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Integrating biodiversity offsets within Circular Economy policy in China

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ABSTRACT

China aims to realize the aspiration of sustainable development using the Circular Economy (CE) policy which, apart from other objectives, aims to minimize raw material extraction and preserve natural resources. While CE can be an important policy tool to promote more sustainable development trajectories, in practice it does not always avoid or mitigate adverse impacts on biodiversity and ecosystem services caused by resource extraction and infrastructure development. Here we review the current status of biodiversity protection and CE policy in China, highlighting some of their challenges. We then explore the prospects for market-based biodiversity offsets to address the current shortcomings in existing CE policy. Finally, we propose a conceptual model that incorporates a commitment to no-net-loss mitigation into the overall CE strategy to expand the use of biodiversity offsets in China and to remove some of the deficiencies by involving private enterprises in conservation efforts. This model can be used to analyze a set of parameters for comparing different offsets against one another. We propose that such an integrative framework can help CE policy achieve the intended goal of decoupling economic growth from impacts on biodiversity and ecosystem services in China. Important next steps are the implementation of case studies for target industries and ecosystems to demonstrate the synergy between CE and biodiversity offsets and evaluate on-the-ground effectiveness of the proposed integration by adapting our framework.

1. Introduction

China is one of the most biodiversity-rich countries with 13.7% of the total vertebrate species and the third largest inventory of the vascular land plant species in the world (Ministry of Environmental Protection (2010)). Many of the species in China are endemic and endangered (Liu, 2013), and yet China has experienced the loss of 90% of the grasslands and 11.5% of the wetlands in recent decades (Ministry of Environmental Protection (2010)). Drivers species and habitat losses include rapid industrial and urban development, which in turn has resulted in serious pollution, inefficient resource utilization, and health damage costs in China (Xie, 2009). Associated problems in affected areas include decreasing ground water levels (Han et al., 2016), desertification (Cheng et al., 2016), loss of biodiversity (Güneralp and Seto, 2013), deterioration in soil quality (Kuzyakov et al., 2016), and the loss of farmland (Song and Liu, 2016). Some examples include loss of 40.69 km^2 of forest to urban development in Qin-Ba mountainous area (Xu et al., 2016); loss of 760 km^2 of wetland in the Pearl river delta between 1992 and 2012 due to urban expansion (He et al., 2014); and loss of loss of critical habitats for 46 endemic species due to a cascade of 10 hydroelectric dams on the Yangtze river (Yang et al., 2013). The ecological footprint per capita in China has continuously increased over the last few decades (Borucke et al., 2013) and is currently 3.4 global hectares, which is greater than the world average of 2.84 global hectares (Global Footprint Network, 2014).

A decoupling of economic growth, resource use, and environmental impact has yet to occur in China (Geng et al., 2016). Hence, there is a strong need for policies that can protect or compensate for environmental degradation caused by agricultural, industrial and urban development (Yang et al., 2017). In this paper, we discuss how market-based biodiversity and ecosystem services offsets could be put into place through effective policy-making in coming

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years. Ecosystem services refer to the goods and services provided by natural processes and components to, directly or indirectly, satisfy human needs (De Groot et al., 2002). Biodiversity can enhance functions that ultimately lead to different ecosystem services, e.g. wetlands can aid water purification as well as provide habitat for fish for human consumption. In China, ecosystem services are seen with an anthropocentric view, where overlapping interests of humans and nature are regarded in addition to the intrinsic value of nature itself (Ahlheim et al., 2015). In the Chinese sustainability policy context, the government aims to improve the generation of ecosystem services, promote the establishment of eco-compensation mechanisms, and strengthen ecosystem monitoring and research (Chen et al., 2013).

In our opinion, these objectives can be achieved by aligning them with other policies for resource conservation in China, in particular Circular Economy (CE) policy. CE aims to preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows; optimise resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles and foster system effectiveness by revealing and designing out negative externalities (MacArthur, 2013). Since 2003, several national laws and regulations have been enacted to facilitate the implementation of CE in China and the size of the enabling environmental industry has been estimated to be ~USD $750 billion (Xiaoxue Weng, 2015). While biodiversity preservation is integrated within the CE concept, examples are lacking that demonstrate a clear link between CE and biodiversity protection. Moreover, in spite of CE policy, China has been losing biodiversity across the country, which indicates that the current policy needs a revision to resolve such issues.

