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Assessing the importance of cultural ecosystem services in urban areas of Beijing municipality

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ABSTRACT

The world is rapidly urbanising, with both positive and negative consequences. One major challenge is how to secure the long-term quality of life for urban residents. Many studies on quality of life are based on 'material' ecosystem services (i.e., provisioning and regulating services), with less attention paid to the non-material benefits gained from nature (e.g., green and blue spaces), which have been called cultural ecosystem services (CES). However, these non-material services are often most important to urban residents. Understanding perceptions and awareness of CES provided by urban blue space (i.e., water and wetlands) and green space (i.e., urban forest and grassland) are therefore important to support planning, creation, and protection of these spaces. To tackle these problems, we assessed and quantified the CES provided by urban green and blue space in six metropolitan areas of Beijing. By combining ecosystem services valuation with surveys (466 questionnaires and 16 expert interviews), we gained insights into residents' perceptions of CES. Surprisingly, blue areas in metropolitan Beijing were valued at least 4.3 times higher than the value of green areas. More than 80% of the residents were willing to pay for maintenance of urban blue and green areas (an average of almost 64 RMB/year). The contributions of cultural services are likely to increase if stakeholders value natural ecosystems more in urban areas than in rural or mountainous areas because of the additional value of these rare resources in densely populated areas.

1. Introduction

The world is rapidly urbanising. One major challenge is how to secure long-term quality of life for people living in urban areas (Andersson et al., 2015). Since the 1990s, research about the impacts of urbanization on ecosystems (Likens et al., 2012) has been expanded by many ecosystem-assessment studies. These have established that the quality of life in cities depends, among other things, on ecosystem services generated locally by the natural components of cities (González-Oreja et al., 2010). Such 'nature in cities' comprises multifunctional blue areas (i.e., water) and green areas (i.e., grassland), and these areas inevitably compete with other land-uses and infrastructure for resources and space (Li et al., 2016). Urban green and blue spaces help maintain human health physically, emotionally, and psychologically (Pearson et al., 2014; Mantler and Logan, 2015; Trigueromas et al., 2015). Thus, it is essential for planners and policy-makers to obtain broad public support for these areas based on improved awareness of the importance of the blue and green areas for human well-being.

It's also necessary to consider perceptions of these areas and find ways to evaluate their performance by exploring the experiences of urban users. This knowledge can support planning and creation of a city in which green and blue areas are established and protected in attractive urban locations (Baur et al., 2013; Buchel and Frantzeskaki, 2015). Environmental psychology research supports this goal. Researchers in this field have found that people observe and value their surroundings for more than just the spatial quality; they also evaluate the changes over time, forms of maintenance, use for sensory experiences, and use options, among other things (Buchel and Frantzeskaki, 2015).

Ecosystems provide many functions and services to human society, including services that meet material and spiritual needs (De Groot, 1992). Cultural ecosystem services (CES) are often generated interdependently from other critical ecosystem services, and engaging people in the stewardship of CES could increase the awareness of these benefits for a larger group of non-cultural urban ecosystem services (Milcu et al., 2013; Jennings et al., 2016). CES include spiritual enrichment, religious beliefs, cognitive development, recreation, reflection, and aesthetic experiences, and are normally considered to represent non-material links between people and ecosystems (MEA, 2005). In developed countries, CES

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are highly valued for their therapeutic and recreational benefits (Tielbörger and Sternberg, 2010). In contrast, societies in developing countries value CES more for their cultural identity and survival roles (MEA, 2005). However, compared to the more familiar and more easily quantified provisioning, regulating, and supporting ecosystem services, the scientific assessment and public understanding of CES have been insufficiently studied due to difficulties identifying the most important intangible and subjective attributes, and the difficulty valuing these attributes in monetary terms (Seppelt et al., 2011; Chan et al., 2012; Russell et al., 2013).

Most of what is known about CES has been studied in natural ecosystems, and little is known about CES in urban areas, especially in the world's most rapidly developing cities (such as Beijing). In such a city, CES may be more directly experienced, and their benefits may be more rapidly appreciated, particularly for aesthetic services (beauty appreciation), recreational services (recreational and leisure activities), inspirations for art and design, cultural heritage and identity services, spiritual or religious inspiration, and education and science opportunities (Langemeyer et al., 2015; La Rosa et al., 2016).

In contrast to other ecosystem services, there is therefore limited information and recognition about the benefits of CES for human well-being, particularly in terms of the information needed to support decision-making processes (Liu et al., 2015). This is because the intangible and subjective nature of CES makes it challenging to assign economic values (UN DESA, 1999). Consequently, CES are routinely omitted from ecosystem services assessments or, if they are included, it is usually in a limited capacity that focuses mainly on more easily quantified elements such as recreation, tourism, and health (Daniel et al., 2012; Buchel and Frantzeskaki, 2015). In previous studies, research on addressing and assessing such less tangible services has been weak (Seppelt et al., 2011).

