

# Exploring Population Exposure Patterns to Urban Green Spaces Using the 2SFCA Methodology

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**Background:** Urban green spaces are essential for enhancing the mental and physical health of urban residents. Specifically, green spaces within a 15-minute walking distance have been shown to significantly improve the quality of life for city dwellers (Korea Forest Research Institute, 2023). Recently, the Two-Step Floating Catchment Area (2SFCA) method has been employed to assess accessibility to green spaces by calculating the available green space per capita. This approach primarily focuses on demand side, identifying areas with inadequate green space accessibility or where additional supply may be required. However, shifting the perspective to that of the green space provider can offer new insights into the extent and diversity of population exposure to each urban green space, thereby informing function development and resource allocation.

**Methods:** This study seeks to quantify the exposure of various population groups to each urban green spaces. The research involves calculating the population exposed per unit area of green space by dividing the number of people in the vicinity by the total green space area near each building. This data is then aggregated to determine the total population exposure for each green space. Variables such as gender, age, and time of day are considered to define potential green space usage patterns, and the results are clustered using the K-Means algorithm to identify green spaces exhibiting similar exposure patterns.

**Results:** Real-time population data from KT mobile users, reflecting the dynamic distribution of urban populations, was used for demand analysis. Green space information from OpenStreetMap (OSM) was standardized by dividing into a 100m grid to prevent overestimation of large forests. GIS technologies, including the Dijkstra pathfinding algorithm, were applied to compute realistic travel distances, with distance decay and slope-adjusted walking speeds also considered.

**Conclusions:** Using Seoul as a case study, the interactions between green spaces and urban residents within a 15-minute walking distance were categorized. The analysis identified multiple distinct categories, each characterized by the gender, age, and time of day of the exposed population. These findings provide valuable insights for urban forest management and resource allocation strategies, helping to optimize the distribution and management of urban green spaces.

**Keywords:** Urban Green Space, Accessibility, GIS, OpenStreetMap, G2SFCA, De facto population

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