

Improving Census-based Socioeconomic GIS for Public Policy: Recent Immigrants, Spatially Concentrated Poverty and Housing Need in Vancouver

Rob Fiedler, Nadine Schuurman and Jennifer Hyndman¹

Department of Geography, Simon Fraser University,
Burnaby, BC, Canada V5A 1S6

Email: rfiedler@sfu.ca | nadine@sfu.ca | hyndman@sfu.ca

Abstract

There are a number of socioeconomic phenomena that are difficult to discern using only census data. We present an innovative approach developed to discern the spatial dimensions of risk for homelessness amongst recent immigrants in Vancouver, Canada. Dasymetric mapping and a postal survey are employed to improve the resolution and utility of census data. The results illustrate the potential for developing a more nuanced understanding of the spatial dimensions of complex socioeconomic phenomena using a combination of secondary data and primary data. It is argued that higher-resolution data aids in identifying and understanding socioeconomic phenomena that are highly localized and misrepresented by coarsely aggregated data. Finally, the potential for population surveillance is discussed and weighed against the benefits for policy-makers, non-governmental organizations, and researchers.

¹ © Rob Fiedler, Nadine Schuurman and Jennifer Hyndman, 2006

Introduction

Data describing the socioeconomic and demographic characteristics of areas and populations remain the “essential backbone” of empirical social science studies (O’Sullivan, 2004). Indeed, census data is often relied upon as “framework” data in social scientific research using geographic information systems (GIS). Its elevated status is due to widespread use - as one of the few comprehensive sources of ‘mappable’ statistics. While it is not possible to provide a precise accounting of census data usage, it is safe to consider its role ubiquitous in academic and policy-oriented research employing GIS.

Crampton (2004) suggests that the automated mapping functionality of GIS software has reinstated the problematic practice of census mapping to represent—and manage—populations. Crampton advocates reintroducing dasymetric mapping practices to socioeconomic GIS to improve the representation of populations. A dasymetric mapping approach uses ancillary data sources like landuse and remotely sensed imagery, in conjunction with high-resolution census data, to produce more meaningful spatial units for mapping (Eicher and Brewer, 2001). While GIS enables fast and efficient choropleth mapping of census data, GIS methods also facilitate dasymetric mapping. In this study dasymetric mapping was used as a tool to highlight the combination of housing stress and new immigration.

In Canada, the relationship between sustained immigration, the concentration of new immigrants in just a few cities (Montreal, Vancouver, and Toronto), and the resulting urban and social change produced, has attracted considerable research attention (see Hiebert, 2000). Increasing levels of immigrant poverty and unaffordable housing are cited as barriers that new immigrants (and refugees) face in obtaining suitable housing (Mattu, 2002; Miraftab, 2000; Murdie, 2004; Statistics Canada, 2003). The combination of poverty and unaffordable housing may leave many new immigrants precariously housed and at-risk for economically induced homelessness (Bunting, Walks, and Fillion, 2004). Although studies have examined the spatial association of immigrants with concentrated poverty and deprivation (see Kazemipur and Halli, 1997; Ley and Smith, 1997, 2000), less is known about their presence in areas of severe housing need.

A GIS approach was developed to identify areas where concentrations of poverty, deprivation, and housing need intersect with recent immigrants. A dasymetric approach to census mapping was implemented using municipal landuse data, remotely sensed imagery and high-resolution small-area census data. The resulting cartographic representations reveal the existence of geographically dispersed, but highly localized concentrations of poverty, deprivation, and housing need. It is shown that these concentrations are frequently more localized than, or

imperfectly matched to, census tract geography, rendering them invisible in cartographic or statistical results at this spatial resolution.

In addition a postal survey was conducted to complement the findings of the GIS analysis. Census areal units that showed potential for hidden homelessness amongst recent immigrants were identified by GIS analysis. Final selection of two tracts was made using local knowledge, and site visits were used to better understand the housing conditions of residents. This mixed approach provided rich and disaggregate household level data, as well as the opportunity to ask residents more directly about their housing situations than the census alone reveals. Based on these data, we were able to conclude that spatial concentrations of poverty, deprivation, and housing need intersect with highly localized concentrations of low-quality/low-cost housing supply – some of which are associated with recent immigrants.² There are a number of background issues that bear on this research. The paper begins by describing socioeconomic GIS and its role in geographic governance, which is followed by a brief discussion of the issues facing new immigrants to Canada. We then present details of the study and methodology, and conclude with a discussion of the implications of using such high resolution data as an adjunct to census data.

Socioeconomic GIS

A great majority of GIS use in social science employs very simple cartographic techniques. Martin (2003, 305) describes this convention pointing out “[t]he majority of non-academic use of socioeconomic GIS rarely moves beyond the level of shaded area census mapping, yet these representations of people and their characteristics provide some of the most emotive GIS outputs, particularly in the realm of geodemographic classification.” Businesses use GIS in the form of geodemographics, because the resulting maps provide a useful ‘abstraction’ of the world that helps them make decisions and ‘target’ market (Harris et al., 2005; Longley, 2003; Longley and Harris, 1999). Outside the academic community, and sometimes within it, census mapping is often seen as being—all there is to—socioeconomic GIS.

The use of GIS for market research has prompted serious epistemological and methodological critiques, as well as privacy concerns (see Curry, 1997; Goss, 1995a, 1995b). It has been argued (recently) that geographers be ‘pragmatic’ and incorporate geodemographic classification and ‘lifestyles’ data into their analyses

² In the Canadian census, ‘recent immigrants’ refers specifically to immigrants who have arrived since the last census (within the last 5 years).

of urban systems (see Longley, 2003; Longley and Harris, 1999). O'Sullivan (2004) is sceptical about the potential of 'lifestyles' data for analysis, pointing out that it is not freely available, is usually irretrievably flawed from a statistical perspective, and is often poorly maintained, while others have voiced concern about their possible impact on individual privacy rights (see Curry, 1997). Goss (1995b, 182) focuses on the 'strategic intent' of geodemographic systems, noting that GIS's promotional discourse is "replete with metaphors of vision, insight, omniscience, prediction, manipulation, and control." Geodemographics and socioeconomic GIS typified by systematic area (neighbourhood) classification engage in what Pickles (2004) calls the 'cartographic gaze' characterized by Cartesian perspectivalism, ocularcentrism, and the epistemology of the grid.

Academic studies that employ census mapping to identify (and label) areas/neighbourhoods by ethnicity, immigrant status, visible minority status, or as being deprived, impoverished, or at-risk create power-laden images. While socioeconomic GIS research in the academic realm is motivated by very different impulses than the application of geodemographics in business or marketing, it shares similar societal implications. Goss (1995b) speaks to this problem, commenting he is less concerned with the issue of validity (whether or not geodemographics works), and does not rule out the possibility that it has benign uses, but is concerned that widespread usage of geodemographic classifications might actualize its models of social identity and residential structuring.

This is problematic given the important role of mapping in geographic governance (Crampton, 2004) where census mapping (facilitated by GIS) is used to identify and define problem areas for public policy development and action. While reservations about the use of socioeconomic GIS (and in particular geodemographics) exist, this has not slowed interest outside the confines of critical human geography for this type of analysis. Put simply "...the growing role of census mapping in the identification and definition of neighbourhoods and communities, and often in resource allocation and facility planning, ensures that policy-makers and the public are increasingly interested in the results of our analysis" (Martin, 2003, 305).

GIS and Governmentality

Crampton (2004) shows the use of thematic mapping has played a central role in enabling the state to shift the focus of governance from people to populations, by tracing their development and refinement since the late eighteenth century for political means. Taylor and Johnston (1995, 58) note, "the state represents a concentration of formal power that both facilitates and relies upon the collection of information." Censuses are a prominent element in the 'governmentalization of the state' as they provide the statistical information used to

determine public policy (Hannah, 2000). In conjunction with surveying and mapping, censuses are also a vital element in the establishment of ‘territorial mastery’ (Hannah, 2000) in which maps link law and population with territory, while simultaneously creating it (Wood, 1992). Censuses are a way to ‘see’ populations, rendering them legible, and manageable.

