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SUBURBAN NATION? ESTIMATING THE SIZE OF CANADA'S SUBURBAN POPULATION

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Canada is a suburban nation. The research for this article developed new models to define and classify suburbs and then estimated the proportion of Canadians who live in suburbs. The research method extracted and classified census tract data with basic geographic information system software to test definitions of suburbs for all 33 census metropolitan areas in Canada and a sample of census agglomerations. We checked anomalies using the Google Earth and Google Street View mapping services, and an expert panel examined the results. Density classifications proved most useful for classifying exurban and rural areas. The most reliable definitions of inner-city and suburban development emerged from journey-to-work data. Active cores were defined as areas with higher proportions of active transportation (walking and cycling). We tested 12 models for classifying suburbs, with the most credible results emerging for a model classifying active cores, transit suburbs, auto suburbs, and exurban areas. These classification models estimate that suburban areas make up approximately 80% of Canada's metropolitan population and 66% of the total Canadian population.

INTRODUCTION

We routinely hear that Canada is one of the most urbanized nations in the world (Artibise, 1988; The Canadian Press, 2012; MacGregor, 2009), but that does not mean most Canadians live in apartments and travel by public transit. Although it is estimated that approximately 80% of the Canadian population lives in an urban setting (Martel and Caron Malenfant, 2007), this category includes downtown, inner-city, suburban, and exurban development. Our initial estimates indicate that perhaps two-thirds of the Canadian population live in neighborhoods that most observers would consider suburban (*i.e.*, cars and many postwar single-family homes).

The existing urban/rural classification has genuine utility, since many demographic, environmental, housing, and economic policies need to be different for rural areas. However, if "urban" simply means non-rural, then it is too broad a category for community planning. Suburban planning techniques and problems, such as resource conservation and auto dependence, are significantly different from those related to inner-city intensification and brownfield redevelopment.

The main objective of this paper and the research program on which it is based is to create a rough estimate of the number and proportion of suburban residents in Canada. We do not need an exact count of suburban households for practical policy making. However, an improved estimate of the proportion and rate of growth of the Canadian suburban population may be useful, for example, for shaping an urban infrastructure program or for public-health research (Frank and Frumkin, 2004; Turcotte, 2009). A secondary objective is to establish a definition of "suburb" that would produce credible results across Canada. This paper describes the four-year struggle to establish a definition that would produce a dependable classification of neighborhoods in all 33 Canadian census metropolitan areas (CMAs), rather than the handful of case studies usually covered in research studies. We conclude with an estimate of the Canadian suburban population but leave the policy implications for future comment.

CONTEXT FOR SUBURBS

The literature on how Canada became an urban nation was summarized by McCann and Smith (1991), while Stone (1967) described a precise method of measuring the urban population. The 1931 Canadian census was the first in which the urban population exceeded the rural population. This means Canada was likely an urban nation for only about half a century, since our preliminary calculations indicate that many CMAs became majority suburban by the 1980s.

The pre-World War II urban areas had suburbs, of course, with pleasant neighborhoods of mainly single-family detached homes within walking distance of the central city in the 19th century and streetcar suburbs in the early 20th century (McCann, 1996, 1999). Some superb historical scholarship by Richard Harris (Harris, 1996, 2004; Harris and Larkham, 1999) has demonstrated that there was considerable diversity in these prewar neighborhoods, including unplanned suburbs where working-class citizens built their own homes.

In contrast, the scale and delivery of suburban development changed rapidly after 1945, as the federal government encouraged mass home ownership with long-term mortgages at the same time that automobile ownership soared. Large-scale land developers who were capable of building entire satellite communities emerged; Don Mills, a mixed-use neighborhood in Toronto, became an influential example of this (Hancock, 1994; Sewell, 1993). This new version of suburbia proved to be quite popular, and automobile-dependent neighborhoods expanded to comprise more than half of Canada's urban population in a remarkably short time — perhaps as early as 1981.

Postwar suburban expansion was not unique to Canada, of course. The United States also saw a rapid and wide-scale emergence of low-density, automobile-oriented suburban neighborhoods (Beauregard, 2006; Hayden, 2003). Some researchers have attacked the broad extent of American suburban expansion as urban sprawl (Burchell, *et al.*, 2002; Duany, *et al.*, 2000; Kunstler, 1993; Talen, 2012), while others have suggested it is a preferred lifestyle and a reflection of market demand (Bourne, 2001; Bruegmann, 2005; Gordon and Richardson, 1997; see also Christens, 2009).

American analysts typically use political boundaries to distinguish between pre-1946 inner cities and more recent suburbs (Gans, 1968; Katz and Lang, 2003). However, this method is not reliable in Canada, where local-government annexations and amalgamations are more common (Parr, 2007; Walks, 2007). For example, cities such as Calgary and Winnipeg comprise a large proportion of their CMA's population, including all inner-city and most suburban areas. Some cities, such as Ottawa, also include substantial exurban and rural areas following recent local-government restructuring.

