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A Comparative Study on Payment Schemes For Watershed Services in New York City and Beijing

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Abstract

Payment for Ecosystem Services (PES), also known as Payment for Environmental Services, has become an increasingly popular economic approach to address environmental problems. According to the United Nations Food and Agriculture Organization (FAO), watershed is among the services that are currently receiving most funds and interest worldwide. The author compares two distinctive watershed PES programs, namely the New York City Watershed Program and Beijing Watershed Program in China, discusses their different levels of success due to approach towards the program, program framework and watershed economic gains and program management and operation, and put forward suggestions for program improvement for similar PES projects.

Payment for Ecosystem Services (PES), also known as Payment for Environmental Services, has become an increasingly popular economic approach to address environmental problems. In absence of an officially recognized definition, PES is generally understood as the payment made by the beneficiary of a particular ecosystem service to the service provider (Wang 2007). The variety of ecosystem services, which are "components of nature, directly enjoyed, consumed or used to yield human well-being" (Boyd and Banzhaf 2006), has enabled diversified PES programs targeting different ecological services. According to the United Nations Food and Agriculture Organization (FAO), watersheds are among the services currently receiving the most funds and interest worldwide (2007). This author compares two distinctive watershed PES programs, namely the New York City Watershed Program and Beijing Watershed Program in China, and attempts to discuss their differential levels of success.

1. Overview of New York City Watershed Program

The New York City water supply system is comprised of 19 reservoirs and 3 controlled lakes, which are located up to 125 miles from the city and are interconnected by a complex series of tunnels and aqueducts (New York City Environmental Protection Department 2012). The System provides water services to 9 million people and comes mostly (90%) from the Catskill-Delaware watershed system west of the Hudson River (Appleton 2002). Since the 1980s, concern over the quality of unfiltered surface water from the Catskill-Delaware watersheds began to grow in response to the advent of more toxic land use and agricultural practices. In consultation with the U.S. Environmental Protection Agency (EPA), New York City decided to avoid a filtration plant—estimated to cost between $4 billion and $6 billion for construction, and 250 million annually for operation and maintenance—and instead, opt for a comprehensive watershed protection program to meet federal and state water quality standards in a cost-effective manner (Appleton 2002). The comprehensive watershed protection program of New York City included a number of projects aiming at promoting sustainable farming practices and better forest management, and proved to be remarkably successful. As a result of this success, the EPA issued the first New York City Filtration Avoidance Determination in 1997, which stated that the City would not be required to filter Catskill-Delaware public water if it complies with the filtration avoidance criteria and all conditions set in the Determination (EPA 1997). In 2007, EPA issued a second New York City Filtration Avoidance Determination recognizing that the City has an adequate long-term watershed protection program for Catskill-Delaware water supply and extending the program for another 10 years until 2017 (EPA 2007).

After rounds of consultations among relevant stakeholders, such as environmental protection, agriculture, and forestry authorities, as well as the local communities in Catskill-Delaware watersheds, the non-profit Watershed Agricultural Council (WAC) was created in 1993. This organization oversees the continuously evolving voluntary incentive-based watershed protection programs. The main PES schemes administered by

WAC are: (1) Watershed Agricultural Program; (2) Watershed Forest Management Plan; and (3) Conservation Easement (WAC 2011).

1.1 Watershed Agricultural Program (WAP)

Landowners in the Catskill-Delaware watershed can sign up to the WAP and agree to follow the prescribed Whole Farm Plan (WFP) on a voluntary basis, Their farm operation will follow individualized state-of-art best management practices (BMPs) that benefit water quality and land conservation. New York City will cover all the cost for infrastructure construction and follow-up technical assistance throughout the period of a WFP contract, which is normally 10 to 15 years (WAC 2012).

1.2 Watershed Forest Management Plan (WFMP)

Owners of over 10 acres of forest in the watersheds can be voluntarily enrolled in WFMP, which provides technical assistance from certified foresters regarding better forest management (WAC 2012). The forest owners would have the technical capacity to reduce pesticide use and hence mitigate water contamination risks. Healthy forests also serve as natural purifiers for rainwater, which will be then stored in aquifers. Technical assistance can be costly and the support from WAC makes it much more viable economically for land owners to seek for such help.

1.3 Conservation Easement

WAC's Conservation Easement program was initially prescribed in the New York City Watershed Memorandum of Agreement as part of the Land Acquisition Program (New York City 1997). In practice, conservation easements are normally sold by a landowner to the City at a fair price suggested by a certified appraiser and constitute a legally binding agreement that may limit or condition certain types of uses or activities from occurring on a property or prevent development from taking place on a property in order to fulfill the conservation purposes of the easement. Conservation easements function as non-possessory, legal covenants on a property. As such, landowners still possess the property and may sell or transfer a property encumbered by an easement. Only those who own a land larger than 50 acres in size and have an active and current Whole Farm Plan (WFP) are eligible for Conservation Easement program (WAC 2012), which serves as an additional incentive for farm owners for watershed protection.

