Mapping Urban Green Space and Air Quality in Jakarta Using QGIS

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Abstract

This study explores the relationship between urban green spaces and air quality in Jakarta using open geospatial data and QGIS. Landuse polygons were obtained from GeoFabrik OSM, while administrative boundaries were derived from GADM. Air quality data, specifically PM2.5 concentrations, were sourced from the World udara.jakarta.go.id platforms. The datasets were integrated in QGIS to calculate the percentage of green space by district and correlate these with average PM2.5 values. Preliminary findings suggest that districts with a higher percentage of green space (e.g., Central Jakarta, ~10%) exhibited relatively lower PM2.5 levels compared to districts with smaller green space (<10%). The results highlight the potential of GIS for supporting environmental planning and emphasize the importance of expanding and protecting green areas in urban settings like Jakarta.

Introduction

- Urban areas in Southeast Asia face critical challenges in balancing air quality and rapid land development. Green spaces can act as natural filters, improving air quality, reducing heat islands, and supporting ecosystem services (Fitriana, 2018; MDPI, 2025).
- Jakarta consistently records poor air quality, often exceeding WHO guidelines (IQAir, 2025; WAQI).

Objective

Map and quantify green spaces in Jakarta using QGIS. Compare green space coverage with PM2.5 air quality levels at the district scale.

Data and Methods

Data Sources

Greenspace / Landuse : GeoFabrik OSM

Administrative Boundaries : GADM (Jakarta Raya)

Air Quality (PM2.5) : udara.jakarta.go.id

(accessed September 2nd, 2025)

Software

QGIS

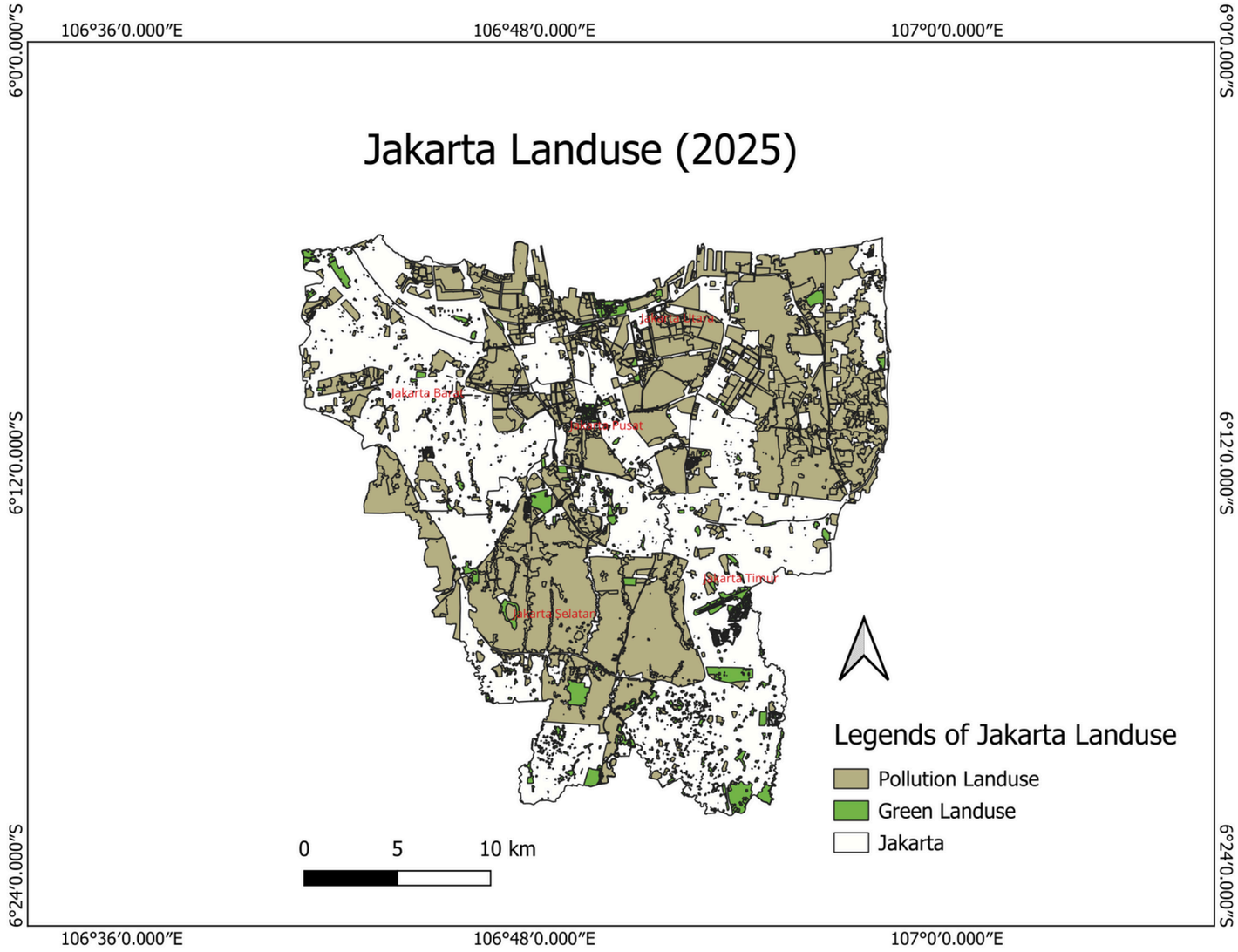
for mapping,
spatial joins,
area calculation

