Towards Urban Green Equity in Australia -

Developing Australia Urban Green Space Equality Dashboard

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Introduction

Urban green spaces provide numerous ecological, social, economic, and health benefits, including stress relief, recreation, urban heat alleviation, stormwater mitigation, biodiversity enhancement, and pollution filtering. Access to urban green spaces also aligns with United Nations' Sustainable Development Goals (SDGs), such as SDG 3 and SDG 11. Numerous cities across Australia, including Sydney, Brisbane, Melbourne, and Adelaide, are currently engaged in large-scale planning and implementation of urban green spaces. Sustainable urban development cannot disregard the importance of green space planning.

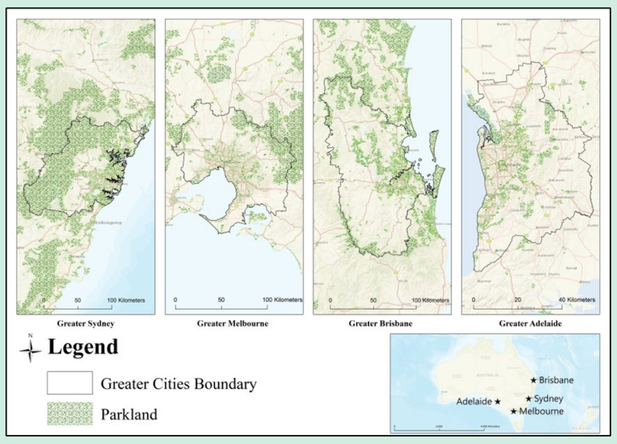
However, the COVID-19 pandemic has drawn attention to the issue of urban green space inequality, as reduced park hours and limited services during the pandemic have highlighted the unequal availability of such spaces in Australian cities. This issue may persist even in the post-pandemic era. Therefore, decision-makers in Australia need to reassess and reevaluate their strategies for urban green spaces.

To assist decision-makers in monitoring the accessibility and equality of urban green spaces, this work aims to develop an intuitive, interactive, and well-organized urban green space dashboard using the Gini coefficient and socio-economic indices to assess inequality and explore spatial clustering. The integrated dashboard will provide decision-makers with valuable evidence for future green space planning and informed decision-making.

Materials and Method

Study areas

Greater Sydney, Melbourne, Brisbane, and Adelaide are selected as the study areas because they have recently been implementing new green space policies.



Methodologies

Gini coefficient is applied to measure the green space inequality. It is an extension of the concept of the Lorenz curve. The Gini coefficient ranges from 0 to 1, with a value closer to 0 indicating an equal distribution, and a value closer to 1 indicating an unequal distribution.

$$G = 1 - \sum_{i=1}^{n} \frac{P_i}{P}(B_{i-1} + B_i)$$

where *i* is the count of sub-districts in a unit of analysis; *P* is the total population of the unit of analysis ; *Bi* is the cumulative share of accessibility to urban green space of the sub-district *i*.

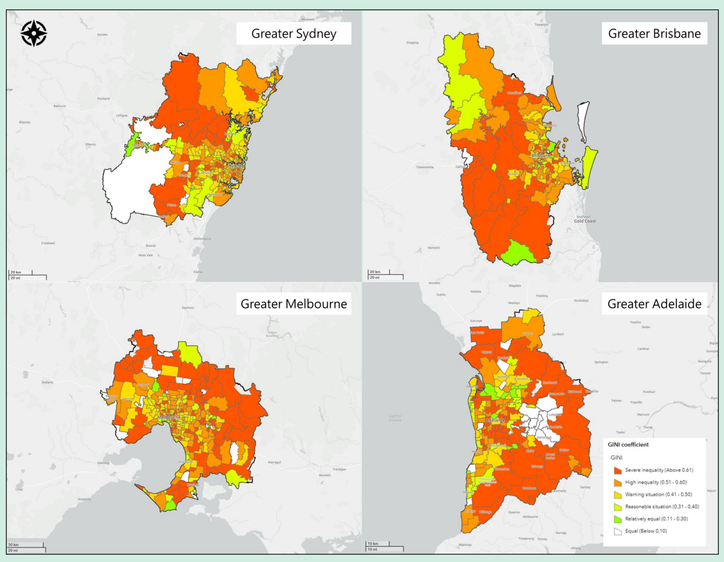
Hotspot Analysis (Getis-Ord Gi*) is applied to explore whether the Gini coefficients occur in spatial cluster phenomena. It provides z-scores and p-values to identify areas with high or low values that cluster spatially.

ArcGIS Dashboard is utilised to integrate all the information to create an interactive and user-friendly dashboard, which enables real-time monitoring and trend tracking to support decision-making.

