

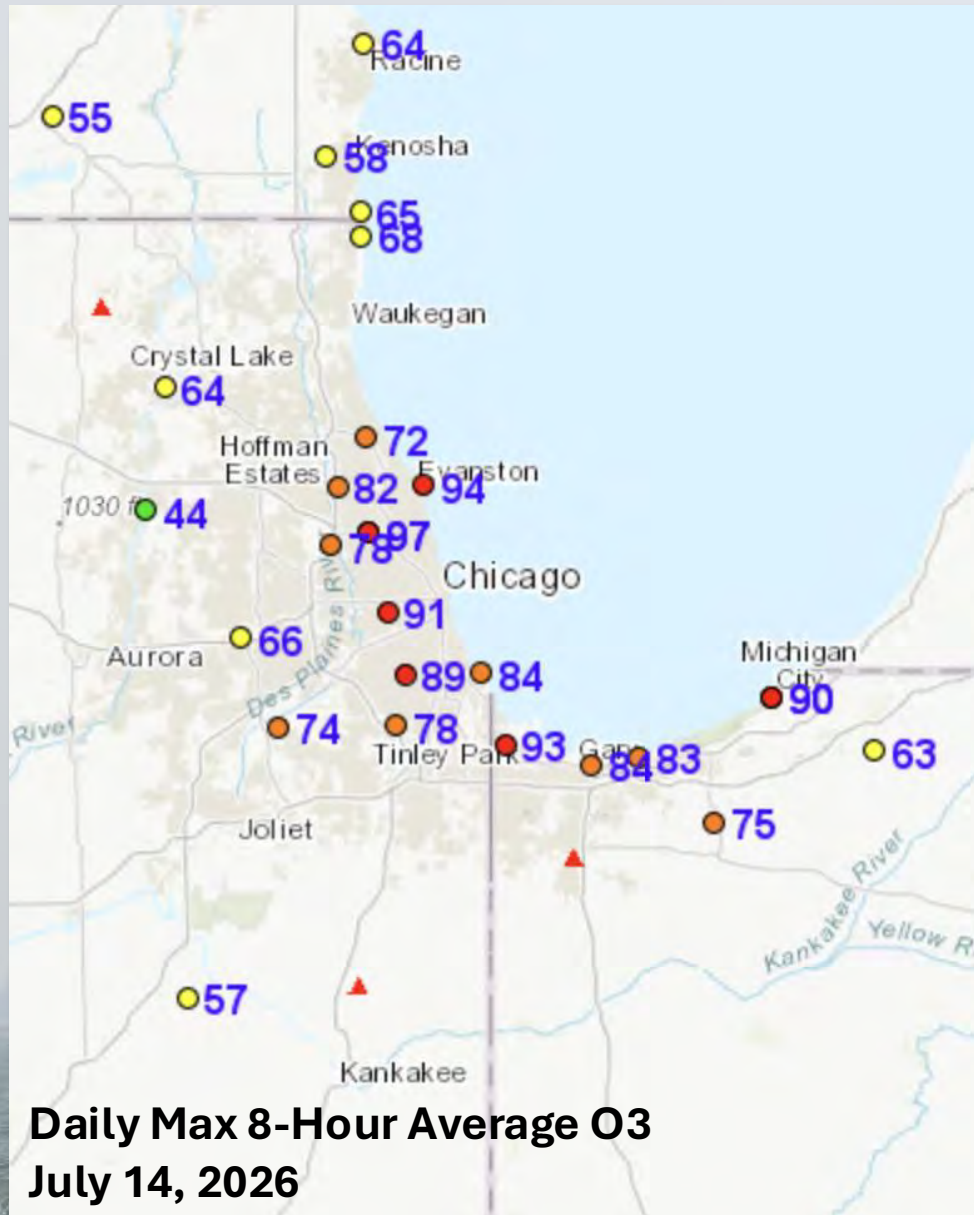
Air Quality Insights from a Dense Sensor Network and High- Resolution Land-Use In Chicago

Grant Coleman, LADCO Summer Intern

July 2026

170,850

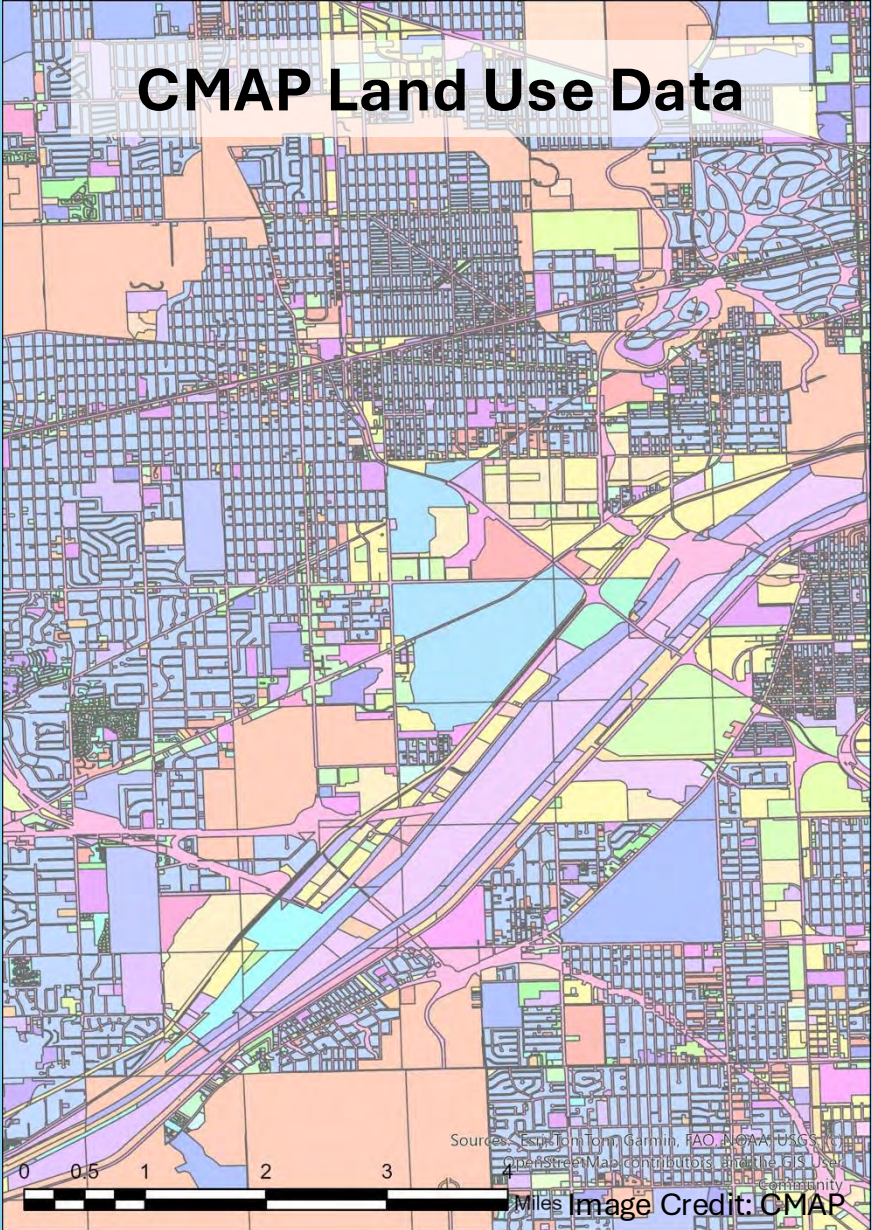
Premature deaths per
year are linked to NO₂
exposure in the U.S.



