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Buyer, Regulator, and Enabler
The Government's Role in Ecosystem Services Markets

International Lessons Learned for Payments for Ecological Services in the People's Republic of China

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1 Introduction

The People's Republic of China (PRC) is at an exciting stage in the development of its national environmental policy framework. The fast-paced economic growth of the past 3 decades, while having lifted hundreds of millions of rural denizens out of poverty, has unfortunately also greatly multiplied the environmental challenges faced by policy makers at all levels of government, increasing pressures on fragile ecosystems, creating a range of new pollution and environmental safety issues, and further straining the country's already limited per capita natural resource base. At the same time, economic growth has also created opportunities, since the PRC's "economic miracle" is giving the government the financial wherewithal to improve its capacity to monitor and enforce existing environmental laws, and to fund new environmental initiatives and policies. At the nexus of these countervailing trends, policy makers have been experimenting with new approaches to environmental management, resulting in a wide range of policy and program innovations, many under the broad heading of "eco-compensation." Many of these incorporate, or provide a framework for, market-based approaches to environmental policy, and in particular for payments for ecological services (PES) (Bennett 2009).

PES is gaining traction internationally as a valuable new approach to conservation that uses direct payments, either in cash or other forms of compensation, from ecosystem services beneficiaries (e.g., private businesses, communities and society as a whole) to land stewards (i.e., those who can influence the provision of ecosystem services) to encourage ecosystem conservation and restoration (Wunder 2005). In general, four types of 'market' or 'market-like' instruments exist for ecosystem services provision:

- Private payments for private benefits (that may or may not have public benefits);
- Public payments (on behalf of the public interest) for public benefits;
- Private payments motivated by cap-and-trade or floor-and-trade regulatory systems; and
- Eco-certification where ecosystem services provision is included as a characteristic of a standard market good (e.g., "green" and organic agricultural products in the PRC).

In the backdrop of PES is the broader vision of creating the institutional foundations necessary to engender ecosystem service markets. 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" regimes to identify and align the social costs and benefits of ecosystem services provision. International interest in PES has been growing in recent years due to a number of factors, including the increasing value of ecosystem services due to their growing economic demand, the need to tap into new sources of finance for conservation, growing corporate interest in making environmentally responsible investments, and supportive changes in the governance of natural resources (Scherr et al. 2006). As a result, these direct payment schemes have been flourishing, expanding 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 around $77 billion worldwide, and these total payments are expected to increase to approximately $300 billion by 2020 (Carroll and Jenkins 2008). Currently, the biodiversity and certified agriculture (i.e., eco-labeling) markets are the most active in terms of volumes of monetary transactions.[1] 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 comparison to PES, the Chinese term "eco-compensation" is broader, encompassing PES-like policies as well as a range of other policies and programs types, both with and without market-based elements (Bennett 2009). The PRC's national government has been playing a central role in promoting ecosystem service market development through its various eco-compensation programs and policies; it has made extraordinary efforts in driving some of the largest public payment schemes for ecosystem services in the world, having spent over CNY130 billion on the Conversion of Cropland to Forest and Grassland (CCFG) program to date, under which over 9 million hectares (ha) of cropland has been afforested, and more than CNY13 billion since 2001 on the Forest Ecosystem Compensation Fund (FECF), which currently covers 105.2 million ha of forest area across 30 provinces in the PRC (State Forestry Administration [SFA] 2007; Economic Daily 2007; SFA 2008a).[2] 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 the country's environmental and development challenges.

At this critical stage, the PRC has the opportunity to both benefit from and provide innovative examples for international developments in PES. In particular, the PRC's experience highlights an important point often implicitly overlooked in the international discourse on ecosystem service markets and PES: the central role of the public sector. Current international literature on PES tends to emphasize its private-sector and voluntary aspects, since one of the exciting promises of PES is to broaden and deepen sources of conservation finance by directly engaging a wider array of economic actors as buyers of ecosystem services. In contrast, much discussed amongst policy circles in the PRC is the concept of "combining market mechanisms with government guidance," indicating a predominantly public-sector driven approach.[3] At first glance, the PRC's situation thus appears to be unique. It is not. The public sector is still very much the dominant player in ecosystem service markets worldwide. Excluding eco-certified products markets, the public sector contributes roughly 70% of annual ecosystem services payments internationally by value (Milder et al. 2009).[4]

To provide insights for the PRC's policy makers in the development of a national eco-compensation policy framework, this paper discusses the public sector's role in PES internationally. In general, the public sector's role in these markets is both critical, and evolving.

1 Milder et al. (2009) estimates these to comprise roughly 58% of all PES annual transactions by value.

2 It could be argued that the PRC has been tentatively experimenting with PES programs and market-based instruments for environmental policy for decades. This includes experiments of the Ministry of Water Resources' (MWR) with leasing "wasteland" in small watersheds beginning in the early 1980s (later formalized in law)—whereby leaseholders could keep the economic gains of land development activities (e.g., horticulture, agriculture, etc.) in return for the obligation to protect against soil erosion and degradation—as well as pilots for emissions trading schemes that have been ongoing since the mid-1980s (MWR 1991; Liu 2005; Wang et al. 2008).

3 This expression in Chinese is 政府主导与市场机制相结合 (zhengfu zhudao yu shichang jizhi xiang jiehe).

4 With eco-certified products markets included, the public sector contributes roughly 29% of total annual payments, with eco-certified products markets contributing roughly 58% (Milder et al. 2009).

As will be discussed in the paper, its roles are evolving in three distinct ways:

- Government as buyer of ecosystem services (a strategy to replace or complement government regulation);
- Government as regulator, mobilizing private demand for ecosystem services through environmental compliance rules, or setting up cap-and-trade systems; and
- Government as enabler, facilitating the growth of private voluntary transactions.

In the remainder of the paper we detail these different roles, provide some key examples, and discuss what insights international experience and trends have for the PRC, as it continues to modify and refine the government's role in conservation and environmental policy.

