Characterising Effects of Air Quality In Maternal, Newborn and Child Health

CHAC2024 Climate and Health Africa Conference

Validation of pollution proxy indicators using personal exposure air quality data from 2 sub-Saharan African Countries

Paper No. 364

Track B : Health impacts and epidemiology

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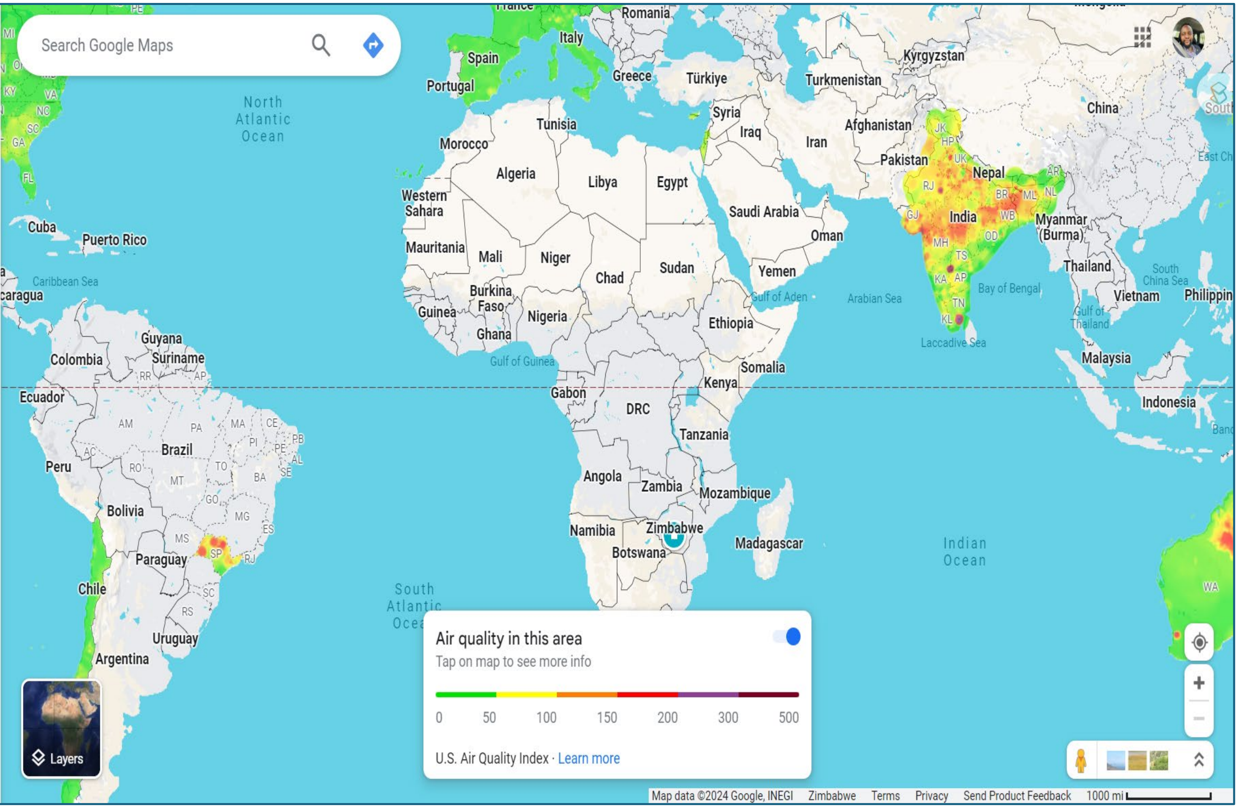

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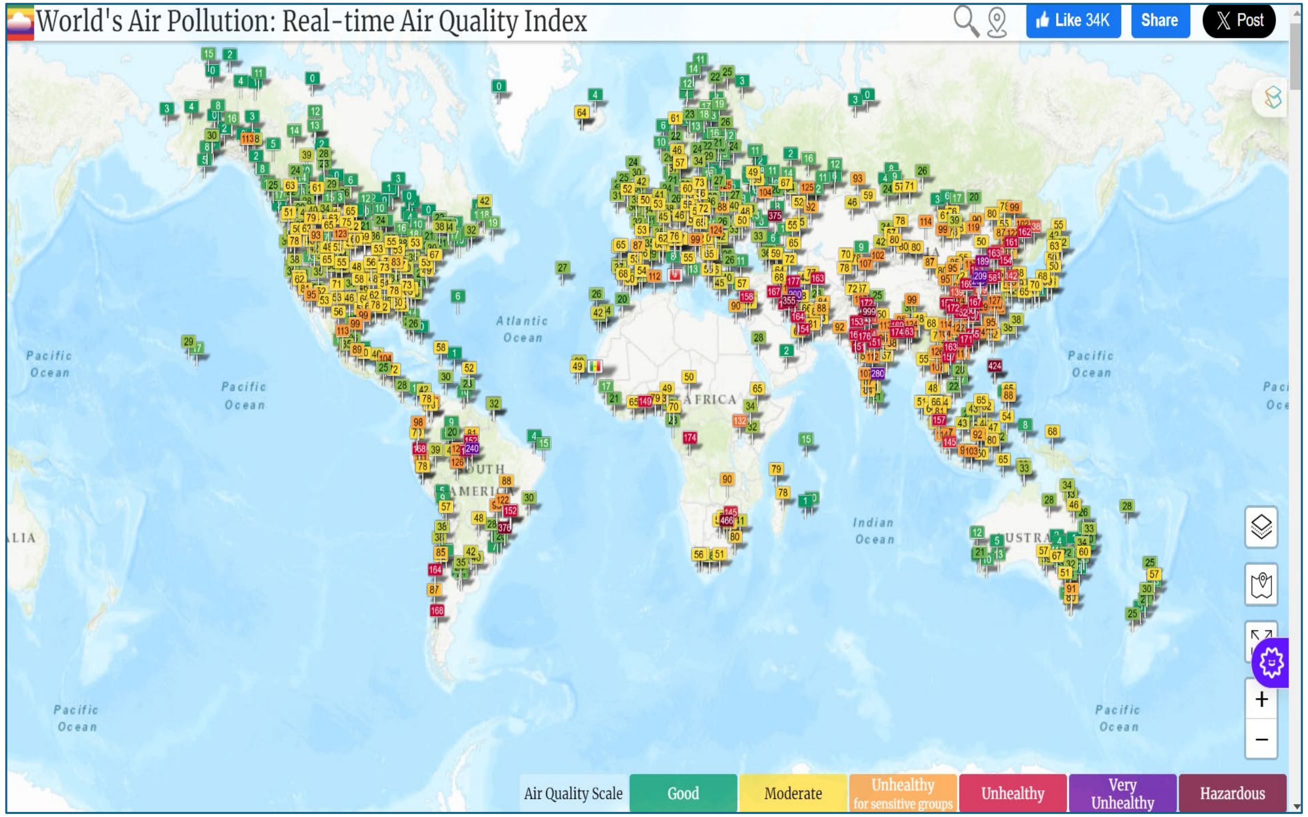