Results

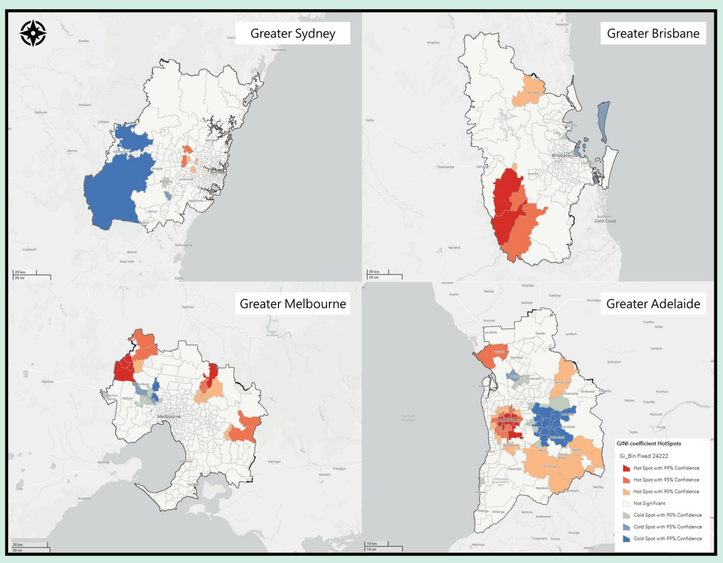
The Gini coefficient results reveal the level of green space inequality in 4 Greater Cities. Below summarise the number of Postal Areas that face severe green space inequality.

- Sydney: 45 (17.44%)
- Melbourne: 81 (28.83%)
- Brisbane: 48 (32.88%)
- Adelaide: 34 (23.78%)

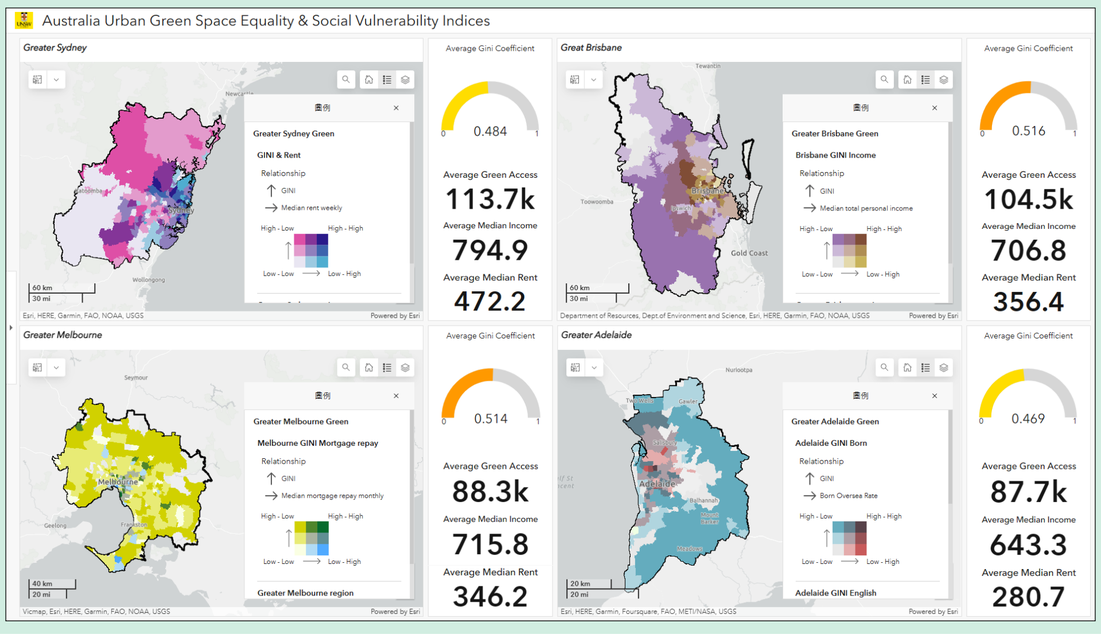


The Hotspot analysis identifies the spatial cluster of the Gini coefficient. Below summarised the main hot spot areas in each Greater Cities.

- Sydney: around Blacktown
- Melbourne: around suburban areas
- Brisbane: around southwest areas
- Adelaide: around CBD



Bivariate maps illustrate the correlation between two variables in a geographical area. The values of Gini coefficient are displayed on the vertical axis, and the values of the other variable are displayed on the horizontal axis.



Conclusion

- ***Significance***

Using the Gini coefficient and Hotspots analysis can help decision-makers identify areas with low accessibility and inequality in urban green spaces.

Incorporating socio-economic indicators in the dashboard can help understand the impacts of these factors on green space inequality.

The dashboard can assist decision-makers in monitoring and addressing issues of green space accessibility and inequality in major Australian cities.

- ***Extension***

Incorporating more comprehensive socio-economic data, utilising time-series data for spatio-temporal analysis, and applying spatial statistical models can be further integrated into the dashboard.

The dashboard can be developed and adapted to other cities worldwide.