GEOGRAPHICALLY WEIGHTED REGRESSION (GWR) FOR THE ENVIRONMENTAL DATA

DR RUOYU WANG

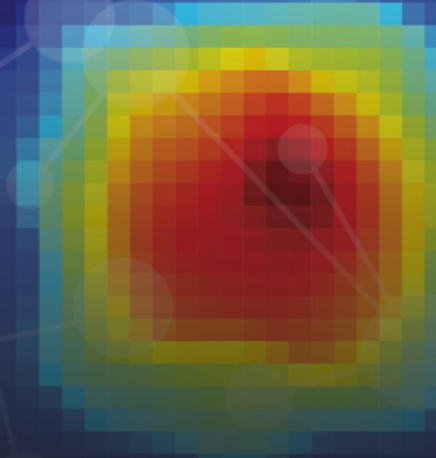**SPACE**

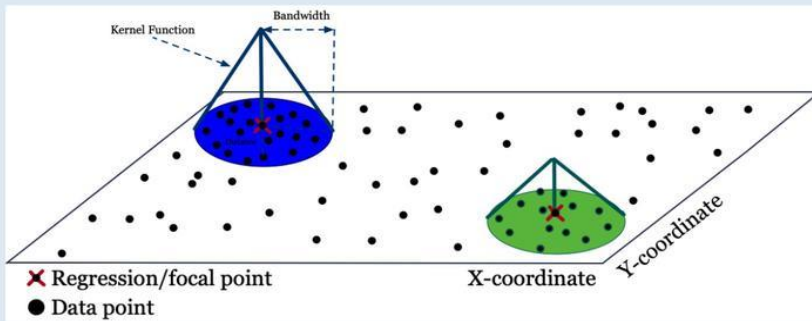SUPPORTIVE ENVIRONMENTS FOR PHYSICAL & SOCIAL ACTIVITY, HEALTHY AGEING & COGNITIVE HEALTH

Multiscale Geographically Weighted Regression

Add spatial heterogeneity and scale via the MGWR model

$$g(y_i)_{0,T} = \beta_{0i(Y_i,X_i)}^{BW(0)} - \beta_{1i(Y_i,X_i)}^{BW(1)} log(y_i)_0 + \sum_{j=1}^{k} \beta_{ji(Y_i,X_i)}^{BW(j)} (x_{ji})_0 + \epsilon_i$$

We can study an effect's direction, magnitude, location, and scale

(Carlos Mendez, 2021)

Geographically weighted regression (GWR) is a spatial analysis technique that takes non-stationary variables into consideration (e.g., climate; demographic factors; physical environment characteristics) and models the local relationships between these predictors and an outcome of interest.
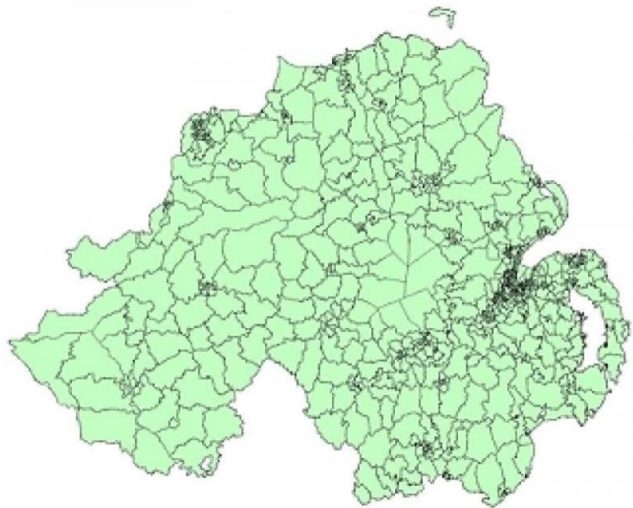
CASE STUDY

Title: Examining the spatially varying and interactive effects of green and blue space on health outcomes in Northern Ireland using multiscale geographically weighted regression modelling

Super Output Area

Research area: Super Output Areas (SOAs) were a new geography that was developed NISRA to improve the reporting of small area statistics in Northern Ireland (NI).