2 Government as Buyer

The public sector has historically been the largest purchaser of ecosystem services (Food and Agriculture Organization of the United Nations [FAO] 2007a). Government-created ecosystem services programs have been important catalysts for the development of ecosystem services markets, with many examples in places such as the United States (US), European Union (EU), Australia, Mexico, Costa Rica, and South Africa. Government watershed payment schemes have been set up in many Latin American countries, including Colombia and El Salvador. (Natural Resources Conservation Service [NRCS] 2008; EU 2008; Forest Trends et al. 2008). This is hardly surprising. A review of the history of the federal government's innovation policy, for example, finds that the state's most effective role has been in "stimulating or providing demand, particularly in the industry's early stages" (Henderson and Newell 2010). Often, where a clear public or financial benefit is present, but is one that does not flow to a sufficiently distinct and concentrated set of beneficiaries, the government steps in as the major buyer of hard-to-value ecosystem services. An example of this is in biodiversity conservation services, where public and quasi-public agencies are currently the largest buyers with payments totaling at least $3 billion annually.

The PRC aside, the largest public biodiversity PES programs are the US and EU's agri-environmental payment programs, which pay farmers for providing a variety of conservation-friendly land-use and management practices. At a cost of about $1.5 billion, around 20% of the farmland in the EU is under some form of agri-environmental program to reduce the negative impacts of modern agriculture on the environment (although much of this land is managed for ecosystem services other than specifically biodiversity conservation). Seven programs in the US are authorized under the 2002 Farm Bill to pay land owners for habitat protection and restoration, or for the presence of wildlife on farms, so as to encourage the provision of fish and wildlife habitat on private lands, with payments over $4.5 billion in 2005 (Scherr et al. 2007).

Public PES schemes internationally are struggling with improving design and implementation to increase efficiency and effectiveness, and are developing new tools and methods to do so. This section briefly touches upon some of the important considerations in PES design and efficiency that has resulted from this experience.[1]

2.1 Targeting and monitoring

Better targeting and monitoring are central to improving ecosystem services delivery under PES. Pagiola et al. (2002) identify the lack of good information over land uses and services as the 'Achilles heel' of payment schemes. Technical experts, producers and buyers must agree on the biophysical linkages between land uses and ecosystem service benefits, and develop suitable methods for measuring and monitoring provision of the service. Lack of reliable data on this might argue for the use of some other instrument than PES. Though absolute precision and certainty are not required, when ecosystem services are highly bundled or poorly targeted, this will be

[1] For a more in-depth discussion of these design issues as they pertain to the PRC, please refer to Scherr et al. 2006.

reflected in higher program costs for service provision, and could overlook important tradeoffs and complementarities between the different ecosystem services provided by the same land area. Most public PES systems, when initially set up, have had quite inefficient targeting of funds, in that many payments went to landowners or land uses that actually did not produce the desired ecosystem services. Mexico's hydrological payments program, the US's Conservation Reserve Program and Costa Rica's payments for reforestation (which inadvertently reduced water flow) have all run into limitations due to program targeting and design issues. The PRC's Conversion of Cropland to Forest and Grasslands program has also suffered from inefficiencies due to problems in the bundling of and poor differentiation between the multiple ecosystem services targeted (Bennett 2008). Targeting systems should reflect the context, since some methods are costly and require scientifically-trained individuals to implement them. More informal methods will work where there is a high degree of trust between buyers and sellers, where outcomes of land use change are readily observable by the buyers, and where the financial value of the ecosystem services is relatively low (Scherr et al. 2006).

2.2 Scaling up, regional differentiation and aggregation

Another important consideration is the balancing of the costs and benefits of scaling up, regional differentiation and aggregation of providers in public PES schemes. W hereas ecosystem services such as carbon sequestration, methane emissions reduction, carbon emissions reduction and water flow regulation, for example, generally require a low level of coordination, and so are more amenable to private sector financing, other services require higher levels of coordination for sufficient provision, thus arguing for a public sector role.

These include water quality management, erosion and sedimentation control and provision of biodiversity conservation via conservation corridors, which require moderate to high levels of coordination (FAO 2007b). These types of PES schemes also generally need to be of a sufficient scale, whole watershed or whole landscape, to ensure consistent and effective ecosystem service delivery. Ability to scale up is thus important, and will not only depend on the capacity of field programs on the ground to support farmers to implement improved land management practices at scale, and to engage effectively with farmer and other local organizations, but also the capacity of the government to manage transactions over long time periods with large numbers of people (e.g., some programs, including the PRC's Conversion of Cropland to Forest and Grassland program, have been using innovations in electronic payment schemes to reduce transactions costs associated with payment delivery). Whether 'economies of scale' in monitoring the adoption of land management practices or actual changes in ecosystem services exist is also another important consideration (FAO 2007a).

For large public PES schemes, however, scaling-up is less of an issue than regional differentiation. Too large of a scale with insufficient regional differentiation can reduce the cost effectiveness of PES due to fuzzy targeting and a high degree of bundling of ecosystem services, which does not take into account the potential tradeoffs between different services (e.g., downstream water quantity versus upstream carbon sequestration). Tradeoffs also exist regarding the degree of aggregation of service providers. The costs involved in the program administration and the targeting and monitoring of PES schemes encompassing huge numbers of individual providers and land parcels spread over large areas can be significant, and thus cost efficiencies can be achieved via aggregation of providers into, for example, community-level groups. At the same time, however, over-aggregation risks diluting the potential cost efficiencies that can be achieved from use of market mechanisms involving numerous heterogeneous service providers bidding on provision of services.

2.3 Measuring ecosystem services: valuation or quantification?

A key component of PES is the use of market mechanisms to determine price. In the PRC,

current debate regarding PES (or more precisely, "eco-compensation") often concerns the question of "how much are ecosystem services worth?", or more specifically, "what should the subsidy rate be?" A sufficiently clear understanding of upstream-downstream linkages in ecosystem services flows is a prerequisite for the development of an effective PES scheme, and science plays a key role in this. However, in examining science's role, it is important to distinguish between the valuation versus the *quantification* of ecosystem services flows.