To ‘see like a state’ implies that “certain forms of knowledge and control require a narrowing of vision. The great advantage of such tunnel vision is that it brings into sharp focus certain limited aspects of an otherwise far more complex and unwieldy reality” (Scott, 1998, 11). Statistical representation is “political to the core”, and “the census is one of the contested sites upon which relations between the state and civil society are worked out” (Kobayashi, 1992, 513). Census taking involves using categories that are socially constructed, leading Kobayashi to suggest that the categories and the means of establishing categories be examined critically, as ‘statistexts’, that are created from competing representations that census takers must reduce into a singular representation (as problematic as this is).

Researchers or policy makers who use census data to develop indicators or indexes for identifying and measuring social phenomena such as deprivation, poverty or housing need to operate in a similar manner. Critical cartographies view maps as social constructions with embedded power relations that can be understood by what they conceal, subjugate, and/or silence (Crampton, 2001; Harley, 1989; Pickles, 2004). The appeal of census mapping is that it reduces the complexity of the real world into shaded-area patterns - with progressively increasing color intensity creating a visual ordering - that separates an overall population into groups visually. This reduces, simplifies, and generalizes information collected by censuses, which are already a reduction.

The plight of new immigrants: poverty, deprivation, and housing need

According to the most recent Canadian census, new immigrants are earning a lower proportion of the average Canadian wage in 2000 than in 1990; this is despite generally high education levels among new immigrants (see Statistics Canada, 2003). The deteriorating economic circumstances experienced by many new immigrants has been called the “new poverty” in Canada (Kazemipur and Halli, 2000) - one that is linked to global economic restructuring, and is spatially concentrated in neighbourhoods disproportionately inhabited by visible minorities and immigrants (Kazemipur and Halli, 1997). Ley and Smith (1997, 29) ask, “[a]t what point in this apparently deteriorating trajectory do immigrants then become a significant part of the growing poverty problem in Canada with its accompanying burdens of deprivation, homelessness, and welfare dependency?”

Canadian policy-makers are concerned that the incomes of recent cohorts of immigrants do not appear to be following the traditional pattern of gradual convergence with the national mean income (Picot, 2004). Others have noted that while new immigrants do experience significantly lower initial earnings than past cohorts, there is evidence that their earnings catch-up capacity is greater (Li, 2003) although highly dependant on entrance class (see CIC, 1998). Significantly lower initial earnings, when compared with non-immigrants, are particularly problematic because contemporary immigrants settle overwhelmingly in Canada's largest - and most expensive - cities (Hiebert, 2000). This has stirred concern that new immigrants might become entrapped in impoverished or deprived conditions like those described in American urban underclass studies (see Clark, 1998; Hughes, 1990; Wilson, 1987).

Finding suitable housing in a supportive community is seen as a vitally important part of successful immigrant settlement and integration (Murdie and Teixeira, 2003). There is no singular immigrant housing experience (Ray, 1994). Immigrants to Canada are diverse, both in terms of social and financial capital, as well as culturally, and this produces differing immigrant experiences (Ley, 1999). While it is inappropriate to conceptualize an 'average' or 'typical' immigrant in Canadian cities, there is good reason to expect that certain new immigrants are precariously housed and at-risk for homelessness. Murdie (2004, 147) points out "[f]or many newcomers, the process of finding appropriate housing is made more difficult by the lack of adequate financial resources, high housing costs, a shortage of rental vacancies, and discriminatory practices in the housing market."

Canada Mortgage and Housing Corporation's Core Housing Need model identifies households unable to access acceptable housing (CMHC, 1991).³ Analysis of immigrant households using 2001 census data revealed that while recent immigrants have lower incomes and homeownership rates, and higher rates of core housing need when compared to non-immigrants, the housing conditions of previous immigrant cohorts converge toward those of non-immigrants with increased residency in Canada (CMHC, 2004). Still the incidence of in core housing need for recent immigrant renters in Vancouver was 39.2% almost 10% higher than for non-immigrant renters, and the gap was even more extreme (35.0% to 16.9%) when all recent immigrant and non-immigrant households are used (CMHC, 2004). A recent CMHC report, on evolving housing conditions in Canadian cities, found recent immigrant households (and aboriginal households) in

³ The Core Housing Need model consists of, *adequacy*: a dwelling should need only regular repairs, or at most minor repairs; *suitability*: based on the National Occupancy Standard (NOS), the number of bedrooms require for a household based on its size and composition; and *affordability*: Shelter cost-to-income ratio must be below 30%. To be considered in core housing need a household must fall below at least one housing need indicator and have insufficient income to access housing meeting housing norms (CMHC, 1991).

core housing need tend to be more spatially concentrated than the incidence of core housing need more broadly (Engeland et al., 2005).

Defining at-risk areas: poverty, deprivation, and housing need

According to Bramley (1988, 24) “there is no single, simple definition of homelessness, but rather a range of definitions including partially overlapping approaches and categories...and we cannot assume that everyone agrees about the definition of homelessness.” Homelessness can be seen as “the end state of a long and complex social process and personal process...[t]he culmination of a long process of economic hardship, isolation, and social dislocation” (Wolch et al., 1988, 443). Households with low incomes must spend excessive amounts of their income for housing making them less able to weather difficult financial circumstances caused by family break-up, injury, illness or loss of employment leaving them at-risk for homelessness (Ringheim, 1990). Households that find themselves in this situation may also experience ‘shelter poverty’ where consumption of other non-shelter necessities is limited in order to pay the rent (Stone, 1993). In this context, at-risk homelessness refers not to those already homeless, but to those who are precariously housed (i.e. living in substandard housing, doubled-up, or paying excessive rent-to-income ratios) (Bunting et al., 2004). At-risk areas are defined as locations where concentrated poverty, deprivation and housing need intersect.

Canadian studies have already investigated the relationship between spatially concentrated poverty, deprivation and immigrants (Kazemipur and Halli, 1997; Ley and Smith, 1997, 2000; Smith, 2004), while the spatial dimensions of housing need has been examined, but not in an immigrant specific context (Bunting et al., 2004; Engeland et al., 2005). Immigrants have been linked to areas of concentrated poverty, defined by high-rates of low income, but linking immigrants to deprived areas has proven less conclusive. Ley and Smith (2000) found at best a weak link between concentrations of immigrants and deprivation in Montreal, Vancouver and Toronto using 1971 and 1991 census data, while a recent update using 2001 census data found the relationship strengthened over the last decade (Smith, 2004). In concluding Smith (2004) acknowledges two problems confronting this type of research: the scale of analysis, and the choice of indicators.

American studies of urban deprivation describe large contiguous areas of deep poverty and disadvantage concentrated in inner-city neighbourhoods (Ley, 1999). Ley and Smith (2000) found that deprivation in Montreal, Vancouver and Toronto, while sharing similarities with the American pattern in 1971, have since diverged – by 1991 it was more geographically dispersed (often in suburban locations) and not as deep (indicated by fewer overlapping indicators). Their analysis can support several possible conclusions: (1) concentrated poverty and

deprivation (an urban underclass) are not prominent in large Canadian cities, (2) poverty and deprivation may be indicated by different factors, or (3) in Canadian cities the geographical distribution of poverty and deprivation may differ from the American case.