Economic
and Social
Research Council

Healthy Ageing Challenge
Social, Behavioural and
Design Research

DATA

The proportion of grassland

The proportion of woodland

The proportion of waterbody

Green space

Blue space

UKCEH Land Cover Maps

DATA

Aggregate health data was collected from 2017 Northern Ireland Multiple Deprivation Measure at the Super Output Area (SOA) level.
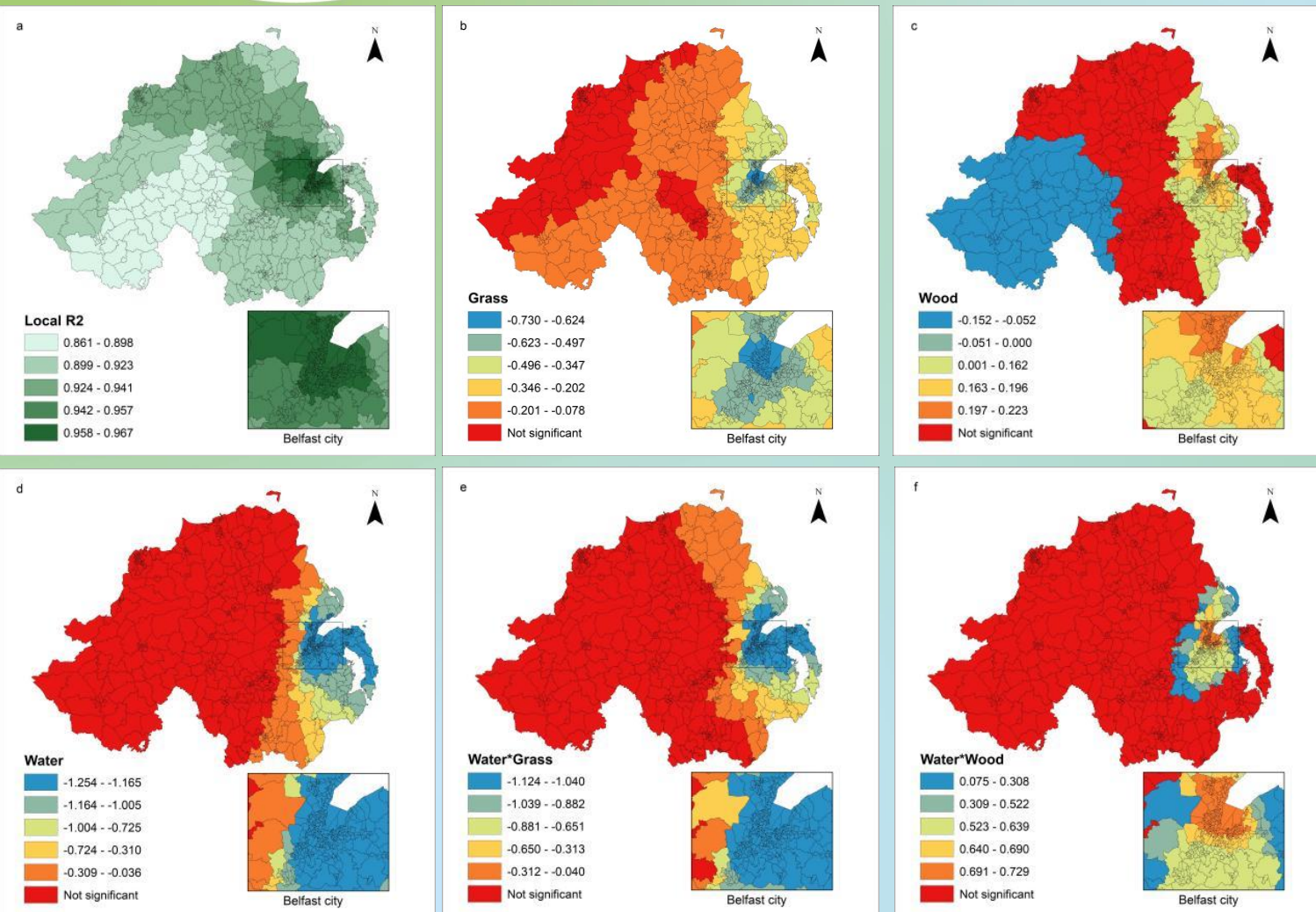
RESULT