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Background

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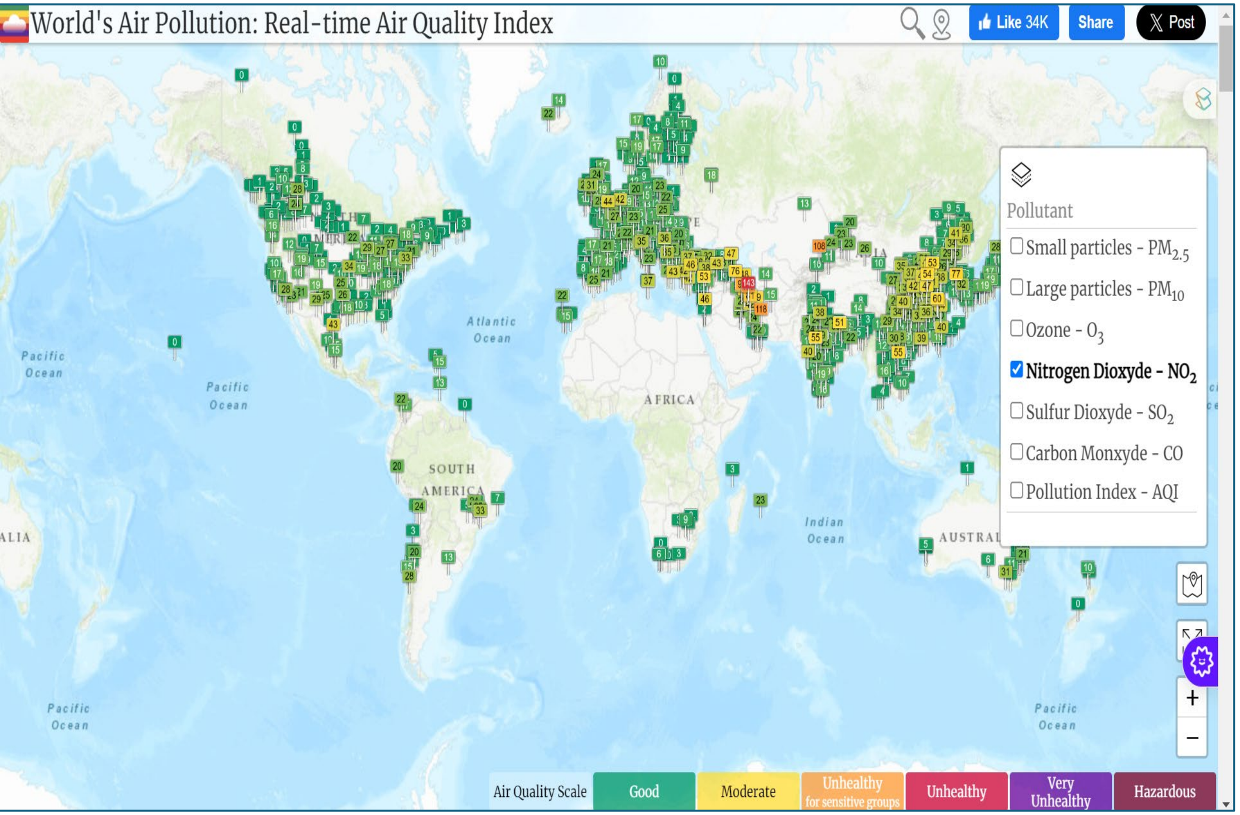
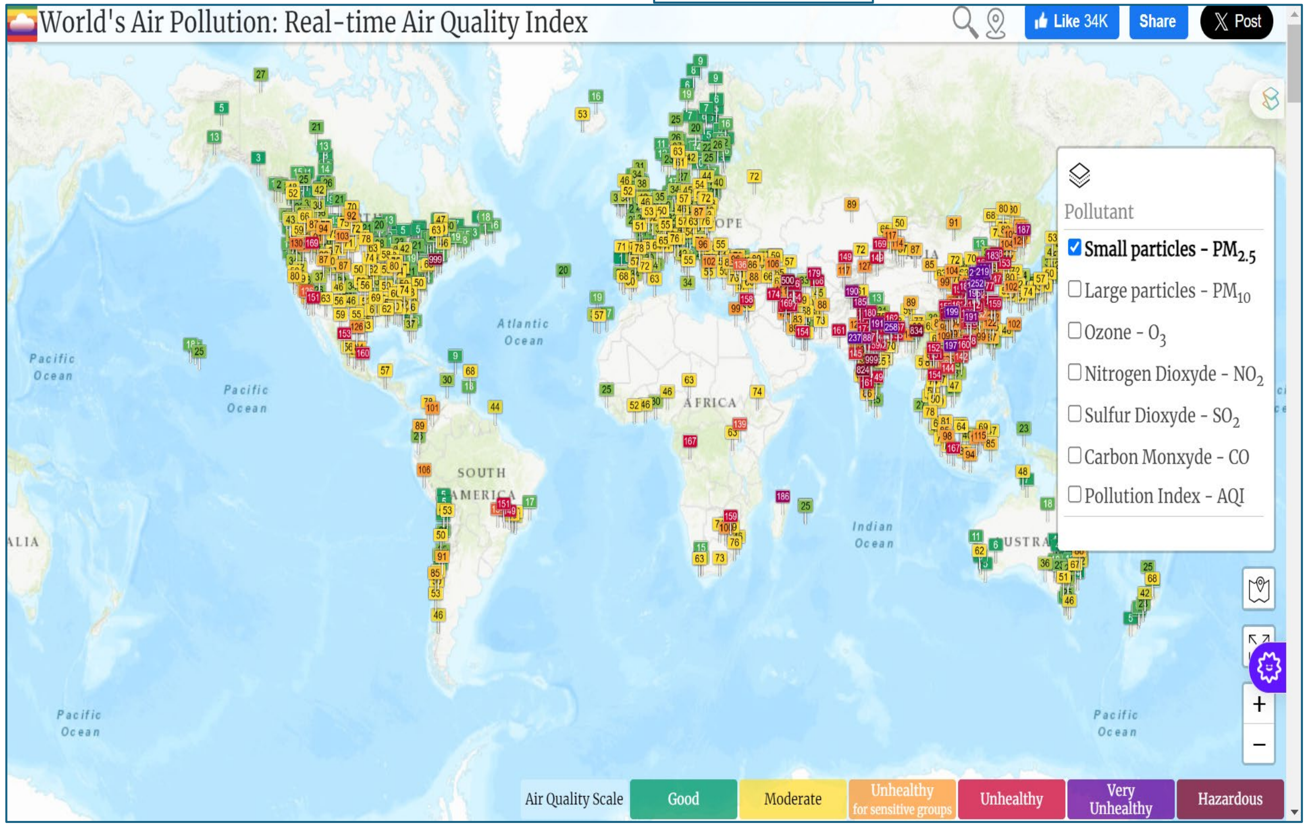
NO2



PM 2.5



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Introduction

Poor air quality is the 2nd leading risk factor for death worldwide.