The geography of low-cost residential housing offers at least a partial explanation. High Canadian housing expectations (as well as building and habitability code requirements) have contributed to affordability problems by limiting the supply of low-cost rental housing available (Moore and Skaburskis, 2004). In Vancouver increased homelessness has been partially attributed to the loss of low-cost housing (single room occupancy hotels (SROs) and rooming houses) via the gentrification of areas immediately surrounding the downtown core (Hulchanski et al., 1991). In Canadian cities a number of factors, including waning government support for social housing, municipal zoning and housing market forces, have converged to severely limit the construction of new rental apartments. As a result when low-cost housing is redeveloped it is seldom replaced elsewhere (Moore and Skaburskis, 2004).

Bunting et al. (2004) investigate the geographic dimensions of housing affordability need, examining the spatial patterns of affordability need between (and within) the major metropolitan areas in Canada.⁴ For Vancouver, statistical analysis revealed that affordability need among renter households, while higher in the inner city, is geographically dispersed with a significant proportion of stressed households found in the inner and outer suburbs. Similarly, cartographic analysis reveals a dispersed geographical pattern, where (with the exception of the downtown/downtown eastside) areas of concentrated housing affordability need are spatially contained in localized pockets, rather than as large contiguous areas (see Bunting et al., 2004, 383). This reflects the geographic distribution of rental apartments in Vancouver.

Spatial resolution: moving beyond census tracts

The intraurban (neighbourhood) studies of poverty, deprivation and housing need discussed here all use census tract level data, which warrants further discussion. Recent studies in the U.K. have investigated the use of small-areas census data for identifying deprived areas by asking “at what scale does

⁴ Bunting et al. (2004) define housing affordability need as households spending 50% or more of their income on shelter costs. This is a more conservative measure than the affordability standard used in the CMHC’s Core Housing Need model (30%) in that it reduces the number of households identified overall by about half. The households identified are therefore considered to be experiencing severe housing affordability stress.

deprivation and social exclusion exist and persist” (Harris and Longley, 2002; 2004, 91)? Similarly, Sheppard (1990) asks whether census tracts are the appropriate scale to observe the indicators and formation of an urban underclass. It is his contention that the scale of neighbourhood described by Wilson (1987) is smaller than a census tract, warning that the functional neighbourhoods perceived by residents could be more localized, and mismatched with census tracts (Sheppard, 1990).

Consider the residential geography of Ghanaian immigrants in Toronto, Canada. Owusu (1999, cited by Hiebert 2000) found that at the census tract level Ghanaians did not appear to be spatially concentrated, but shifting the analysis to a finer-scale revealed a high-degree of clustering – 30% of Ghanaians lived in just 17 enumeration areas (out of about 7500).⁵ This unusual micro-geography is explained by the tendency of Ghanaians to reside in low-rent Limited Dividend housing which is scattered throughout suburban Toronto (Owusu, 1999).⁶ Replicating studies that examine the relations between spatially concentrated poverty, deprivation, and immigrants in Canadian cities also revealed significantly different results when analysis was conducted with finer-scale dissemination areas instead of census tracts (see Appendix 1).

In practice, studies employing high-resolution data are a rare exception. Coarsely aggregated census data over-generalize socioeconomic patterns, yet studies of Canadian cities have consistently employed lower-resolution census tracts to conduct neighbourhood analyses or study spatial patterning, rather than use available higher-resolution enumeration areas or dissemination areas. Traditional preference for census tracts may be attributed to several factors: (1) they were originally designed for socioeconomic analysis and planning purposes, (2) they allow for temporal analysis as their boundaries seldom change (except for splitting to account for population growth, which follows a protocol that allows them to be easily re-aggregated), and (3) with minimum populations of 2500 they are statistically stable. In contrast enumeration areas—the smallest areal unit available prior to the 2001 census—had none of these characteristics.

⁵ Enumeration areas (EAs) were the smallest areal unit available for the Canada census prior to 2001 when they were replaced by dissemination areas (DAs). Both EAs and DAs represent small-areas (400-700 people approx.), but EAs were designed as a collection unit, whereas DAs were designed and implemented for analysis purposes. Census tracts (CTs) are larger, representing “neighbourhood-like communities” with target populations of 2500-8000 (Puderer, 2001; Statistics Canada, 2002).

⁶ Limited dividend housing is low-rent housing developed through a CMHC program that provided preferential mortgage financing (i.e. below market interest rates) to private developers/landlords in exchange for providing housing units at below market rent.

The introduction of dissemination areas for the 2001 census is an improvement over enumeration areas, in that they were designed with input from the research community (Puderer, 2001), are less prone to suppression (small population counts), and their boundaries remain stable from census to census facilitating easier temporal analysis than was possible with enumeration areas (see Schuurman et al., forthcoming). The introduction of dissemination areas offers Canadian socioeconomic research an improved ability to incorporate high-resolution analyses going forward. While this conflicts with privacy concerns (see Curry, 1997), and concerns about the statistical stability of rates produced with small counts remain (Nakaya, 2000), these are offset by potential benefits. Employing higher-resolution data produces more granular representations that allow researchers and policy-makers to see high-localized socioeconomic conditions hidden by more coarsely aggregated data.

Identifying at-risk areas: poverty, deprivation, housing need, and recent immigrants

We present a method for identification of areas where recent immigrants are at-risk for homelessness using census data that identifies where concentrated poverty, deprivation and housing need intersect with concentrations of recent immigrants. Poverty and deprivation are identified at the dissemination area level using approaches developed for existing studies conducted using census tracts. Poverty areas are identified using thresholds that classify areal incidence of low-income according to the following scheme: non-poverty - below 20%, poverty - 20 to 29%, high poverty - 30 to 39% and extreme poverty - 40% or higher (see Kazemipur and Halli, 1997; Ley and Smith, 1997). Deprived areas are identified using the urban underclass approach employed by Ley and Smith (2000). A dissemination area is considered deprived if it exceeds twice the census metropolitan area (CMA) median value for the following indicators: (1) incidence of female lone-parent families, (2) male unemployment rate, (3) percentage non-high school graduates, and (4) percentage of income from government transfer payments. We have modified their low income requirement by raising the minimum incidence rate from at least 20% to 40% in order to limit identification to areas with the most extreme concentrations. Finally, areas are considered to have concentrated housing need if their incidence of core housing need exceeds twice the CMA median value ($\approx 23.5\%$ for dissemination areas).

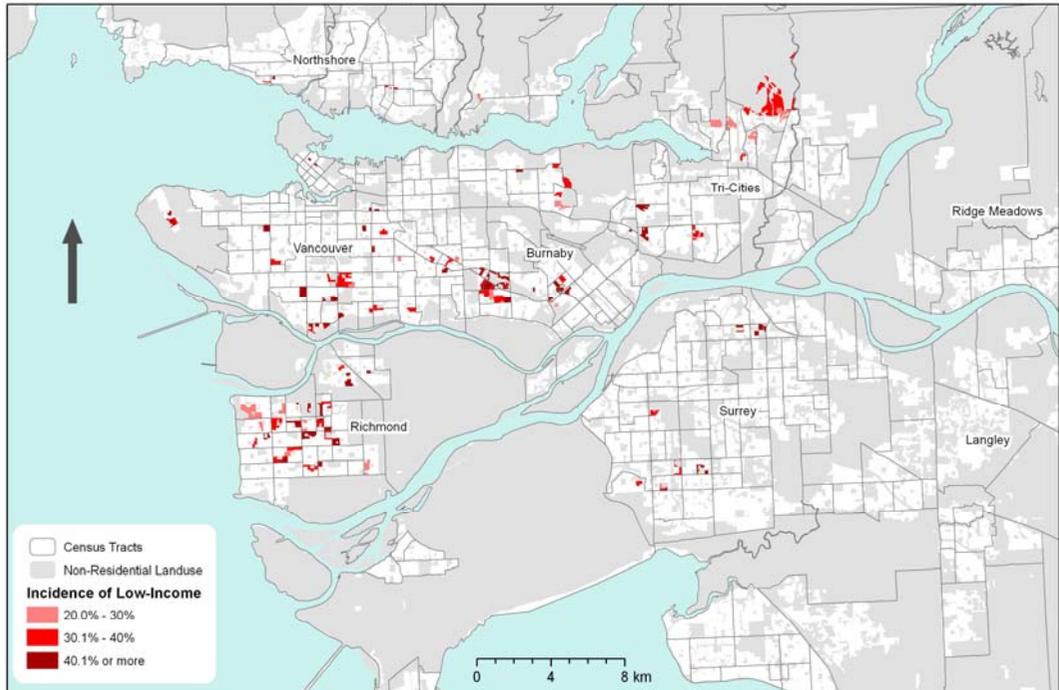
To better represent the spatial variation of these socioeconomic phenomena cartographically, a dasymetric mapping approach is used. Census data are disseminated as counts or summary values for areal units using a hierarchical data model where smaller less aggregated areal units nest inside larger more aggregated ones. Census areal units must completely divide-up geographic space, producing representational difficulties for cartographic output of urban areas, as some areal