for quick
statistical
summaries

Workflow

1. Import district boundary shapefile.
2. Clip land cover polygons to Jakarta.
3. Calculate % green space per district (green area ÷ total district area × 100).
4. Join air quality readings by district.
5. Create thematic maps :
   Green space distribution.
   AQI distribution.
   Overlay map showing spatial relation.
6. Export maps and compile results into report

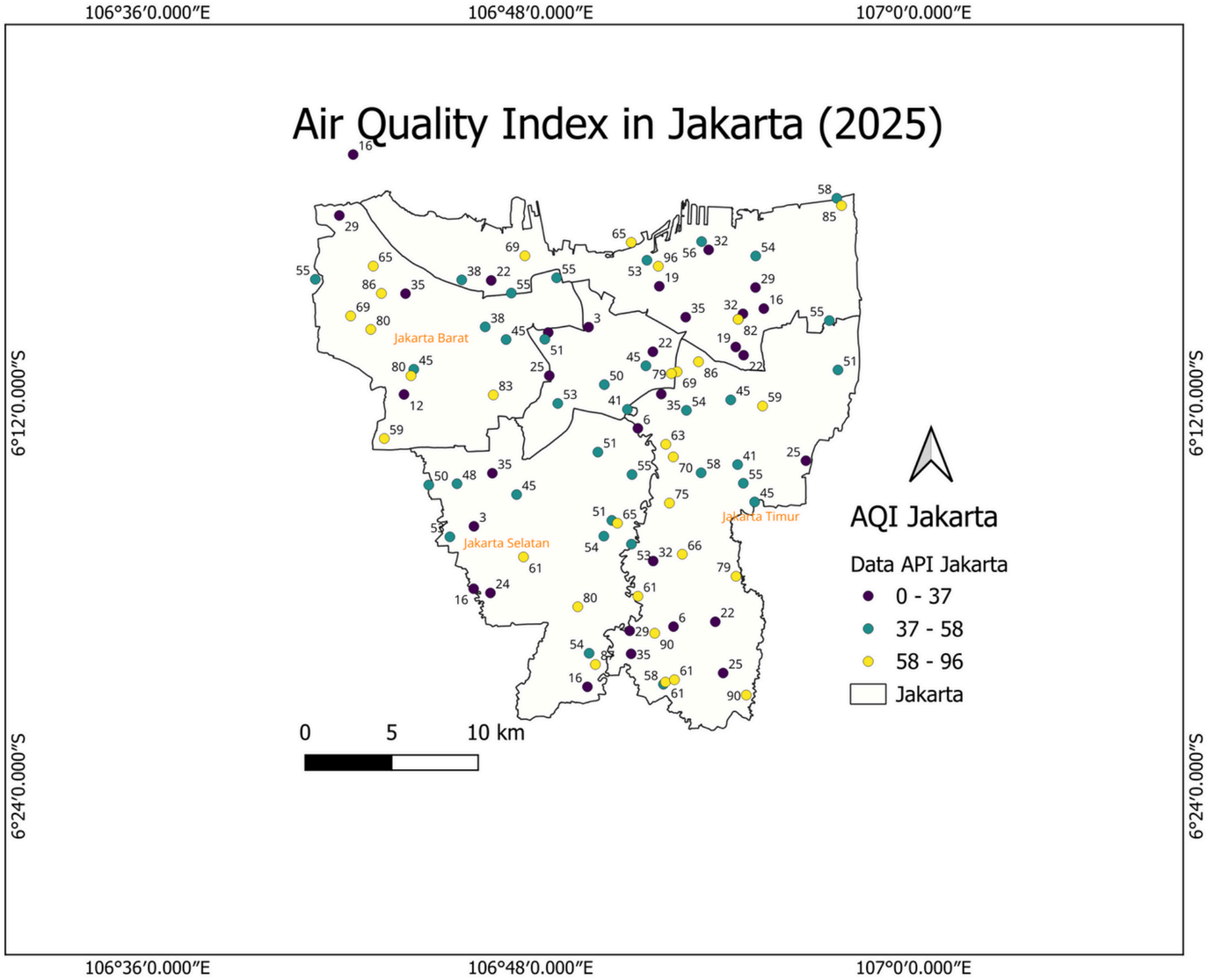
Results



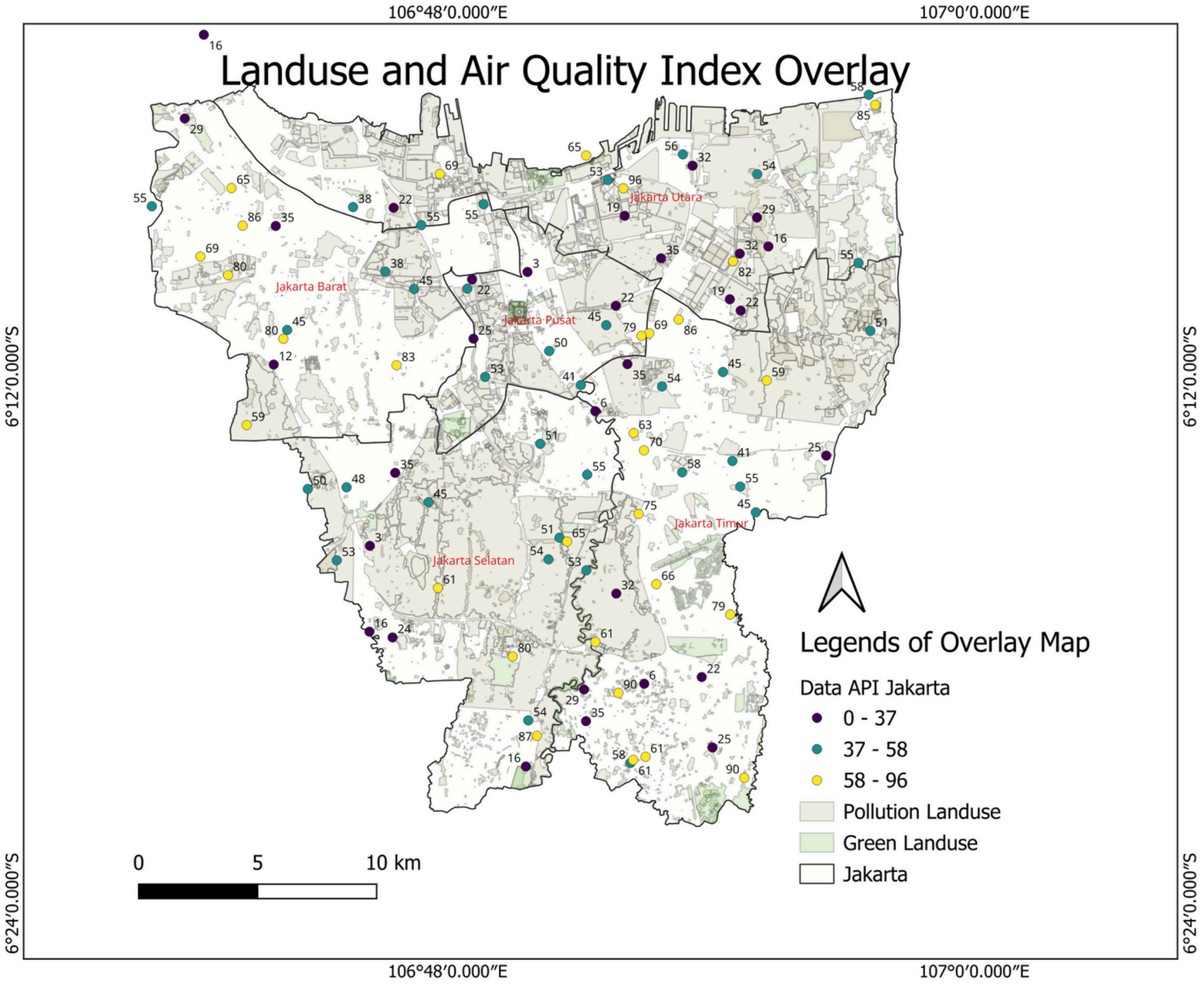
Jakarta Landuse:

