



College of Science – GIS and Remote Sensing

Special Topics in GIS and Remote Sensing

## **Milestone 4: Results, Discussion, and Conclusions**

Title: GIS-Based Health Risk Assessment in Sharjah Using Weighted Overlay Analysis

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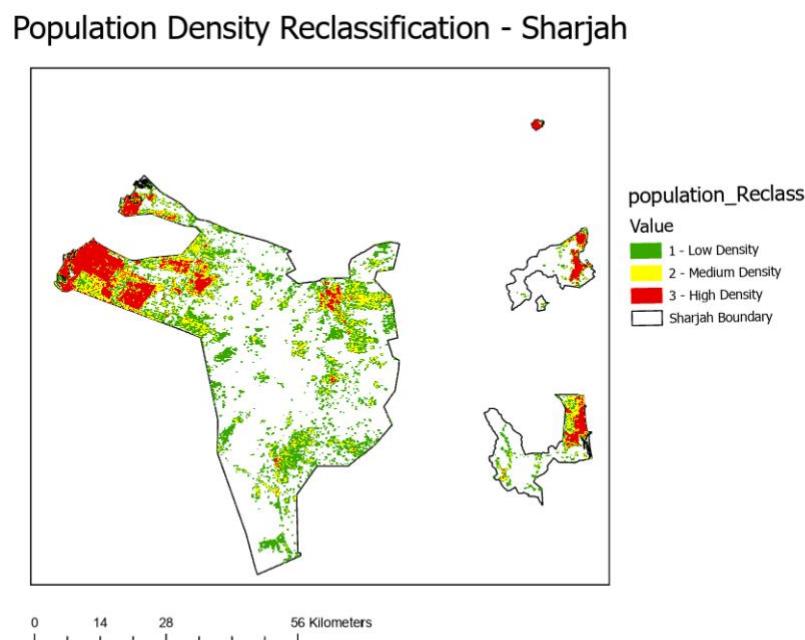
## 1. Introduction

This milestone presents the final outputs of the GIS-based health risk assessment conducted for Sharjah. Building on earlier milestones—problem definition, literature review, and methodology—this phase focuses on interpreting the spatial analysis results, examining patterns of industrial activity, population density, and road networks, and evaluating their combined influence on health risk levels across the emirate.

## 2. Results

This section presents the main outputs generated from the analysis. All maps were prepared in ArcGIS Pro and include full legends, color-coded classes, and spatial clarity suitable for interpretation. Each figure is accompanied by a brief explanation describing its relevance to the research objectives.

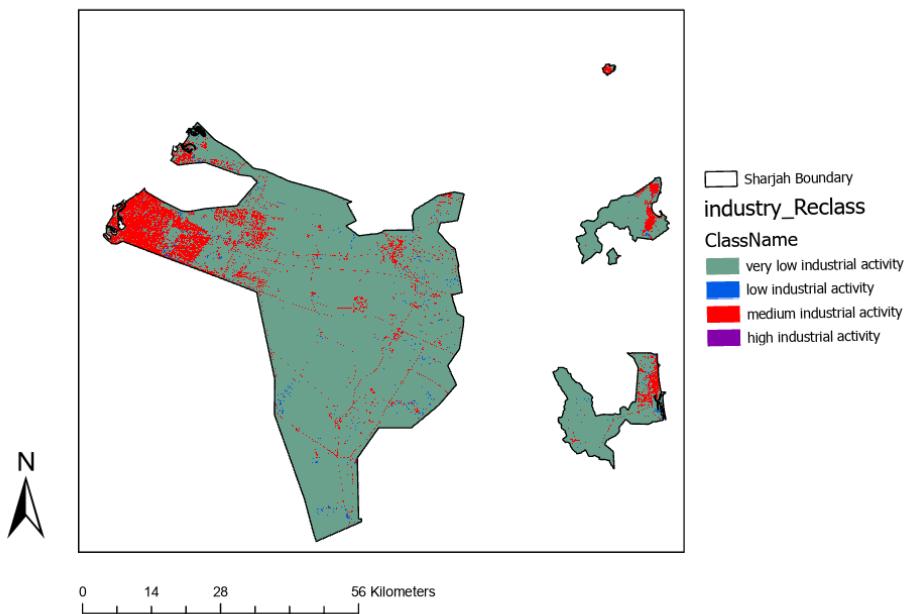
**Figure 1. Population Density Reclassification**



This reclassified map shows low, medium, and high population density zones. Higher-density areas represent greater potential exposure to environmental health risks.