units will contain significant non-residential landuse and be misrepresented visually (Martin, 2005). Dasymetric approaches mitigate this by using secondary data sources such as landuse data or remotely sensed imagery to display statistical data using more meaningful spatial zones that more accurately reflect the underlying geographic distribution of populations (Eicher and Brewer, 2001; Holt et al., 2004). Unlike more sophisticated dasymetric approaches that aim to create interpolated population surfaces, the approach implemented here only uses polygon landuse data to redraw areal unit boundaries so they contain residential landuse only. The aim is to improve representation by eliminating areas of non-residential landuse that can distort cartographic representation of census data by overemphasizing the visual importance of low-density areal units.

Figure 1 identifies impoverished dissemination areas where recent immigrants represent 25 percent or more of the overall population. While useful in an exploratory sense, this representation is problematic because it identifies at-risk areas that appear to be intuitively incorrect when juxtaposed with local understandings. For example, the dark-red areas in Richmond and medium-red areas above the Tri-Cities label are associated with immigrants (mostly from Hong Kong), but they are not considered poor areas. Quite the opposite, they are regarded locally as desirable and affluent areas. Yet census data indicates unusually high rates of low-income in these areas. One explanation is that low-income does not account for net worth or assets, information the census does not measure. Many recent business-class immigrants from East Asia are ‘asset-rich’ yet ‘income-poor’ as they are admitted to Canada as entrepreneurs/investors often declaring assets in excess of a million dollars (Canadian) upon arrival (Ley, 1999, 2003).

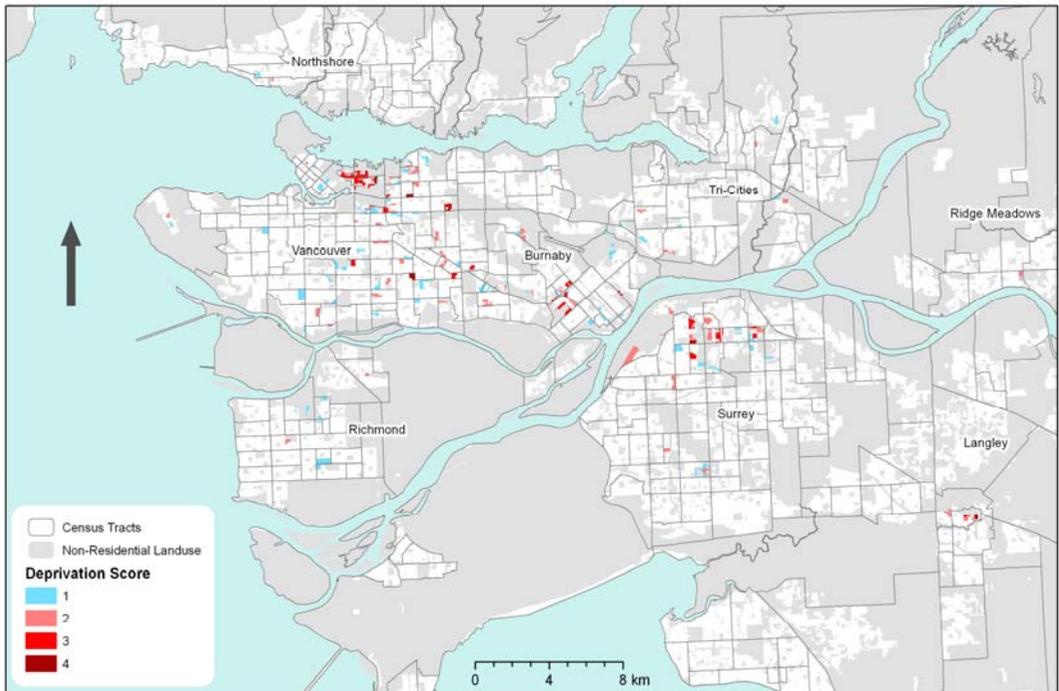
Figure 2 identifies deprived dissemination areas that also contain high concentrations of core housing need (at-risk DAs). This approach identified 176 dissemination areas out of 3269 (5.4%) containing 102,170 people (or 5.2% of the total CMA population). As a proportion of their respective CMA populations, both non-immigrant and non-recent immigrant presence in at-risk DAs were roughly equal (4.5% and 5.3%), while recent immigrant presence was considerably higher at 9.5%. These results are also echoed by the population composition within at-risk DAs, where 15.8% were recent immigrants, slightly less than double their proportion of the CMA population (8.6%). While recent immigrants are over-represented in at-risk DAs, it is important to consider that they represent only a moderate proportion of the population in at-risk DAs, which itself only represents a small proportion of the CMA’s population. That said almost 1 in 10 recent immigrants in the Vancouver area reside in at-risk DAs. Figure 3 further refines the analysis by identifying at-risk DAs that contain a high concentration of recent immigrants (at least 25% of the DA population). This approach narrowed 176 at-risk DAs down to just 34. This indicates that within at-risk DAs, recent immigrants are further concentrated, with 52.2% residing in just 19.3% of at-risk DAs (or 5.0%

Figure 1: Impoverished DAs with High Recent Immigrant Presence - Greater Vancouver 2001



Data Sources: Statistics Canada, 2001 Census, Electronic Profile Data; GVRD Landuse Data.
Note: where at least 25% of DA's population are recent immigrants.

Figure 2: At-Risk DAs - Greater Vancouver 2001



Data Sources: Statistics Canada, 2001 Census, Electronic Profile Data & Custom Table 4161 (includes CMHC census-based housing indicators and data); GVRD Landuse Data.
Note: at least 40% of DA's population must live in households that are low-income.

of all recent immigrants reside in at-risk DAs that account for only 1.1% of the Vancouver CMA's total population).

Cartographic analysis reveals that at-risk DAs are geographically dispersed across the metropolitan area, but significant clustering of at-risk DAs (especially those with deprivation scores 2 or higher) is prominent in the area known as the downtown eastside (an area immediately east of Vancouver's central business district). Less prominent are scattered clusters of at-risk DAs found along the SkyTrain route that runs from the downtown core diagonally (north-west to south-east) to the Whalley area of Surrey (see figure 2). Clustering of at-risk DAs where recent immigrants are concentrated is more limited - as figure 3 shows. In this case small areas with multiple at-risk DAs are only really present in the Metrotown and Edmonds areas of Burnaby. The presence of at-risk DAs associated with recent immigrants in Burnaby, one of Vancouver's inner suburbs, echoes the findings of other studies, which have noted increasingly poor immigrants in Canadian cities are found in suburban locations where low-cost rental apartments are available (Bunting et al., 2004; CMHC, 2003; Ley and Smith, 1997, 2000; Smith, 2004).