2. Overview of Beijing Watershed Program

China is a water stressed country with per capita water resources less than a third of the world average (FAO 2003). For the national capital city Beijing, the situation is even worse. The population in Beijing reached 19.61 million in 2010, while the per capita water resources was merely 107 cubic meters, or 1/20 of national average (Beijing Municipal Government 2011) (United Nations 2011). In addition to severe water shortage, the city's water challenge is futher complicated by water pollution. In 2010, only 54.4% of monitored surface water in Beijing met national and municipal water quality standards (Beijing Environmental Protection Bureau 2011). To ensure sufficient quantity and safe quality of water supply, Beijing has historically used command-and-control policies. Since the 1990s, Beijing has also tried PES schemes to help protect the Chao-Bai watersheds in neighboring Zhangjiakou and Chengde Municipalities of Hebei Province that feeds the Miyun Reservoir in Beijing, which provides 60% of the city's tap water (Liao and Li 2003). The following are examples of these schemes.

2.1 Beijing-Chengde Water Resource Protection Program

In 1995, a working group on water resource protection between the governments of Beijing and Chengde municipality was established. The working group oversaw a water resource protection program under which Beijing municipal government provided 2.08 million RMB annually to Chengde between 1995 and 2002. The fund was dedicated to water protection projects in Chengde watershed (Zheng 2010).

2.2 Beijing-Chengde/Zhangjiakou Water Protection Program

In 2005, Beijing agreed to provide 20 million RMB each year for a five-year period until 2009 to Chengde and Zhangjiakou municipalities. According to the Utilization Guidelines of Water Resource Protection and Environmental Treatment Fund between Beijing and Surrounding Areas, the fund was to ensure water quality and quantity of Miyun Reservoir through energy saving technology promotion, water quality monitoring, water pollution treatment and soil erosion abatement projects in Chengde and Zhangjiakou Watersheds (Beijing Municipal Government 2005). In the end of 2008, the mayor of Beijing and the Governor of Hebei Province agreed to extend this program until 2011.

2.3 "Paddy to Dryland" Program

In October 2006, a Memorandum of Understanding (MOU) was signed between the Beijing municipal government and Hebei provincial government to promote economic and social cooperation between the two neighbors. As part of the MOU, Chengde and Zhangjiakou municipalities of Hebei Province would carry out "paddy to dryland" programs, converting a total of 183,000 mu (30,134 acres) of water-intensive rice paddies to dryland suitable for less water-demanding crops. Recognizing the income loss may incur on the farmers, Beijing would subsidize the farmers for each mu of rice paddy converted at the rate of 450 RMB (Beijing Municipal Government 2006). The "income loss" subsidy was raised in 2008 to 550 RMB/mu (3,339 RMB or roughly 520 U.S. dollars/acre). Between 2008 and 2011, an annual subsidy of 39.05 million RMB were provided by Beijing municipal government. The program was extended in 2012 and the subsidy rate remained the same (Hebei Provincial Government 2012).

2.4 Forest Management Program

To review the progress under the MOU, the mayor of Beijing and the Governor of Hebei met in 2008 and agreed to carry out cooperation on forest management to better protect the watersheds of Chengde and Zhangjiekou municipalities. For the period 2009-2011, Beijing would provide 100 million RMB to create 200,000 mu (32,933 acres) of "water conservation forests" in the watersheds. An additional 50 million RMB was committed by Beijing for fire prevention and pest control projects in the watershed forests (Zheng 2010).

3. Comparison of New York City and Beijing Watershed Programs

The two payment programs for watershed services in New York City and Beijing differ in terms of how the program was approached, structured and implemented. The reason for varied level of success may be deeply rooted in the political, institutional and legal differences of the two countries.

3.1 Approach Towards the Program

In developing the Catskill-Delaware watersheds PES program,, the authorities of New York City took a bottom-up approach. Policy makers in the New York City Department of Environmental Protection (NYCDEP) had rounds of face-to-face discussions and consultations with residents of the watersheds, a process that helped

build understanding and trust between the beneficiaries of the watershed services, namely 9 million people in New York City represented by the NYCDEP, and the service providers, namely the landowners in the watersheds who commit to BMPs that protect the watersheds (Appleton 2002). This participation of all the stakeholders in the watersheds during the design and decision making phases is essential to ensure their active future participation in the payment scheme. In contrast, in the case of Chao-Bai watersheds program, the governments of Beijing and Hebei Province played a dominant role in developing the scheme, setting the subsidy standard, and implementing the program. That was a top-down approach with no evidence that farmers and residents in Chao-Bai watersheds were consulted for the development of the payment scheme.