Quantification of ecosystem service flows, i.e., the estimation of how many units of service provision are achieved via particular land-uses is essential for the long-term effectiveness and viability of PES (Pagiola et al. 2002). Science clearly has a role to play in gaining a better understanding of the linkages between land use and ecosystem service provision, and in the experimentation and testing of different institutional designs. In comparison, valuation, i.e., the estimation of the economic value, or the monetization, of ecosystem service flows is important for the initial development of a PES scheme, for example, by helping to determine whether a scheme can be cost-effective and therefore worth developing, and by helping to estimate a starting payment rate. However, over-emphasis on science to estimate the "value" of ecosystem services for the purpose of payments risks losing the benefits of a market mechanism.

In particular, market mechanisms can potentially identify the socially optimal "price" of ecosystem service provision, via the process of bargaining and bidding of numerous buyers and sellers, more effectively than traditional command-and-control measures. Use of markets to arrive at negotiated contractual arrangements helps to ensure that sellers are willing to accept, and buyers are willing to pay for, a set level of ecosystem service provision (or a particular land use or land-use change proxy) at a given price. Furthermore, these mechanisms can also help improve targeting and cost effectiveness by helping to identify those who can provide services at the lowest price, and ensure that the welfare of participants is not adversely affected by participation. An example of these types of mechanisms is the use of reverse auctions in voluntary public payment schemes to explicitly cover the opportunity cost of alternate land uses, and through self-selection to effectively eliminate those landowners whose agricultural income exceeds their potential income from PES payments. The US Conservation Reserve Program uses this approach, whereby landholders submit bids specifying the environmental services they provide and the lowest price for these goods (often termed the "rental rate") they will accept. The US government then ranks the bids for cost-effectiveness, paying for that land that provides the greatest environmental impact at the lowest cost (Chomitz et al. 2007). Market mechanisms can also give programs flexibility in adapting to changing relative resource scarcities, as reflected in negotiated prices.

2.4 PES and poverty alleviation

As with the PRC, policy makers internationally are intrigued by the potential of PES to achieve poverty alleviation co-benefits along with ecosystem service provision. Recent work has found some evidence that PES schemes could help to alleviate poverty, however only under the right conditions. Important pre-conditions for PES programs to have beneficial effects on poverty reduction is that the poor should:

(i) be in the "right place;"
(ii) want to participate (e.g., programs should fit into their overall household production strategy); and
(iii) be able to participate (e.g., they are able to make the necessary investments, have sufficiently secure tenure, have the necessary skills, etc.) (Bulte et al. 2008; Bracer et al. 2009).[2]

In terms of location-based eligibility, the spatial correlation between poverty and

[2] Please refer to the special edition of Environment and Development Economics on PES and poverty (Volume 13, Issue 03) for more on this.

degraded and marginal lands in key upper watershed areas is often assumed to be high, yet the relatively few studies that have looked at this have found a mixed picture (Pagiola et al. 2008). For example, Nelson and Chomitz (2007) find that watersheds in Guatemala and Honduras, where substantial active deforestation is occurring on steep slopes, tend to have the highest concentration of poverty, while Pagiola and Colom (2006) find very little correlation between poverty rates and the importance of an area for water service provision in Guatemala. In terms of ability of poor households to participate, this is influenced by the degree to which PES schemes involve significant changes in land uses. PES schemes targeting large land-use changes, for example, could be inappropriate for poorer households, since these likely require a level of up-front investment and of human capital (i.e., level of education, experience, and amount of household labor) that poorer households do not possess. Overall, while it is possible to link PES with poverty alleviation, policy makers need to be careful, since current evidence finds that tying the two together risks reducing the efficiency of meeting either environmental or poverty reduction objectives (Bulte et al. 2008; Bracer et al. 2009). In the PRC's Conversion of Cropland to Forest and Grassland, in fact, local officials have often over-emphasized the program's poverty alleviation goal, often using it as a way of avoiding the more difficult environmental goals (Bennett 2008).

3 Government as Regulator of Ecosystem Services Markets

Another important and evolving role of the government is as a regulator of ecosystem services markets. This encompasses both the "setting the rules of the game," as well as the use of legislative and regulatory mechanisms to mobilize private sector market demand for ecosystem services. Some of the earliest types of programs under this heading can be termed as "regulation-driven markets" whereby the government creates market demand via regulatory requirements to, for example, offset the impacts of development activities on important ecosystems and watersheds. In many cases, an environmental impact assessment for a project or investment may require development of biodiversity offsets to compensate for unavoidable biodiversity damage in the project. Government-run eco-certification regimes are another, more recent, type of instrument that falls under this heading. In fact, biodiversity and certified agriculture (i.e., eco-labeling) are the most active ecosystem services markets in terms of volumes of monetary transactions (Carroll and Jenkins 2008).

3.1 Regulation-driven markets

Under regulation-driven markets, the government first sets the allowable total- or enterprise-level environmental impact (e.g., a cap on total pollution emissions, restrictions regarding the maximum allowable impacts on ecosystems/wetlands as a result of land development, etc.), and then establishes a market mechanism and regulatory regime for use by economic actors to satisfy these stipulations, such as buying wetlands mitigation credits, investing in biodiversity offsets to be able to conduct land development activities, or purchasing carbon emissions credits to satisfy allowable emissions restrictions. A classic example of this is the wetlands mitigation banking system of the US. Initially developed in the early 1990s by the US Army Corps of Engineers and the Environmental Protection Agency, wetlands mitigation banking was created and adopted to ensure wetland conservation at minimum cost using market mechanisms, and, in particular, to resolve the conflict between growing economic pressure to develop coastal and wetland areas in the US and the strong laws that exist to ensure wetlands conservation. Under this system, a 'bank' of wetlands habitat is created, restored, or preserved, and then made available to developers of wetlands habitats, who must 'buy' habitat mitigation as a condition of government approval for development. Over more than a decade of development, this has progressed beyond a system of project-specific individual `banks' of mitigation credits, to large commercial and public wetlands banks that are not tied to any particular project and that sell mitigation credits to third-party developers (Salzman and Ruhl 2004).