Project Background



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Open Air Chicago

**277 sensors across 77
community areas**

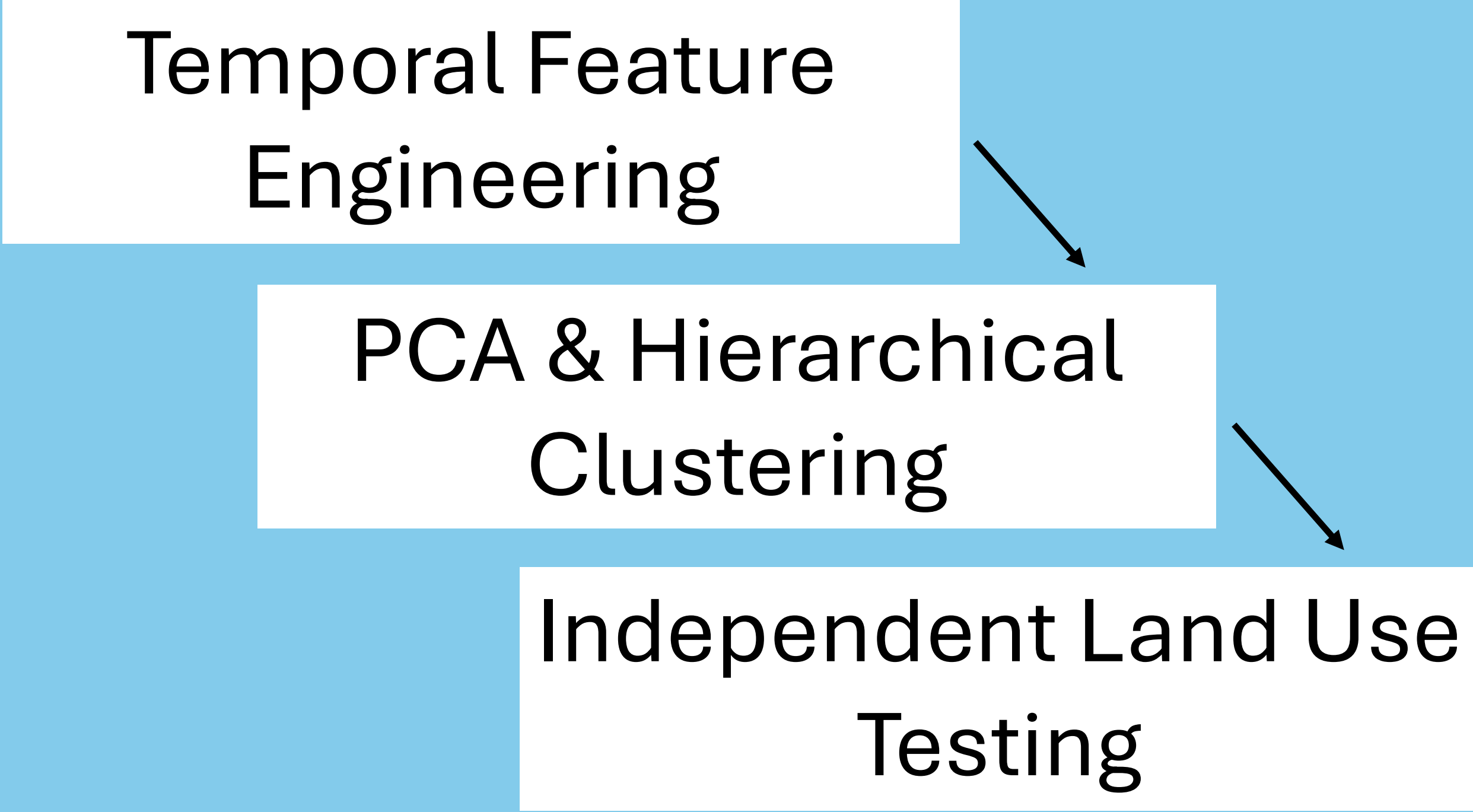
MOTIVATING QUESTION

What emission sources drive the distribution and dynamics of NO₂ concentrations in Chicago?

RESEARCH QUESTION

Are there associations between landuse and OpenAir Chicago NO₂ concentrations?