Figure 3: At-Risk DAs with High Recent Immigrant Presence - Greater Vancouver 2001



Data Sources: Statistics Canada, 2001 Census, Electronic Profile Data & Custom Table 4161 (includes CMHC census-based housing indicators and data); GVRD Landuse Data.
 Note: at least 40% of DA's population must live in households that are low-income and at least 25% of DA's population are Recent Immigrants

While this approach helps identify areas at-risk, it does not reveal much about the individual households (and especially recent immigrant ones) who reside within them. Nor does it address the problem of ecological fallacy. While it is possible to identify at-risk areas and describe whether or not they are associated with concentrations of recent immigrants, it is not possible to distinguish between

at-risk recent immigrants and recent immigrants who merely reside in at-risk areas. This problem is inherent to area-based profiles created using census data (Openshaw, 1984a; Voas and Williamson, 2001). Notwithstanding the important role neighbourhoods are seen to play in the 'cycle of poverty' (see Wilson, 1987), many residents of at-risk areas may themselves not be at-risk. Conclusions that do not recognize this reality are seen as committing an ecological fallacy. Similarly, while the dasymetric mapping approach employed here improves cartographic representation, it does not mitigate the modifiable areal unit problem (MAUP).

MAUP recognizes that areal unit boundaries are both arbitrary and modifiable making maps and statistical results dependent on the scale and configuration of the areal units employed (Openshaw, 1984b). Dasymetric approaches have been used to create population density surfaces that mitigate MAUP using known relationships between land-use (or zoning) and population distribution (Holt et al., 2004; Mennis, 2003). The suitability of dissemination area boundaries for revealing spatial variations in socioeconomic conditions, like deprivation and housing need, is largely a function of how well they are matched to the geographical distribution in housing tenure and dwelling type (Alvanides et al., 2002; Morphet, 1993). While there is a noted relationship, between dwelling type and tenure, and spatially concentrated poverty, deprivation and housing need in the Vancouver metropolitan area (i.e. low-rent apartments), it is complex at the DA level, and for recent immigrants the relationship is tenuous at best – preventing the implementation of a more sophisticated dasymetric approach in this study.

Figure 4 shows census tract and dissemination area boundaries superimposed on remotely-sensed imagery of the Edmonds neighbourhood in Burnaby. The remotely-sensed imagery highlights how the irregular geometric shapes of census geography frequently do not reflect socially homogeneous 'optimal' zones for analysis (Alvanides et al., 2002). The dissemination areas labelled 1 and 2 (in Figure 4) are split between mostly owner-occupied single-family detached dwellings and rental apartments. Site visits revealed that rental apartments in the mixed-housing dissemination areas (1 and 2) were similar in age and condition to apartments in the more homogeneous DAs (3, 4, and 5); most of the apartments in the mixed-housing DAs were across the street from rental apartments in the more homogeneous DAs. It is difficult to ascertain the overall impact this has on the spatial analysis across the entire study region (Greater Vancouver), but it illustrates that additional high-resolution data along with contextual information can reveal, even at relatively fine-resolution, that relevant spatial variation may remain hidden in a census map (see Morphet, 1993).



Complementing socioeconomic GIS

Recent GIScience literature has suggested employing multiple methods to allow for more sophisticated analysis than is possible with GIS methods alone (Kwan, 2002; Pavlovskaya, forthcoming). Kwan (2002, 651), recognizing the limitations of a GIS approach, suggests several mitigation strategies, including “complementing secondary data with other contextual information” and “collecting primary quantitative and/or qualitative data from individual subjects.” To augment our exploratory GIS approach and ascertain potential for at-risk homelessness in a more nuanced way, a postal survey of all households living in rental apartments in two of the dissemination areas identified in Figure 3 was conducted. This included one dissemination area from each of the Metrotown and Edmonds areas of Burnaby, British Columbia.⁷ The specific dissemination areas selected for the postal survey were determined using a combination of local knowledge and site visits with the aim of selecting areas where the physical condition of housing and tenure status of residents within are reasonably homogeneous. The survey questionnaire, while closed-ended, asked participants about neighbourhood safety, their housing conditions, and the adequacy of their financial resources, as well as asking directly about household structure and living arrangements, financial resources, housing costs, and immigration status.

⁷ DA unique identifiers: 59151259 (Edmonds DA) and 59151314 (Metrotown DA).

A total of 122 households returned completed surveys (out of the 588 questionnaires mailed out) for an overall response rate of 20.7%. The survey yielded interesting insights into the subtle differences between the two areas, which share similar levels of low-income, core housing need, and recent immigrants according to the most recent census (approximately 60%, 40%, and 50% respectively). When asked about the physical condition of their apartment, 26.2% of respondents from Edmonds reported it was in poor or substandard condition, while only 6.3% of the Metrotown respondents did. Similarly when asked whether they considered their neighbourhood safe, 45.2% of Edmonds respondents answered no, while only 28.8% of Metrotown respondents did.

The difference between areas was just as apparent in the responses to questions about economic welfare. Asked to indicate their income from a set list of household revenues, 23.8% of Edmonds respondents said they earned less than \$1000 per month, while 15.1% of Metrotown respondents fell under this level; more significantly only 28.6% of Edmonds respondents reported monthly household incomes over \$2000, while 47.7% of Metrotown respondents did. This means the majority of respondents from both areas surveyed reported household incomes that, annualized, would fall below \$24,000 which is less than half the Vancouver CMA median household income (\$49,940).⁸ The proportion falling below \$24,000 was noticeably higher in the Edmonds area compared to Metrotown (71.4% to 52.3%), indicating a difference in the depth of poverty. This was also detected in the responses to another question asking whether the respondents had enough money for food, clothing, and transportation after paying rent.⁹ In response only 23.8% of Edmonds respondents answered yes, in contrast to 47.5% of Metrotown respondents.

Both the survey and census revealed that approximately 50% of the population in the two study areas are recent immigrants, indicating that they function as reception neighbourhoods. The postal survey asked respondents if they were born outside Canada, and if applicable, to indicate the year they came, and their country of origin. Survey responses indicated that 28.6% of Edmonds respondents had immigrated to Canada in the past 2 years, while this was the case for 21.3% of Metrotown respondents. In relation to the place of birth question, 31% of respondents from the Edmonds area were from African countries, a very small group in Greater Vancouver – so small that census privacy norms render this highly

⁸ In the 2001 Canada census the median household income in the two DAs were \$22,272 (Edmonds DA) and \$27,360 (Metrotown DA).

⁹ Respondents could answer 'Yes', 'Usually', 'Sometimes', or 'No'. The Edmonds responses were Yes - 23.8%; Usually - 26.2%; Sometimes - 19%; No - 28.6%. The Metrotown responses were Yes - 47.5%; Usually - 28.8%; Sometimes - 10%; No - 11.3%. Percentages may not add up to 100% due to non-responses to this question.

variegated group largely ‘invisible’ in published DA level data (most African countries are included in the category ‘all other places of birth’). Thus, developing fine-scale understandings of the residential geography of pan-African immigrant population in Vancouver is limited. This issue has proved problematic for research interested in relatively small and newly arrived groups, especially refugees.

The housing conditions experienced by new immigrants and (especially) refugees are of particular research interest. While our survey does not distinguish between responses by entrance class, there is a contingent of survey participants from African countries that are typically associated with refugees in the Edmonds sample. There is no way to verify if these participants are indeed refugees, but their responses to the survey’s housing questions echo what other studies on refugee housing experiences have reported (see Mattu, 2002; MirafTAB, 2000). Perhaps most striking is the degree of overcrowding reported. We have used persons per room to report overcrowding in the survey responses because the persons per bedroom measure used by CMHC (1991) requires more detailed information about household composition than our survey collected. Using this measure, overcrowding is indicated when household density exceeds 1 person per room, while it has been suggested that 1.5 persons per room indicates more extreme overcrowding (Myers et al., 1996).