This mechanism has also provided a model for dealing with the impacts of land development on biodiversity conservation, either via "conservation banking" (which uses identical mechanisms to wetlands banking for a broader range of biodiversity conservation) or "biodiversity offsets." Biodiversity offsets are instruments for "offsetting" the unavoidable impact of projects on on-site biodiversity by creating, restoring, or preserving an "equivalent amount" of biodiversity off-site. The US, EU, Brazil, Australia and South Africa all have laws requiring biodiversity offsets in certain circumstances. The *Brazilian National System of Conservation Units*, for example, converts

the damages inflicted by a development project, based on the scale of the investment, into "units" to be spent on conservation by the government anywhere within the jurisdiction concerned, with the aim of achieving optimal conservation results. The system is administered at the federal level by the Brazilian Ministry of Environment's enforcement agency, the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), which delegates implementation to state agencies. While most of the Conservation Units created through offsets to compensate for private investment fall under state jurisdiction, and so are created within a given state's boundaries, IBAMA has the discretion to create *Conservation Units* in any of the States involved in a cross-boundary project (ten Kate et al. 2004).

Most offset legislation tends to include guidelines and rules for types of methodologies and metrics that are acceptable, the geographical limits for screening potential offset sites, and the types of activities that constitute an offset, a high-level goal (e.g., no net loss of biodiversity as a result of development activities), guidelines for determining when an offset may be required and when it may be inappropriate (i.e., due to the significance of the biodiversity impact), and reference to the 'mitigation hierarchy' principal, which requires that offsetting must constitute a last resort, only used to offset the negative effects of an indispensable plan or project for which no alternative solutions could be envisaged, and in which the project first mitigates its onsite impacts to the utmost extent possible (Business and Biodiversity Offsets Programme [BBOP] 2009).

Another important example of these types of schemes is the US framework for water quality trading. While the US regulatory structure has been quite effective at controlling "point-source" pollution (e.g., from industries), non-point source pollution has been more difficult to control, and thus is currently the leading source of water pollution in the US today, with pollution from agriculture the leading cause (Boyd 2000; US EPA 2007). To address this, the US Environmental Protection Agency (EPA) has been promoting the development of water quality trading, or "nutrient trading." Similar in concept to emissions trading, nutrient trading involves within-watershed trading of water pollution permits, often between point-source and non-point-source polluters, to achieve set water quality targets, embodied in *Total Maximum Daily Loads* (TMDLs) for individual watersheds under the US Clean Water Act (King 2005). The US EPA first drafted a Framework for Watershed-Based Trading in 1996 and, after funding numerous pilot studies, released a Final Water Quality Trading Policy in 2003. The Agency says it may look to nutrient trading schemes to help fight one of the most significant environmental problems it currently faces the huge hypoxic dead zone in the Gulf of Mexico, which is primarily caused by agricultural watershed pollution, and currently provides policy support, training, and funding for the development of trading schemes (Hawn 2010; US EPA Water Quality Trading website: http://water.epa.gov/type/watersheds/trading.cfm). As of 2004, more than 70 schemes are in development in states across the US (up from around 25 only a few years earlier), with these involving a range of mechanisms and performance targets (Breetz et al. 2004).

3.2 Government eco-certification schemes

As mentioned in the introduction, ecocertification schemes currently comprise the largest share of ecosystem market payments internationally. Such eco-certified goods and services are certified for the ecosystem services they provide via their production process (e.g., low chemical input use, or organic, agriculture, wood certification ensuring source timber was legally obtained, and sustainably harvested). Many of these systems are run by independent certifying organizations that draw legitimacy from multistakeholder processes for establishing certification criteria (e.g., Forest Stewardship Council, Rainforest Alliance, "bird-friendly") or have other private or civil society labeling. But governments play a major role as regulator in many eco-certification regimes, creating certification standards (e.g., US and EU organic food standards); developing criteria, indicators, and audit process rules governing the certification of goods and services that meet particular environmental criteria; and possibly also establishing procurement requirements for public or private buyers. In this regard, the PRC government is ahead of the curve, having already developed its own "green"

and organic foods certification system, and a *China Environmental Label* certification system for non-food products, and having in 2008 put into effect a government "green" procurement law which requires all levels of government to place precedence on purchasing environmental-label products, and forbids them to purchase goods harmful to the environment or public health (Bennett 2009).

Though food safety concerns were the initial impetus for the development of low-chemical-input and organic food certification regimes, both in the PRC and internationally, an important trend in these markets is the expansion of current eco-certification regimes, and the creation of new standards, to incorporate a broader and more sophisticated bundling of ecosystem services (e.g., beyond simple low-or no-chemical-input agriculture). This includes landscape labeling initiatives targeting scale- and location-dependent services such as biodiversity and watershed conservation that operate like denomination of origins, so that private farmers and others within the landscape who comply with guidelines for biodiversity or watershed conservation can sell their products with that label (Ghazoul et al. 2009). Initiatives to track and certify the carbon footprint of food products are also gaining ground, such as the "food miles" labeling being considered by the UK's Department for Environment, Food and Rural Affairs (DEFRA) (Shames and Scherr 2010; Ecoagriculture Partners 2008; DEFRA 2005). These trends indicate that the public sector will continue to have an important role to play in regulating, promoting and deepening these markets.

3.3 Considerations in regulating ecosystem services markets

For regulation-driven market schemes, reliable and enforceable regulations are critical. If regulatory agencies permit landowners to clear more wetlands than the law permits, then the incentive to invest in offsets will disappear, as has happened in some parts of the US during administrations with lax environmental policies. Also, a critical component of cap-and-trade and related schemes, but one which can often be politically charged, is the way in which the initial rights to credits are allocated by the government to economic actors. This can involve auctions, allocation based on an enterprise's historical levels of pollution or relative size in the market, and the inclusion of a 'grandfather clause' that exempts older enterprises from some portion or all of the stipulations of the new regulatory regime, since the costs of technological upgrade implicit in meeting requirements can be prohibitive in some cases. Pending these issues being satisfactorily resolved, one of the advantages of cap-and-trade is that it creates a class of people who actually benefit from increasingly stringent environmental regulation. Thus, in the US private investors involved in developing wetland mitigation banks actively support legislation to expand conservation targets. Political support for a climate action bill in the US critically depends upon support from segments of the farm sector who eagerly anticipate receiving payments for carbon sequestration.

