Diurnal Versus Nocturnal Activity Impacts on Duration Times in Urban Parks: Based on Mobile Phone Data

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１．はじめに

As awareness of the benefits of green spaces has grown, interest in urban parks has also continued to increase. In recent years, researchers have shifted their focus from static accessibility indices to dynamic analyses that consider changing demands for park recreational services. Initial assessments typically utilized methods such as Gravity models to analyze the inherent attributes of parks, their geographic distribution, and surrounding population density (Wang et al., 2015; Guo et al., 2019). However, these indicators typically remained static and did not reflect the dynamic and temporal nature of park visits. Additionally, the specific landscape characteristics that encourage these activities during the daytime and nighttime are not well understood, and strategies to enhance the diversity of recreational activities remain unclear.

On this foundation, this study explores the potential of big data to support dynamic analyses of urban park visitation by examining the impact of environmental and temporal variables on long-term park use patterns. Specifically, the research addresses the following questions:1)How does park dwell behavior vary across different temporal scales when tracked through mobile phone data? 2)Which variables significantly influence the demand for dwell time in urban parks? 3) Upon detailed analysis of these indicators, what disparities are revealed in the public demand for recreational amenities in urban parks?

２．分析方法

we used mobile phone data(AGOOP) to capture the behavioral patterns and dynamics of urban park users. This study analyzed the duration of recreational activities in 16 urban parks in Sapporo, Japan, focusing on both day and night activities. Using Pearson correlation analysis and a Random Forest Regression Model,

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we examined the relationship between recreational behaviors and environmental variables, including surrounding Points of Interest (POIs) that urban facilities around parks, such as education facilities, restaurants, and tourist attractions, and identified driving factors.

３．分析結果

The results show that the total number of visitors decreased by 59.83 percent compared to the number of visitors to urban parks in 2019 before the epidemic, but the duration time per visit by people increased. The most frequent departure time for people was between 07:00-10:00 am and the leaving time was between 17:00-19:00 pm. Nighttime park activity was more frequent in 2019 at approximately 72.41% compared to approximately 62.07% in 2020. Thirteen parks consistently demonstrated higher nighttime activity in both years. Only 3 parks consistently showed higher daytime activity in both years. The number of POIs, park size, and the distance from the city center were the underlying reasons for the differences in recreational activity across urban parks. In addition, a further correlation analysis of the differences in the recreational activity of parks and the number of POIs were the most important factors influencing recreational stays in parks at night, while education facilities, restaurants, and financial and public services around parks had the greatest influence on the duration of recreational stays in the daytime.

４．結論

This research has demonstrated the importance of mobile phone derived visitation patterns to enhance our understanding of urban park duration pattern and utilization. We considered "duration time" as a standard for monitoring recreational activity and employed a Random forest regression model to reveal the differences in daytime and nighttime recreational activity levels and the dominant influencing factors and structures in 28 urban parks in Sapporo city from 2019 to 2020. This research in-depth analysis aids urban planners and policymakers in providing a scientific basis to optimize park design and the surrounding urban spatial arrangement, thereby more effectively meeting the daily recreational needs of citizens.

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