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Environmental Inequity Examination of the Spatial Characteristics of Urban Parks in Seoul, South Korea

Seulkee Heo, Michelle L. Bell

School of Forestry and Environmental Studies, Yale University, New Haven, CT, USA

Background

Growing evidence has suggested benefits of urban parks such as mitigation of urban heat island effect and enhanced physical activities. This study aims to assess how the size, type, and proximity of urban parks are associated with socio-economic status (SES) in Seoul, South Korea.

Significance

- Inequality studies on parks have emerged strongly over the last two decades. Previous studies mostly focus on the relationships between regional total area of parks and socio-economic factors. Yet, little is known for inequality/inequity of park provision regarding type and spatial characteristics of parks especially in Asian countries.
- Park size is one of the potential determinants of cooling effects of ambient temperature. The type or parks is often related with park size and park facilities that attract user's visits. Large-scale parks can potentially lead to high real estate and thereby unequal health benefits of parks among people with different socioeconomic resilience.
- Unlike the area of all parks within a region, area of parks near to residential area would provide an insight for provision of accessible urban parks.

Methods

Study area

The study regions and spatial unit are the 25 administrative districts ('GU'; equal to 'US borough') in Seoul, the capital city of S Korea. The data of urban parks, SES factors, and demography in 2015 were used.

Data

- The park Geographical Information System data in Seoul (2015) included information on legal park type (e.g. natural, residential, theme) and park opening date.

Table 1. Demographic, environmental, and SES data (2015).

Variable		Source
Demographic factors	Population density	Korean Statistical Information Service
	Population density (age 65+)	
Environmental factors	Air quality (SO_2, CO, O_3, NO_2, PM_{10}, $PM_{2.5}$)	Air Korea
	Ambient temperature	Korea Meteorological Administration
Socio-economic factors	Number of basic livelihood security recipients	Seoul Yeollin Data
	Number of elder persons living alone	
	Education level	Korean Community Health Survey
	Household income	

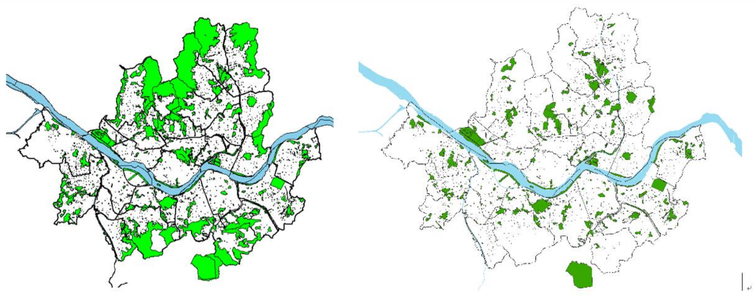

Figure 1. Map of parks in Seoul, Korea (2015).
Left: including 'natural parks' such as forest and mountain areas and 'urban parks.' Right: showing only 'urban parks.' Blue area is river.

Analysis

- The analysis was conducted based on a cross-sectional study design.
- We focused on 'urban parks' excluding 'natural parks' to address regions' capability to build planned green space.
- We categorized residential and theme parks as follows using the park GIS data. Area of a theme park is normally larger than residential parks.
  - **Residential** parks are legally built near to residential areas (e.g. <1000 m). This type of parks includes small park (i.e. pocket park), children park (i.e. playground), and neighborhood park.
  - **Theme** parks are built to provide specific purposes such as relaxation and education without restriction of legal distance to residential area. They include cultural park, riverside park, historical park, sports park, ecologic park, and cemetery park.
- Correlation analysis and logistic regression analysis were applied.

