



Research article

Eco-compensation in China: Theory, practices and suggestions for the future

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ABSTRACT

Eco-compensation is the most important form of compensatory conservation in China. However, this compensatory mechanism is criticized for vague definition and massive government participation. For better understanding of eco-compensation in China, this paper compares theories and practices of compensatory mechanisms in China and abroad. The analysis of theoretical backgrounds shows that eco-compensation in China is a combination of 'ecological compensation' and 'payments for ecosystem services'. Ten compensatory projects in China and abroad are assessed to reveal characteristics and problems of eco-compensation in China. The results show that compensatory projects in China lagged behind mature foreign compensatory projects in clarity of property rights, responsibility fulfillment, executive efficiency, effectiveness, sustainability and equality. The massive participation of the government is the major reason for the poor performance of compensatory projects in China. However, government participation is necessary at the present stage in China for the income gap and beneficiaries' low willingness to pay. For the improvement of eco-compensation in China, suggestions are given on the choice of non-market valuation methods, the creation of property rights and the establishment of market mechanisms.

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1. Introduction

Compensatory conservation has gained wide acceptance as an effective method to protect ecosystems. At least 56 countries had made laws or policies that required compensatory conservation in 2014 (OECD, 2014). Human well-being and social development largely depend on services generated by ecosystems (Brismar, 2002; MA, 2003; Nelson et al., 2009; Costanza et al., 2014). However, ecosystems need adequate matter and energy to sustain these services, making environmental conservation essential to sustainable development (Arthington et al., 2006; Deal et al., 2012). Human activities often impose the externality effect on other people (Buchanan and Stubblebine, 1962). Some human activities related to ecosystems, such as afforestation and soil conservation, may generate positive environmental externalities; whereas others,

such as pollution and overgrazing, generate negative environmental externalities. Achieving zero externalities can be unrealistic (van den Bergh, 2010), but environmental externalities are often disregarded in individual economic decisions (Kosoy et al., 2007). Without compensatory measures, developers may keep destroying ecosystems as they can benefit from avoiding paying for their negative environmental externalities, while protectors of ecosystems may stop environmental protections from which they are unlikely to benefit (Engel et al., 2008). Thus, compensatory mechanisms have been increasingly promoted in ecological conservation (Pascual et al., 2014). By internalizing environmental externalities, compensatory mechanisms aim to protect natural resources, biodiversity, ecological functions, ecosystem services and other kinds of ecological values (Madsen et al., 2010; Stanton et al., 2010; OECD, 2013a). However, it is very hard to evaluate all the aspects of

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ecological values. Generally, only important components are considered. For instance, the ecological values of damaged habitats and compensation areas can be calculated through the area, species composition, structure, landscape, ecosystem services et al. (Quétiér and Lavorel, 2011; Vaissière and Levrel, 2015). The selection of components of ecological values and evaluation methods depend on laws, policies or contracts (Küpfer, 2008; GWA, 2014; NZG, 2014).

Ecological compensation (EC) is an important compensatory mechanism to internalize negative environmental externalities. This mechanism has a short history. Ecological compensation for wetlands was originated in the 1970s in America (Brown and Lant, 1999). In 1976, the German Federal Nature Conservation Act required compensatory measures to be taken to keep the essential functions in nature and in landscape unaltered after a project (Küpfer, 2008). Nowadays, ecological compensation is frequently employed worldwide (May et al., 2017).

Payments for ecosystem services (PES) is widely used to internalize positive environmental externalities. The research about PES started in the 1970s and developed very fast during 2000–2010 (Schomers and Matzdorf, 2013). PES practices have proliferated rapidly in the twenty-first century. In 2010, more than 300 PES projects were operating worldwide for the promotion of watershed services, biodiversity, carbon and so forth (OECD, 2013a).

Rapid economic growth in China has placed an increasing pressure on its already strained ecological conditions. In recent years, the growing emphasis on compensatory conservation has been indicative of a greater focus on protecting ecosystems by internalizing the externalities in China (Stanton et al., 2010; Schomers and Matzdorf, 2013). The most popular compensatory mechanism for ecological conservation in China is 'eco-compensation'. The Chinese central government and many local governments have started exploring and implementing eco-compensation, and several laws and regulations about eco-compensation have been promulgated (MEPC, 2006; Bennett and Trends, 2009). With decades of exploration, eco-compensation in China has attracted international attention. However, perceptions of eco-compensation in China are divided. Some researchers regarded eco-compensation in China as 'EC' (Madsen et al., 2010; OECD, 2013a). But in some papers and reports, eco-compensation in China is discussed under the term 'PES' (Bennett and Trends, 2009; Stanton et al., 2010; Deng et al., 2011; Wang et al., 2016). These two kinds of perceptions are conflicting as there are significant differences between 'EC' and 'PES'.

