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# Landscape ecology, land-use structure, and population density: Case study of the Columbus Metropolitan Area

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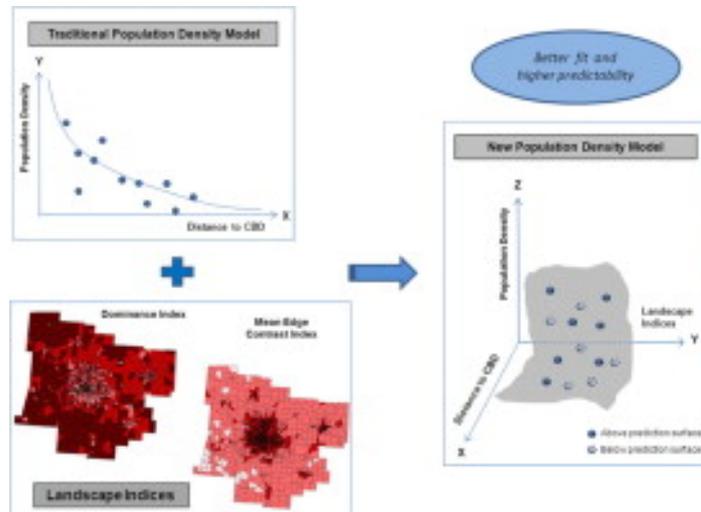
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### Abstract

Traditional population density models based on the distance to the major Central Business District (monocentric) or on distances to multiple employment centers (polycentric) are extended to include land-use structure variables derived from landscape ecology theory. A comprehensive database is developed for the Columbus Metropolitan Area (CMA) at the Traffic Analysis Zone (TAZ) level, using remotely sensed land-use data, Census socio-economic data, and other local data. Fifteen landscape indices, organized into four groups “size, complexity, diversity, neighborhood” are computed for each of the 1763 CMA TAZs, using Fragstats. Models are estimated for each of the 7 CMA counties separately, yielding homogeneous and consistent results. These county models are then pooled into a comprehensive CMA model, with dummy variables and second-order terms. Overall, the results provide evidence of a polycentric

structure, with both downtown Columbus and county CBDs acting as strong population attractors, and of the importance of land-use structure in the determination of population density. Spatial indices representing neighborhood and diversity factors significantly impact population density in most counties.

## Graphical abstract



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## Highlights

- A new population density model combines traditional distance variables with land-use structure variables derived from landscape ecology theory.
- A GIS is used to integrate remotely-sensed land-use data with Census socio-economic data.
- Fifteen landscape indices are considered for inclusion into the model.
- Models are estimated at both county and metropolitan level.
- Spatial indices representing neighborhood and diversity factors have a significant impact on population density.



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## Keywords

Population density; Urban modeling; Landscape ecology; Land use; GIS; Quantitative analysis

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**Jia Lu** is an assistant professor at Valdosta State University. She received her Ph.D. in city and regional planning from The Ohio State University. She also holds a master degree in Community Planning from University of Cincinnati. Her research interests focuses on urban modeling, urban planning, GIS, environmental studies, and geography. She has published a book and a few book chapters regarding these issues.

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