

Assessing the Timing, Location, and Mechanisms of Agricultural Conversion to Different Residential Landscape Types in Southeastern Michigan

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Paper Abstract: Residential land-use expansion is one of the most important components of urban sprawl, with a variety of environmental and ecological implications. The timing, location, and mechanisms of such expansion, though addressed separately, have seldom been studied as a whole due to technical or data-acquisition difficulties. This research addresses this issue using an approach that accommodates interdisciplinary data and methods. Using land-parcel data and a residential landscape classification interpreted from aerial imagery between 1960 and 2000 for eight townships in southeastern Michigan, we sampled 854 land parcels (4% of the total) and classified them into four residential landscape types, i.e., rural lots (RL), country subdivisions (CS), horticultural subdivisions (HS), and remnant subdivisions (RS). Using spatial analysis functions in GIS, we derived the geographical and environmental characteristics of each parcel. Socioeconomic features of each parcel were collected from US census data aggregated at the township level for the same time frame. We then implemented survival analysis to detect the temporal trend of the hazards of different residential landscape types, and how these hazards are linked to the socioeconomic and geographic factors. We found (1) the hazards vary over time and between landscape types, e.g., rates of HS and RS development increased after 1990, while CS did not; and (2) the evolution of these residential types over time and space can be explained by different types of factors, e.g., RL is explained by socioeconomic factors like population density and population growth rate, while HS by geographical and environmental factors like distance to highway and slope. In addition to identifying variables and relationships that may have policy implications in sustainable land-use management, our model results suggest that integration of survival analysis with GIS methods and remote sensing data is an effective approach in modeling land-use and land-cover changes, especially when the timing of such changes is also of concern.

Topic Area: Human Influences on Landscape and Watershed Processes

Key Words: Residential land use; Survival analysis; Socioeconomic driving forces; GIS.