Temporal Feature
Engineering

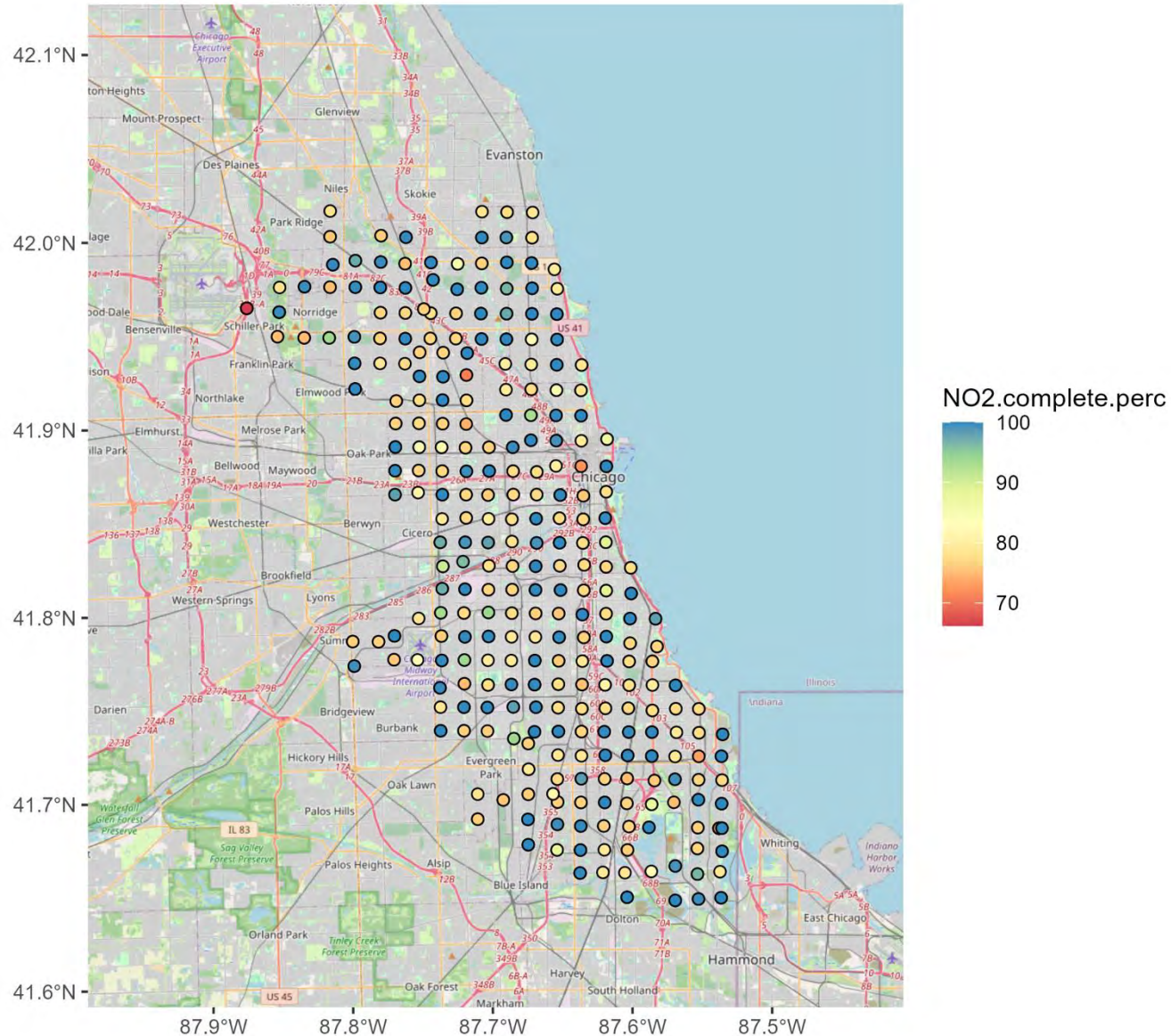


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graph TD; A[Temporal Feature Engineering] --> B[PCA & Hierarchical Clustering]; B --> C[Independent Land Use Testing];
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PCA & Hierarchical
Clustering