Existing literature on CE focuses on assessing operational issues such as waste minimization through supply chain efficiency and industrial symbiosis. Thus, in the absence of any direct or clear link between successful implementation of CE (in its present form) and biodiversity protection, new solutions for improved conservation should be explored. Such policies should, in addition to the three R's of reduction, reutilization and recycling espoused by CE (Murray et al., 2017), also avoid, minimize, restore and/or offset environmental impacts of developmental projects (Kiesecker et al., 2010). Since CE has been offered as a system for the accounting of natural resources and ecosystem services, ecological compensation, and market-based instruments for environmental management in China (Geng et al., 2016), it only makes sense to incorporate in CE a system that ensures demonstrable financial and legal commitment towards biodiversity protection. In this paper, we discuss market-based biodiversity offsets in terms of their ability to act as such a device within the overall CE framework. By involving market levers into conservation activities, the Chinese government can help ensure that individual companies are held accountable for the impacts from their economic activities.

We aim is to show how biodiversity offsets could be put into place through effective policy-making. First, we describe the current status of biodiversity protection in China. Next, we explore biodiversity offsets as a market oriented tool of environmental conservation. Finally, we propose a model that incorporates market based biodiversity offsets in the context of CE in China.

2. Literature review

2.1. Environmental conservation programs in China

China is signatory to several international agreements that at their core seek to protect biodiversity and ecosystem services: including the Convention on Biological Diversity (Campbell et al., 2014), the Convention on Wetlands (Kun, 2005), Convention on Migratory Species (as a nonparty member) (Luo et al., 2016), the Convention on International Trade in Endangered Species (Zhou, 2015), International Convention for the Protection of New Varieties of Plants (Ross and Zhang, 1999), the Intergovernmental Platform on Biodiversity and Ecosystem Services (Honglie et al., 2014), among others. China also has a set of laws targeting environmental protection with Environmental Impact Assessment included in their provisions which cover forests, grasslands, wildlife, natural reserves and water and soil protection. (Liu et al., 2015b). Moreover, China has adopted different strategies for biodiversity protection. Some of the Chinese planning initiatives include the China Biodiversity Conservation Strategy and Action Plan, the National Environmental Protection Plan, and a dedicated National Council for Biodiversity Conservation that is responsible for overall coordination of national biodiversity conservation activities (Zhao et al., 2015). China has also established an 'ecological red line' that demarcates ecological hotspots in the country for conservation (Bai et al., 2016). So far, China has established 2541 nature ecological preserves across different parts of the country, which cover around 15.3% of its total territory (Ministry of Environmental Protection (2010)).

In China, ecological compensation through biodiversity offset schemes has been established in the recently updated Law of Environmental Protection (State Environmental Protection Administration, 2006). Such schemes are collectively known as *shengtai buchang jizhi*, which translates as ecological compensation and comparable to Payment for Ecosystem Services (PES) schemes in other parts of the world (Zhen and Zhang, 2011). While PES schemes in developed countries are meant to achieve net gains in ecosystem services, in China, such programs are used to halt further loss of biodiversity and ecosystem services (Pan et al., 2017). Most of the ecological compensation/PES schemes in China are Pigouvian and serve to pay the costs of restoring degraded ecosystems (He and Lang, 2015). Either a fee is levied to reduce negative externalities or compensations in different forms are distributed for the provision of positive externalities (Schomers and Matzdorf, 2013). Since private property in China is rare, many of the beneficiaries and stewards of PES schemes include local governments.

One of the prominent PES schemes in China includes the Sloping Land Conservation Program (SLCP) (Deng et al., 2016; Liu and Henningsen, 2016). SLCP was launched in the wake of droughts and floods to halt soil erosion by converting cropped area on slopes and terraces in hilly areas into forests. The farmers are compensated through grain subsidies, which are monetized using current grain prices for in-kind offsets (Bennett, 2008). Similarly, the Natural Forest Protection Program (Liu et al., 2008) serves to conserve forests by banning logging, and affected parties in this case are compensated through cash payments. Funding for the program is provided by the central government (81.5%) and local governments (18.5%) (Liu et al., 2008). Compensations are determined on the basis of direct expense of replantation and the opportunity cost of forest protection. Chinese PES schemes also include watershed management programs, which usually involve financial payments from the downstream beneficiaries that use the water and/or the upstream polluters that drain waste items in the water. Prominent examples include the Watershed Eco-compensation Program (Bennett, 2009) and the Water Use Rights Transfer (Liu, 2003) scheme. Payments are determined on the basis of opportunity cost upstream, cost of infrastructure and water consumed downstream. China also has projects and incentives for controlling soil erosion and promoting eco-agriculture. Examples include Four Wastelands policy that auctioned wasteland for farming (Ho, 2003), soil erosion control fees and Soil & Water Conservation Installation Compensation Payments (Zhen and Zhang, 2011). Compensations in this case are based on the cost of environment rehabilitation. Similarly,