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Predicting informal food vendor distributions in Kuala Lumpur using maxent: A spatial modelling approach for urban food environment research

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Abstract

Informal food vendors are a prominent feature of urban food environments in the Global South, shaping food accessibility and availability. Amidst rapid urbanisation and development, informal food vending continues to thrive due to high consumer demand for its accessible, affordable and convenient food offerings. Food environment research often utilises Geographic Information Systems (GIS) to examine the geography and spatial distribution of food outlets to understand its associations with population health. However, informal food vendors are systematically underrepresented in spatial food environment datasets due to their fluid and mobile operations which are challenging to document. Yet, excluding the informal food vendors and their spatial distribution create an incomplete or inaccurate picture of the overall food environment, potentially leading to flawed decision making to improve food environments and ultimately population health. To address these gaps in current data and knowledge systems, this study aimed to introduce a methodological framework which applies MaxEnt, a machine learning based species distribution model to predict informal food vendor distribution in Kuala Lumpur. To ensure a robust data system, occurrence data was collected across both high and low population density areas to minimise sampling bias and spatial clustering. A spatially explicit probability surface of informal food vendor distribution in Kuala Lumpur was modelled based on key environmental, socio-economic, and built environment predictors. The MaxEnt model showed strong discriminatory performance, assessed using the area under the receiver operating characteristic curve (AUC = 0.705) in distinguishing vendor presence from background conditions. Proximity to formal food outlets, population density, proximity to train stations and land use land cover (integrating remote sensing data to capture urban land use change) were the strongest contributors to predict vendor suitability. These findings demonstrate that applying digital modelling tools such as MaxEnt can generate spatially explicit suitability maps for informal food vending, providing a scalable and replicable approach to support urban food environment assessment and guide data driven decision making in Global South cities.

Keywords: Food environment, Global South, informal food vendors, maximum entropy modelling, spatial analyses, spatial modelling

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