Another important consideration in the development of these markets is the protection of buyers and sellers. In developing countries with less secure land tenure protections, there is considerable concern that PES schemes will trigger 'land grabs' from economically favored groups who are informed about PES rules and opportunities. Thus some countries are considering legislation to ensure protection of sellers' tenure rights. Other countries are putting in place protections involving processes ensuring that local communities are fully informed of and fully consent to the terms of PES payments.

A final consideration in establishing eco-certification standards is the tradeoff between rigor and scale of impacts. Producers deciding whether or not to adopt particular eco-certification standards generally weigh the benefits of adoption (the added revenue stream due to the price premiums gained from eco-certification) with the costs (the expenses of the associated monitoring, verification, and certification regime). As the rigor of a standard increases, so does its costs. Thus, while an insufficiently rigorous eco-certification standard can result in negligible environmental impacts, even if broadly adopted due to its low cost, a very rigorous (and thus expensive to adopt) standard might also produce relatively minimal or even negligible impacts, since its added costs might significantly reduce the number and diversity of producers willing to adopt it.

4 Government as Enabler of Ecosystem Services Markets

An increasingly common role taken up by governments is as an "enabler" of ecosystem services markets, by assisting private actors to buy and sell ecosystem services and by providing new legal and policy frameworks to expressly encourage and facilitate market development. This can be seen as an evolution and extension of the two roles discussed above, since an important consideration in the development of public sector schemes is that they create new private sector market opportunities. In recognition of this, many governments internationally have been making a shift from a centralized regulatory approach to environmental governance to greater emphasis on decentralized, flexible mechanisms that allow for the private sector to be a provider of public goods and services, and that allow for the development of public-private partnerships (FAO 2007a). To some extent, this is not unlike trends in the privatization of other public goods and services, such as utilities, telephone and postal services. Swallow et al. (2007b) identifies three important linkages between these "flexible" and "regulatory" approaches to environmental governance, with these having bearing on the potential entry points for the private sector into ecosystem services markets:

(1) The institutional space created via allowing flexibility in the approach to compliance in new environmental regulations for public utilities, local governments, and private firms to innovate with regard to PES activities;

(2) The incentives that exist for firms or industry groups to actively promote PES schemes as a way of demonstrating commitment to the environment so as to forestall environmental regulations; and

(3) The incentives that exist for firms or industry groups to voluntarily establish or illustrate best practice in environmental management as a means to influence the shape of future environmental regulations.

While the public sector's role as buyer is important for catalyzing ecosystem services market development, if too predominant it risks crowding out other potentially important economic actors in these markets. Thus, "government as key buyer" programs have been shifting in some cases to allow participation by private sector buyers. For example, the Kitengela Land Lease Program in Kenya signs leases with private landowners to allow wildlife from Nairobi National Park open access to some portion of their land. Landowners then receive three annual payments of about $4/acre, which is approximately equivalent to what they would make from grazing livestock on the same land. The average household in the program makes a total of $400–$800. The program includes over one hundred households and 8,500 acres (Dunkel 2007). Mexico's national PES scheme for forest conservation is actively seeking local private sector buyers of watershed services (Muñoz-Piña et al. 2008). Costa Rica has set up a PES scheme based on charging consumers via their utility companies (Pagiola 2008). Government watershed payment schemes, such as the Kagera River payment for watershed services scheme in Tanzania, are also actively courting potential private sector buyers to supplement this effort (FAO 2008). These considerations are also coming into play in the PRC. Concerned with the long-term financial sustainability of the Conversion of Cropland to Forest and Grassland program, for

example, policy makers have been considering how to bring in greater private sector support of afforestation efforts (Bennett 2008). The State Forestry Administration's China Green Carbon Foundation (formally the China Green Carbon Fund), for example, is one of the first public sector instrument in the country for tapping into private sector financing of afforestation (Bennett 2009).[1]

Government assurances and policy frameworks are critical to facilitate greater private sector participation in both public sector and "voluntary" schemes. For example, governments can underwrite some of the risks the private sector faces in participation, or can agree to buy any credits that investors cannot sell in the case of voluntary 'cap-and-trade' markets (Bayon and Jenkins 2010). Other types of enabling activities include the following:

Policy and regulatory support

- Provision of oversight and quality control over national registries of ecosystem services;
- Development of standards around what constitutes an ecosystem service credit; and
- Development of national certification systems.

Training, technical support and other services

- Provision of offices where sellers and buyers can meet;
- Provision of training and informational services to market actors, such as business and advisory services hub for new buyers or sellers of ecosystem services;
- The mapping of ecosystem values so that private actors (or lower government levels) can easily select sites. This includes identifying priority/critical areas (e.g., mapping work underway in Africa of soil ecosystem services, by Columbia University with Gates funding), and encouraging buyers to focus on areas where institutional conditions are already in place to enable transactions;
- Partnering with private sector firms to help them design and initiate a private PES scheme (e.g., for water bottling plant).

One example of these types of enabling activities is the US Department of Agriculture's Office of Environmental Markets (www.fs.fed.us/ecosystemservices/OEM/index.shtml), established in 2008 to pilot, document and advise private actors in ecosystem services markets, and to coordinate the work of various government agencies on ecosystem services and on the creation and monitoring of new environmental markets. While it still faces a range of challenges-it is small with few powers, and faces an uphill struggle trying to coordinate government agencies that are notoriously poor at communicating with each other-if allowed to flourish, it would represent a great step forward, for example by helping the US Forest Service to measure the extent of ecosystem services provided by the country's forests and consider how best to value them. Governments in Australia, Europe, Latin America, and elsewhere have begun to set up similar systems to manage natural infrastructure (Bayon and Jenkins 2010). National carbon offices are also being set up in many countries as a sort of 'one-stop-shop' for buyers and sellers (or intermediaries, as an information clearinghouse, a source of legal advice, etc.).

In the case of the PRC, various local governments have been setting up environmental exchange platforms in anticipation of domestic trading schemes for carbon, water pollution emissions, and energy efficiency credits, with these involving public-private partnership in several cases. This includes the Tianjin Emission Rights Exchange-which was set up in 2008 and is a collaboration between the Tianjin Property Rights Trading Center, China National Petroleum Corporation's Resource Management Co. Ltd., and the Chicago Climate Exchange-and the Panda Standard (www.pandastandard.org/), the country's first voluntary carbon standard, which

[1] Since Bennett (2009), this has been upgraded from a "Fund" to a "Foundation" (*China Green Times*, 2010).

is being developed in collaboration between the China Beijing Environmental Exchange and BlueNext (Wang et al. 2008; Bennett 2009).