Figure 2 Composite maps for MGWR parameter estimate surfaces of physical health-related burden model for a) Local R^2; b) Grassland; c) Woodland; d) Water body; e) interaction term between water body and grassland; f) interaction term between water body and woodland.
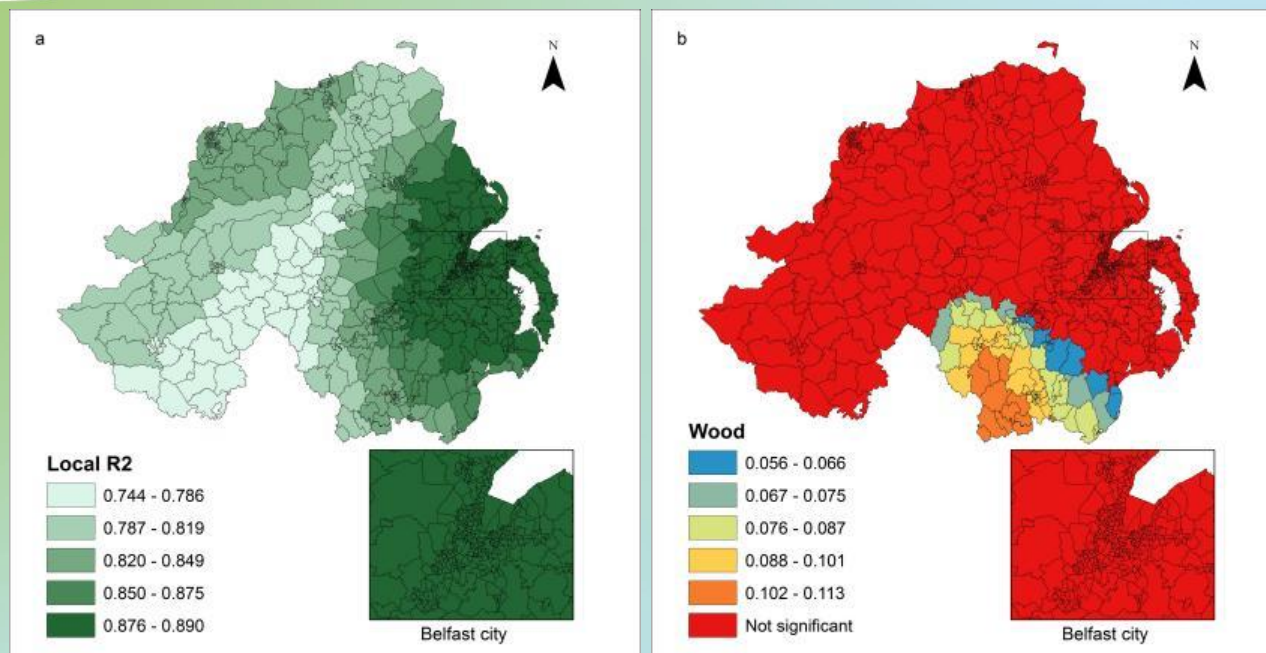
Figure 3 Composite maps for MGWR parameter estimate surfaces of ratio of