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Managing urban ecological land as properties: Conceptual model, public perceptions, and willingness to pay

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ABSTRACT

Rapid and large-scale urbanization can lead to the loss of ecological land and the degradation of ecosystem services. The effective management of urban ecological land is crucial to maintaining urban sustainability. In this study, we first categorized ecological land from two dimensions, i.e. its ecological function and social property. We then put forward a framework of managing the urban ecological land as a property. Dongying City in China was selected as our case to investigate public perception and willingness to pay (WTP) for managing urban ecological land. Our findings showed that 94.8%, 87.1%, and 97.7% of respondents supported improvements of ecological land management in residential, business, and public areas, respectively, indicating that there is a good public opinion base. For residential areas, the management of ecological land by collecting property charges from households is largely acceptable; for the management of the ecological land in business areas, the vast majority supports the enterprise or government funding; for public areas, the vast majority prefers the government funding. Our further analyses of the factors influencing WTP show that the transparency of information on property fees has a significant impact. We also found that higher income levels lead to a higher WTP for managing ecological land in residential areas, but not for business or public areas. Furthermore, neither higher awareness about pollution nor higher level of formal education significantly induces higher WTP. Our finding could provide an evidence-based reference for policy-making and the operational design of the management model that we proposed.

1. Introduction

Urbanization has been occurring for centuries and has brought tremendous changes to our planet, not only in terms of modernization and economic growth, but also great pressures on the ecosystem, such as human-induced land use and land cover change, which has led to huge ecosystem service loss (Foley et al., 2005). Ecosystem services are derived from “ecological land,” which usually refers to the lands used for forest, grass, wetland, water bodies, etc. (Li et al., 2015). Ecological land plays a crucial role in urban ecosystems. It provides the base for supporting biodiversity and ecosystem services, such as improving urban air quality, regulating microclimate, beautifying urban landscape, preventing and mitigating urban flooding, and providing recreational entertainment for residents (Colding, 2007; Li et al., 2017a,b). These lands should be managed for preserving their ecosystem services since they provide basic needs for human society that are crucial for urban sustainability (Li et al., 2017a,b). However, for a

long time the value of ecosystem services has not been regarded as an important issue in urban planning. As a result, many ecological lands have been used for construction due to a lack of effective management schemes.

Since the 1980's, China has been experiencing rapid urbanization and industrialization. The great economic growth has been combined with negative impacts to the ecosystem. Extensive urbanization requires large amounts of land that have caused ecosystem services loss due to land use change (Long et al., 2014; Zhang et al., 2017a,b). The past trend of urbanization is no longer sustainable for China, and a new type of urbanization is greatly needed (Liu et al., 2017; Zhang et al., 2017a,b). Internalizing the value provided by ecological land has been regarded as an important approach; however, there are still barriers to the practice: first, giving the appropriate market value to ecological land is very difficult; second, even if the market value of ecological land can be accurately measured, there is often a lack of sufficient funding, especially when the supply of urban land has been intensely

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diminishing in recent years in many cities (Wang et al., 2017).

Payments for Ecosystem Services (PES) has been regarded as an effective policy instrument in many different regions (Pagiola, 2008; Wunder et al., 2008). In China, the term Ecological Compensation (EC) has been frequently used by the government and academia (Liu et al., 2008). By definition, EC has a wider range compared to PES because it not only addresses financial payments, but also considers other approaches, such as technological assistance. However, while most current studies about PES and EC take into account natural reserves, watershed, forest, grassland, etc., little attention is given to urban ecological land. Urban ecological land is the basis for urban ecosystems and the foundation of green infrastructure, and plays a crucial role in maintaining urban sustainability (Chang et al., 2017). Thus, urban ecological land should be managed properly. Scholars have initiated debates over whether urban ecological land should be managed as a property by ecological assets and services management companies. The literature, however, is still very sparse, and more detailed studies are needed (Wang et al., 2014). Measuring the value of urban ecological land is an important step toward better management. The contingent valuation method (CVM) is one of the most commonly used approaches for the valuation. The CVM inquires respondents about their willingness to pay for goods or services and is widely used to estimate the value of items that do not have market prices, such as the value of a wetland. The purpose is to support the cost-benefit analysis of relevant policies and to optimize social welfare. As Carson (2011) summarized, hundreds of countries have used CVM to conduct research to assist public policymaking. Although CVM is often challenged or misunderstood, research evidence has shown that properly designed and operated CVM can provide reliable support for measuring the value of public goods (Carson, 2012).

