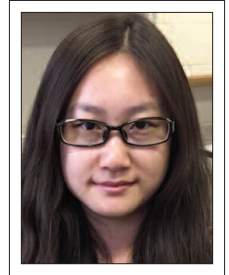


# EXAMINING URBAN EXPANSION IN THE GREATER TORONTO AREA USING LANDSAT IMAGERY FROM 1974–2014

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*The Greater Toronto Area is the most vital economic centre in Canada and has experienced rapid urban expansion in the past 40 years. This research uses Landsat images to detect the spatial and temporal dynamics of urban expansion in the Greater Toronto Area from 1974 to 2014. We quantitatively analyzed the extent of urban expansion and spatial patterns of growth from classified Landsat images. We then integrated our expansion findings with population data to observe the relationships between urban growth and population. We found that the Greater Toronto Area had significant growth of 1115 km<sup>2</sup>, expanding mainly in radiated and ribbon expansion modes. There was substantial correlation between urban extent and population in the period of study. These results demonstrate the efficacy of combining statistical population data with remote sensing imagery for the analysis of urban expansion.*

*La région du Grand Toronto est le centre économique le plus important au Canada et a connu une expansion urbaine accélérée au cours des 40 dernières années. Cette recherche utilise des images Landsat pour détecter les dynamiques spatiale et temporelle de l'expansion urbaine de la région du Grand Toronto entre 1974 et 2014. Nous avons analysé, sur le plan quantitatif, l'expansion urbaine et les tendances spatiales de croissance à partir des images Landsat classifiées. Ensuite, nous avons intégré nos résultats aux données de population afin d'observer les liens entre la croissance urbaine et la population. Nous avons déterminé que la région du Grand Toronto avait connu une importante croissance de 1 115 km<sup>2</sup> de même qu'une expansion principalement dans les modes en rayonnement et en ruban. Il y a eu une importante corrélation entre l'étendue urbaine et la population pendant la période étudiée. Ces résultats démontrent à quel point il est efficace de combiner les données statistiques de population et les images de télédétection pour analyser l'expansion urbaine.*



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## 1. Introduction

Urbanization represents the absorption of less developed areas, such as agricultural and forest land, by built-up areas, such as residential and commercial land. Some researchers suggest that urban expansion is an indicator of a region's economic vitality [Yuan *et al.* 2005]. Urban expansion is typically a product of the development of suburban areas into high-density built-up areas and the replacement of rural areas with low-density built-up areas. Urban expansion not only affects the economics in the region, but also influences ecosystem balances, as reflected in changes in water quality and receding agricultural and forest areas [Squires 2002]. As a result, studies of urban expansion are quite important for local or regional planners, as well as policy makers in helping them

to make reasonable and effective decisions for planning, environmental management, and land resources integration [Yuan *et al.* 2005; Dewan and Yamaguchi 2009].

Decision-makers require the latest geographical information on urban sprawl patterns in both quantitative and qualitative ways; therefore, it is important to keep geospatial information of urban expansion up to date. In recent years, remotely-sensed images have become a great data source for urban expansion research. There are an increasing number of studies that focus on using remote sensing technology to monitor urban dynamic changes. Some studies have shown that remote sensing can provide an accurate measure of land use and land cover (LULC) changes, which are