As the number of African responses in our Edmonds sample is quite small (14 out of 42) results drawn from them should be used with caution. They represent a largely invisible and arguably ignored group in Greater Vancouver.¹⁰ Among African households, 11 exceeded 1 person per room (with 7 of these exceeding 2 persons per room), while only 3 were below the threshold for overcrowding. The degree of overcrowding may be explained partly by large households residing in rental apartments; 7 responses were from households with 5 or more members.¹¹ When asked whether they had enough money for food, clothing, and transportation after paying rent 11 responded no, indicating a limited ability to obtain housing that is not overcrowded, which was also indicated by their low reported incomes in the survey. African respondents also indicated that their housing is in poor condition (only 3 responded it was in good condition, while 7 reported it was in poor condition). African survey respondents from the Edmonds area appear to be precariously housed and at-risk of homelessness, generating new questions for both researchers and policy-makers.

¹⁰ African Immigrants in Greater Vancouver have received little research attention with the exception of Creese and Kambere (2002).

¹¹ Responses to the question: how many people live in your apartment were, 5 persons – 1; 6 persons – 2; 7 persons – 2; 8 persons – 1; 9 persons - 1

The postal questionnaire is an important addition to this study and offers more direct in-depth information than is available in census data yielding deeper insight into the housing situations/conditions of residents. The survey also provided more temporally relevant information that highlighted changes in the two areas that had occurred since the last census. The postal survey was able to aid in illuminating certain ‘blind-spots’ in the census data, yet without the census we would not have known where or whom to survey. The next logical step might be to employ semi-structured interviews or focus groups (with willing survey respondents) to follow up and expand on the responses to survey though this was not part of our project.

Conclusion

Harris and Longley (2004) assert that geographic research has become too focused on specificity at the expense of understanding system-wide phenomena. While knowledge generated by systematic social area analysis approaches are useful, their limitations have been the focus the perceived qualitative/quantitative divide within human geography (Sheppard, 2001). Generalized indicators, models and area-profiling may identify the contours of social difference, but they cannot adequately represent the complexity of street level realities, or disentangle the diverse range of experiences within identified areas. Research approaches that Harris and Longley (2004) deem “introspective and individualistic” are more suited for this task. In this study, a high-resolution GIS analysis was conducted in conjunction with a postal survey to aid in developing an improved—though still incomplete—understanding of risk for homelessness amongst recent immigrants in Vancouver, Canada. The approach is a compromise – one that represents an incremental improvement in GIS practice.

It is incremental in that it leaves many of the tensions identified by GIS critics unresolved. High-resolution analyses, especially those using ‘lifestyles’ data (see Harris and Longley, 2004; Longley, 2003, 2005; Longley and Harris, 1999) have not adequately addressed the surveillance and privacy concerns long voiced by critical scholars (see Curry, 1997; Goss, 1995b; Pickles, 1995). GIS-facilitated dasymetric mapping represents an improvement for the geographic governance of populations, but it retains the basic problem of treating them as manageable resources (Crampton, 2004). Here the divide between GIS critics and researchers is most clearly illustrated. Proponents see the over-reliance on coarsely aggregated data and models as problematic, while critics view the project itself largely as problematic.

The compromise advocated here is a high-resolution approach, one that recognizes that census data (and mapping) will likely continue to dominate GIS use for socioeconomic analysis. Rather than abandon census mapping in socioeconomic GIS (which would be impractical in our opinion), the resulting

representations should be used more cautiously, with - as Hannah (2001) suggests - a more thorough awareness of the advantages and disadvantages (technical and political) of the underlying (census) data. The approach described here attempts to achieve this by explicitly acknowledging the 'situated' and 'partial' nature of results produced by census data and/or GIS analysis alone (Kwan, 2002; Pavlovskaya, forthcoming). The postal survey complements GIS analysis by highlighting potential 'blind-spots' produced by census mapping, and by also suggesting directions for future research. This would include extending this approach to include more qualitative methods like focus groups and semi-structured interviews that would allow more active participation by the residents in the construction and representation of their housing conditions and experiences.

Acknowledgments

Funding for this research was generously provided by the Vancouver Centre of Excellence for Research on Immigration and Integration in the Metropolis (RIIM).

References

- Alvanides, S., Stan Openshaw, and Philip Rees. 2002. Designing your own geographies. In, Philip Rees, David Martin and Paul Williamson (eds.), *The Census Data System*. New York: John Wiley & Sons.
- Bramley, Glen. 1988. The Definition and Measurement of Homelessness. In, Glen Bramley, Kevin Doogan, Philip Leather, Alan Murie and Evelyn Watson (eds.), *Homelessness and the London Housing Market*. Bristol: SAUS, University of Bristol.
- Bunting, Trudi, Alan Walks, and Pierre Filion. 2004. The uneven geography of housing affordability stress in Canadian metropolitan areas. *Housing Studies* 19(3), 361-393.
- CIC. 1998. *The Economic Performance of Immigrants: Immigrant Category Perspective*. Ottawa: Citizenship and Immigration Canada.
- Clark, William A. V. 1998. Mass migration and local outcomes: Is international migration to the United States creating a new urban underclass? *Urban Studies* 35(3), 371-383.
- CMHC. 2004. *2001 Census Housing Series - Issue 7: Immigrant Households* (No. Socio-economic Series 04-042). Ottawa: Canada Mortgage and Housing Corporation.

- CMHC. 2003. *Special Studies on 1996 Census Data: Housing Conditions of Immigrants in the Toronto Census Metropolitan Area* (No. Socio-economic Series 55-12). Ottawa: Canada Mortgage and Housing Corporation.
- CMHC. 1991. *Core Housing Need In Canada*. Ottawa: Canada Mortgage and Housing Corporation.
- Crampton, Jeremy W. 2004. GIS and Geographic Governance: Reconstructing the Choropleth Map. *Cartographica* 39(1).
- Crampton, Jeremy W. 2001. Maps as social constructions: power, communication and visualization. *Progress in Human Geography* 25(2), 235-252.
- Creese, Gillian, and Edith Ngene Kambere. 2002. "What Colour is Your English?" (No. 02-20). Vancouver: Research on Immigration and Integration in the Metropolis (RIIM).
- Curry, Michael R. 1997. The digital individual and the private realm. *Annals of the Association of American Geographers* 87(4), 681-699.
- Eicher, Cory L., and Cynthia A. Brewer. 2001. Dasymetric mapping and areal interpolation: implementation and evaluation. *Cartography and Geographic Information Science* 28(2), 125-138.
- Engeland, John, Roger Lewis, Steven Ehrlich, and Janet Che. 2005. *Evolving Housing Conditions in Canada's Census Metropolitan Areas, 1991-2001* (No. 89-613-MWE2004005). Ottawa: Statistics Canada, Canada Mortgage and Housing Corporation (CMHC).
- Goss, Jon. 1995a. Marketing the new marketing: The strategic discourse of geodemographic information systems. In, John Pickles (ed.), *Ground Truth*. London: Guilford Press, pp. 130-170.
- Goss, Jon. 1995b. "We know who you are and we know where you live": The instrumental rationality of geodemographic systems. *Economic Geography* 71(2), 171-198.
- Hannah, Matthew G. 2001. Sampling and the politics of representation in US census 2000. *Environment and Planning D: Society and Space* 19, 515-534.
- Hannah, Matthew G. 2000. *Governmentality and the Mastery of Territory in Nineteenth-Century America*. Cambridge: Cambridge University Press.
- Harley, J. B. 1989. Deconstructing the map. *Cartographica* 26(2), 1-20.

