



Heterogeneous preferences for social trail use in the urban forest: A latent class model



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ABSTRACT

This study explored visitors' preferences for social conditions of trail use in urban forests. It is important to understand the heterogeneous nature of visitor preferences because the recreational use of urban forests is characterized by multipurpose uses with different visiting motivations. To understand preference heterogeneity, this study used a discrete choice experiment using a latent class model that incorporated motivational and sociodemographic factors as membership likelihood function. In 2006, 256 visitors to the Nopporo Forest Park, Hokkaido, in northern Japan, completed questionnaires with a series of discrete choice tasks using computer-manipulated images presenting various social conditions of trail use, such as visitor numbers and harvesting behavior on wild food plants. The study identified two visitor groups. One group consisted of more elders whose motivation was to enjoy the natural environment. Although they tended to tolerate crowded conditions, they particularly disliked plant pickers, who harvest wild vegetables alongside the trail. The other group was less tolerant of crowds, and enjoying the natural environment was not their primary purpose for visiting the park. These visitors especially disliked excessive numbers of visitors, but they did not dislike plant pickers. These results suggest that traditional park management assumptions about typical visitors poorly serve the heterogeneous nature of the visitor population.

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1. Introduction

The few urban natural areas that still remain in densely populated regions are valuable because they provide many opportunities for city-dwellers to escape from hectic urban life (Hammitt, 2002). At the same time, these areas are heavily used by a large number and a wide variety of visitors. Crowding and visitor conflicts can arise and may affect the quality of recreational experiences. The former is defined as a negative evaluation of a certain number of people in a given situation, and the latter as goal interference attributed to other users' behavior or social value differences (Manning, 2010). Thus, one of the key challenges in urban forest management is to provide appropriate recreational opportunities with the most desirable trail conditions for visitors (Dwyer et al., 1992; Arnberger et al., 2010). To address this issue, information on visitors' preferences for social conditions of trail use (e.g., use lev-

els, types of use, visitor behavior) based on their visiting motives is needed. Motivation has been found to be important in explaining differences in visitors' preferences and behaviors (Manning, 2010).

Urban forests serve multiple purposes for their visitors (Dwyer et al., 1992). For example, Hammitt (2002) revealed that visitors seek solitude; however, as demonstrated by Vaske and Shelby (2008), levels of use affect solitary visitors to varying degrees according to the country, region, and type of activity. People living in Asian countries, where our study area is located, generally tolerate congestion, due to their crowded living conditions according to Gillis et al. (1986) and Homma (1990). However, it should not be assumed that Asians are uniformly tolerant of congestion: Arnberger et al. (2010) categorized visitors to urban forests in both Sapporo, Japan and Vienna, Austria into subgroups according to preference for congestion. This indicates that visitors are probably heterogeneous in their preferences for social conditions in urban forests, where various activities occur for different purposes.

This study uses an image-based discrete choice experiment (DCE, hereafter) to examine visitors' preferences, and any heterogeneity, for social conditions in trail use in the Nopporo Forest Park

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(NFP), Hokkaido, in northern Japan. Little is currently known in Japan about how visitors' motivations and sociodemographic characteristics relate to such preferences, and so this study aims to: (1) understand heterogeneity in preferences for trail use in urban forests, (2) identify the factors for preference heterogeneity, and (3) derive practical management recommendations.

DCE was initially developed by [Louviere and Hensher \(1982\)](#) and [Louviere and Woodworth \(1983\)](#), and is one option from a family of stated preference approaches ([Louviere et al., 2000](#)). In addition to recreation management, the method is widely used in marketing and transportation. In our case each respondent received four choice sets, each containing three alternative trail scenarios with attributes (i.e., social conditions of trail use), from which they selected their preference; the random utility approach was then used to formulate respondents' choice behaviors. Once one understands how changes in attributes influence behaviors and/or satisfaction levels through DCE, one can predict how they will be affected by different levels of attributes ([Louviere and Timmermans, 1990](#)).

To achieve the above-mentioned research aims, DCE was used with a latent class model (LCM, hereafter). LCM not only elicits heterogeneous preferences but also identifies the sources of heterogeneity in a single estimation framework. Identifying the sources of heterogeneity can be useful to land managers in predicting what trail conditions or uses are preferred by specific groups, through observing their characteristics. Thus, LCM makes an important contribution to the literature of urban forestry management. As a point of comparison, a conditional logit model (CLM, hereafter) estimation was also undertaken.