Proxy air quality indices offer a vital alternative in areas lacking ground sensor data.

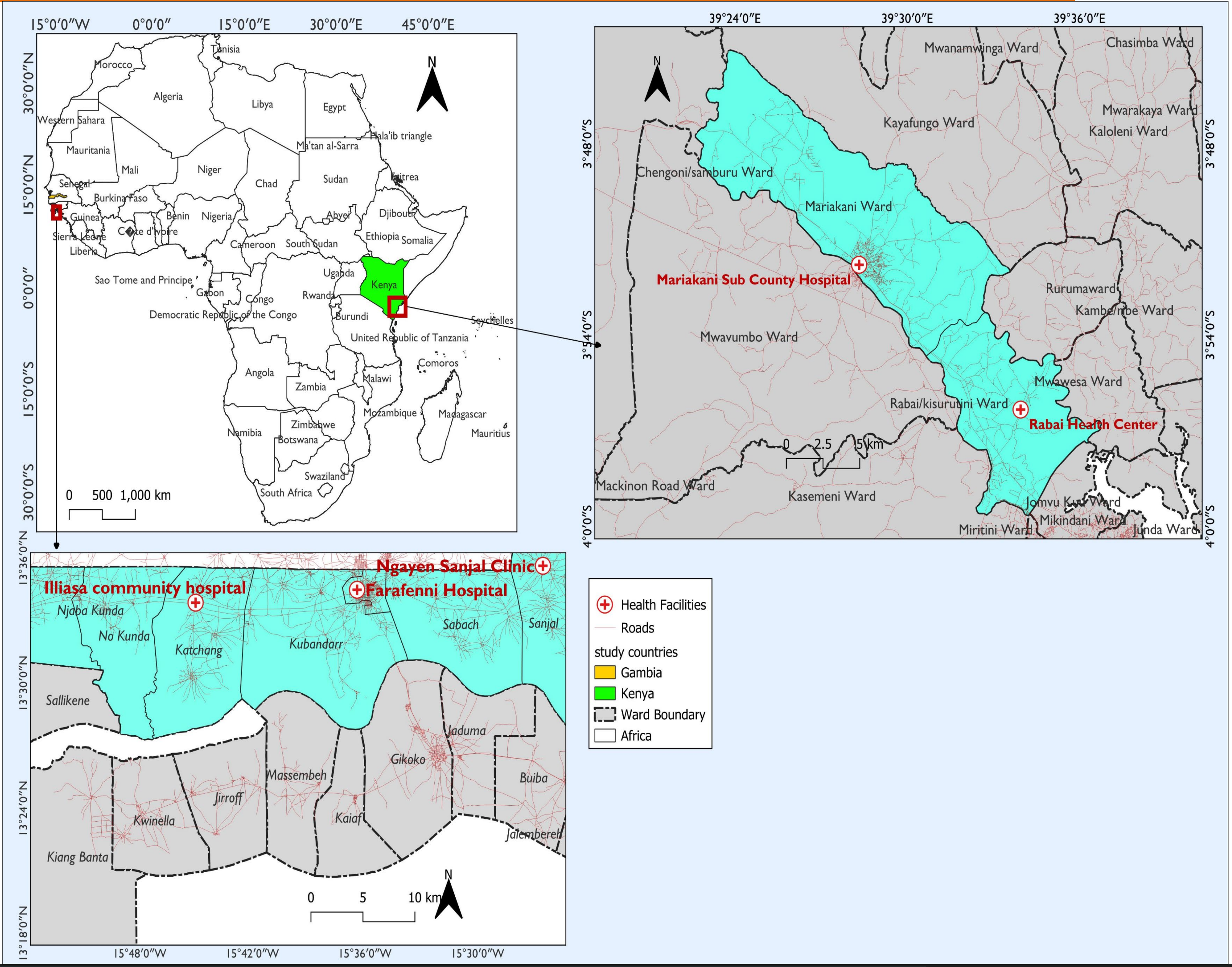
This project focused on validating proxy pollution indicators using extensive personal exposure datasets.

The validation process utilized 1,048,576 multi-dimensional exposure data points recorded by low-cost personal sensors .

Objectives

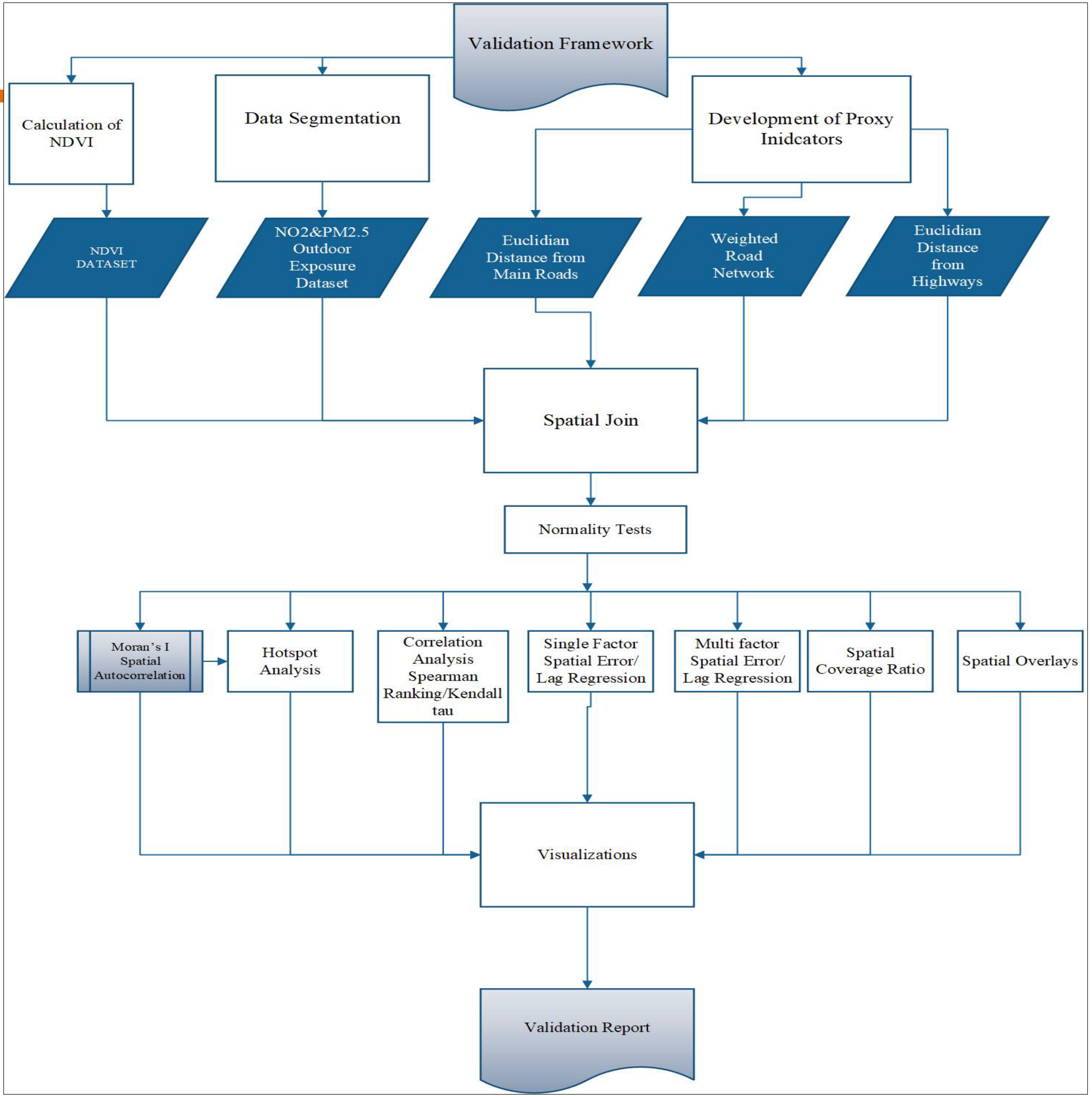
- Develop a validation framework
- Validation criteria , methodology and validation report
- Assess the significance of proxy indicators
- Scale up proxy indices
- Support modeling and upscaling efforts
- Enhance understanding of pollution drivers