- Harris, Richard, and Paul Longley. 2004. Targeting clusters of deprivation within cities. In, John Stillwell and Graham Clarke (eds.), *Applied GIS and Spatial Analysis*. New York: John Wiley & Sons, pp. 89-110.
- Harris, Richard, and Paul Longley. 2002. Creating small area measures of urban deprivation. *Environment and Planning A* 34, 1073-1093.
- Harris, Richard, Peter Sleight, and Richard Webber. 2005. *Geodemographics, GIS and Neighbourhood Targeting*. West Sussex: John Wiley & Sons.
- Hiebert, Daniel. 2000. Immigration and the changing Canadian city. *Canadian Geographer* 44(1), 25-43.
- Holt, James B., C. P. Lo, and Thomas W. Hodler. 2004. Dasymetric estimation of population density and areal interpretation of census data. *Cartography and Geographic Information Science* 31(2), 103-121.
- Hughes, Mark Alan. 1990. Formation of the Impacted ghetto: Evidence from large metropolitan areas, 1970-1980. *Urban Geography* 11(3), 265-284.
- Hulchanski, David, Margaret Eberle, Dana Stewart, and Kris Olds. 1991. *Solutions To Homelessness: Vancouver Case Studies*. Vancouver: Centre for Human Settlements: UBC for Canada Mortgage and Housing Corporation.
- Kazemipur, A., and S.S Halli. 2000. *The New Poverty in Canada: Ethnic Groups and Ghetto Neighborhoods*. Toronto: Thompson Educational Publishing.
- Kazemipur, A., and S.S Halli. 1997. Plight of Immigrants: The spatial concentration of poverty in Canada. *Canadian Journal of Regional Science*, 20(1,2), 11-28.
- Kobayashi, Audrey. 1992. Representing Ethnicity: Political Statistexts. In, Statistics Canada and U.S. Bureau of the Census (eds.), *Challenges of Measuring an Ethnic World: Science, Politics and Reality*. Washington D.C.; U.S. Government Printing Office, pp. 95-112.
- Kwan, Mei-Po. 2002. Feminist visualization: Re-envisioning GIS as a method in feminist geographic research. *Annals of the Association of American Geographers* 92(4), 645-661.
- Ley, David. 2003. Seeking homo economicus: The Canadian state and the strange story of the business immigration program. *Annals of the Association of American Geographers* 93(2), 426-441.
- Ley, David. 1999. Myths and meanings of immigration and the metropolis. *Canadian Geographer*, 43(1), 2-19.

- Ley, David, and Heather A. Smith. 2000. Relations between Deprivation and Immigrant Groups in Large Canadian Cities. *Urban Studies* 37(1), 37-62.
- Ley, David, and Heather A. Smith. 1997. Immigration and poverty in Canadian cities, 1971-1991. *Canadian Journal of Regional Science* 20(1,2), 29-48.
- Li, Peter. 2003. Initial earnings and catch-up capacity of immigrants. *Canadian Public Policy - Analyse de Politiques* XXIX(3), 319-337.
- Longley, Paul. 2005. Geographical information systems: A renaissance of geodemographics for public service delivery. *Progress in Human Geography* 29(1), 57-63.
- Longley, Paul. 2003. Geographic information systems: Developments in socio-economic data infrastructures. *Progress in Human Geography* 27(1), 114-121.
- Longley, Paul, and Richard Harris. 1999. Towards a new digital data infrastructure for urban analysis and modelling. *Environment and Planning B: Planning and Design* 26(6), 855-878.
- Martin, David. 2005. Spatial representation: the social scientist's perspective. In Paul Longley, Michael Goodchild, David J. Maguire and David W. Rhind (eds.), *Geographical Information Systems: Principles, Techniques, Management, and Applications* (2nd (Abridged) ed.). New York: John Wiley & Sons, pp. 71-80.
- Martin, David. 2003. Reconstructing social GIS. *Transactions in GIS* 7(3), 305-307.
- Mattu, Parveen. 2002. *A Survey on the Extent of Substandard Housing Problems Faced by Immigrants and Refugees in the Lower Mainland of British Columbia*. Vancouver: Multilingual Orientation Service Association for Immigrant Communities (MOSAIC).
- Mennis, Jeremy. 2003. Generating surface models of population using dasymetric mapping. *Professional Geographer* 55(1), 31-42.
- Miraftab, Faranak. 2000. Sheltering refugees: the housing experiences of refugees in metropolitan Vancouver, Canada. *Canadian Journal of Urban Research* 9(1), 42.
- Moore, Eric, and Andrejs Skaburskis. 2004. Canada's Increasing housing affordability burdens. *Housing Studies* 19(3), 395-413.

- Morphet, C. S. 1993. The mapping of small-area census data-a consideration of the role of enumeration district boundaries. *Environment and Planning A* 25(9), 1267-1277.
- Murdie, Robert A. 2004. Housing affordability: Immigrant and refugee experiences. In, David Hulchanski and Michael Shapcott (eds.), *Finding Room: Policy Options for a Canadian Rental Housing Strategy*. Toronto: Centre for Urban and Community Studies Press, University of Toronto.
- Murdie, Robert A., and Carlos Teixeira. 2003. Towards a comfortable neighbourhood and appropriate housing: immigrant experiences in Toronto. In, Paul Anisef and Michael Lanphier (eds.), *The World in a City*. Toronto: University of Toronto Press, pp. 132-191.
- Myers, Dowell, William C. Baer, and Seong-Youn Choi. 1996. The changing problem of overcrowded housing. *Journal of the American Planning Association* 62(1), 66-84.
- Nakaya, Tomoki. 2000. An informational statistical approach to the modifiable areal unit problem in incidence rate maps. *Environment and Planning A* 32, 91-109.
- O'Sullivan, David. 2004. Too Much of the wrong kind of data: Implications for the practice of micro-scale spatial modeling. In, Michael Goodchild and Donald G. Janelle (eds.), *Spatially Integrated Social Science*. New York: Oxford University Press, pp. 25-46.
- Openshaw, Stan. 1984a. Ecological fallacies and the analysis of areal census data. *Environment and Planning A* 16, 17-31.
- Openshaw, Stan. 1984b. *The Modifiable Areal Unit Problem* (Vol. 38). Norwich: Geobooks.
- Owusu, Thomas Y. 1999. Residential patterns and housing choices of Ghanaian Immigrants in Toronto, Canada. *Housing Studies* 14(1), 77-97.
- Pavlovskaya, Marianna. forthcoming. Theorizing with GIS: A tool for critical geographies. *Environment and Planning A*.
- Pickles, John. 2004. *A History of Spaces*. London: Routledge.
- Pickles, John (ed.). 1995. *Ground Truth: The Social Implications of Geographic Information Systems*. London: The Guilford Press.
- Picot, Garnett. 2004. The deteriorating economic welfare of Canadian immigrants. *Canadian Journal of Urban Research* 13(1), 25-46.

- Puderer, Henry. 2001. *Introducing the Dissemination Area for the 2001 Census: an Update* (No. 92F0138MIE, no.2000-4). Ottawa: Statistics Canada.
- Ray, Brian. 1994. Immigrant Settlement and Housing in Metropolitan Toronto. *Canadian Geographer* 38(3), 262-265.
- Ringheim, Karin. 1990. *At Risk of Homelessness: the Roles of Income and Rent*. New York: Praeger Publishers.
- Schuurman, Nadine, Darrin Grund, Michael Hayes, and Suzana Dragicevic. forthcoming. Enabling spatial analysis across Canadian time and space: A conflation protocol for census geometry. *Canadian Geographer*.
- Scott, James C. 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press.
- Sheppard, Eric. 2001. Quantitative geography: representations, practices, and possibilities. *Environment and Planning D: Society and Space* 19, 535-554.
- Sheppard, Eric. 1990. Ecological Analysis of the "Urban Underclass": Commentary on Hughes, Kasarda, and O'Regan and Wiseman. *Urban Geography*, 11(3), 285-297.
- Smith, Heather A. 2004. *The Evolving Relationship between Immigrant Settlement and Neighborhood Disadvantage in Canadian Cities, 1991-2001* (No. 04-20). Vancouver: Research on Immigration and Integration in the Metropolis (RIIM).
- Statistics Canada. 2002. *Census Dictionary*. Retrieved March 26, 2004, from <http://www.statcan.ca/english/census2001/dict/index.htm#dictionary>
- Statistics Canada. 2003. *Longitudinal Survey of Immigrants to Canada: Process, progress, and prospects* (No. 89-611-XIE). Ottawa: Statistics Canada.
- Stone, Michael. 1993. *Shelter Poverty: New Ideas on Housing Affordability*. Philadelphia: Temple University Press.
- Taylor, Peter J., and Ron J. Johnston. 1995. Geographic information systems and geography. In, John Pickles (ed.), *Ground Truth*. London: Guildford Press, pp. 51-67.
- Voas, David, and Paul Williamson. 2001. The diversity of diversity: a critique of geodemographic classification. *Area* 33(1), 63-76.
- Wilson, William J. 1987. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago: University of Chicago Press.