Our analysis is also unique in identifying visitors' preferences for harvesting behaviors of edible plants in urban forests. To the best of our knowledge, there was no study that tried to understand preferences of harvesting (or poaching) behavior and their trade-offs among other social variables such as visitor numbers and visitor behaviors. Harvesting wild food plants such as berries, mushrooms and mountain vegetables are popular and usual recreation activities in the world (e.g., [Bell et al., 2007](#)). In Japan, people have traditionally harvested wild plants and mushrooms. While these plants were important parts of the rural diet in the past, today, the harvesting of edible plants and mushrooms by city dwellers is almost exclusively considered a recreational activity ([Saito, 2001](#)). On the other hand, harvesting is also a major challenge in some urban forests, since natural resources may be exhausted by consumptive recreational harvesting by city dwellers. Moreover, even when harvesting is not so severe, such behavior may produce conflict with visitors who have other purposes.

1.1. Review on visitor preferences

Over the past few decades, a large number of studies have been conducted on recreational preferences, especially in backcountry areas. The effect of crowding on visitors' recreational experiences is one of the most intensively studied issues, as crowding is considered to have the most direct and significant social impact (e.g., [Graefe et al., 1984](#); [Shelby and Heberlein, 1986](#); [Manning et al., 1999](#); [Vaske and Shelby, 2008](#)). The earliest hypothesis claimed that the perception of crowding is predominantly affected by the number of encounters one has with other recreationists. However, later studies have found that crowding is an individual, subjective judgment and that variability across individuals is attributable to social, psychological and situational factors ([Absher and Lee, 1981](#); [Ditton et al., 1983](#); [Shelby and Heberlein, 1986](#)). That is, in addition to use level in a recreational setting, other factors such as the type of use and other visitors' behaviors need to be considered when we examine visitors' preferences for social conditions of trail use. For example, previous studies show that unwanted behaviors

such as littering, letting dogs off their leashes and the size of other visitor groups also influence outdoor recreation quality ([Altman, 1975](#); [Manning and Valliere, 2001](#); [Heywood and Murdock, 2002](#); [Arnberger and Haider, 2005](#)).

Nonetheless, to date, only a few studies have addressed preferences for social conditions of trail use in urban forests ([Arnberger and Haider, 2005](#); [Arnberger et al., 2010](#); [Arnberger and Eder, 2011](#)). Moreover, past studies have focused on urban forests in Central European countries and the USA. To our knowledge, there have been few such studies in Asian countries, although a notable exception is the study of [Koo et al. \(2013\)](#). Findings in European countries and USA may not generalize to Asian recreational settings, as previous studies have found that Asian people have different preferences in recreational settings. (e.g. [Sayan et al., 2013](#); [Arnberger et al., 2010](#)). Therefore, preferences for social conditions of trail use and specific visitor behaviors in urban forests remain rather unknown in Asian countries.

1.2. Analysing preference heterogeneity

While DCE is powerful in eliciting the impact of social attributes on visitors' satisfaction, it is not straightforward in modeling preference heterogeneity. For example, some studies first conduct a multivariate cluster analysis of individual-specific characteristics (e.g., psychometric or socioeconomic), and then estimate choice behavior by cluster. However, unlike LCM, clusters are based only on characteristics and not preferences; consequently, there may be multiple clusters with different visitor characteristics but similar preferences. LCM, though, avoids this by basing clusters on both characteristics and preferences, which helps the identification of characteristics responsible for preference heterogeneity.

Difficulty in understanding preference heterogeneity is due to modeling individual-specific characteristics, which are considered to be the main source, but are canceled out in the context of DCEs within a random utility framework. Previous studies therefore introduced interaction terms between individual-specific characteristics and choice attributes under the CLM framework (e.g., [Morey et al., 2002](#); [Arnberger and Haider, 2005](#)); however, this is limited because it requires a priori selection of key individual characteristics and attributes. Another way of modeling preference heterogeneity is the random parameter logit models (e.g., [Train, 1998](#)), but it is not well suited to explaining the sources of heterogeneity. In contrast, LCM not only elicits preference heterogeneity but also identifies its sources in a coherent framework. Over the past few decades, especially in the field of marketing, studies have focused on modeling preference heterogeneity or identifying consumer segmentation for goods and services (e.g., [Wedel and Kamakura, 2000](#)), and this study follows this methodological trend.

In the literature on recreation, LCM has been applied to model choice behaviors in wilderness parks and wildlife tourism ([Boxall and Adamowicz, 2002](#); [Semeniuk et al., 2009](#)), while [Arnberger et al. \(2010\)](#) and [Reichhart and Arnberger \(2010\)](#) used LCM to understand preferences for social conditions of trail use in urban forests. [Arnberger et al. \(2010\)](#) first estimated an LCM without modeling how visitors' characteristics affected preference heterogeneity, and then made post-estimation comparisons of visitors' characteristics across groups to identify the sources. This study takes a different approach by explicitly modeling group membership as a function of visitors' motivations and sociodemographics.

2. Method

2.1. Study area

The study area was the NFP, which is east of the City of Sapporo. With a population of about 1.9 million people, Sapporo is the fifth

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