Study Sites



Mariakani Sub County Hospital
Rabai Health Center
Illiasa community hospital
Ngayen Sanjal Clinic
Farafenni Hospital
Health Facilities
Roads
study countries
Gambia
Kenya
Ward Boundary
Africa

Methodology



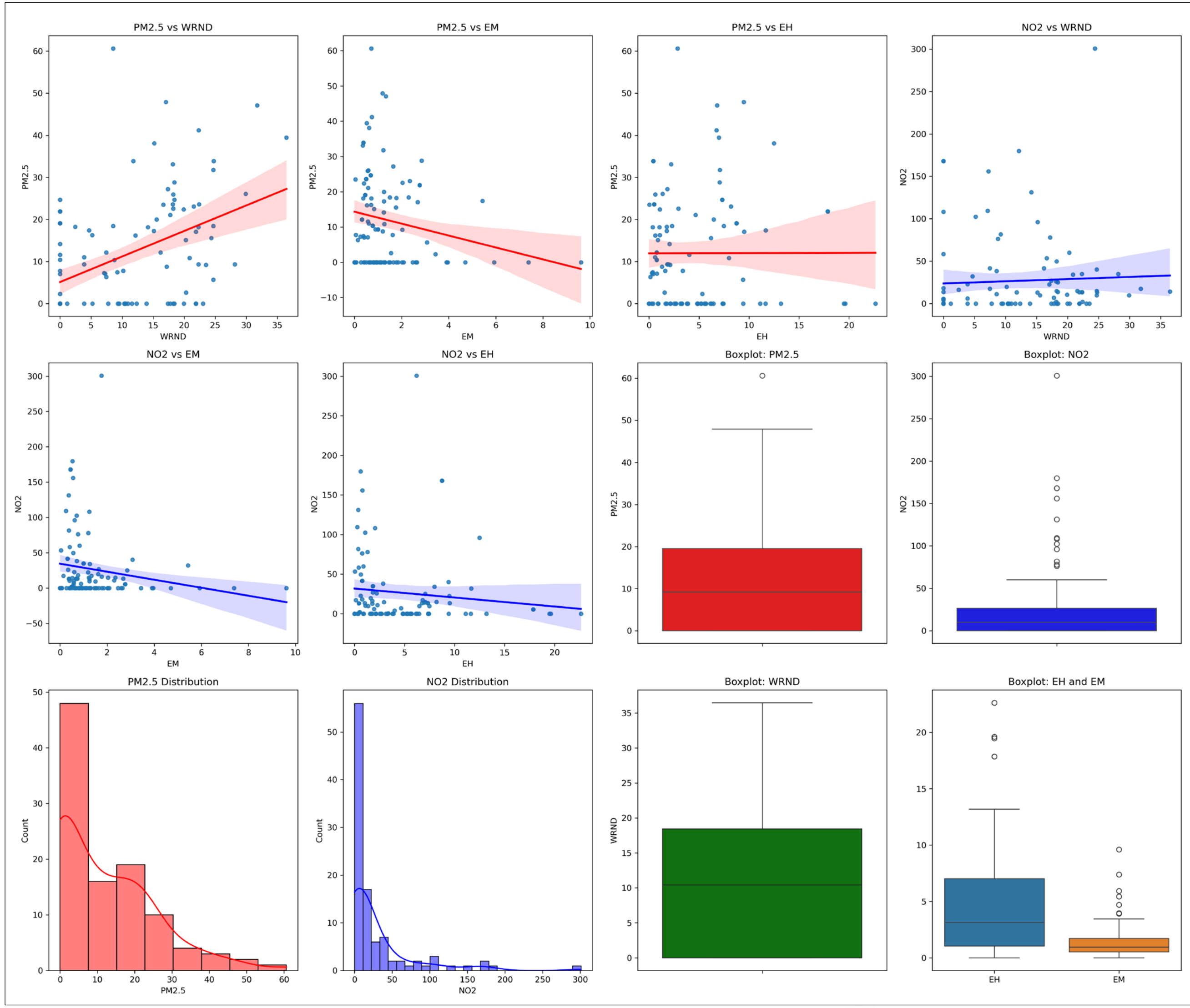
Descriptive Statistics

Gambia

The data did **not follow normal distribution** And there were outliers.

Scatter plots confirm a **positive** relationship between **wrnd and exposure.**

Scatter plots also highlight a **negative** relationship between **personal exposure and distance** from the main road and highway.



