Ecological Economics 120 (2015) 139–152

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

The role of urban green space for human well-being

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ARTICLE INFO

Article history:
Received 20 October 2014
Received in revised form 13 October 2015
Accepted 20 October 2015
Available online 11 November 2015

JEL classification:
I31
Q51
Q57
R20

Keywords:
Human well-being
Life satisfaction
Urban green space

ABSTRACT

Most people in Europe live in urban environments. For these people, urban green space is an important element of well-being, but it is often in short supply. We use self-reported information on life satisfaction and two individual green space measures to explore how urban green space affects the well-being of the residents of Berlin, the capital city of Germany. We combine spatially explicit survey data with spatially highly disaggregated GIS data on urban green space. We observe a significant, inverted U-shaped effect of the amount of and distance to urban green space on life satisfaction. According to our results, the amount of green space in a 1 km buffer that leads to the largest positive effect on life satisfaction is 35 ha or 11% of the buffer area. In our sample, 75% of the respondents have less green space available.

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1. Introduction

Approximately 75% of the people in Europe live in urban areas (World Bank, 2013). One important element for their well-being and quality of life is the availability of urban green space. There are different ways in which urban green space can positively influence well-being and health (see Tzoulas et al. (2007) for an overview). Benefits can accrue from increased activity levels as a result of being in contact with nature (see Bowler et al. (2010) for a review). Further benefits are brought about by the moderation of adverse environmental conditions such as air pollution, high temperatures, and noise (e.g. Gidlöf-Gunnarsson and Öhrström, 2007). However, in most urban areas, and particularly in inner-city areas, green spaces are in insufficient supply (Kabisch and Haase, 2011).

Individual countries and/or cities have begun to take an increasing responsibility in developing urban green space and improving the services provided by different types of urban open space. Following the Convention on Biological Diversity (UN, 1992), these countries and cities have formulated national, regional, or local action plans. The German National Strategy on Biological Diversity, for example, calls for an increase in green space in settlement areas (BMU, 2007).[1] At the city level, some German cities have defined minimum targets for per capita supply of urban green space.[2]

City development, however, always has to address trade-offs and conflicting interests between inner development, e.g., for housing, and the development or preservation of urban green space and other types of open space (Schetke et al., 2012). Information on the benefits and costs of alternative land uses can, therefore, be valuable in supporting decision-making and ensuring that land is used sustainably, meeting the needs of the residents.[3] Information on the monetary benefits of urban green space, however, is often not available. Despite the relevance of urban green space for city residents, environmental valuation studies have so far focused on the benefits of natural areas in rural contexts. Existing studies on the economic valuation of urban green space have mostly used traditional valuation techniques such as stated or revealed preference approaches (see Brander and Koetse (2011) and Perino et al. (2014) for topical meta-analyses).

[1] This objective is integrated into federal law by requiring that open spaces in urban and peri-urban areas have to be preserved and developed where they are not sufficiently available (§ 1 Abs. 6 BNatSchG, 2009).

[2] The City of Berlin, e.g., has the goal to provide 6 m^2 of public green space per inhabitant (SSUB, 2013).

[3] The EU Biodiversity Strategy (EC, 2011), for example, requires all member states to assess their ecosystems and the economic value of those systems by 2020.

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http://dx.doi.org/10.1016/j.ecolecon.2015.10.013
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A recent alternative in the field of environmental valuation is the life satisfaction approach (LSA).[4] The two existing economic studies analyzing the effect of urban green space on life satisfaction cover cities in Australia (Ambrey and Fleming, 2013) and China (Smyth et al., 2008). Unlike Ambrey and Fleming (2013) and Smyth et al. (2008), we use green space measures that capture a respondent's individual green space availability. Moreover, we offer the first application of the LSA to value urban green space in a European city, namely Berlin, the capital city of Germany. Berlin, located in the Eastern part of Germany with an area of 892 km^2 (SSUB, 2012) and a population of 3.4 million (ASBB, 2013a), is particularly interesting. The expected population growth and the trend toward smaller household sizes will exert strong pressure on existing green spaces in the inner-city districts, particularly if a densification strategy is to be followed and urban sprawl is to be avoided. Such a conflict can currently be observed in the case of the Tempelhofer Feld.[5] In contrast, there are still many open spaces such as brownfields that might be turned into residential or commercial areas (Simons et al., 2012).

This paper focuses on urban green space as one important type of urban open space and its relevance for human well-being. The objective of this paper is to answer the following research questions: (1) In which ways does urban green space affect the well-being of people? (2) Is more green space always better, or is there a level of urban green space at which the positive impact on well-being is largest? and (3) What is the monetary equivalent of a change in the availability of urban green space? To address these questions, we use spatially explicit survey data of Berlin residents together with spatially highly disaggregated GIS data on urban green spaces. We use two individual green space measures for our analyses. Based on land cover data from the Urban Atlas (EEA, 2012) we calculate the amount of urban green space available in the living environment of each respondent as well as the distance to the nearest urban green space.

