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ANALYSIS

Going to the Woods Is Going Home: Recreational Benefits of a Larger Urban Forest Site — A Travel Cost Analysis for Berlin, Germany

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ABSTRACT

We present an application of the travel cost method to a large urban forest site in Berlin, Germany. The analysis is based on a large onsite survey and the same survey administered online. Although such applications are rare in an urban context, applying a seasonal demand model to the case of Grunewald is possible because the distances travelled are relatively large, the majority of the respondents use motorized or public transport, and Grunewald is a large and unique urban forest site with very few substitutes. The main results are the following: (1) The demand for visits to Grunewald is less elastic if only Berlin residents are taken into account compared to when residents from the entire larger urban area of Berlin are considered. (2) Estimated consumer surpluses are therefore greater if only Berlin residents are taken into consideration. (3) In addition, demand is more elastic for the internet sample than for the on-site sample. (4) Results suggest a lower bound overall consumer surplus of 14.95 € per visit. The results indicate that despite its inherent limitations, non-market economic valuation through the travel cost method can provide administrations with a powerful tool to monetize the benefits of urban forest recreation to increase public funding and redirect resources to address intensified use.

1. Introduction

In an increasingly urban world (UN, 2014), the maintenance of urban green space plays an important role in safeguarding human well-being in cities (Elmqvist et al., 2013). Large forest areas, which are an important type of green space in cities, for example, offer numerous benefits to society (Dobbs et al., 2011; Ninan and Inoue, 2013; Wang and Fu, 2013). Improved air and water quality (Baumgardner et al., 2012; Larondelle et al., 2014; McPherson et al., 1997; Paoletti, 2009), the elimination of pollutants and carbon sequestration (Brack, 2002; Jansson and Nohrstedt, 2001) are just a few of examples of the regulating ecosystem services or indirect benefits that urban dwellers derive from the presence of large forest areas in and around cities. The most important direct effect of urban forest sites probably is cultural ecosystem service provisioning, and, more specifically, the benefits provided from their recreational values (Hörnsten and Fredman, 2000; Jim and Chen, 2009; Zandersen and Tol, 2009). The recreational benefits that urban forests and other green spaces provide are closely connected to their positive effect on the mental and physical health of citizens (Bratman et al., 2015; Clement and Cheng, 2011; Velarde et al., 2007).

Even though forest areas in cities can provide multiple services, they are also threatened by urbanization and increasing population density (EASAC, 2009; Loewenstein and Loewenstein, 2005; U.S. EPA, 2000). Indicators are needed to assess the demand and supply of this valuable urban ecosystem in order to safeguard its existence. A range of biophysical and socio-ecological indicators are commonly used to assess the benefits that humans can derive from urban forest ecosystems (Dobbs et al., 2011). Additionally, several economic valuation methods have been developed to express the value that people attach to the flow of benefits from natural ecosystems in monetary terms. This can be useful information if managers have to weigh the costs and benefits of policy measures that affect environmental goods and services for which no market exists.

Economic valuation of urban green in general and urban forest sites in particular has so far mostly been carried out using the contingent valuation method (e.g., Tyrväinen, 2001; Vesely, 2007) or the hedonic pricing method (Sander et al., 2010). See Gómez-Baggethun and Barton (2013) for a recent overview of the approaches used for the valuation of urban ecosystem services. Based on the ground-breaking research conducted by Clawson and Knetsch (1966) and subsequent methodological developments, the travel cost method (TCM) has commonly been used to place a value on the benefits of forests in rural areas. Examples of research where the random utility framework has been applied to select forests for recreation in rural surrounding areas Bujosa Bestard and Riera Font (2009) for forests in Mallorca, Spain, or

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Termansen et al. (2013) for forests in Denmark. Examples of research where the single site TCM has been applied to value the benefits of forests in rural areas include Elsasser (1996), Garrod and Willis (1992) and Ovaskainen and Kniivil (2005). For a detailed meta-analysis, see Zandersen and Tol (2009).

The TCM has, however, rarely been used for the economic valuation of urban forest sites. We are aware of only a few examples. Chaudhry and Tewari (2006) use the zonal TCM for the valuation of recreational benefits of an urban forest in India. Other examples include the application of the TCM to urban parks. Dwyer et al. (1983) for example use the TCM to estimate the willingness to pay for hypothetical entry fees to parks in Chicago, and Liu et al. (2014) use the TCM to evaluate the benefit of an urban park in Taiwan. As early as 1983 Dwyer et al. already stress that "the technique is well known among economists and recreation planners and will hopefully be applied more widely to urban forest sites" (Dwyer et al., 1983:184). The main objections against and consequently limited use of the application of the TCM in urban contexts are related to the supposedly large number of substitute sites, various means of transport, and consequently, the low costs associated with visiting recreational sites within cities (Gómez-Baggethun and Barton, 2013; Tyrväinen et al., 2005). If a lot of visitors reach the site by free means of transport, their valuation of the recreation site will not be captured by the TCM, such that the calculated consumer surpluses may be underestimated (Zandersen et al., 2012). However, it has also been mentioned that "the method is useful in a setting where large urban forests within city limits are scarce and people have to travel further to reach the areas" (Tyrväinen et al., 2005).

