete Standards, Certification and Verification System"
http://www.sepa.gov.cn/tech/lssf/xgbd/200806/t20080612_123845.htm.
- Xinhua News Agency. 2007a. "Calming Beijing's Water Worries, Chengde Enrolls 71,000 mu in the 'Paddy to Dryland' Program." <http://www.xinnongcun.gov.cn/counter.asp?id=11599&Iclass=1401>.
- Xinhua News Agency. 2007b. "Shandong Will Implement an Eco-compensation Pilot in National Key Watersheds." http://wirmc.sepa.gov.cn/hjyw/200707/t20070724_107102.htm
- Xinhua News Agency. 2007c. "South-North Water Transfer Central Channel Project: Compensation Mechanism is Implemented in Earnest" http://news.xinhuanet.com/focus/2007-02/23/content_5714528.htm.
- Xinhua News Agency. 2007d. "Gansu Province Zhangye City's Water Rights Reform: A New Road to Developing Water Saving." <http://www.hwcc.com.cn/newsdisplay/newsdisplay.asp?Id=157954>
- Xinhua News Agency. 2006a. "Henan Establishes Province-Level Forest Ecology Benefit Compensation Fund" http://news.xinhuanet.com/newcountryside/2006-06/30/content_4771399.htm.
- Xinhua News Agency. 2006b. "Henan Establishes Province-Level Forest Ecology Compensation Fund

- to Protect the Ecological Environment” <http://www.qh.gov.cn/html/137/22656.html>.
- Xinhua News Agency. 2006c. “Water Saving in Gansu Province’s Zhangye City Alleviates Conflicts Between Middle and Lower Hei River Watershed Water Use.” <http://www.hw-ts.com/html/slxw/200610161001477916.html>.
- Xinhua News Agency. 2005a. “Qiantang River Watershed Ecological Protection Becomes the ‘Number One Proposal’ of Hangzhou People’s Congress” <http://www.zjol.com.cn/gb/node2/node138665/node138751/node138766/userobject15ai3850619.html>.
- Xinhua News Service. 2005b. “Beijing: Beijing-Tianjin Sandstorm Source Control Program Focuses on Long-Term Mechanisms.” June 21, 2005 http://news.xinhuanet.com/newscenter/2005-06/20/content_3111586.htm.
- Xinhua News Agency. 2004. “News Background: ‘Yangtze River Upper Watershed Water and Soil Conservation and Key Prevention’ Program”. http://news.xinhuanet.com/newscenter/2004-10/24/content_2131822.htm.
- Xu, Zhigang, Xu, Jintao, Deng, Xiangzheng, Huang, Jikun, Uchida, Emi, Rozelle, Scott, 2005. “Grain for green versus grain: conflict between food security and conservation set-aside in China.” *World Development* 34 (1), 130–148.
- Yang, Jintian and Jeremy Schreifels. 2003. “Implementing SO₂ Emissions in China.” OECD Global Forum on Sustainable Development: Emissions Trading. Concerted Action on Tradeable Emissions Permits Country Forum.
- Yang, Ruizhen, 1994. “Cultivated land soil and water loss and control measures in China.” *Bulletin of Soil and Water Conservation* 14 (2), 32–36.
- Yangtze Water Resource Net. 2008. “The Outcomes of the Yangtze River Upper Watershed Water and Soil Conservation and Key Prevention Program are Clear in 2007” <http://www.cjw.gov.cn/index/detail/20080318/100668.asp>
- Yangtze Water Resource Net. 2004. “‘Yantze Control’ Program Resolves the Livelihood Issues of 10 million people” <http://www.mwr.gov.cn/index/20040622/35803.asp>
- Yiwu City Agriculture Net. 2006. “This Year My Province’s Provincial-Level Forest Ecology Benefit Compensation Fund Formally Establishes RMB 6 million to Support the Greenification of the Central Chinese Plains” <http://www.ymsny.gov.cn/asp/showdetail.asp?id=69280>.
- Youth Daily. 2005. “Hangzhou Will Use Eco-compensation Mechanism to Control Pollution” http://www.greengz.cn/inew/inew_details.asp?INew_ID=7599.
- ZGTJNJ. 2007. *China Statistical Yearbook*. Beijing, China: China Statistical Press.
- Zhang, Huiyuan, Guihuan Li, Jinnan Wang and Jun Wan. 2007. “Policy and Practice Progress of Watershed Eco-compensation in China.” *Chinese Geographical Science* 17(2): 179-185.
- Zhang, Junlian, Fengrong Zhang, Liqin Zhang & Wei Wang. 2009. “Transaction Costs in Water Markets in the Heihe River Basin in Northwest China.” *Water Resources Development* 25(1): 95-105.
- Zhang, Lubiao, Haixia Zheng and Yanjun Cheng. 2006. “Paying for Watershed Services in Jinhua Watershed in Zhejiang Province, China,” in Proceedings from Workshop on Payment for Watershed Services: Roles of Government and Market. IIED and College of Humanities and Development,

China Agricultural University.

Zhejiang Provincial Government. 2005. *Several Views of the Zhejiang People's Government on Improving Eco-compensation Mechanisms*. Zhejiang Peoples Government Issue [2005] No. 44 http://www.tzda.zj001.net/show_hdr.php?xname=POL1LU0&dname=HCFHI11&xpos=9.

Zhejiang Provincial Forestry Office. 2004. "Zhejiang Province Significantly Increases Eco-Compensation Funds, Province-Level Ecological Public Benefit Forest Subsidies Increase from RMB 3 to RMB 8 Per Year" <http://www.zjagri.gov.cn/html/zjhh/summarizeView/2006012546043.html>.

Zhen, Mingtao and Leshan Jin. 2006. "Case Studies of Watershed Eco-compensation" in Proceedings from Workshop on Payment for Watershed Services: Roles of Government and Market. IIED and College of Humanities and Development, China Agricultural University.

Zheng, Haixia and Lubiao Zhang. 2006. *Chinese Practices of Ecological Compensation and Payments for Ecological and Environmental Services and its Policies in River Basins*. Report submitted to the World Bank.

Zhou, Jianxiang. 2005. "Holding Back the Desert: Entrepreneurs have embarked on a mission to protect the ecology of the Arlarshan Plateau" *Beijing Review* 48(24).

Zhuan, Zhaizi. 2005. "Protection Shouldn't Become a Burden, and Benefits Should No Longer be Enjoyed for Free — Deqing County Explores the Establishment of an Eco-compensation Mechanism" *Zhejiang Daily*, June 16 <http://www.dqep.gov.cn/showmain.asp?tid=1599>

ZPDRC (Zhejiang Provincial Development and Reform Commission). 2005. "Dongtou County Implements Water Resource Protection Area Eco-compensation." http://www.djw.gov.cn/NewsDetail.jsp?u_UID=1845

Zuo, Ting, Leshan Jin, Tianlai Guo, Binqian Guan and Xiaoyun Li. 2005. *Moving Towards a Market-Oriented Approach: Case Study of the Forest Ecological Compensation Program in Miluo Watershed, Hunan, China*. IIED Payments for Watershed Services- China Diagnostic Study, Case Study Report.



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