**Figure 2. Industry Reclassification**

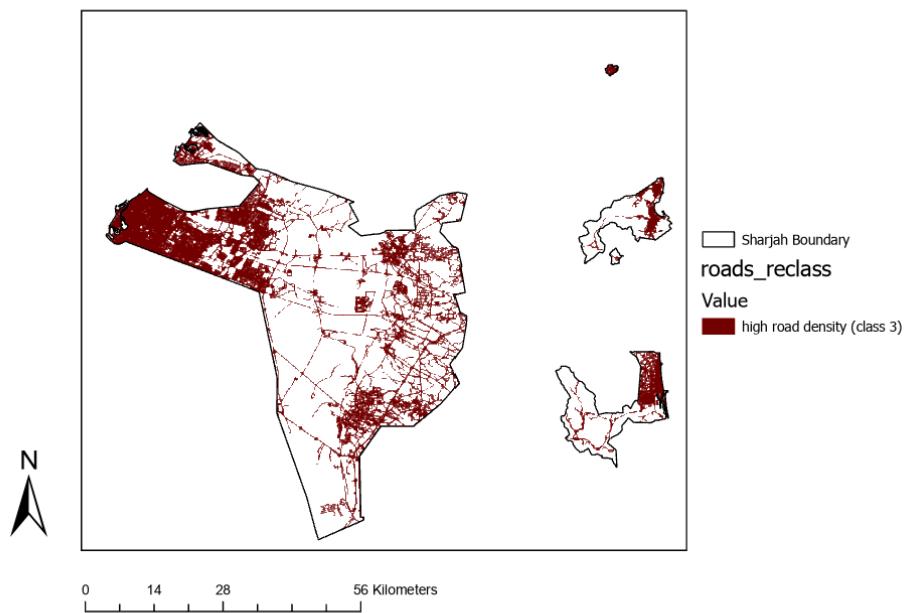
### Industry Reclassification - Sharjah



Industrial activity was reclassified into four impact levels. High and very-high industrial zones represent stronger pollution sources.

**Figure 3. Road Density (High-Impact Areas)**

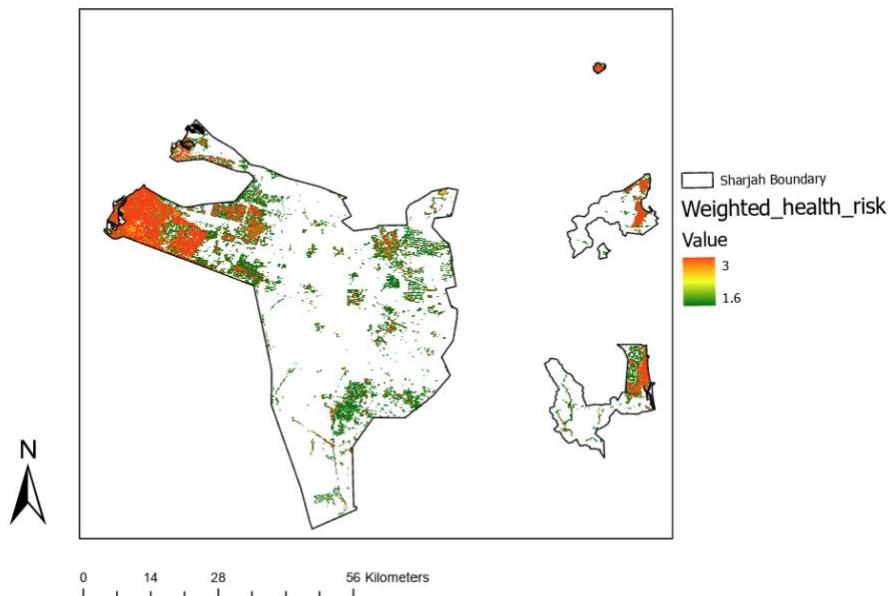
### Road Density (High impact areas) - Sharjah



This map highlights areas with dense major roadway networks, which contribute to noise, emissions, and air pollution.

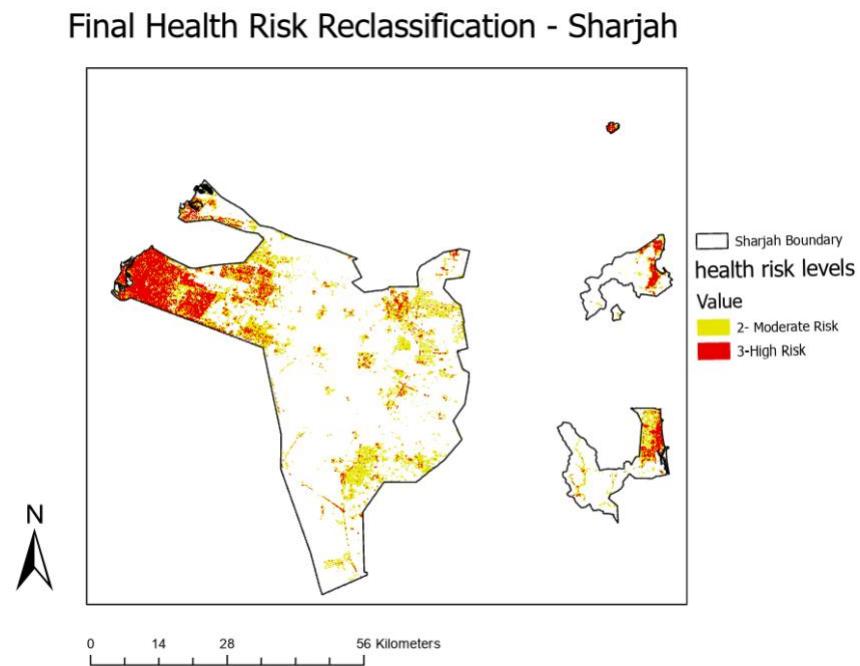
**Figure 4. Weighted Health Risk Index**

