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# Preface: Population estimation using remote sensing and GIS technologies



Knowledge of the size and distribution of human population is essential for understanding and responding to many social, political, economical and environmental problems (Liu 2003). In the United States, the decennial census is the primary source of demographic data. Although the US Census Bureau conduct census surveys at the household level, they only release the data by aggregated enumeration units to preserve the confidentiality of original respondents. Currently, the finest census-population data available to the public is at the block level. In addition, detailed and accurate population and socioeconomic information is only available for one date per decade through the national census. Even the new American Community Survey (ACS) of the Bureau of the Census does not provide the timely local-level detail that is often needed. Therefore, the generation of accurate and frequent inter-censal population estimates, particularly in rapid growth areas, is critical for public- and private-sector planning (Smith *et al.* 2002).

Remote sensing and geographic information systems (GISs) have long been used to estimate population, particularly for large areas. Wu *et al.* (2005) provided a comprehensive review of most of the studies in this direction before 2005. They grouped all the relevant methods into two different categories: (1) areal-interpolation methods and (2) statistical-modelling methods. In terms of the remote-sensing data that have been employed, the earliest application of remote sensing for population estimates involved manually counting the number of houses using aerial photos (Lo 1986a,b). Thereafter, automatic approaches with satellite remote-sensing imagery have been proposed for estimating population density (Lo 1995). Since 1999, with the launch of the IKONOS satellite, the so-called 'very-high-resolution' (VHR) satellite sensors, with metre or sub-metre resolutions, have offered tremendous new opportunities to investigate urban physical configurations at a fine spatial scale, such as at the individual-housing level. In addition, airborne Light Detection and Ranging (LiDAR) has become a widely used technology for deriving high-resolution vertical information in urban studies. However, the integration of the two sensors for refining population estimation has been little reported to date.

This special issue of the *International Journal of Remote Sensing* includes nine papers that focus on recent developments in population estimation using innovative remote-sensing and GIS technologies. Among them, three papers (Dong *et al.* 2010, Lu *et al.* 2010, Silván-Cárdenas *et al.* 2010) showcase small-area (census-block level) population estimation with integrative use of LiDAR and optical remote sensors. Two papers (Azar *et al.* 2010, Kim and Yao 2010) introduce new dasymetric methods for deriving population estimates at refined spatial resolution. Deng *et al.* (2010) introduce a method to estimate housing units and persons per household by incorporating GIS, remote-sensing and demographic data. Zhan *et al.* (2010) present a geographic-knowledge-guided cellular-automata model for understanding population growth in small geographic areas. Lang *et al.* (2010) investigate population dynamics with time-series QuickBird imagery. Anderson *et al.* (2010) explore the relationship between population density and nighttime imagery.

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