The paper is structured as follows. Section 2 provides a review of the literature on the economic valuation of urban green and the relevant literature on subjective well-being. Section 3 presents the methodological approach, the empirical strategy, and the data. Section 4 reports the results of the main regressions and sensitivity analyses. Section 5 discusses the results and concludes.

2. Literature Review

2.1. Effects of Urban Green Space on Human Health and Well-being

There is a broad body of literature in psychology and medicine that analyzes the effects of nature in general and urban green space in particular on people's health and well-being (see Tzoulas et al. (2007) for an overview). General findings underline that contact with nature and urban green space can have various positive impacts on human health and well-being. Firstly, contact with nature has psychological benefits. For example, it can reduce stress and increase positive self-reported emotions (Ulrich, 1983; Ulrich et al., 1991), restore attention (Kaplan and Kaplan, 1989), and affect self-regulation and restorative experiences positively (Hartig et al., 2003; Van den Berg et al., 2010). In addition to psychological benefits, there are also direct health benefits such as increased longevity (Takano et al., 2002) and improved self-reported health (De Vries et al., 2003; Maas et al., 2006). Urban green spaces can also be beneficial for social well-being as they may increase social cohesion and identity (Newton, 2007).

There are different ways in which green spaces can influence well-being and health positively. Proximity to parks may increase physical activity levels (Kaczynski and Henderson, 2007). Physical activity in turn unequivocally increases human health, both in physical and psychological terms. Bowler et al. (2010) carried out a meta-analysis analyzing whether activities in natural environments increase health more than activities in more synthetic environments. They find evidence that lower negative emotions, such as anger, mental fatigue, or sadness, are reported after exposure to a natural environment in comparison to a more synthetic environment. See Coon et al. (2011) for a similar meta-analysis.

But not only activities in natural environments but also passive views onto natural elements may improve health and well-being. Kaplan (2001), for example, shows that natural elements in the view from a window can contribute to the residents' satisfaction with their neighborhood and to different aspects of their well-being. Nature can also act as a buffer to moderate adverse conditions (e.g. Evans, 2003; Wells and Evans, 2003). Gidlöf-Gunnarsson and Öhrström (2007), for example, provide evidence that perceived availability of nearby green space can help to alleviate noise annoyances.

However, urban green space may also negatively affect people's health and well-being. This may be due to the fact that the presence of certain animals may be perceived as scary, unpleasant, or disgusting or by the fact that unilluminated green space is perceived as unsafe in night-time (Bixler and Floyd, 1997). In addition, negative effects might occur due to wind-pollinated plants causing allergic reactions (D'Amato, 2000), branches of trees falling onto roads (Lyytimäki et al., 2008), and the emission of volatile organic compounds by trees and bushes (Chaparro and Terradas, 2009). See Gómez-Baggethun and Barton (2013) for a short overview.

2.2. Valuation of Urban Green Space Using Stated and Revealed Preference Methods

Despite the relevance of urban green space for city residents, there are relatively few economic studies that elicit the value of urban green space using either stated preference methods such as contingent valuation (CV) and choice experiments (CE) or revealed preference methods such as hedonic pricing (HP) and travel costs (TC). The majority of the existing studies on the valuation of urban green space use the HP framework.

The results of a range of CV and HP studies are analyzed in two recent meta-analyses that focus on different types of urban open space and have different regional foci. Brander and Koetse (2011) provide a meta-analysis of 32 international CV and HP studies valuing different types of urban open space with a focus on the USA. They find that most of the CV studies refer to urban forests and urban agriculture, and far fewer studies investigate urban green spaces and parks. HP studies, in contrast, mostly investigate the role of urban parks and green spaces for property prices. A more recent meta-analysis for the UK is provided by Perino et al. (2014). It is based on five studies analyzing the effect of increased distance to formal recreation sites and city-edge green space on property prices using HP, CV, and expert interviews.

With respect to CE, there are even fewer examples of studies analyzing preferences for urban green spaces. The only study that values urban green spaces or parks that we are aware of is an application for Dublin, Ireland, by Bullock (2006).[6] Two examples of TC studies are Fleischer and Tsur (2003), who use the individual TC method to estimate the economic value of urban parks in Israeli cities, and Chaudhry and Tewary (2006), who use the zonal TC method to assess the recreational value of urban forests in Chandigarh, India.

[4] Self-reported life satisfaction is used as a proxy for subjective well-being. Please note that we use the terms life satisfaction and well-being interchangeably throughout the paper.

[5] The so-called Tempelhofer Feld is located on the area of the former airport Berlin Tempelhof. The associated free areas including the former airfield have a size of 303 ha. They can be used by the public, e.g., for recreational purposes and are left more or less in their original state until a decision on the development of the area will have been made (GrünBerlin GmbH, 2013).

[6] Examples of CE used in other urban contexts are studies by Lanz and Provins (2013), who focus on local environmental improvements in the UK, or Bae (2011), who analyzes preferences for urban stream restoration in Korea.

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