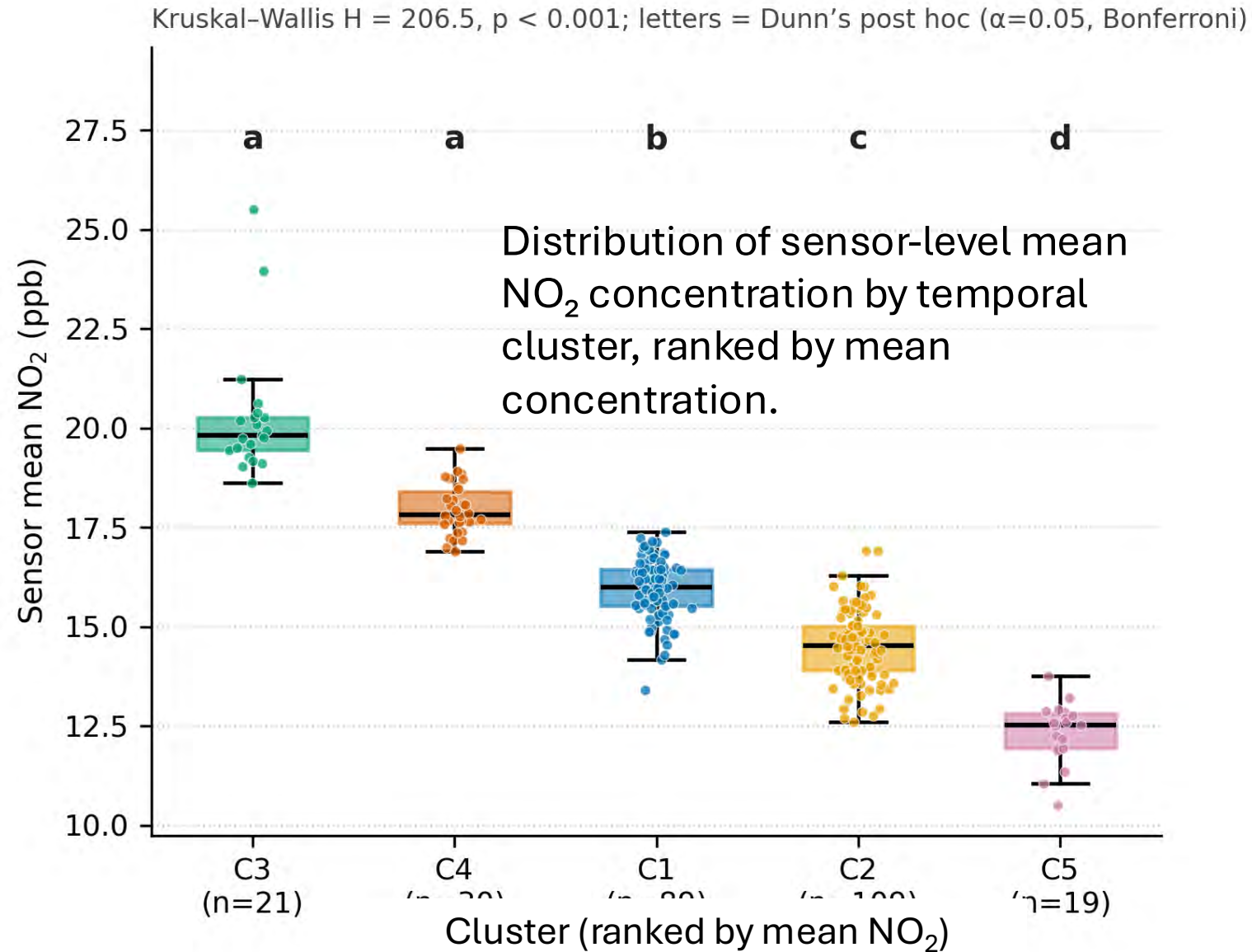
Independent Land Use
Testing

Data Completeness

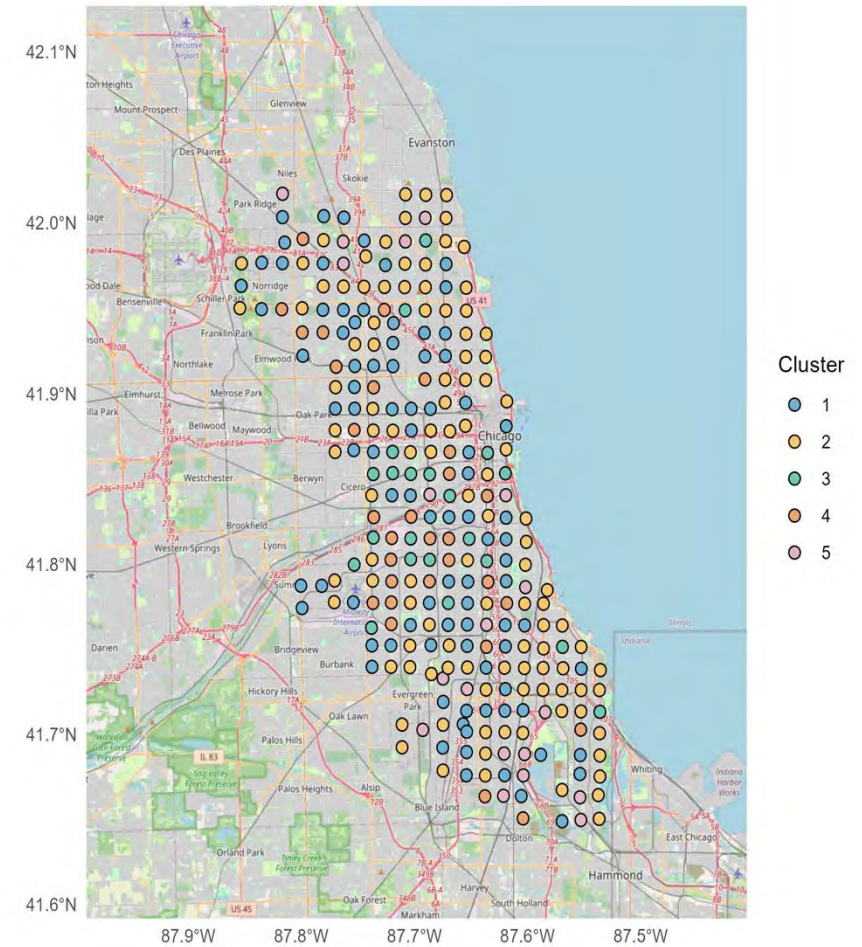


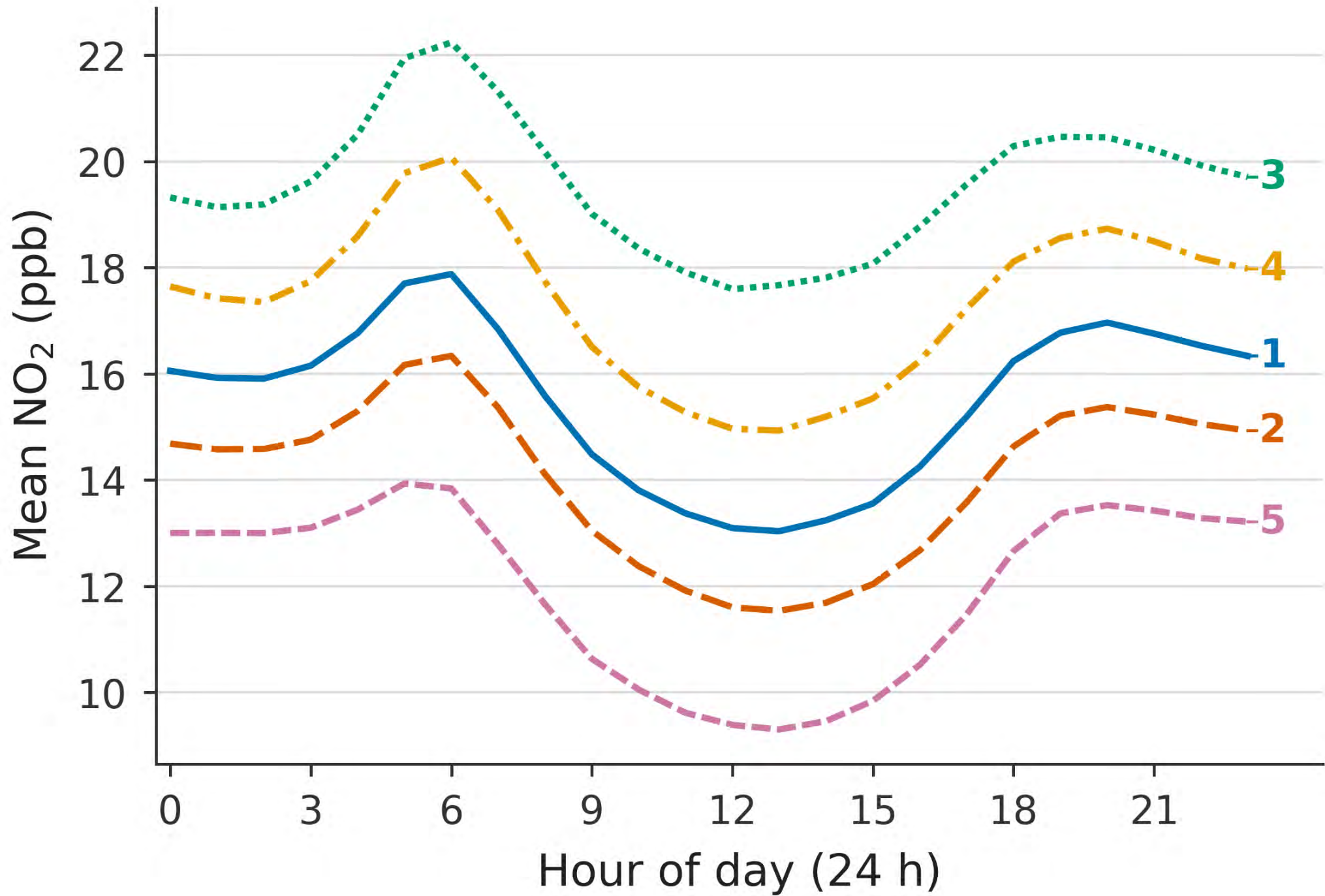
Completeness is defined on an hourly basis (any data in that hour counts as a complete hour). Numbers indicate the percentage of hours in a month that had data.