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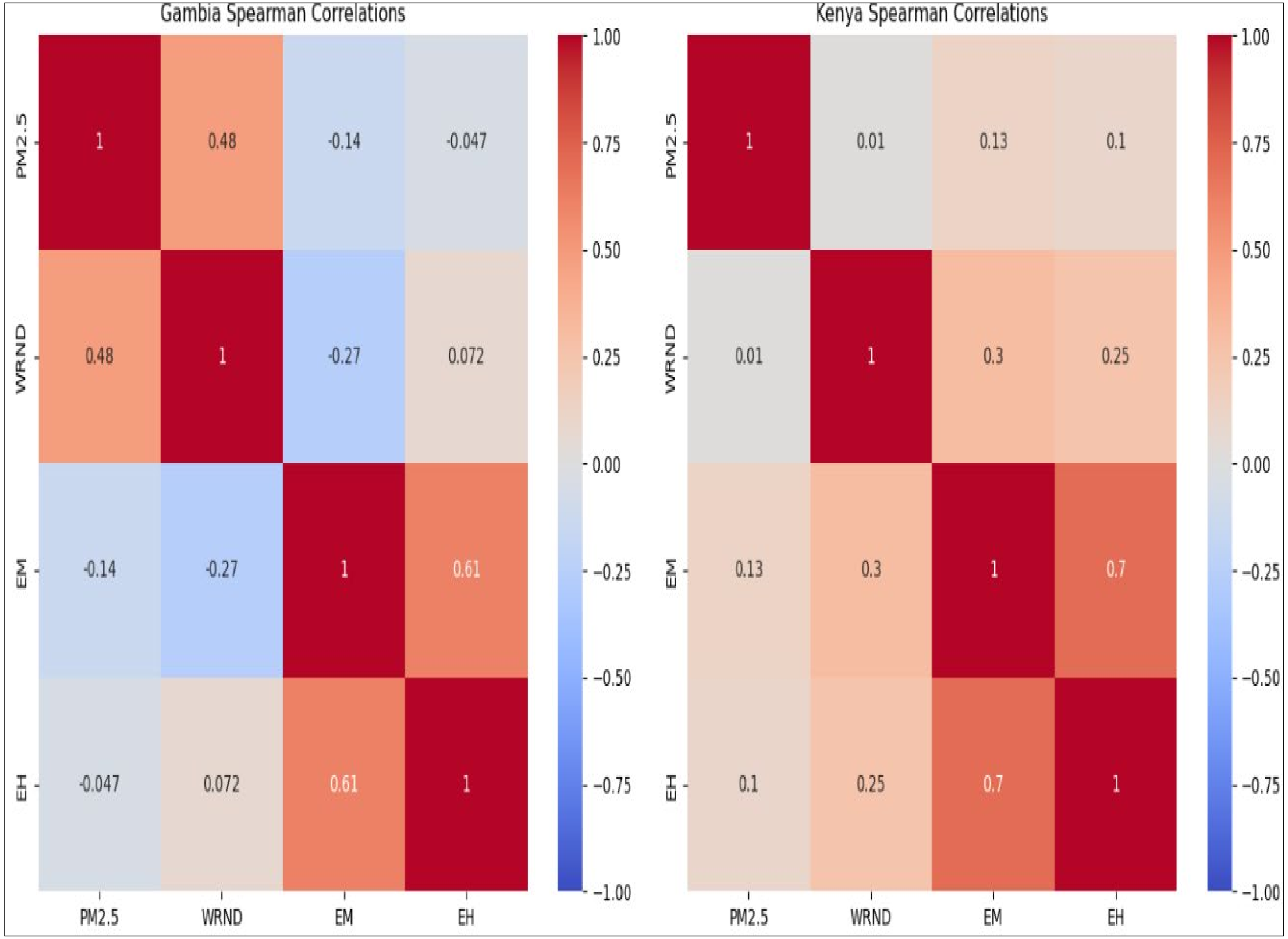
Correlation Analysis

There was **positive association** between **WRND and exposure data in both countries** confirming initial hypothesis

negative correlations were observed between **EH &, EM** and Exposure data in the 2 countries

Weak **Positive correlations** between **EH ,EM, and PM 2.5 data** were observed in **Kenya** suggesting that **other factors** are also contributing to exposure in Kenya .

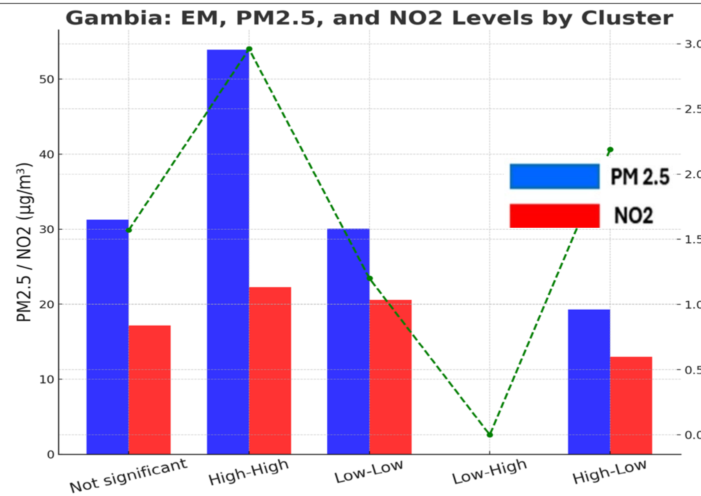


Moran I and Cluster Analysis

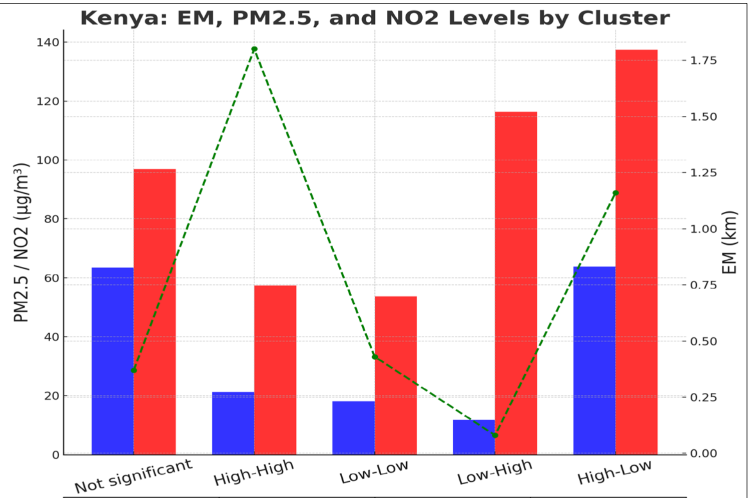
All the proxy indicators were **autocorrelated**.