Wolch, Jennifer R, Michael J. Dear, and Andrea Akita. 1988. Explaining homelessness. *Journal of American Planning Association* 54, 443-453.

Wood, Denis. 1992. How Maps Work. *Cartographica* 29(3 and 4), 66-74.

Appendix 1: Deprived Census Tracts and Dissemination Areas.

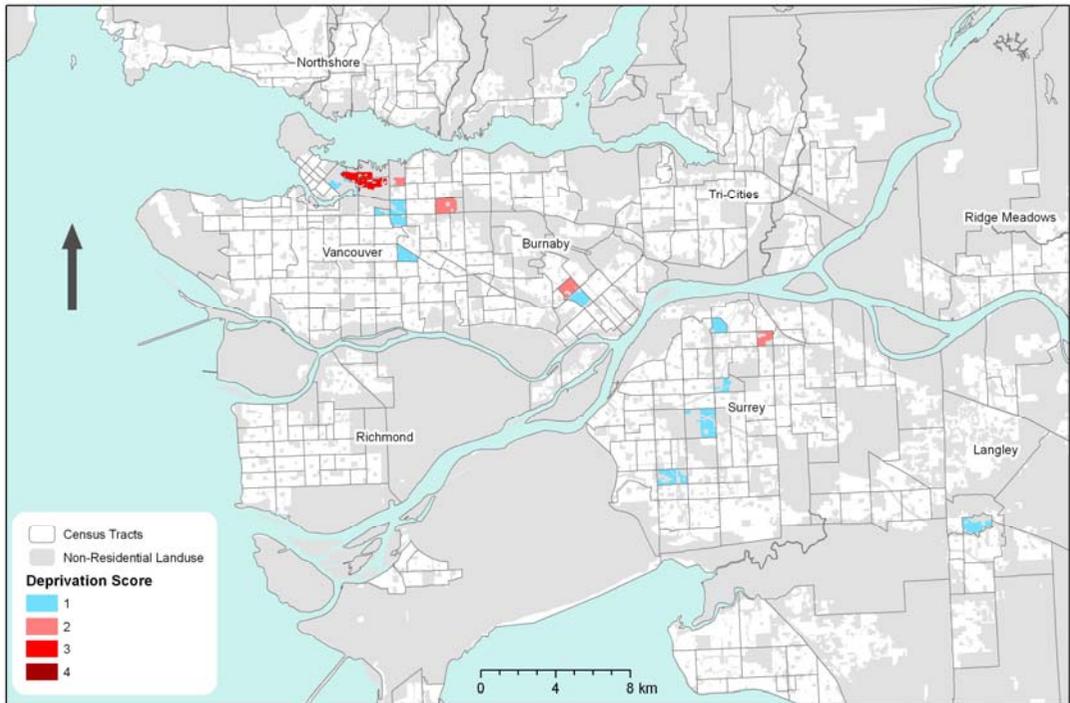
Deprived Census Tracts and Dissemination Areas using Urban Underclass Approach ²	% Female Lone Parent	Male Unemployment Rate	% with No High School Diploma	% of Area Income from Govt. Transfer Payments
CMA-wide	8.5	7.3	21.4	9.6
CT Median	8.6	6.8	20.6	9.7
DA Median	8.2	6.9	20.3	9.4
No. CTs 2x CT Median	2	14	9	10
% of CTs (n=386)	0.5	3.6	2.3	2.6
No. DAs 2x DA Median	379	496	237	325
% of DAs (n=3269)	11.6	15.2	7.2	9.9
	1 Indicator	2 Indicators	3 Indicators	4 Indicators
Number of CTs (2x CT Median)	15	4	4	0
Deprived CTs ¹	11	4	4	0
Number of DAs (2x DA Median)	747	219	68	12
Deprived DAs ¹	448	165	61	10

¹ the incidence of low-income must be at least 20% of population

² urban underclass approach as defined in Ley and Smith (2000)

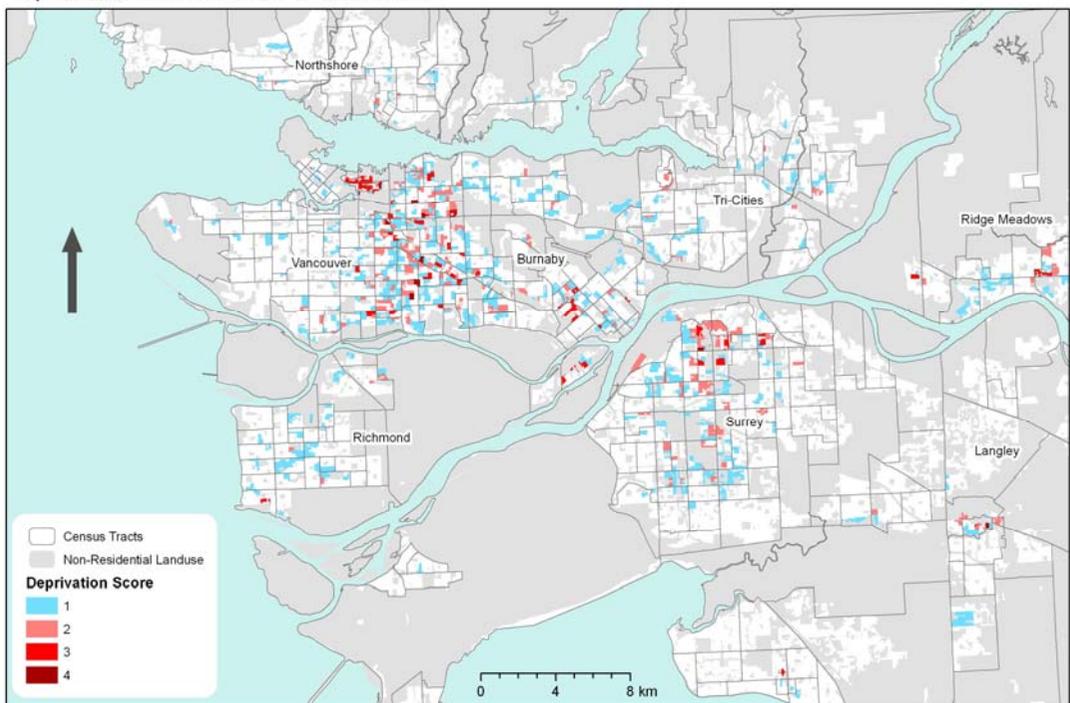
Data Sources: Statistics Canada, 2001 Census, Electronic Profile Data.

Deprived Census Tracts - Greater Vancouver 2001



Data Sources: Statistics Canada, 2001 Census, Electronic Profile Data; GVRD Landuse Data.
 Note: at least 20% of CT's population must live in households that are low-income to be considered deprived.

Deprived Dissemination Areas - Greater Vancouver 2001



Data Sources: Statistics Canada, 2001 Census, Electronic Profile Data; GVRD Landuse Data.
 Note: at least 20% of DA's population must live in households that are low-income to be considered deprived.