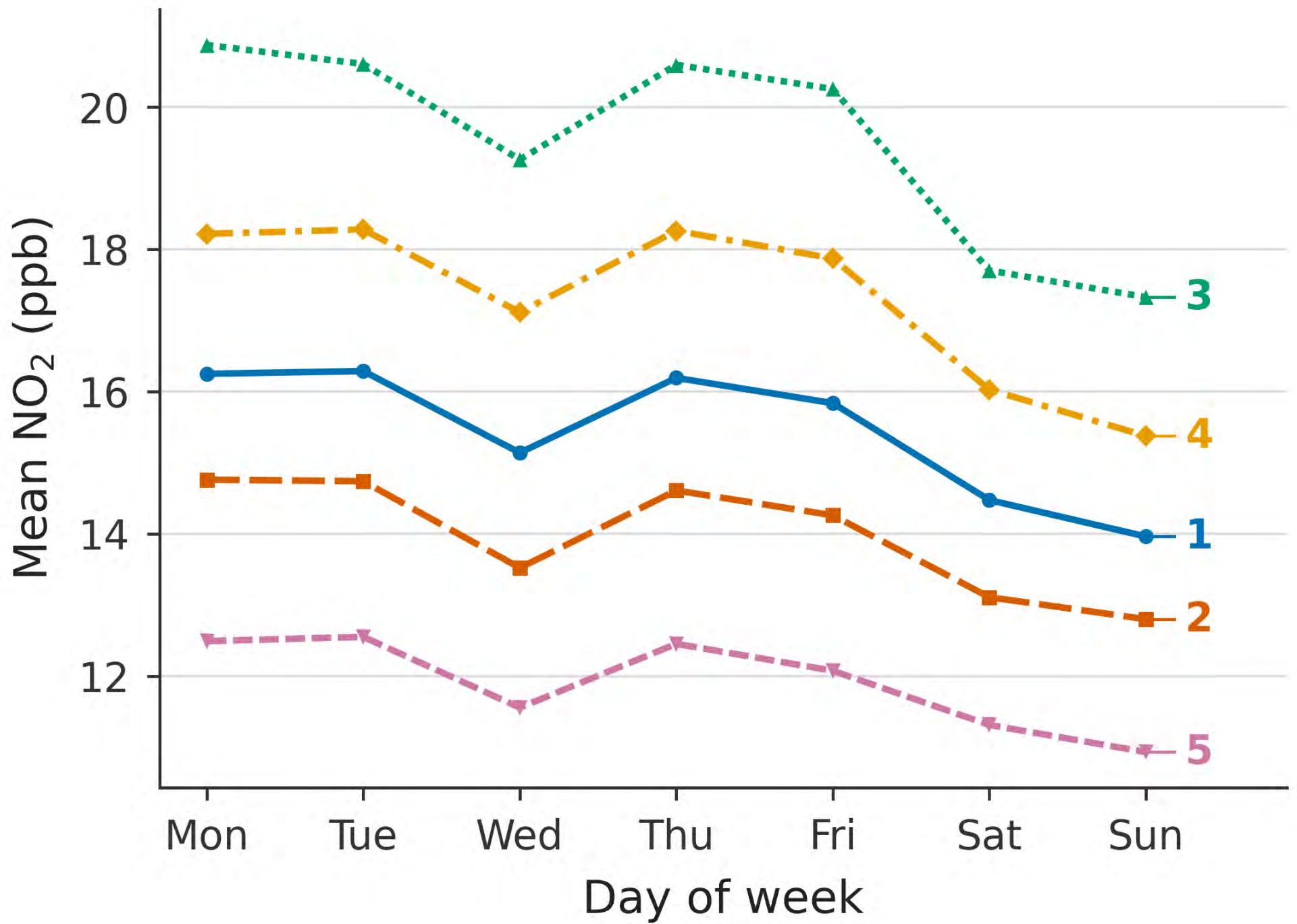
OpenAir Sensor Clusters

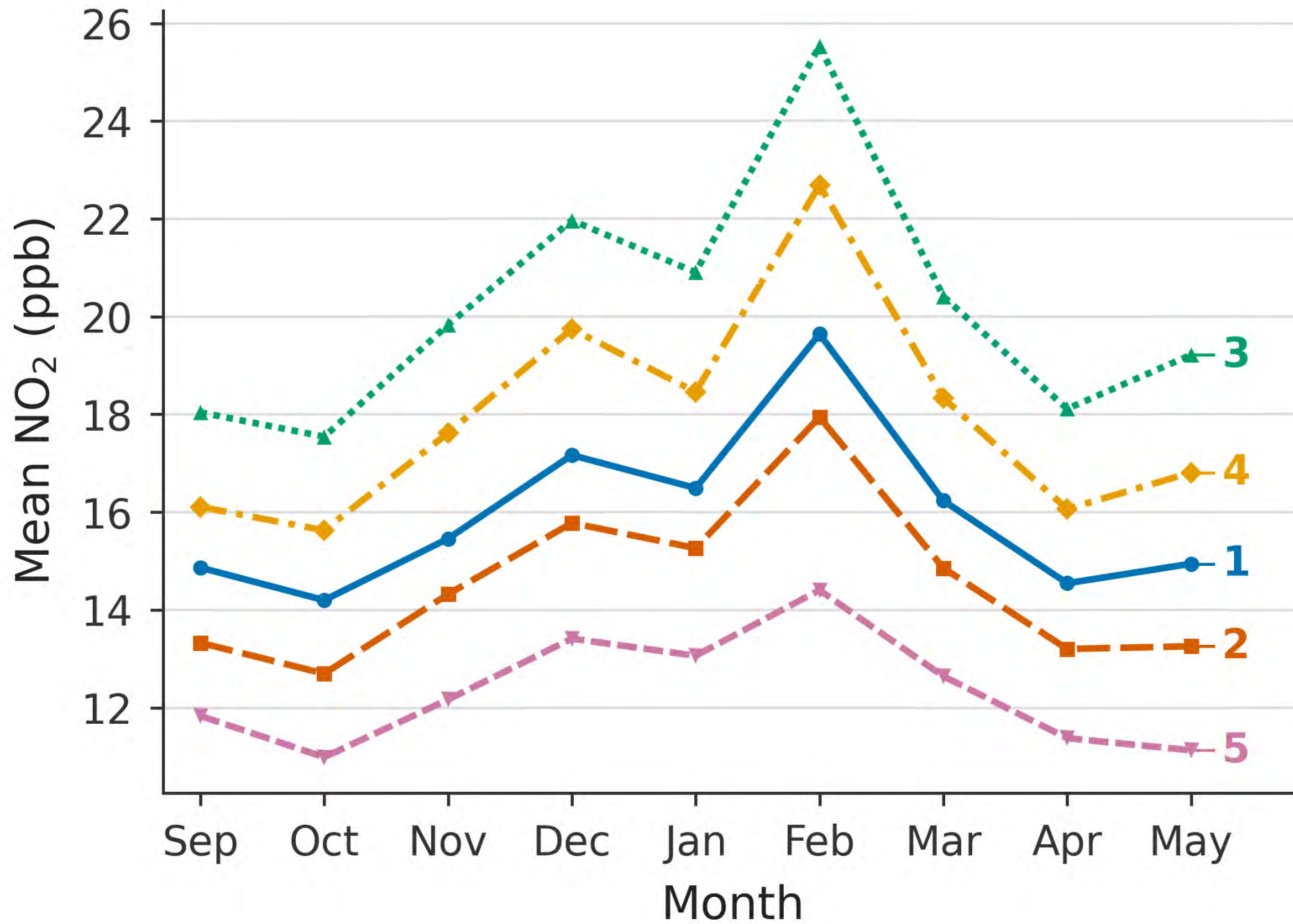


OpenAir Chicago Sensor Clusters

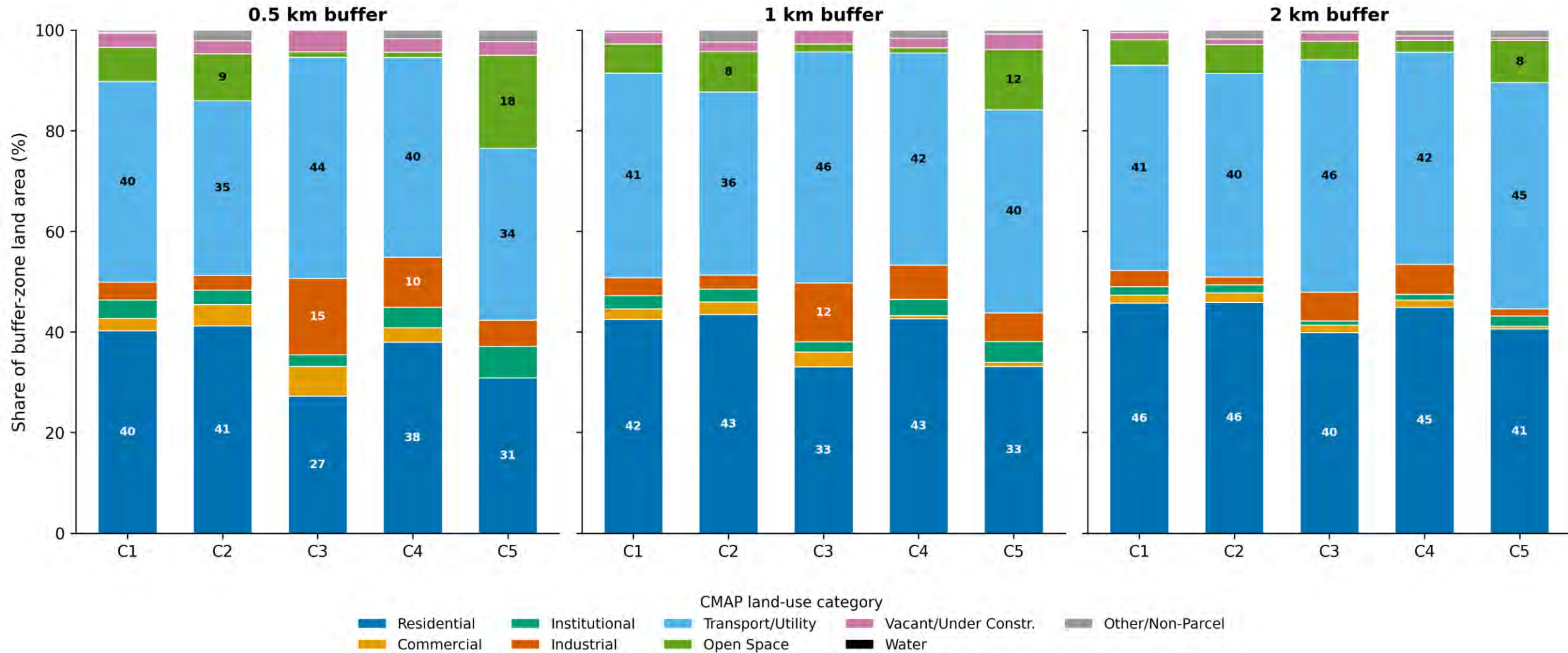




