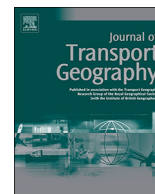




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The impact of spatial accessibility and perceived barriers on visitation to the US national park system



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ABSTRACT

Visits to the US national park system continue to increase, but racial/ethnic minorities are consistently under-represented among national park visitors compared to Whites. Research suggests several reasons for historic underrepresentation of racial/ethnic minorities, including limited spatial accessibility, marginality, subcultural differences, and discrimination. This study uses spatial analysis of survey data collected in a range of geographic locations across the US, to assess the spatial accessibility of three racial/ethnic groups to units of the national park system. The study also considers the relationships between spatial accessibility and measures of marginality, subculture, and discrimination. Results show that access to national parks varies greatly between geographic areas: residents of large metropolitan areas have better access to units of the national park system than residents of rural areas. The effect of spatial accessibility on visitation varies among racial/ethnic groups. The study also highlights the importance of culturally-oriented parks, provides information about park accessibility in order to enhance relevancy, and informs management strategies that can encourage visitation across different geographic areas and more diverse populations.

1. Introduction

The US national park system preserves many of the nation's most important natural and cultural resources. The two-fold mission of the National Park Service (NPS) is to preserve the parks and to make them accessible to the people. When most people think of America's national parks, then tend to think first of the large Western iconic parks such as Yosemite, Yellowstone, and Grand Canyon. But the NPS manages more than twenty types of parks of varying characters and sizes. These units include national parks, national battlefield parks, national seashores, national monuments, national memorials, and many others.

Research suggests that visits to national parks and protected areas are increasing in many countries (Balmford et al., 2009, 2015). Annual visits to the US national park system exceeded 300 million for the first time in 2015 (Olson, 2016). However, racial/ethnic minorities have relatively lower visitation rates compared to Whites (Solop et al., 2003; Taylor et al., 2011). In response to this disparity, the NPS has committed to encouraging more racially and ethnically diverse visitors in its

recent “Call to Action” Plan (NPS, 2016).

Relative spatial accessibility is an important issue being considered by the NPS as a factor that measures the quality of people's connection and proximity and how this impacts visitation (NPS, 2015; Weber and Sultana, 2013). Research has found that spatial accessibility has an impact on visitation to protected areas, and measuring accessibility can help understand and explain the differences in visitation patterns to national parks among racial/ethnic groups (Byrne and Wolch, 2009; Weber and Sultana, 2013). Studies on spatial accessibility of parks help managers understand the equity of park distribution across the country and identify populations that have limited access to parks and outdoor recreation areas (Weber and Sultana, 2013; Wen et al., 2013; Xingyou et al., 2011). If such populations are identified, policies and programs that to increase awareness or mobility can be developed. However, most research on spatial accessibility has been focused on local or neighborhood parks, with few studies addressing spatial accessibility of national parks. Moreover, limited research has measured the impact of spatial accessibility on visitation and use of parks by racial/ethnic

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groups.

Research has suggested that those who live in proximity to national parks may have a higher likelihood to visit those national parks than those who live further away from these areas (Weber and Sultana, 2013; Xingyou et al., 2011). Given the lack of uniformity in the distribution of different types of parks, a nation-wide study to measure spatial accessibility is valuable to understand the spatial distribution patterns of these areas. Moreover, different levels of access to NPS units may contribute to different visitation rates among racial/ethnic groups (Weber and Sultana, 2013). Based on the reasonable hypothesis that visitation may be related to different levels of access, the research objectives for this study include the following:

- (1) measure spatial accessibility¹ to units of the national park system using different geographic areas of analysis in the U.S. (e.g., zip code areas, counties, states, and the entire US),
- (2) examine spatial accessibility of various types of NPS units by racial/ethnic group, and
- (3) assess the effects of spatial accessibility on visitation to NPS units by members of different racial/ethnic groups.

The first two objectives are addressed using US Census population data and the spatial locations of national park units, while the third objective uses data from the latest Comprehensive Survey of the American Public (CSAP 2) survey, which was commissioned by the NPS in 2008. The home location of the respondents was based on their landline telephone area code.

2. Background

Two types of prior research are important for defining the context of these research questions. First, application of spatial analysis to parks has been limited and has been more commonly conducted at the local and regional scales. Second, the research findings on why minority racial/ethnic groups in the US have lower visitation rates to national parks when compared to Whites inform the variables used within the models in this paper. The following two sections of this paper address these two areas of prior research.