Final Health Risk Index(Weighted Overlay) - Sharjah



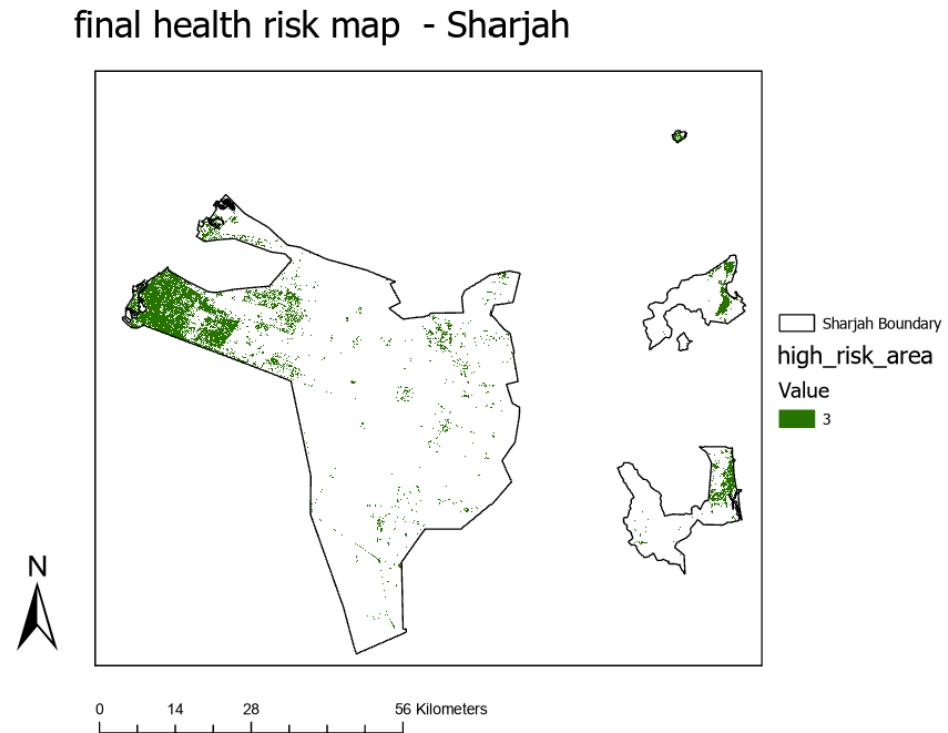
The weighted overlay index combines population, industry, and road density according to their relative influence on health risk. The final index was calculated in Raster Calculator using the expression  $(\text{industry_Reclass} \times 0.5) + (\text{roads_reclass} \times 0.3) + (\text{population_Reclass} \times 0.2)$ , which assigns the highest weight to industrial activity, a medium weight to road density, and a lower weight to population density.

**Figure 5. Final Health Risk Reclassification**



The weighted output was reclassified into two risk levels: moderate and high for ease of interpretation.

**Figure 6. High-Risk Areas Only (Class 3)**



This extraction shows only Class 3 (high-risk) zones. These areas represent the highest-priority regions for monitoring and mitigation.

### **3. Discussion**

The results reveal clear spatial patterns reflecting the interaction between industrial activity, road density, and population concentration. Industrial areas contributed most strongly to the final risk index due to their consistent emission output. High-density road corridors were also found to elevate risk levels because of traffic-related pollutants. Population density amplified exposure risk in certain zones.

The weighted overlay successfully integrated these factors and revealed high-risk clusters near major industrial zones and transportation corridors. These findings align with previous studies indicating that industrial emissions, vehicle exhaust, and dense population areas collectively heighten environmental health risks.

Limitations include the resolution of the WorldPop population dataset, possible simplification in the industrial activity classification, and the reliance on major road networks without incorporating dynamic traffic or air-quality sensor data.

### **4. Conclusions and Recommendations**

The objectives of the project were achieved successfully. The weighted overlay model identified high-risk health zones and revealed strong associations between industrial concentrations, road density, and population exposure. High-risk clusters were primarily located around major industrial facilities and dense transportation corridors.

Recommendations include validating high-risk zones through on-site environmental measurements, integrating additional criteria such as air quality sensor data, improving dataset resolution, and applying time-series analysis for future research.

## **5. References**

- ESRI Living Atlas. (2023). Environmental and infrastructure datasets.
- Sharjah Municipality Open Data. (2023). Administrative boundaries and infrastructure datasets.
- WorldPop. (2022). Global High-Resolution Population Density Maps.  
<https://www.worldpop.org>
- World Health Organization. (2021). Air Quality Guidelines: Global Health Recommendations.
- Xu, H. (2013). GIS-based environmental pollution assessment. *Environmental Monitoring and Assessment*.