Overall, the public sector has the potential to play an important role in enabling and encouraging the development of these markets. It can play an important role in research on ecosystem services, including the mapping of these services, developing improved monitoring systems, understanding how ecological processes change across scales, and in training national and sub-national leaders in PES management. It would be good for governments to both direct private investments towards opportunities where institutional conditions are already in place to enable transactions (since private investment can provide public benefits) and to protect public environmental goods by not allowing PES schemes that divert public benefits to private buyers.

5 Looking to the Future: The Evolving Role of Government

As with international experience, the PRC's ongoing development of eco-compensation regulations and other market-based environmental policies will have much to say regarding a fundamental question underlying PES: how are ecosystem service markets created? The public sector is clearly a critical part of the answer to this, serving both to create and to catalyze ecosystem services market development. The PRC's Conversion of Cropland to Forest and Grassland and Forest Ecosystem Compensation Fund are important examples of this; despite ongoing design, implementation, and funding challenges, these programs by their sheer scale have generated significant momentum for the development of future ecosystem services markets in the country. Through the awareness-raising (regarding the offsite impacts of particular rural land-uses, and therefore their potential economic value) and hands-on experience in implementation that has been provided by these programs, rural communities throughout the PRC have been able to improve their ability to effectively participate in future PES schemes as sellers of ecosystem services. Local governments' capacities to develop and manage PES programs have as well been strengthened via the hands-on experience in the planning, implementation, targeting, monitoring, and evaluation activities that they have gained as a result of being involved in these programs. Thus, in the PRC as elsewhere, the government has been instrumental in "getting the ball rolling."

Policy makers are now at a stage to consider next steps, and to determine the government's evolving role and level of involvement in these growing markets. Too little involvement, on the one hand, risks letting the immature fruit of ecosystem services markets shrivel on the vine. Sufficient scale is necessary in markets in order for secondary and tertiary actors, aggregators, intermediaries, insurers, market information services, etc.to begin to arise, and thus for markets to deepen and mature. Also, sufficient regulatory oversight and legal frameworks are necessary to protect both ecosystem services providers and buyers when developing contractual agreements. Thus, governments will definitely need to strengthen their regulatory role, and will likely need to remain key ecosystem services buyers for the foreseeable future. However, at the same time, exclusive government control of ecosystem services markets risks crowding out potentially significant sources of conservation finance from non-government economic actors, dampening incentives for innovation in these payment schemes, strengthening incentives for inefficient rent-seeking behavior by the government agencies that manage these programs, and creating yet more, costly, "big government" regulatory instruments for conservation. Central to the ongoing development of these markets is the question of how to incentivize the participation in these markets by a wider range of economic actors, since it is in this way that some of the key potential benefits of PES schemes, the improved mainstreaming of ecosystem services values into economic activities, and the broadening of sources of finance for conservation activities can be realized. This trend is already taking place internationally. While public sector buyers have historically been the largest purchasers of ecosystem services, this is changing as cap-and-trade programs for carbon and various habitat mitigation schemes are increasing the role of private sector buyers acting under regulatory obligation. Thus, the global portfolio of PES is shifting from a preponderance of

government programs financed by tax revenue, foreign aid, and loans to a greater share of true market instruments driven by private demand and facilitated by the maturation of supporting institutions (FAO 2007a; Bracer et al. 2009).

In assessing next steps, however, it should be remembered that the PRC is both ahead of and behind current international trends in environmental policy reform. While numerous frameworks for innovative, flexible environmental management mechanisms are already taking shape in the country, more fundamental improvements in basic monitoring and enforcement capacity are also needed. PES and other market-based instruments should not be considered as a low-cost alternative to basic improvements in the environmental management regime, since these tools are designed to achieve conservation and environmental restoration beyond what is required under current regulatory structures. To be viable and effective, such tools require effective monitoring, verification, and certification regimes, as well as effective enforcement of existing regulations. In the case of Tai Lake, for example, despite strong political leadership, the government still faces numerous challenges in improving water quality in the lake watershed, which has suffered various effects of development over the past 50 years, and particularly over the past decade (ADB 2008). In the absence of measures that address the underlying causes of pollution in the lake, including the lack of a strong, integrated management framework backed by a sufficiently strong legal authority, it is unlikely that PES-like eco-compensation programs or other market-based instruments, such as the emissions rights trading pilots currently being developed in the watershed, will achieve what other policies have not.

However, the government is clearly addressing these issues in its ongoing reforms of the country's environmental regulatory and enforcement regime, of which eco-compensation is a part. And it is encouraging to see that while doing so it has also been actively exploring the types of innovative approaches discussed above, such as regulation-driven market mechanisms and eco-certification schemes.

Both central and local governments, for example, have been experimenting with water and air pollution emissions-trading mechanisms since the mid-1980s, and the pace of policy and pilot developments has quickened significantly since 2000. A number of government eco-certification regimes have also been taking shape since the early 1990s. One is the PRC's environmental label certification system, recently augmented by the government "green" procurement policy, which stipulates that, as of 1 January 2007, 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. The Ministry of Agriculture also has a "green" (i.e., low chemical input use) and organic food certification system, and the Ministry of Environmental Protection has its own organic food label (Bennett 2009).

As regulatory and enforcement capacity improve, these policies and programs can provide an excellent framework to be built upon and expanded to target other ecosystem services, and a wider range of economic actors. Ongoing concerns regarding the financial sustainability, design, and implementation of the PRC's current large-scale 'eco-compensation' programs suggest that these could benefit from the participation of a broader range of actors. This includes both economic actors as payees, as well as the academic and research community. Similar to Mexico's national PES scheme for forest conservation, or the Costa Rican watershed PES example, the PRC government could consider revising the funding mechanisms for these programs, in particular watersheds, to exploit the direct linkages between service providers and beneficiaries, e.g., by adding charges to water fees through utility companies. In fact, this is already taking place in some locales (Bennett 2009). These types of approaches would require clarification of land use impacts on watersheds, and a framework of ongoing payments conditional on monitored and verifiable service delivery from altered land uses. This argues for more government-academic collaboration to pilot new PES designs and methodologies for monitoring, verification, and evaluation of ecosystem service delivery and program implementation which would help to improve current and future programs.