WRND cluster analysis results confirm that increase in wrnd **increases PM 2.5 &No2** exposure

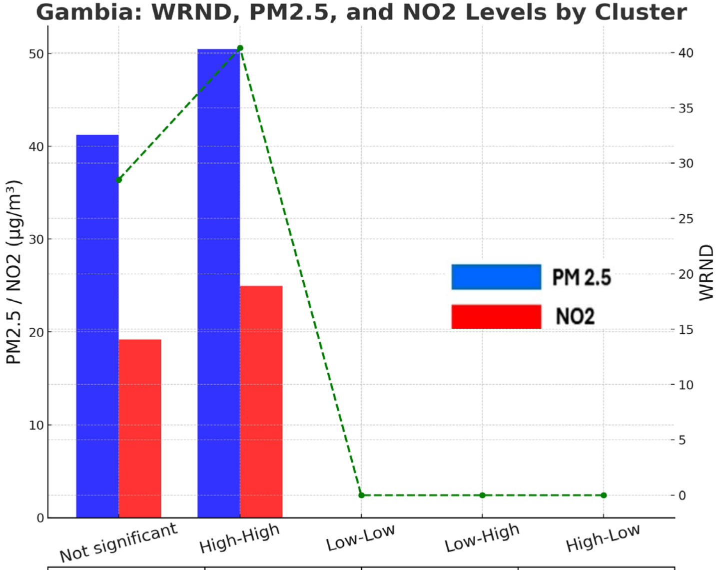
EM cluster analysis confirms that **lower values of EM** are associated with **high values for PM2.5 and No2** exposure.



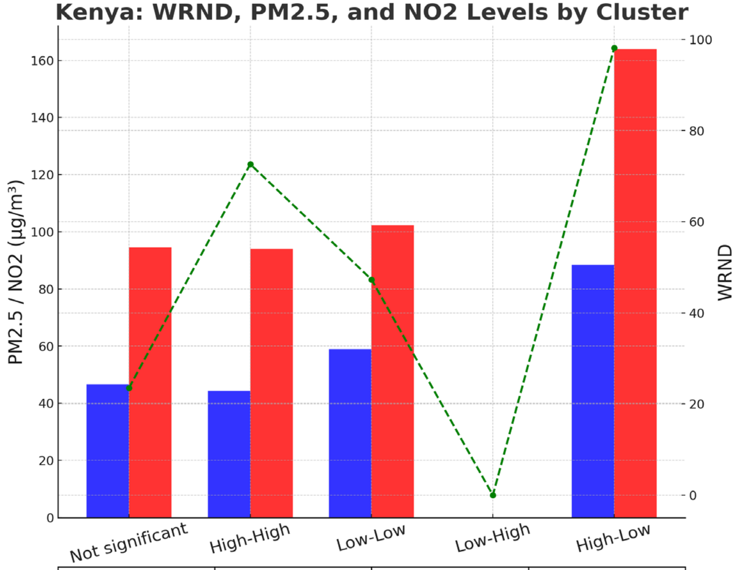
Cluster	PM2.5	NO2	EM
Not significant	31.25	17.18	1.57
High-High	53.92	22.28	2.96
Low-Low	30.08	20.58	1.2
Low-High	0.0	0.0	0.0
High-Low	19.3	13.01	2.19



Cluster	PM2.5	NO2	EM
Not significant	63.43	96.88	0.37
High-High	21.25	57.47	1.8
Low-Low	18.1	53.73	0.43
Low-High	11.8	116.38	0.08
High-Low	63.83	137.35	1.16



Cluster	PM2.5	NO2	WRND
Not significant	41.24	19.19	28.52
High-High	50.5	24.97	40.41
Low-Low	0.0	0.0	0.0
Low-High	0.0	0.0	0.0
High-Low	0.0	0.0	0.0



Cluster	PM2.5	NO2	WRND
Not significant	46.6	94.6	23.51
High-High	44.4	94.06	72.63
Low-Low	58.87	102.24	47.32
Low-High	0.0	0.0	0.0
High-Low	88.5	163.98	98.13

Single Variable Spatial Regression

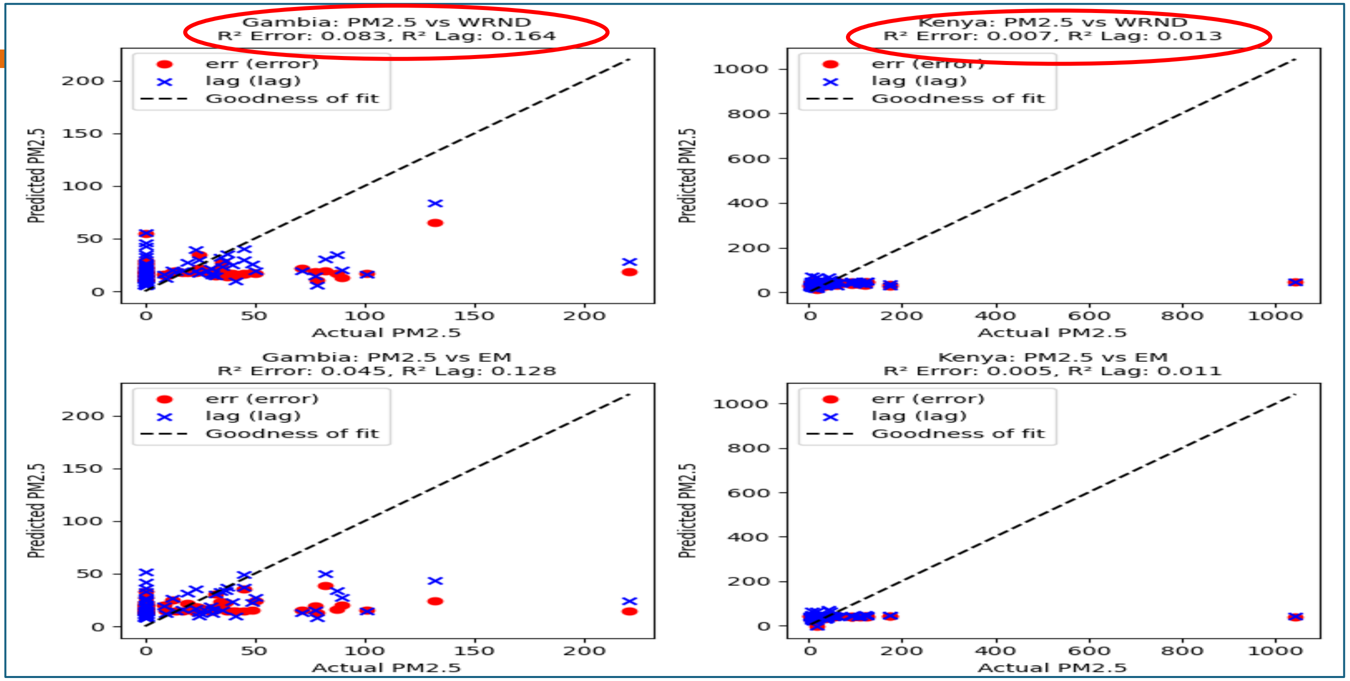
The **WRND regression** models predicted **PM 2.5 better** than other models in **Gambia (R-sqr(0.1-0.17, *p-value 0.001*)**