This study demonstrates the applicability of the TCM in an urban context by applying it to a large urban forest site in Berlin, Germany. We argue that this is particularly interesting because Berlin citizens travel on average as much as 11.5 km per single distance within the vicinity of the city to the forest site, which is quite a distance compared to most cities where the distances covered are smaller. The distance that Italians travel on average to a forest site in the country amounts to 32 km and is thus not that much higher, considering that this distance refers to journeys within a whole country (Tyrväinen et al., 2005). The reason for the large distances covered by Berlin citizens is that Berlin can be regarded as a big city from an area point of view, covering an area of 891.8 km^2 (by comparison: New York City: 789.4 km^2, Paris: 105.4 km^2) with a comparably low population density of 3872 inhabitants per km^2 (by comparison: New York City: 10,560 inhabitants/km^2, Paris: 21,258 inhabitants/km^2) (Amt für Statistik Berlin-Brandenburg, 2013; Institut national de la staistique et des études économiques, 2014; United States Census Bureau, 2010). Within Germany, Berlin is by far the biggest and widest city, followed by Dresden with only a third of its area (European Commission, 2011). This makes travelling long distances in the city normal for the citizens of Berlin, which is usually not the case for other German cities.

Responding to the concerns about the means of transport, the majority of forest visitors in Berlin arrive by motorized vehicles or public transport. Multiple answers were allowed for this question, meaning that answers add up to >100%. In the analyzed sample, 66% of the respondents use a car or motorbike to travel to Grunewald, and 13% use public transport as one of their means of transport; 35% of the respondents also report cycling. Cycling also incurs costs related to depreciation and maintenance even though there are no fuel costs. The share of people that report walking as their only means of transport amounts to 9.6%. Furthermore, we argue that the urban context is especially interesting for a TCM application. Urban areas are most complex socio-ecological systems (McPhearson et al., 2014), where the demand and supply of ecological services is often poorly balanced and underlying population and development pressures make it difficult but all the more important to value the intangible benefits of green areas (Gómez-Baggethun and Barton, 2013). Moreover, the different lifestyles and resulting modes of recreation, transportation and appreciation of green are often immense in urban settings, which make the study of socio-ecological interactions challenging and meaningful (Coles and Bussey, 2000).

With this point in mind, this study analyzes the data of a large socio-ecological survey on Grunewald, a large forest site in urban Berlin, using the individual TCM. The results strongly favor the applicability of the TCM within urban areas. The study shows that travel costs have a significantly negative effect on the number of visits to Grunewald, which translates into non-negligible, positive recreational values of this site.

The remainder of the paper is structured as follows: Section 2 presents the case study, the data, the empirical methodology, and the uncertainties related to the analysis. Section 3 presents the results including descriptive statistics of the survey results, the regression results, and the calculations of consumer surplus per visit to Grunewald. Section 4 discusses the results, and Section 5 draws some conclusions.

2. Methods

2.1. Case Study

Berlin is the capital and the biggest city in Germany. Its population is projected to increase by 245,000 to 3.75 million over the next 15 years (Senatsverwaltung für Stadtentwicklung und Umwelt, 2012). Berlin has three big forest sites within the city boundaries which serve as important recreational sites for a large proportion of its citizens. The urban forest site Grunewald covers an area of 3000 ha and is located in the south-western part of Berlin (see Fig. 1). It has been protected by a permanent contract since 1915 in order to maintain it as a recreational area and to sustain the quality of life of the citizens in a city that was already strongly growing at the beginning of the 20th century. Its territory covers an area of about 750 ha, where dogs are allowed off their leads. This is the largest area of its kind in a European city (Senatsverwaltung für Stadtentwicklung und Umwelt Berlin, 2015) and is an extraordinary pull-factor for people travelling to Grunewald. Another pull factor is the existence of several small, clear lakes ideal for swimming.

Other forest areas include the forest administration Treptow-Köpenick in the south-eastern part of the city, surrounding the greater Müggelsee. In comparison to Grunewald, this area is characterized by less public transport stops and no areas allowing dogs off their leads. The forest administration Tegel, which extends along the northern part of the river Havel in the north-west, is even less accessible via public transport. Both substitutes do include water access but lack smaller lakes, where for example the supervision of kids is often much easier due to the smaller area.

Today, Grunewald - as many urban forest sites - has to serve many purposes and deal with conflicting interests such as providing habitat for species, producing timber, hosting environmental education programs, and, above all, providing the citizens of Berlin with one of the biggest and most varied recreational areas for multiple kinds of users. Grunewald is the perfect case study to apply the TCM in an urban context due to its sheer size, its ability to provide multiple services to people, and its unique urban character.

2.2. Survey

The survey was conducted over 20 days in August 2014 (on workdays, at weekends, and during school holidays) in the field at 3 different times and at 9 different locations in the urban forest Grunewald. The date of the survey was chosen to capture summer holidays half of the time as well as regular workdays during the other half of the time. The locations were chosen in close cooperation with the local forest administration and identified beforehand as locations with a good distribution of all possible forest visitor groups. Every visitor encountered at these locations willing to take part in the survey, was asked.

Additionally, the survey was available online between April 2014 and March 2015, officially distributed through the website of the forest