2.1. Measuring spatial accessibility to parks and recreation areas

The importance of spatial accessibility of parks and recreation areas has been increasingly recognized (Comer and Skraastad-Jurney, 2008; Javed et al., 2013). Two distance measurement metrics have been widely used in these studies: Euclidean straight line distance and network distance. Euclidean straight line distance has been used in studies of spatial accessibility to parks at the national level. For example, a US nationwide study examined the spatial accessibility of neighborhood parks by straight-line distance and found that the average travel distance for residential populations to access the nearest neighborhood park was 6.7 miles (Xingyou et al., 2011). Another study measured spatial accessibility to parks and green space in the US by Euclidean straight line distance (Wen et al., 2013). Network distance, however, has been used more in studies of spatial accessibility to parks at the regional and local levels (Rossi et al., 2015; Zhang et al., 1999). For example, a study measured the accessibility of neighborhood parks in Sheikhpura City, Pakistan by network distance, and compared the accessibility of parks among different areas (Javed et al., 2013).

Spatial interaction models, which use a measure of origin population size and park destination attractiveness together with an inverse function of distance, have been applied to identify the effects of accessibility on visitation to parks and recreation areas since 1970s.

¹ The “spatial accessibility” in this study only includes the metrics of population weighted distance.

However, results from these studies are somewhat mixed (Lee and Schuett, 2014; Mowen and Confer, 2003; Wolch and Zhang, 2004). For example, one study that estimated tourism flows to national parks in China found that travel distance had a significant impact on visitation (Zhang et al., 1999). Rossi et al. (2015) applied a gravity model to identify factors that impact visitation to D'Aguilar National Park, Australia and found that distance had no significant impact on visitation to the park. A few spatial interaction studies found that spatial accessibility could be an important barrier to visiting parks and outdoor recreation areas for racial/ethnic minorities (Byrne and Wolch, 2009; Weber and Sultana, 2013; Xingyou et al., 2011), but the effects of spatial accessibility varied across different types of recreation areas.

In recent years, GIS technology has been increasingly integrated into park and recreation research and management (Chang and Liao, 2011; Javed et al., 2013; Xingyou et al., 2011). For instance, a study measured the proximity and equity to access greenways trails by a half-mile buffer in Indianapolis, Indiana using GIS analyses and found that minority racial/ethnic groups had inadequate access to trails (Lindsey et al., 2001). Another study used the method of centroid radii buffer to measure spatial accessibility to neighborhood parks in the city of College Station, Texas, and assessed the equity of park distribution among different racial/ethnic groups (Nicholls and Shafer, 2001). In general, GIS analytics in studies of parks and recreation areas have been based primarily on visualization-based mapping, while advanced geospatial analytics have rarely been used.

2.2. Explaining the underrepresentation of minority racial/ethnic groups at parks and outdoor recreation areas

Three hypotheses about why racial/ethnic minorities have lower rates of participation in outdoor recreation have been identified in the literature and are supported by empirical studies: 1) marginality (Manning, 2011; Washburne, 1978), 2) subculture (Chavez, 2000), and 3) discrimination (Blahan and Black, 1993). The marginality hypothesis suggests that lower participation rates of minority racial/ethnic groups are caused by socio-economic factors, such as more limited knowledge about parks and recreation areas, limited resources for transportation, and unaffordable fees and cost associated with trips to parks (Dwyer and Gobster, 1992; Scott and Munson, 1994; Washburne, 1978; West, 1989; Wolch and Zhang, 2004). The subculture hypothesis suggests that differences in recreation behaviors may be associated with culturally defined interests and preferences (Floyd, 1999; Gobster, 2002; Tinsley et al., 2002). The discrimination hypothesis suggests that perception or experience of personal or institutional discrimination may limit visitation to recreation areas (Floyd, 1999). These hypotheses have been tested and supported through empirical studies, but their effects can vary among different types of recreation settings (Floyd, 1999; Krymkowski et al., 2014; Manning, 2011; Perry et al., 2015; Xiao et al., 2017). Most studies have been conducted on local or state levels, and few studies have tested these hypotheses on a national level.

3. Methods

This section describes the two sources of data for this study: the first is primary data from a national survey (Subsection 3.1), and the other is secondary population data from the Census in various spatial units (Subsection 3.2). Subsections 3.3, 3.4, and 3.5 describe tabulation of three measures used in the analysis: a) average park accessibility by zipcode; b) aggregate population weighted distance measure of accessibility by county, telephone area code and state; and c) the centroid radii buffer measurement of accessibility for each unit of the US national park system.

3.1. Survey data

The survey data were mainly constructed from the latest

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