The **EH and EM regression** models predicted **No2 better** than other models **in Kenya (R-sqr (0.03-0.14), *p-value 0.001*).**

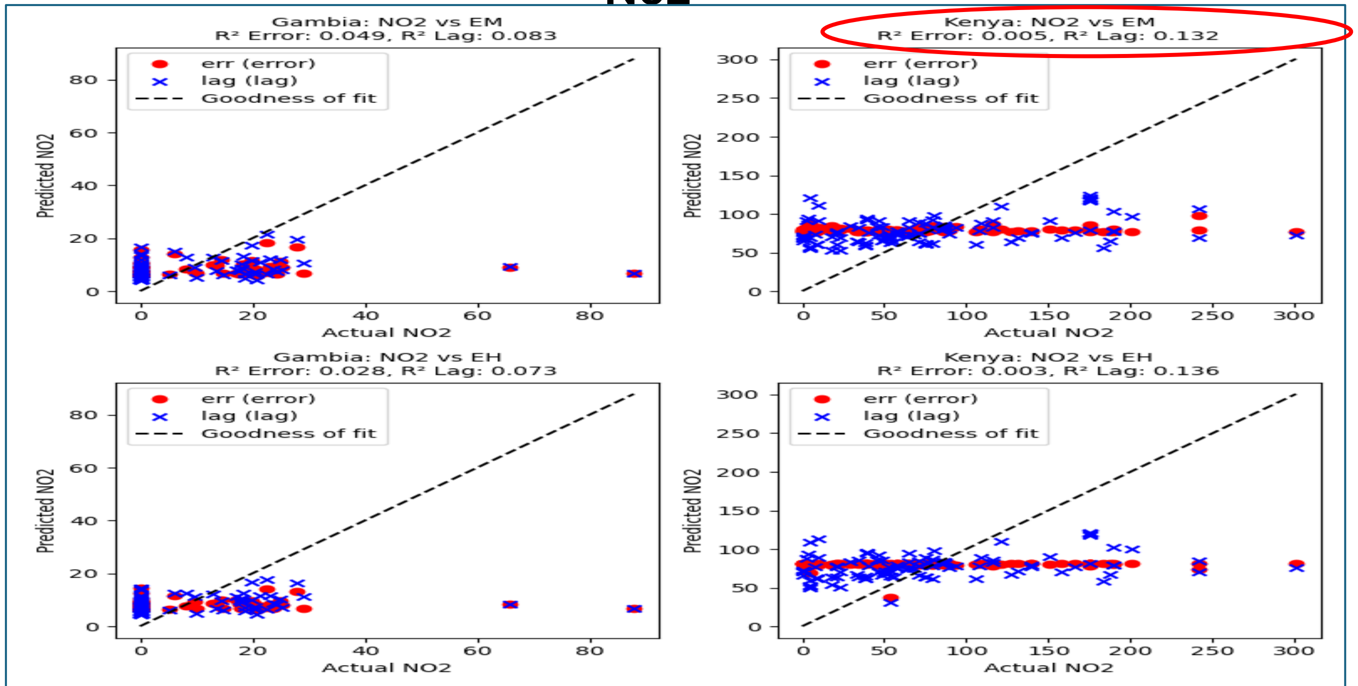
Generally, the **spatial lag model** performed **better** than the spatial error model in the 2 study countries.

Proxy indicators predict **PM 2.5 better** than No2 in the two regions.