This lack of knowledge about urban CES is critical given that approximately 54% of the world's population now lives within urban areas (WHO, 2014). To help fill this research gap, we used the definition of urban CES proposed by Russell et al. (2013): 'ecosystem contributions to human well-being mediated through nonmaterial processes (e.g., the mind or culture)'. This includes more direct experiences of nature (green and blue spaces), with the benefits understood through human cognitive perception. The green and blue spaces represent urban ecosystems that include street trees, lawns, parks, urban forests, cultivated land, wetlands, lakes, and streams (Sander and Zhao, 2015).

In the present study, our goals were to quantify the CES provided by urban ecosystems from the perspective of human perceptions and to provide a monetary valuation of these services. The methodology was specifically developed to analyse urban CES through users' experiences and perception of urban green and blue areas, combined with a monetary ecosystem services valuation. Our main research question was to learn how urban residents perceive and experience Beijing's urban green and blue spaces and how those experiences and perceptions can be represented as CES. To achieve these goals, we first obtained data on the perceptions and experiences of urban blue and green areas and the types and values of CES in Beijing. We then analysed the reasons for these perceptions to provide insights into optimal utilization of Beijing's urban CES.

2. Data and methods

2.1. Case study area

For our case study, we chose Beijing, the capital of the People's Republic of China. Beijing is a typical city in a developing country, and is experiencing rapid economic development combined with urban expansion and reconstruction (Yang et al., 2005). Since 1947, economic development has led to rapid urbanization and further encroachment of Beijing into the surrounding countryside, as well as urban problems caused by the urbanization such as an increasing population density and encroachment of the city on agricultural land (Zhou, 2006, Li et al., 2012). The urbanization process is easily visible from the rapid development of ring roads, which increased from a total of 2 in 1980 to 6 today (Fig. 1). The city's administrative boundary now includes four urban districts, four suburban districts, and two outer suburbs, as well as eight rural counties. This study will focus on the metropolitan area in central Beijing, which consists of six districts: Dongcheng, Xicheng, Chaoyang, Fengtai, Shijingshan, and Haidian (Fig. 1).

Inside the city, natural and semi-natural areas, and especially urban blue spaces, are rare, and most are found in north-western Beijing. The area and proportion of the total area for urban blue spaces in each district is much lower than the area of urban green spaces. In Fengtai District, for example, blue space accounts for only 0.1% of the total area, versus 44.8% for green space. Table 1 summarizes the key demographic, geographic, environmental, and economic characteristics of the case study areas.

2.2. Survey content, design, and implementation

The data used for this analysis were gathered from a field questionnaire and expert interviews carried out within the study area from May to August 2012. The survey's main objective was to identify the experiences and perceptions of residents related to urban green and blue space in a local context. Appendix A provides the survey questions. Using the method of Fowler and Cosenza (2009), we determined that a sample size of 500 would provide a margin of error of ±4%, which represents a 95% confidence interval that the sample would contain the desired information.

In the survey design phase, we validated the questionnaire *ex ante*, before using it to collect data, and we used follow-up questions, *ex post*, to clarify any unclear responses. A pre-test of the questionnaire was conducted with Chinese university students who had no background in ecosystem services or CES. The students were invited to provide feedback about any confusing questions by answering as if they were real respondents. Based on their feedback, the final survey questions were redesigned and clarified. Responses to the final questionnaire were eliminated if the respondent did not successfully complete at least 50% of the questions. The final sample consisted of 466 questionnaires and 16 expert interviews, for an effective completion rate of 93.2%.

We selected potential respondents by means of stratified random sampling at 14 parks or heritage sites (Appendix B). Only residents who had lived in Beijing for more than 10 years were included in the survey. The questionnaires were implemented with help from local researchers who were experienced in social surveys. The surveys were conducted in 'hotspots' selected from remote sensing images to account for the presence of blue and green spaces. (Appendix B summarizes the sample sizes for the selected areas.)

The survey was done several times per day, at different times (in the morning, at lunch, in the afternoon, and in the evening) during a 3-month period. The questionnaire (Appendix A) included questions related to the respondent's beliefs about several important topics related to urban blue and green spaces. In addition, the survey also included questions on the socioeconomic and demographic characteristics of the respondents.

We also conducted expert interviews with 16 experts from university and scientific institution land management programs (13 individuals), from government environmental offices (1 individual), and from tourism management offices (2 individuals). We used open questions that depended on the different roles of these