Eco-compensation projects in China are often criticized for the substantial government participation. Most eco-compensation projects in China used public funds as sources of finance, causing insufficient involvement of private sectors (Bennett and Trends, 2009). Incomplete information, poor administration, and corruption existed in eco-compensation projects in China as many projects were conducted via top-down approaches involving multi-level governments (Bennett, 2008). Sometimes, payments from the government were insufficient to internalize environmental externalities in eco-compensation projects (Komarek et al., 2014; He and Sikor, 2015). But government participation is regarded to be important in developing countries as it can ensure the smooth operation of compensatory projects (Stanton et al., 2010).

For further development of eco-compensation in China, the theory and practices of this compensatory mechanism need to be well understood. Hence, this paper aims to answer the following questions:

- (1) Is eco-compensation in China the same as 'ecological compensation' or 'payments for ecosystem services'?

- (2) What is the role of government in eco-compensation in China, and how does it impact eco-compensation in China?
- (3) If government participation has any negative impact on eco-compensation in China, how to solve it?

2. Theoretical backgrounds of compensatory mechanisms

2.1. Definition of compensatory mechanisms

Lots of compensatory mechanisms have been developed to internalize negative environmental externalities, including 'ecological compensation', 'environmental compensation', 'biodiversity offsets', 'environmental offsets', and 'compensatory mitigation'. All these mechanisms concern about ecological conservation actions aiming to compensate for human's adverse ecological impacts (Norton, 2009; Madsen et al., 2010; Brown et al., 2013; Persson, 2013; GWA, 2014; NZG, 2014). Therefore, the term 'ecological compensation (EC)' is used on behalf of these mechanisms in this paper. EC can be defined as actions that seek to counterbalance ecological values which have been or will be impaired by human activities. Here, ecological values include natural resources, biodiversity, ecological functions, ecosystem services et al. In countries with well-developed laws and regulations for EC, such as America and Australia, the mitigation hierarchy (avoidance, minimization, compensation) is required, making EC the final step of mitigation (Quétiér and Lavorel, 2011; OECD, 2014; GWA, 2014).

Payments for ecosystem services (PES) is created to internalize positive environmental externalities. PES is a voluntary transaction between providers and buyers over a well-articulated ecosystem service for provisions that are continuously secured (Wunder, 2007). In practice, most PES cases cannot meet all the criteria in the definition and are more correctly referred to as 'PES-like' cases (Goldman-Benner et al., 2012; Suhardiman et al., 2013).

In China, the most important compensatory mechanism for ecological conservation is 'eco-compensation' which is defined as a mechanism aims to maintain or improve the status of ecosystems by employing economic means to adjust stakeholders' interests (MEPC, 2006).

Compensations for environmental externalities, especially market-based compensations, depend largely on well-defined and enforceable property rights (Farley and Costanza, 2010). Property rights are a collection of entitlements that are granted to individuals or entities regarding specific assets (Depres et al., 2008). Property rights can be legislated or stipulated. Underlying all ecological policies relevant to privately owned or utilized ecological values is a bundle of assumptions about the distribution of benefits and associated rights and duties, which are shown in Fig. 1 (Lockie, 2013). The location of the horizontal axis indicates socially acceptable damage of ecosystems, which is generally decided by laws or stipulations. The 3rd and the 4th quadrants are not to be discussed in this paper since compensation measures are not to be taken for the pure private benefits.

In the 1st quadrant, the maintenance of ecological values is seen as a reasonable expectation of people involved in ecosystem processes. Thus, following the polluter-pays principle, the institution of EC establishes property rights to intervene in ecosystem processes and create negative environmental externalities (Vaissière and Levrel, 2015). Here polluter is the person who is either likely to cause or has caused damages to ecosystems. In the 2nd quadrant, the provision of ecosystem services is beyond the reasonable expectation of people involved in ecosystem processes. Following the beneficiary-pays principle and provider-gets principle, the institution of PES creates new property rights for ecosystem

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