The bottom up approach of the Catskill-Delaware PES scheme is a typical decentralized approach, where the individuals involved in the environmental problem work out the solution themselves. The advantage of a decentralized approach is that the stakeholders have a strong incentive to put forward a solution; because they are the ones with the best knowledge of damage and abatement costs, they may be able to find the most efficient solutions (Field and Field 2009). In contrast, the case of Chao-Bai PES scheme was a centralized policy where a control administrative agency determined the types of projects and standard of subsidy to be carried out. As a result of the knowledge limitations of the policy makers, it would be extremely difficult for them alone to identify an efficient level of payment. The figures of millions committed by Beijing municipal government to Chengde and Zhangjiakou municipalities in the water protection and forest management programs appeared arbitrary, if not random, and thus may not be effective.

3.2 Program Framework and Watershed Economic Gains

The 1997 and 2007 EPA Filtration Avoidance Determinations and the 1997 New York City Watershed Memorandum of Agreement laid a consolidated framework for the PES schemes in Catskill-Delaware watersheds. Under the purview of these umbrella documents, separate agreements and contracts were negotiated and signed to help institutionalize the scheme. The tools of Watershed Agricultural Program (WAP), Watershed Forest Management Plan (WFMP) and Conservation Easement are all incentive-based. As such, the participants can receive tangible benefits in the form of direct income, subsidies, cost sharing or technical assistance. These strong incentives have helped promote active participation by the local community and effective watershed protection practice. By March 2011, 254 large farm operations in the Catskill-Delaware watersheds had signed up for the WAP, representing 96% of identified large farms, and 90% of all large farms had achieved "substantial implementation" of the practices called for in their Whole Farm Plans (WFP). In terms of land acquisition, since 1997, the City's ownership interest in watershed real property has increased by 321% as a result of conservation easement program (Holloway and Rush 2011). During the one-year period between July 1, 2010 and June 30, 2011, about $15.7 million were spent on WAP, WFMP

and Conservation Easement. Of that, over $6.6 million went to payment for conservation easement alone, and this part was translated as direct income for farm owners who participated in this scheme (WAC 2011).

In contrast, the Chao-Bai watersheds program consisted of stand-alone schemes based on separate MOUs or arrangements that operated in different time periods. There was no single framework that provides a basis for long-term PES programs in the watersheds. At the same time, with the exception of "paddy to dryland" program where the farmers in the watersheds could be subsidized directly, all other schemes were based on government-led projects for constructing pollution treatment facilities, disseminating water saving technology, and reforestation efforts. The benefits of such projects were not always felt by the local farmers. In fact, the per capita GDP of the concerned watershed regions was only a quarter of that in rural counties of Beijing (Beijing Academy of Social Sciences 2006). The ecological compensation made by Beijing so far does not make up for the economic sacrifice made by the upper watersheds in Hebei Province, and the watershed areas had deteriorated into a "belt of poverty" around Beijing (Xiao Jincheng, Li, and Qi 2012) (Asian Development Bank 2005).

The Conservation Easement stands out as a unique component of the Catskill-Delaware watersheds program and nothing similar can be found in the Chao-Bai watersheds program. The legal basis for Conservation Easement is that the farmers have both property rights and operation rights over the farmland. In China however, socialist public ownership prevails and the country's Land Management Law stipulates that urban lands are state owned, rural lands are collectively owned, and no individual may sell or transfer land property rights (2005). The farmlands in rural areas are leased to farmers on contracts with a normal term of 30 years in accordance with the Rural Land Contract Law (2002). Therefore the farmers in Chao-Bai watersheds own only operation rights for the period of their contracts, but not the property rights over their farmlands. While the Land Management Law does allow the state to acquire rural land for public welfare and compensate the contracted farmers (2005), which could serve as a legal basis for a similar conservation easement scheme, this would be politically inpalatable, as the farmers would lose their only operation rights over the farmlands and hence risk their basic livelihood.

3.3 Program Management and Operation

The Catskill-Delaware PES programs are administered by the non-profit Watershed Agricultural Council (WAC) in accordance with its contract with the NYCDEP, which provides more than 90% of funds for the programs (WAC 2011). WAC is overseen by a board of directors, who represent the interests of farm and forest owners in the watersheds. Among the 17 board members of 2012, 16 are current or retired farmers, forest landowners or relevant businessmen (WAC 2012). A single administering entity by the local community representatives ensured the smooth operation and wider participation of the PES programs. In the case of Chao-Bai watersheds program, a single

organization in charge of all programs was missing. Various government agencies, such as environmental protection, water resources, forestry and agricultural authorities oversaw and approved submitted project proposals according to their respective administrative mandates. The Chao-Bai program's time-consuming review and approval process, which involved multiple levels of government authorities constituted higher transaction costs than that of Catskill-Delaware program .