- Pollution Landuse include residential, industrial, commercial.
- Green Landuse include forest, park, recreation ground, grass, meadow, orchard, cemetery.

South Jakarta shows largest Green Landuse with significant Pollution Landuse meanwhile East Jakarta shows largest Pollution Landuse.



Air Quality spread across Jakarta shows West Jakarta being most polluted.



Overlay of Landuse and air quality.

Table

Data Jakarta					
City	**Green (km2)**	**BuiltUp (km2)**	**Ratio (%)**	**AQI Average**	**Category**
Jakarta Barat	2.878	35.684	7.463	5.178	Moderate
Jakarta Pusat	4.688	42.146	10.009	435	Good/Moderate
Jakarta	9.745	82.978	10.509.798	459	Moderate
Jakarta	13.102	77.227	14.504	5.275	Moderate
Jakarta Utara	5.267	70.176	6.981	468	Moderate

This table shows that Jakarta Selatan and Jakarta Pusat have high green ration and low AQI, Jakarta Utara has low AQI but small green ratio, Jakarta Barat has high AQI and small green ratio, meanwhile Jakarta Timur has high AQI but shows the highest green ratio.

Relationship between Green Space Ratio and AQI in Jakarta

Discussion

Districts with higher green space percentages as Jakarta Selatan and Jakarta Pusat tended to show slightly lower PM2.5 levels, though still above WHO thresholds. Jakarta Barat has high AQI and small green ratio indicates the most pollutant area

This aligns with findings from Fitriana (2018) and UGM GIS modeling studies (2023), which emphasized the mitigating effect of urban vegetation on air quality. However, multiple confounding factors exist which are population density, traffic emissions, industrial activities, and meteorology. GIS analysis provides a scalable and cost-effective method for preliminary screening of environmental conditions, but requires integration with temporal datasets and ground-truthing.

Conclusion

QGIS spatial analysis demonstrated a potential negative correlation between green space extent and air pollution. The study provides evidence supporting urban planning policies to increase green coverage as part of Jakarta's environmental management strategies. Future work should incorporate time-series air quality data, remote sensing (NDVI), and multi-variable urban metrics.

References

Fitriana, H. L. (2018). Utilization of Remote Sensing to Support Green Open Space Mapping. LAPAN Journal. UGM (2023). Green Open Space Priority Modelling Using GIS Analysis in West Jakarta. Indonesian Journal of Geography.

IQAir. (2025). World's Most Polluted Cities Ranking.

WAQI. (2025). World Air Quality Index Data Platform.

MDPI (2025). Remote Sensing of Urban Green Spaces in Indonesian Cities.

Thank you