people on multiple prescriptions on a regular basis for a) Local R2; b) Woodland.
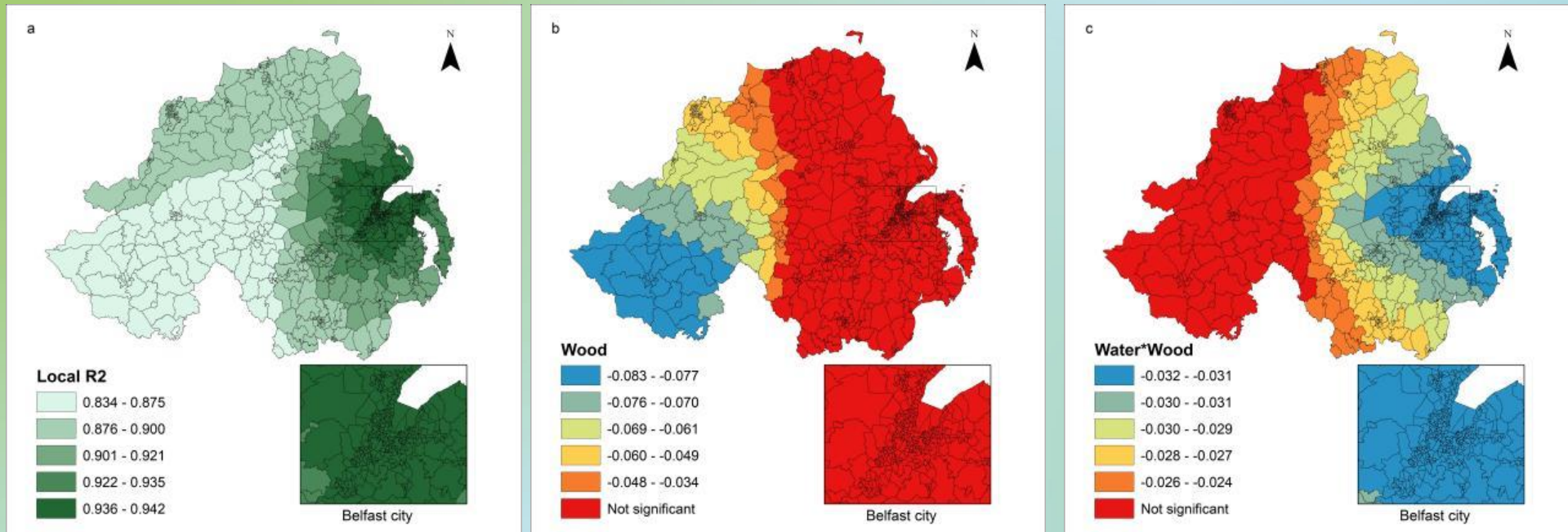
Figure 4 Composite maps for MGWR parameter estimate surfaces of ratio of people with a long-term health problem or disability for a) Local R2; b) Woodland; c) interaction term between water body and woodland.
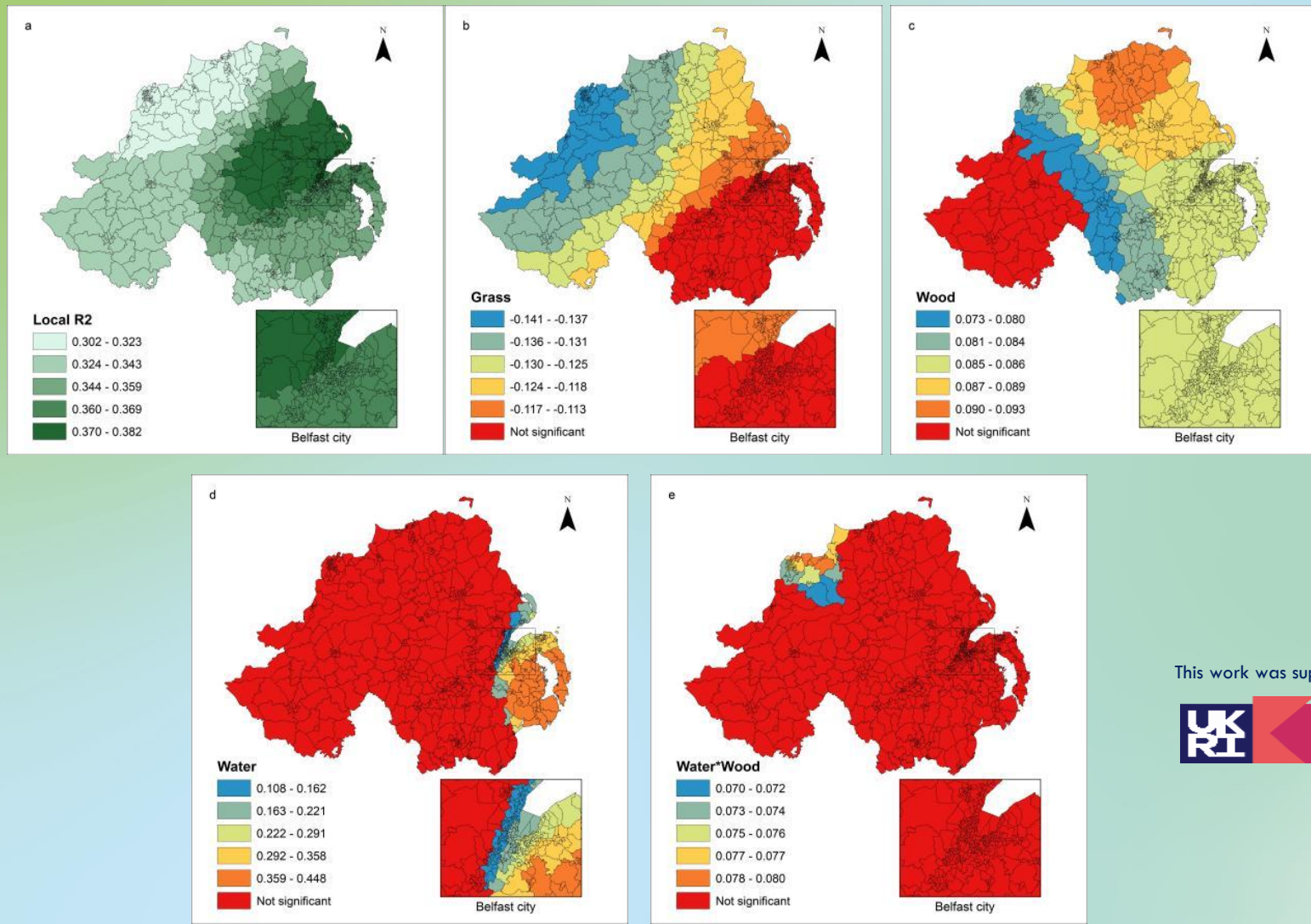
RESULT