Examples of this can be found in other countries, such as experiments in Germany with auction mechanisms to determine payments to farmers for changed land uses that are biodiversity friendly, with the view of incorporating these results into the EU's Common Agricultural Policy (Bertke and Marggraf 2005).

"Regulated-Market" instruments, such as biodiversity offsets and wetlands banking, also hold significant promise for the PRC as a means to cost-effectively achieve environmental targets. Though none yet exist in the PRC, in that current policies still do not involve actual offsetting activity to achieve "no net loss" in biodiversity, a number of policy frameworks are in place that could be expanded to incorporate these types of mechanisms. Examples include the Forest Vegetation Restoration Fee, and the various fee and subsidy standards and regimes governing soil and water erosion prevention and the impacts of mining activities (Bennett 2009). The PRC's various eco-certification regimes can also be expanded to include a wider range of ecosystem services, such as whole landscape scale agricultural certification to ensure biodiversity or watershed impacts. As policy makers develop a national eco-compensation policy framework, they should keep in mind the potential benefits that these types of market-based instruments could add to the environmental policy tool kit, both in terms of added flexibility and cost-effectiveness as well as for the entry points and platforms they provide for engaging and empowering a wider range of economic actors in conservation and environmental restoration.

References

Asian Development Bank. 2008. *Reviving Lakes and Wetlands: Lessons Learned from the People's Republic of China.* Manila.

Bayon, Ricardo and Michael Jenkins. 2010. "The Business of Biodiversity." *Nature* 644(8): 184–185.

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

———. 2008. China's sloping land conversion program: Institutional innovation, or business as usual? *Ecological Economics* 65 (2008): 699–711.

Bertke, E., and R. Marggraf. 2005. *An Incentive-Based Tool for Ecologically and Economically Efficient Provision of Agrobiodiversity.* Bogor, Indonesia: Center for International Forestry Research (CIFOR).

Boyd, James. 2000. The New Face of the Clean Water Act: A Critical Review of the EPA's Proposed TMDL Rules. *Resources for the Future Working Paper* No. 00-12.

Bracer, C., S.J. Scherr, A. Molnar, M. Sekher, B.O. Ochieng, and G. Sriskanthan. 2009. Organizations, institutions and governance for compensation for ecosystem services. *Ecology and Society* [in press].

Breetz, Hannah L., Karen Fischer-Vanden, Laura Garzon, Hannah Jacobs, Kailin Kroetz, and Rebecca Terry. 2004. *Water Quality Trading and Offsets Initiatives in the US: A Comprehensive Survey.* Report for the US Environmental Protection Agency. Hanover, NH: Dartmouth College.

Business and Biodiversity Offsets Programme (BBOP). 2009. *Biodiversity Offset Design Handbook.* Washington, DC: BBOP.

Bulte, Erwin H., Leslie Lipper, Randy Stringer, and David Zilberman. 2008. Payments for Ecosystem Services and Poverty Reduction: Concepts, Issues and Empirical Perspective. *Environment and Development Economics* 13(3): 245–254.

Carroll, N. and Michael Jenkins. 2008. Payments for Ecosystem Services (PES) Markets: The PES Matrix Chart. Washington, DC: Ecosystem Marketplace. http://ecosystemmarketplace.com/pages/article.news.php?component_id=5917&component_version_id=8762&language_id=12

China Green Times. 2010. *China Green Carbon Foundation Established in Beijing.* www.greentimes.com/green/news/yaowen/zhxw/content/2010-09/01/content_103281.htm (last accessed on 15 September 2010).

Chomitz, Kenneth et al. 2007. *At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests.* Washington, DC: World Bank.

DEFRA (UK's Department for Environment, Food and Rural Affairs). 2005. *The Validity of Food Miles as an Indicator of Sustainable Development: Final Report Produced*

for DEFRA. www.defra.gov.uk/evidence/economics/foodfarm/reports/documents/Foodmile.pdf

Dunkel, Tom. 2007. Into Africa. *The Nature Conservancy.* www.nature.org/magazine/spring2007/features/

Ecoagriculture Partners. 2008. Applying the Ecosystem Approach to Biodiversity Conservation in Agricultural Landscapes. *Ecoagriculture Policy Focus* 1(1). [Online] www.ecoagriculture.org/publication_details.php?publicationID=85

Economic Daily. 2007. The State Forest Bureau Issues Report on the Comprehensive Development of the Conversion of Cropland to Forests and Grassland Policy. www.gov.cn/jrzg/2007-02/04/content_517272.htm (in Chinese).

Engel, Stefanie, Stefano Pagiola, and Sven Wunder. 2008. Designing Payments for Environmental Services in Theory and Practice: An Overview of the Issues. *Ecological Economics* 65(4): 663–674.

European Union (EU) Directorate-General for Agriculture and Rural Development. 2008. *Rural Development in the European Union: Statistical and Economic Information.* European Commission.

Faeth, Pau. 2000. *Fertile Ground: Nutrient Trading's Potential to Cost-Effectively Improve Water Quality*. Washington, DC: World Resources Institute.

Food and Agriculture Organization of the United Nations (FAO). 2008. Payments for Environmental Services from Agricultural Landscapes: The Role of Payments for Environmental Services (PES) As Reward Mechanisms for Sustainable Land Management in East Africa. Report for the FAO-CARE capacity-building workshop, Dar es Salaam 4–6 February 2008. www.fao.org/es/esa/PESAL/ attachments/FAO_CARE_TZ_PES_Workshop_Report.pdf

———. 2007a. *The State of Food and Agriculture 2007: Paying Farmers for Environmental Services.* Rome: FAO.

———. 2007b. Sara Scherr and Jeffrey Milder. Payments for ecosystem services: potential contributions to smallholder agriculture in developing countries. SOFA 2007 background paper. Rome. Unpublished.