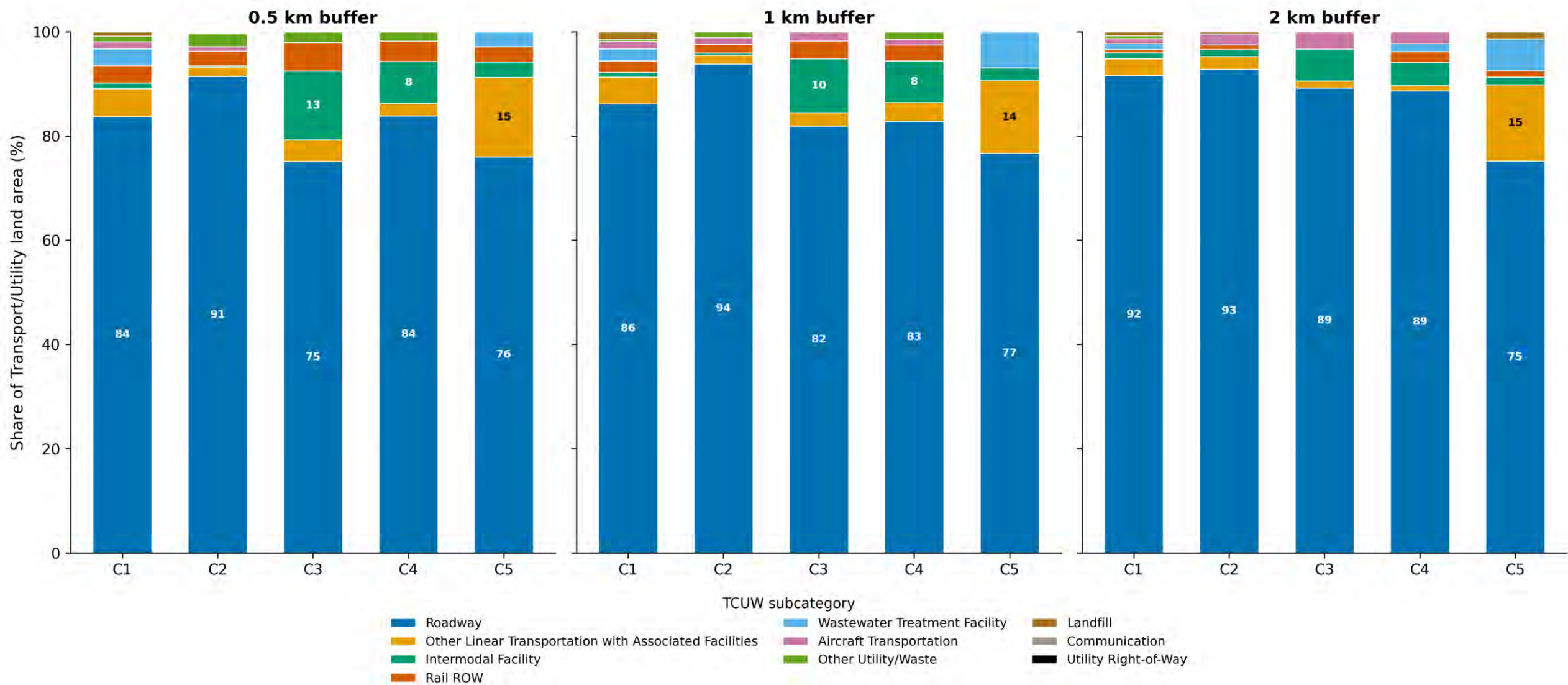




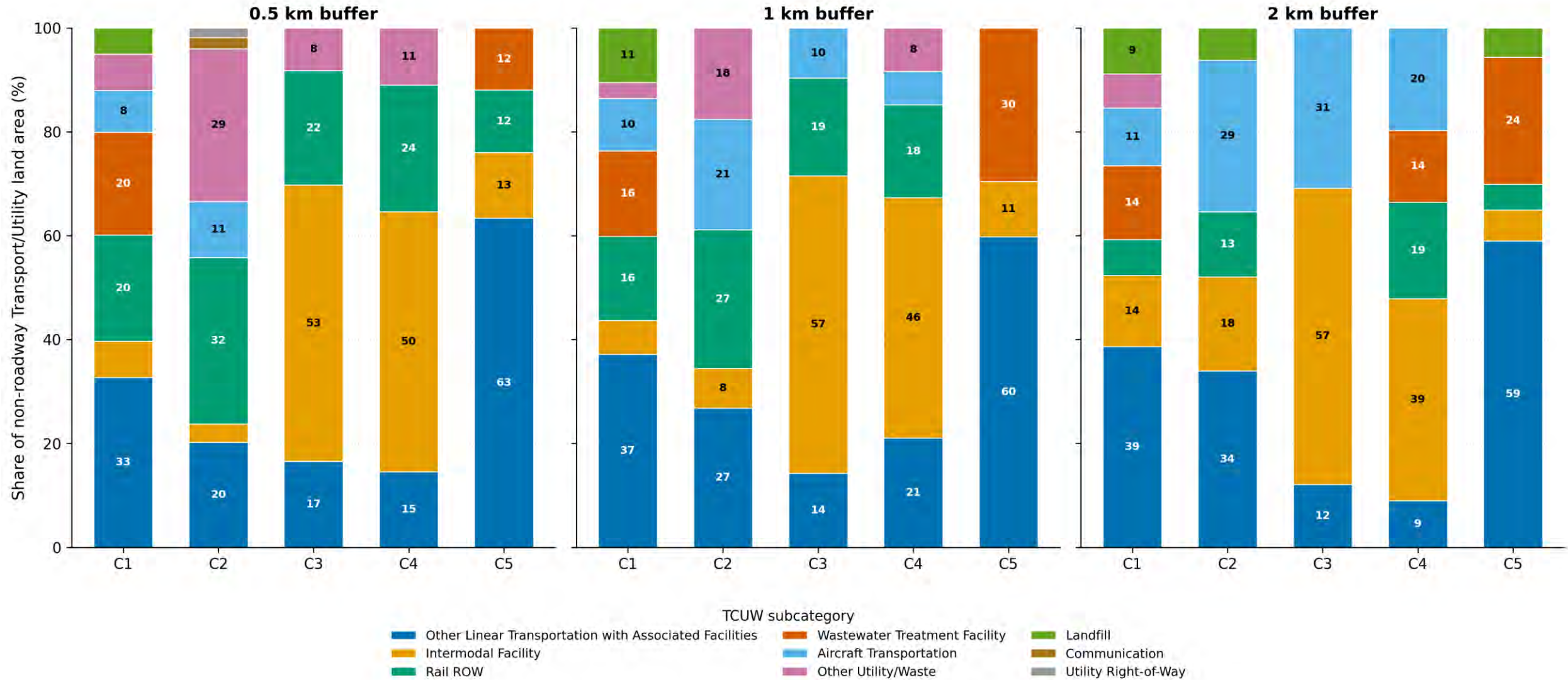
Land-Use Composition Sensitivity Across Buffer Distances



Transport/Communication/Utility/Waste Composition by Cluster and Buffer Distance



Transport/Communication/Utility/Waste Composition (Excl. Roadway) by Cluster and Buffer Distance