4. Discussions

The Catskill-Delaware watersheds payment scheme represents a model PES program, while the Chao-Bai watersheds program represents room for improvement.

4.1 Insufficient Funding

There has been a general understanding that the funds currently "compensated" for Chao-Bai watersheds by Beijing are not sufficient to reflect the full value of the ecosystem. Some scholars estimated the ecological value of Miyun Reservoir as over 47 billion RMB (Hu et al. 2007). The compensation funds, both indirect payment in the form of public projects and direct payment in the form of monetary subsidies, shall be substantially increased to better protect the watersheds and help alleviate the degrading "belt of poverty". Unlike the Catskill-Delaware watersheds where water quantity is not a main issue, Chao-Bai watersheds face challenges in both water quantity and quality. Indirect and direct funds play different roles in ensuring water quantity and quality and are hence both indispensable. For example, indirect funds in the form of public projects work better in treating point industrial pollution and protecting water quality, and direct funds such as "paddy to dryland" subsidies work well in ensuring water quantity.

4.2 Source of Funding

For indirect compensation in the form of public projects, the Beijing municipal government should be able to appropriate a larger portion of its continuously growing budget and support water pollution treatment and forest management projects in the watersheds. As for funding direct subsidies, water price adjustment could be a possible solution. Currently, water in urban Beijing is seriously underpriced. Compared to water-abundant Philadelphia, where water is priced at about 1.2 cents/gallon (Philadelphia Water Department 2011), the price in Beijing is 4 RMB/ton, or 0.25 cents/gallon (Beijing Water Authority 2012), a mere 1/5 that of Philadelphia. Taking into account the water scarcity in Beijing, it is justifiable to raise the water price so that the downstream users can pay a fairer price for the water resources from upstream watersheds. As there are about 20 million residents in Beijing paying water bills, even a slight increase in water price accumulates to considerable funds.

4.3 Fund Management

While a national PES law remains missing in China, the existing MOU on economic and social cooperation signed between Beijing and Hebei is an acceptable basis upon which a separate long-term framework agreement dedicated to PES schemes between Beijing and Chao-Bai watersheds can be developed. Under this framework agreement, the type and rate of PES measures could be specified. For indirect compensation in the forms of public projects, relevant government agencies shall remain responsible for implementation. For subsidy funds, collected from higher water prices for example, a NGO could be set up for its management. This NGO shall reach out to the farmers to understand their practical needs and help develop subsidy rates at a more efficient level. The organization shall also be responsible for direct reimbursements to the farmers according to the agreed rate to minimize transaction costs. In addition, a farm management plan similar to the Whole Farm Plan (WFP) used in the Catskill-Delaware watersheds can be developed for the Chao-Bai watersheds with the full support from the subsidy funds. In addition to the "paddy to dryland" program, which mainly targets water quantity assurance, this farm management plan can encourage the farmers to employ individualized best management practices (BMPs) to reduce non-point pollution from farmlands and better protect water quality.

4.4 Positive verses Negative Incentives

In both Catskill-Delaware and Chao-Bai programs, positive incentives (ie financial rewards for better practices), are adopted rather than negative incentives (ie penalties for non-compliance). In almost all countries, non-point pollution in rural areas, mainly caused by fertilizer and pesticide overuse and animal waste, is a problem more challenging for regulators than point pollution from industrial sources. Industrial pollution can be easily monitored at the chimney or wastewater discharge point and once non-compliance is detected, the polluting factory is undeniably responsible. In the case of farmers, however, the source is less obvious—when pollution is detected in a river, it is not possible to be sure which farmers are responsible and how much each of them contributed. Meanwhile, financial rewards are far more politically palatable than penalties. Therefore, for many watershed PES schemes, positive incentives may prove more pragmatic and effective over negative ones.

5. Recommendations

This paper only discusses two cases of watershed PES programs, but some lessons can be drawn from the comparison and be potentially applied to other localities where a watershed PES program is being considered. First, a well thought out funding scheme is of integral importance. In many cases, the government is the only funding source. It may be applicable in some countries where the government enjoys steady and sufficient revenue, but in others where the government struggles to support important public programs, innovative approaches, including Public Private Partnership (PPP), could be explored to tap private capital. Second, the improvement of ecological services will take years, therefore any PES schemes must be long-term so ensure tangible outcome. In this regard, political support will be essential. The government should lead the efforts in developing a long-term framework under which PES schemes can be implemented. Third, without active engagement of local stakeholders (ie farmers who live in the watershed), no PES programs can be truly successfully implemented. Local stakeholders should be engaged in the whole process, from the program design to the implementation, so that they can be motivated to participate in the initiative.

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