Forest Trends, Ecosystem Marketplace, and PROFOR. 2008. *Payments for Ecosystem Services: Market Profiles.* Washington, DC: Forest Trends and Ecosystem Marketplace.

Ghazoul, Jaboury, Claude Garcia, and C.G. Kashalappa. 2009. Landscape Labelling: A Concept for Next-Generation Payments for Ecosystem Service Schemes. *Forest Ecology and Management* [in press].

Hawn, Amanda. 2010. Nutrient Trading and Dead Zones – Can They Wake Each Other Up? *Ecosystem Marketplace*. www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=607&section=home&eod=1

Henderson, Rebecca and Richard Newell. 2010. Accelerating Innovation in Energy: Insights from Multiple Sectors. *Harvard Business School Working Paper* No. 10-067. www.hbs.edu/research/facpubs/workingpapers/papers0910.html#wp10-067

Huang, Marjorie, Shyam K. Upadhyaya, Rohit Jindal, and John Kerr. 2009. Payments for Watershed Services in Asia: A Review of Current Initiatives. *Journal of Sustainable Forestry* 28: 551–575.

King, Dennis M. 2005. Crunch Time for Water Quality Trading. *Choices* 20(1): 71–76.

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.

Milder, J., S.J. Scherr, and B. Bracer. 2009. Trends and future potential of payment for

ecosystem services to alleviate rural poverty in developing countries. *Ecology and Society* 15(2): 4. www.ecologyandsociety.org/vol15/iss2/art4/

Ministry of Water Resources. 1991. *Water and Soil Conservation Law of the People's Republic of China.* www.mwr.gov.cn/zcfg/fl/19910629000000314204.aspx

Muñoz-Piña, C., A. Guevara, J.M. Torres, and J. Braña. 2008. Paying for the hydrological services of Mexico's forests: analysis, negotiations and results. *Ecological Economics* 65: 725–36.

Natural Resources Conservation Service (NRCS). 2008. 2008 NRCS Farm Bill Conservation Programs At a Glance. www.nrcs.usda.gov/programs/farmbill/2008/ ataglance.html

Nelson, A. and K. Chomitz. 2007. The forest–hydrology–poverty nexus in Central America: an heuristic analysis. *Environment, Development and Sustainability* 9: 369–385.

Pagiola, Stefano. 2008. Payments for environmental services in Costa Rica. *Ecological Economics* 65: 712–24.

Pagiola, Stefano and A. Colom. 2006. *Will payments for watershed services help reduce poverty? Evidence from Guatemala*. Washington, DC: World Bank.

Pagiola, Stefano, Ana R. Rios, and Agustin Arcenas. 2008. Can the poor participate in payments for environmental services? Lessons from the Silvopastoral project in Nicaragua. *Environment and Development Economics* 13(3): 299–325.

Pagiola, Stefano, Josh Bishop, and Natasha Landell-Mills. 2002. *Selling Forest Environmental Services: Market-Based Mechanisms for Conservation.* London: Earthscan Publications.

Salzman, J. and J.B. Ruhl. 2004. Paying to Protect Watershed Services: Wetland Banking in the United States. In Stefano Pagiola, Joshua Bishop and Natasha Landell-Mills, eds. *Selling Forest Environmental Services: Market-Based Mechanisms for Conservation and Development.* London: Earthscan.

Scherr, Sara J., Michael T. Bennett, Molly Loughney, and Kerstin Canby. 2006. *Developing Future Ecosystem Service Payments in China: Lessons Learned from International Experience.* A Report Prepared for the China Council for International Cooperation on Environment and Development (CCICED) Taskforce on Eco-compensation. Forest Trends. www.forest-trends.org/publication_details.php?publicationID=99

Scherr, Sara J., Jeffrey C. Milder, and Carina Bracer. 2007. How Important will Different Kinds of Compensation and Reward Mechanisms Be in Shaping Poverty and Ecosystem Services Across Africa, Asia and Latin America Over the Next Two Decades? *CES Scoping Study Issue Paper 5.* ICRAF Working Paper No. 40. Nairobi, Kenya: World Agroforestry Centre.

Shames, Seth and Sara J. Scherr. 2010. Incentives for Ecoagriculture from Bundled Ecosystem Services. Ecoagriculture Partners. Forthcoming.

State Forestry Administration (SFA) of the PRC. 2008. *Survey Research Report on Regional Forest Ecosystem Compensation Policies.* www.forestry.gov.cn/sub/FstArticle.aspx?id=kjyj.275 (last accessed in June 2009).

———. 2007. The Overall Situation of the Conversion of Cropland to Forest and Grassland Program is Excellent and the Results Significant. www.gov.cn/jrzg/200702/03/content_517012.htm (in Chinese).

Swallow, B.M., B. Leimona, T. Yatich, S.J. Velarde, and S. Puttaswamaiah. 2007. The conditions for effective mechanisms of compensation and rewards for environmental services. *CES Scoping Study, Issue Paper No. 3. ICRAF Working Paper* No. 38. Nairobi, Kenya: World Agroforestry Centre.

ten Kate, Kerry, Josh Bishop, and Ricardo Bayon. 2004. *Biodiversity offsets: Views, experience, and the business case.* Gland and Cambridge: IUCN, and London: Insight Investment.

US Department of Agriculture Office of Environmental Markets (OEM). www.fs.fed.us/ecosystemservices/OEM/index.shtml

United States Environmental Protection Agency (US EPA). 2007. *National Water Quality Inventory: Report to Congress, 2002 Reporting Cycle.* EPA 8410R-07-001. www.epa.gov/305b

———. 2003. *Final Water Quality Trading Policy.* [Online] http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm

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. www.caep.org.n/english/paper/The-Updated-Progress-of-Emission-Trading-Programs-in-China.pdf

Wunder, Sven. 2005. Payments for environmental services: Some nuts and bolts. *CIFOR Occasional Paper* No. 42. Bogor, Indonesia: Center for International Forestry Research.

Wunder, Sven, Stefanie Engel, and Stefano Pagiola. 2008. Taking Stock: A Comparative Analysis of Payments for Environmental Services Programs in Developed and Developing Countries. *Ecological Economics* 65(4): 834–852.

Buyer, Regulator, and Enabler
The Government's Role in Ecosystem Services Markets

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