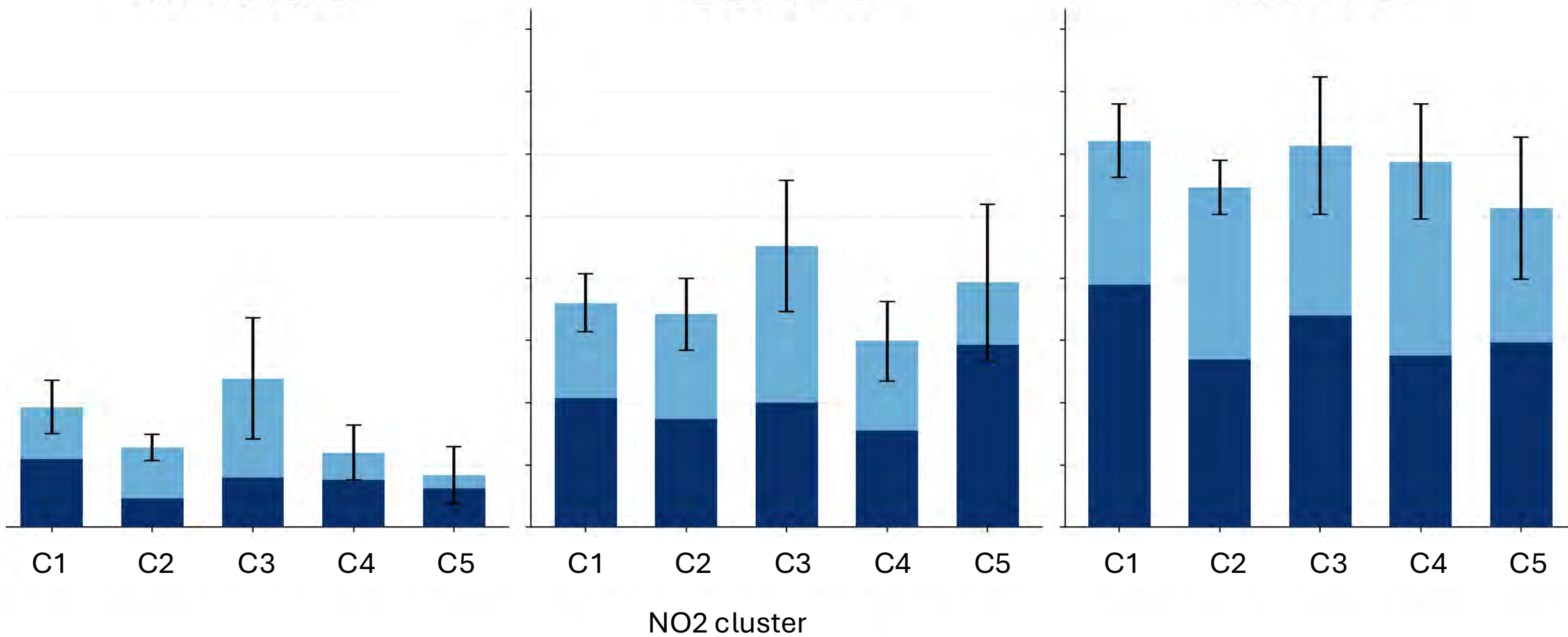


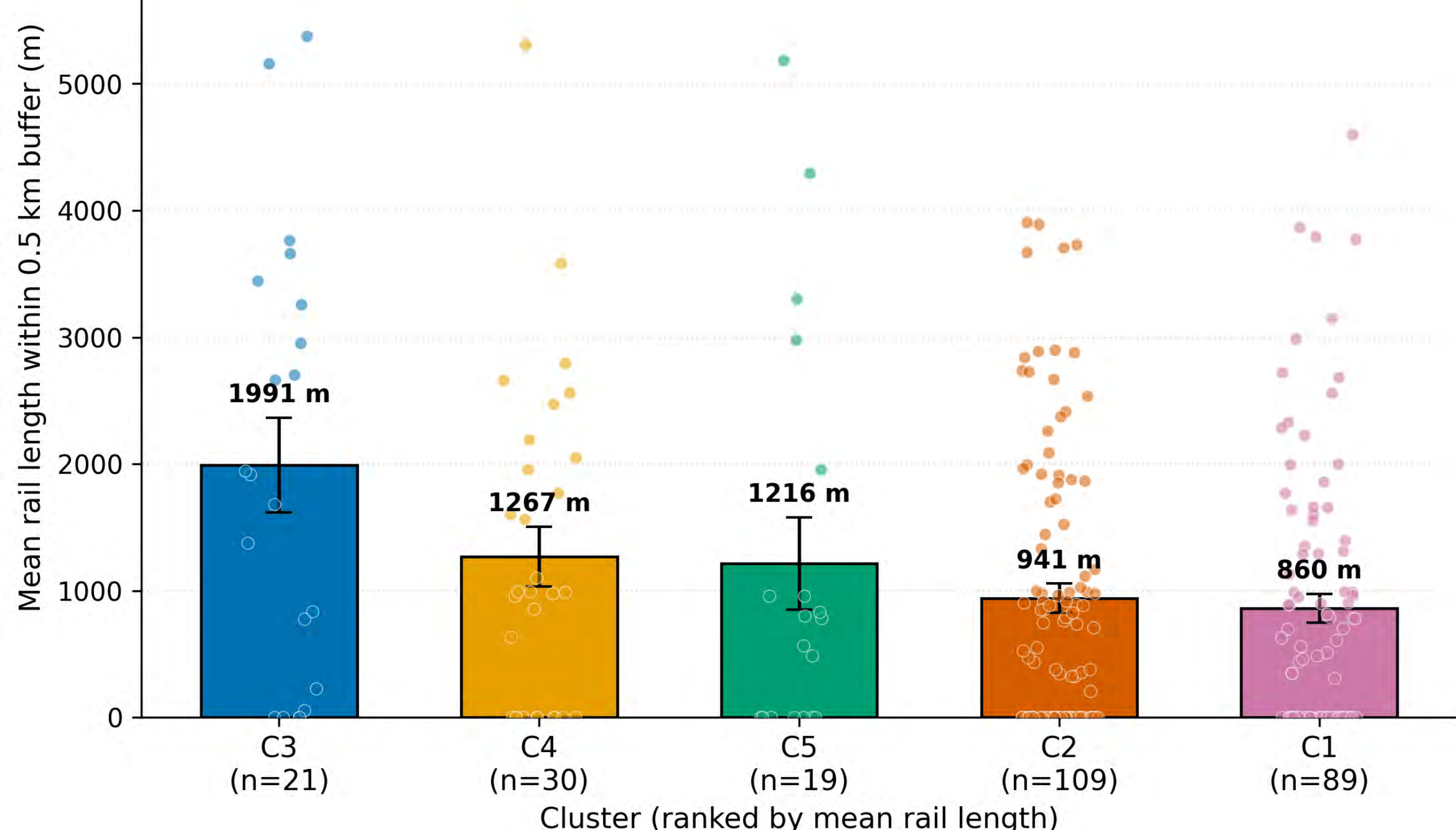
Primary roads (S1100) Secondary roads (S1200)

0.5 km buffer

1 km buffer

2 km buffer





An aerial photograph of the Chicago skyline, showing a dense cluster of skyscrapers. The image has a semi-transparent overlay with text. The text is in a bold, black, sans-serif font. The background shows the city's architecture, including the Willis Tower and other prominent buildings, with Lake Michigan visible in the distance under a hazy sky.

**There are associations between OpenAir
Chicago sensor NO2 measurements and
landuse categories with high emissions**

Study Limitations

- Uncertainty in low-cost sensors
- Meteorological effects were not considered
- Cluster silhouette width
- Sensor data completeness

Acknowledgements

LADCO Staff

City of Chicago

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CMAP