PM 2.5



No2

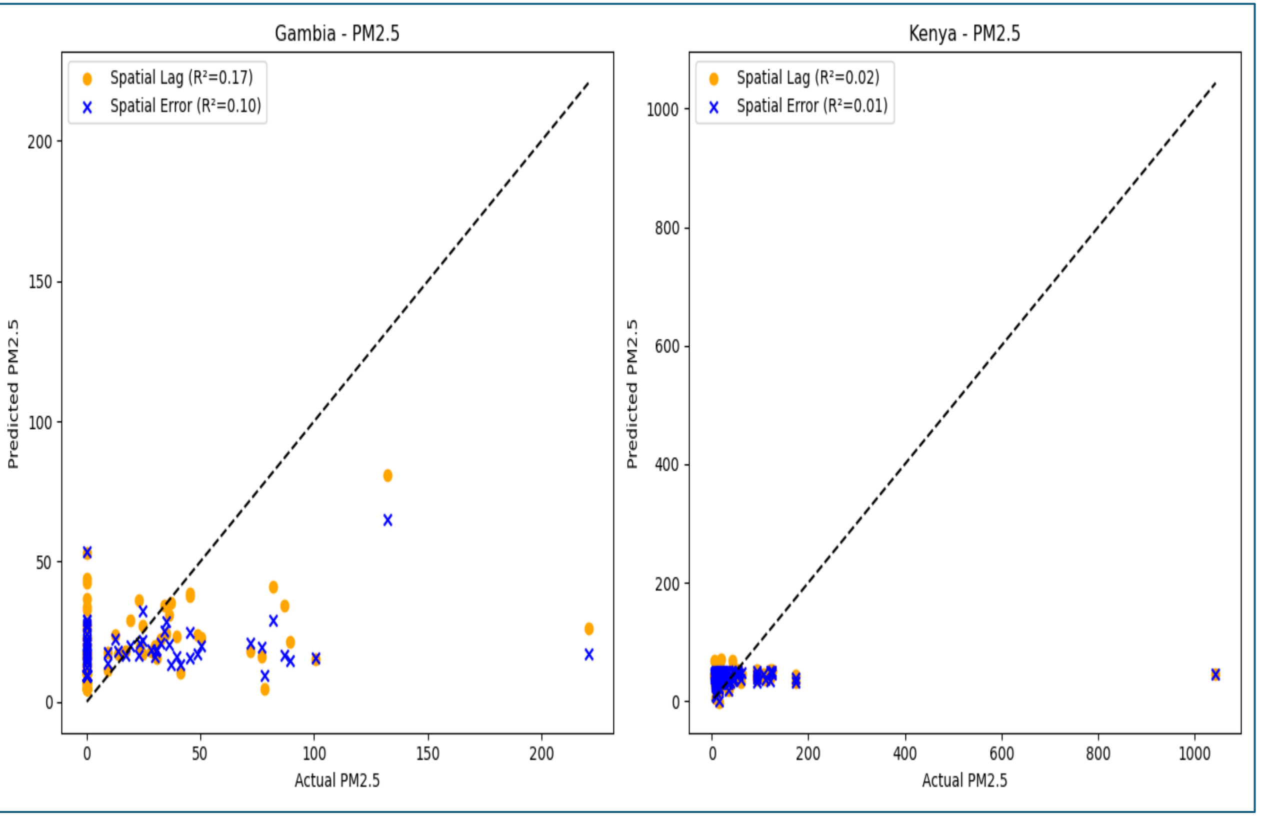


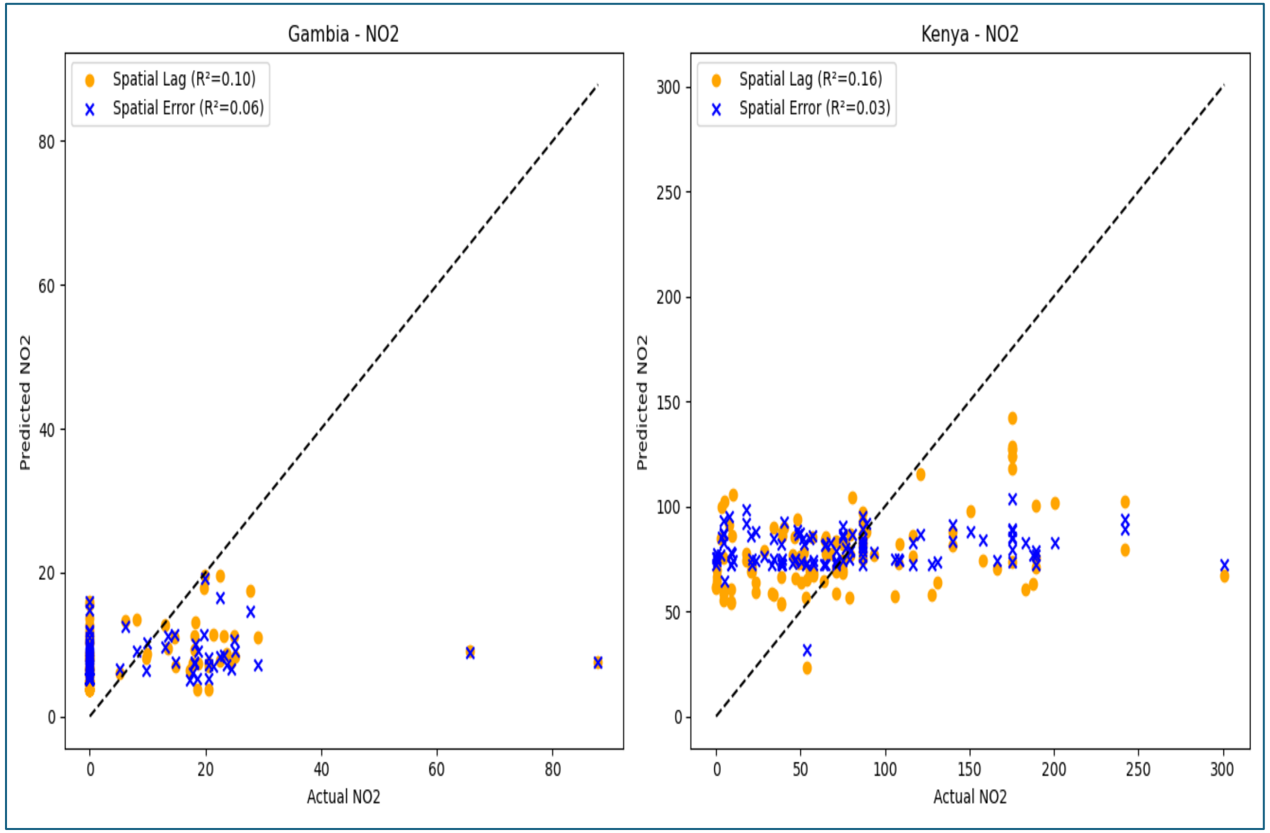
Multi variable (EH,WRND&EM Spatial Regression –PM 2.5

All regression models predicted PM 2.5 better in Gambia **(R-sqr(0.1-0.2, *p-value 0.001*)**

All regression models predicted No2 better in Kenya **(R-sqr (0.03-0.2), *p-value 0.001)***

Generally the spatial lag model performed better than the spatial error model in the 2 study countries.





Conclusion and way forward

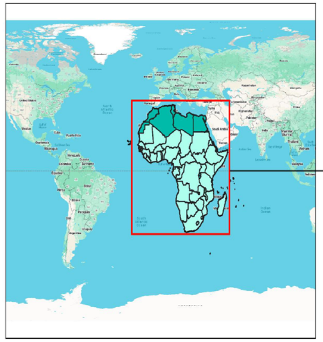
Correlations tests suggest a **positive relationship** between personal exposure and WRND, whilst the EH and EM relationship was **negative.**

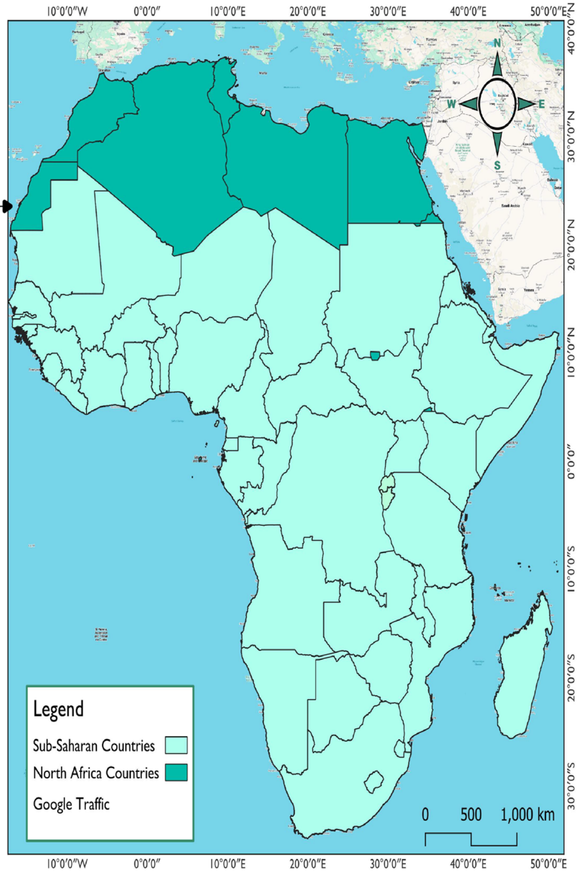
Spatial lag model emerges as a more **reliable predictor** for PM 2.5 and NO2 .

LISA analysis suggests that there was **spatial clustering and outliers** ,hence there is a need to **integrate** with other datasets such as **land use.**

Results can be **upscaled** to other countries if Road network density and population datasets are available.

Need to develop and include other proxy indicators such as NDVI , socio–economic factors , AOD, Land use





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Tatenda,Asante, Siyabonga, Enkosi, አመሰግናለሁ (amesegenallo), Na gode, Dalu, E se, Meda wo ase, Mahadsanid, Kea leboha, Dankie, Merci, Obrigado, Thank you,) شكرًا shukran).

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