Preliminary results

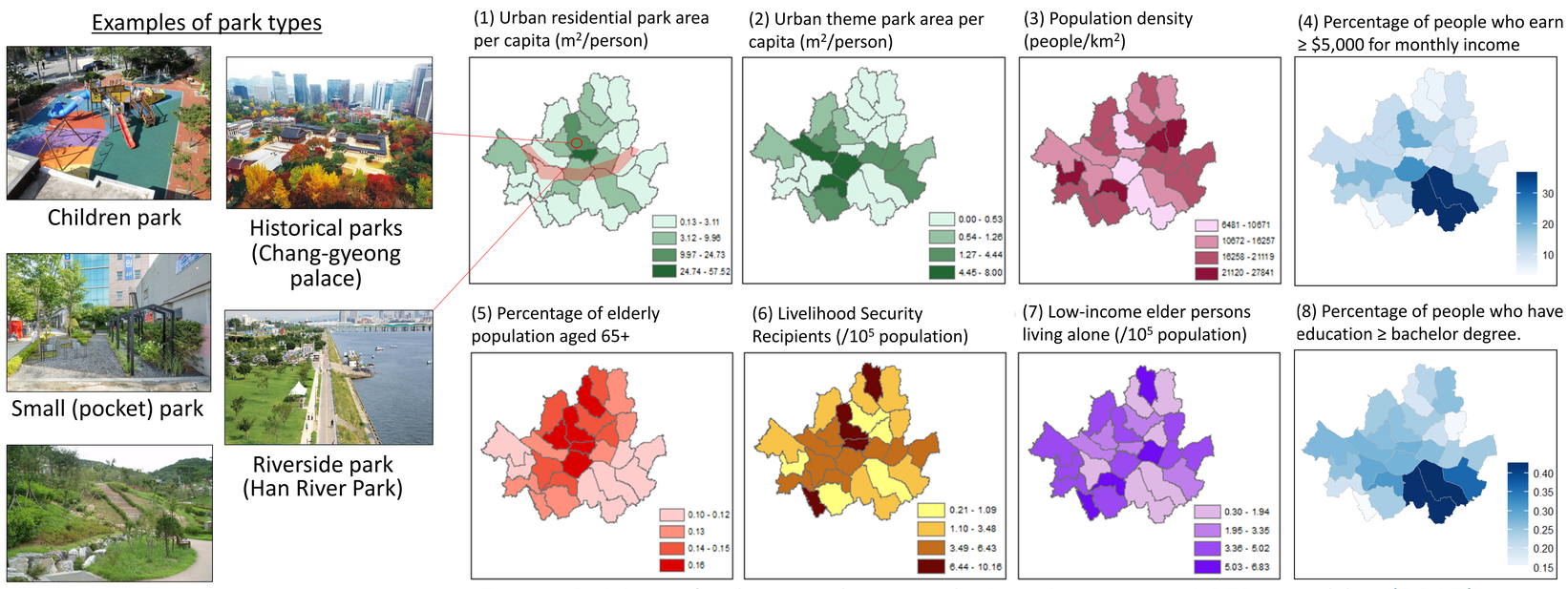

Figure 2. Map of urban parks, population density, and SES variables (2015).

- The park provision attributable to local historical and natural resources (e.g., palace premises or river) in city core regions showed geographical overlaps with regions that had more vulnerable populations (population aged 65+, recipients of livelihood security aids).

Table 2. Descriptive statistics of study variables in 25 districts (2015).

Variables	Mean (SD)	Min – Max
Number of urban parks	80.50 (31.80)	0.0 – 134.00
Residential parks	77.00 (31.59)	0.0 – 131.00
Theme parks	3.50 (3.10)	0.00 – 14.00
Total area of urban parks (m^2) per capita		
Residential parks	3.39 (3.08)	0.13 – 14.81
Theme parks	1.76 (2.78)	0.0 – 12.09
Size of urban parks (m^2)	24,080 (16,692)	4,814 – 80,440
Residential parks	16,300 (11,654)	967 – 43,510
Theme parks	186,700 (249,344)	1,848 – 1,048,000
Population density (1000 persons/km^2)	17.24 (4.87)	6.48 – 27.84
Livelihood security recipients (per 10^5 population)	2 438 (846)	1052 – 4305
Low-income elder population living alone (age 65+) (per 100 000 population)	3.60 (1.72)	0.30 – 6.83
Percent of population aged 65+ (%)	13.02 (1.75)	10.32 – 15.97
Percent of persons with ≥ bachelor's degree *	26.07 (6.89)	14.02 - 42.69
Percent of persons who earn ≥ $5,000 for monthly income	13.84 (8.62)	3.10 - 37.48

*Age-standardized estimates.

Table 3. Regression analysis for the effects of SES variables on the area of urban parks per capita (n=25).

Variable	Model 1 (Only residential parks)		Model 2 (Only theme parks)	
	Beta	95% CI	Beta	95% CI
Population density (1000 persons/km^2)	-0.101	-0.406, 0.202	-0.056	-0.363, 0.251
Percent of population aged 65+ (%)	0.649	-0.182, 1.48	-0.305	-1.144, 0.535
Percent of persons who earn ≥ $5,000 for monthly income	0.094	-0.08, 0.269	-0.019	-0.195, 0.158
Low-income elder population living alone (age 65+) (per 100 000 population)	0.068	-0.67, 0.806	0.189	-0.559, 0.932

* Variables highly correlated with the income variables (i.e. education, livelihood security recipients variable) were excluded from the regression models.

- No socio-economic variables showed statistically significant results possibly due to the small sample size (n=25).
- The area of total theme parks tended to be smaller in regions with more elder persons and high-income persons, whereas the area of residential parks tended to be larger in regions with more of those persons
- This may indicate a possibility that regions with socio-economically more privileged people and older populations have parks located near to their residential areas.

Table 4. Estimated odds ratio of urban parks for being smaller than the median size of urban parks and the effects of potential SES and demographic risk factors.

Variables	Residential parks		All types of parks (residential and theme)	
	OR	95% CI	OR	95% CI
Livelihood security recipients (/population)	0.782*	0.664, 0.923	0.829*	0.697, 0.962
Low-income elder population living alone (age 65+) (per 100,000 population)	1.139*	1.065, 1.219	1.137*	1.064, 1.215
% of population aged 65+	1.115*	1.033, 1.203	1.105*	1.026, 1.191
Population density (person / km^2)	0.977	0.94, 1.005	0.980	0.954, 1.007
Percent of persons with ≥ bachelor's degree (%)	0.933*	0.907, 0.960	0.936*	0.911, 0.963

Notes. Final models were selected based on stepwise variable selection approach. The median was 1250 m^2 for residential parks and 1165 m^2 for both residential and theme parks. * Significant at 5% significance level.

- Parks smaller than the median size were small parks (pocket parks) according to the definition of parks. The regression results were robust when the analysis was applied to both residential and theme parks.
- Parks tended to be larger and, thereby, providing various facilities (e.g. physical training facilities, children amusement facilities, education facilities) in regions with higher population density and high-education persons. (pocket parks are mostly built with grass, shrub, and benches rather than other facilities).
- These results imply a potential discrepancy in provided park facilities and benefits from urban parks on heat mitigation and health effects among districts in Seoul based on their socio-economic status.

Conclusion

- The relationships between the total area of parks and socio-economic variables did not indicate discrepancy in park provision. However, the results by park type and park size indicated a potential inequality for provision of residential parks by socio-economic status.

Future works

- The analyses will be extended to walkability, SES, and environmental factors.
- Spatial regression models will be considered.

References

Photo of palaces in Seoul:
http://www.seouland.com/arti/PRINT/2759.html

Acknowledgement

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Corresponding to seulkee.heo@yale.edu