Figure 5 Composite maps for MGWR parameter estimate surfaces of ratio of people registered as having cancer for a) Local R2; b) Grassland; c) Woodland; d) Water body; e) interaction term between water body and woodland.

RESULT

Results indicate that associations were distributed zonally, with green and blue spaces in eastern areas of NI more strongly associated with health outcomes than in western areas. Within these large regional zones, further spatially varying effects of different green and blue spaces were observed. Grassland was generally positively associated with some health outcomes (e.g. less preventable death ratio, cancer registrations ratio, multiple prescriptions ratio, and long term health problem or disability ratio), while the results of woodland and water body were mixed. Water bodies were found to strengthen the effect of woodland and grassland.

SPACE

DISCUSSION

Super Output Area

-The green and blue space model fits well in East NI, especially in Belfast City and its surrounding areas.

-Green and blue space have different effects on health outcomes. Grassland is generally positively associated with health, while the results of woodland and water bodies are mixed. The mixed results might be because people with poorer health are more willing to move to areas with more woodland and water bodies.

Correlation
≠
Causation
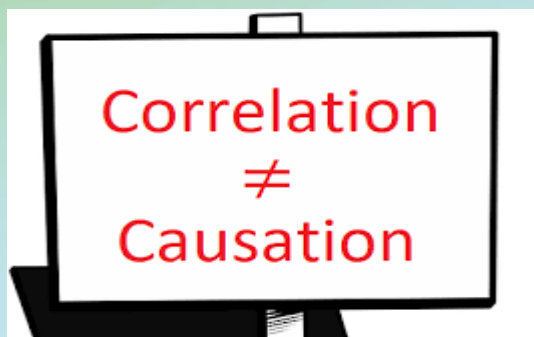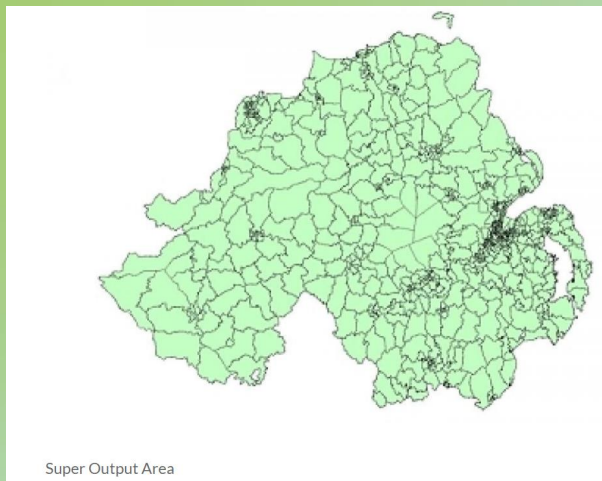
DISCUSSION

-Water body strengthens the effect of woodland and grassland on health.

The richness of different natural elements may enhance the sense of naturalness, so it is important to further understand whether biodiversity and presence of wild animals also strengthen the effects of green and blue spaces

MORE INFORMATION

Please cite: Wang, R., Grekousis, G., Maguire, A., McKinley, J. M., Garcia, L., Rodgers, S. E., & Hunter, R. F. (2023). Examining the spatially varying and interactive effects of green and blue space on health outcomes in Northern Ireland using multiscale geographically weighted regression modeling. Environmental Research Communications, 5(3), 035007.