This study aimed to explore ecological land management for sustainable urbanization in China. The remaining of the article is balanced as follows. In Section 2, we first categorized the urban ecological land based on its functional attributes and social features, and then proposed a conceptual framework for managing urban ecological land as a property. In Section 3, we selected Dongying City in China as our case to investigate public perception and willingness to pay for managing urban ecological land. Thereby it can provide an evidence-based reference for the operational design of the management model and the decision-making of the facilitating policies, which are concluded and discussed in Section 4.

2. Conceptual model for urban ecological land property management

2.1. Urban ecological land and its classifications

A better understanding of the classification of urban ecological land is crucial for management purposes. Already by the 1990's, researchers started to classify ecological land, not specifically focused on urban land, but more generally for whole ecosystems (Sims et al., 1996). Here, we first examine the classifications of urban ecological land from different perspectives before focusing on management issues.

2.1.1. Functional attributes

Urban ecological lands can be classified in two categories: the first is those used to provide services in the urban system, including urban green lands in residential and business areas and green open spaces, such as urban grassland and road green belts, etc., that are usually referred to as urban green spaces. Most green space needs regular maintenance to assure its main functions (Swanwick et al., 2003). The second category is ecological lands that play a key role in maintaining urban ecosystem functions and provide services to the urban system, which we refer to as "supporting ecological land" in this paper. In some cases, there are overlaps between the two categories. Most supporting ecological lands are natural or semi-natural systems, including natural

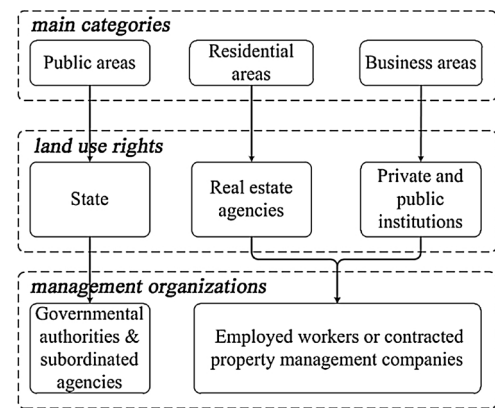


Fig. 1. Classification of urban ecological land based on social attributes.

park, rivers, lakes, wetlands, forests, and grasslands, within urban areas and on the urban fringe. Compared to the first category, supporting ecological lands are more important to urban sustainability, as they play a decisive role in maintaining the urban environment. These lands also decide the total ecological capacity for urban development.

Much attention has been paid to studying the benefits of urban green spaces on public health (Maas et al., 2006), environmental justice (Wolch et al., 2014), human well-being (Bertram and Rehdanz, 2015), and public accessibility (La Rosa, 2014). There have also been many studies assessing the economic value of urban green space. The determination of the monetary value of urban green spaces and ecological services is needed for management purposes, especially when it comes to using market-based instruments (Costanza et al., 2017; Silvennoinen et al., 2017).

2.1.2. Social attributes

We propose a classification of urban ecological land based on property rights and management approaches, as demonstrated in Fig. 1. There is still a lack of classification along this dimension in the ecological land literature. In China, the ownership of all of the land belongs to the public, including state ownership and collective ownership. In contrast, the land use rights are diversified. Urban ecological land can be classified as public areas, residential areas, and business areas. The land use rights belong to the public, real estate agencies, and private and public institutions. Urban ecological land in public areas, such as green space in parks, scenic districts, and road green belts, is usually administrated by the corresponding governmental sectors, such as the forestry authority. In practice, this category of ecological land is managed by governmental authorities or their subordinated agencies, such as the administrative committee of parks. There are also cases where the management of this category of ecological land is outsourced to specialized companies, such as landscape companies. The management of urban ecological land in residential and business areas is usually done by the working staff employed by the land users, or by the management companies.

2.2. Challenges with management

In essence, urban ecological land is a public good, the non-excludability nature of which causes the free-rider problem. Therefore, a fundamental challenge in managing urban ecological land is the undersupply of its quantity and quality (Hardin, 1968). As for urban ecological land in public areas, the governmental authorities manage it for the welfare of the entire society. Nevertheless, problems with government failures may undermine the efficiency of management, impeding the timely and sufficient conservation of the land. In addition, the management funds come from fiscal expenditures as well as ticket revenues of parks and scenic districts. However, whether the scale of these funds can match the needs of maintaining the ecosystem services

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