In addition, the classification of metropolitan areas into inner-city, suburban, and rural areas masks the growing polycentricity of North American cities (Bunting, *et al.*, 2002; Filion, *et al.*, 2004; Yang, *et al.*, 2012). This polycentricity has been strongly encouraged throughout many metropolitan areas by recent planning policies that attempt to cluster development around higher-access nodes in the transit system using mobility hubs and transit-oriented development.

There is a large amount of literature on the geography of the suburban expansion of Canadian cities (Bourne and Ley, 1993; Bunting and Filion, 1999; Bunting, *et al.*, 2002; Filion and Bunting, 2006; Filion and Hammond, 2003; Millward, 2008; Smith, 2006) and a growing literature on planning Canadian suburbs (Filion, 2001; Filion and McSpurren, 2007; Friedman, 2002; Grant, 1999, 2006a, 2006b, 2007; Grant, *et al.*, 2004). Unfortunately, scholars of the history, geography, and planning of Canadian suburbs do not appear to have produced an estimate of the extent of this phenomenon similar to our estimates of urban and rural populations.

However, two Canadian researchers have recently considered how the downtown/suburban/rural spectrum might be analyzed. Alan Walks (2004, 2005) classified inner-city, inner-suburban, and outer-suburban neighborhoods to inform his political analysis of Canadian metropolitan areas. He used the edge of the built-up area in 1945 and 1970 as the boundary between the inner city and the inner suburbs. Walks (2007) concluded that his classification based on urban form outperformed a classification based on local-government boundaries for explaining variations in political support for post-war federal elections in the three largest metropolitan regions in Canada.

Statistics Canada analyst Martin Turcotte (2008b) reviewed four criteria for distinguishing between urban and suburban neighborhoods: political boundaries, zones outside the inner city, distance from the city center, and neighborhood density. He dismissed political boundaries as being unreliable given the variation in local-government structures across the nation. The zones outside the inner city were similar to Walks's inner-city/inner-suburb/outer-suburb classification, but Turcotte found too many difficulties in establishing rules for classifying the zones. Similarly, distance from the city center was not a good criterion for comparing the structure of large and small metropolitan areas since a 5 km (3.1 mi) radius might incorporate the inner city in a large metropolis and the entire urban area of a smaller city. Turcotte found neighborhood density to be the least objectionable method for distinguishing between urban and suburban areas. He used the proportion of single-family detached and semidetached houses as a proxy for density to remove some of the problems with calculating gross population density that are created by employment areas, water bodies, rural areas, and airports. The low-density areas were defined as census tracts (CTs), consisting of more than 66% single-family detached and semidetached housing units. These low-density areas contained more than 50% of the population of the metropolitan areas (*ibid.*:7).

RESEARCH METHODS

Overview of Data Sources and Methods

The primary research method used for this paper was the classification of the 2006 and 1996 Canadian censuses for all 33 CMAs. The classification was based entirely on secondary data; the main source was Statistics Canada (2001, 2006) summary data at the CT level. The Canadian census is the obvious source of data for this research because it collects data on housing types (McCall, 2009), population characteristics, and travel to work and summarizes the results at a variety of scales (Mendelson, 2001). The 2006 census marked the end of several decades of consistent data collection in this series due to 2011 changes that made the "long form" questionnaire optional.

We used aerial and ground photography distributed online by the Google Earth and Google Street View mapping services to check the data classification and analysis for anomalies. The age of the Google Earth aerial photography varied for different municipalities, but the Canadian Google Street View images were mostly taken in 2009, three years after the last census data were collected.

We carried out the classification and analysis of the CTs with simple descriptive statistics using spreadsheets. We transformed the results into choropleth maps using ArcMap geographic information system (GIS) software and then exported them in .kml format to the Google Earth mapping service for error checking. We used the Google Earth and Google Street View mapping services to review apparent anomalies and the morphology of neighborhoods that straddled the divides in the classifications. The morphology of road networks and building types was readily visible using these two resources.

We also used personal knowledge during the review process, producing models and maps for the home cities of the peer reviewers, research assistants, and principal investigators. In this manner, we obtained informed reviews of over half the CMAs. The Google Earth and Google Street View mapping services were particularly useful for this review process, especially in the cities about which the team had less personal knowledge. The reliability of the review process was strengthened by training the research assistants using familiar cities before comparing the classifications in others. Knowledgeable local academics and municipal planners were contacted to resolve final anomalies in a few cases.

Creating Working Definitions

A principal difficulty in estimating the extent of suburban development is defining the phenomenon. There is currently no standard definition, and it is unlikely that a single definition would fit all of the policy analysis requirements. However, there is no reason why working definition(s) could not be developed to help consider the policy implications of suburbia. Our objective was to produce "roughly correct" definitions for practical policy making, similar to Statistics Canada's set of six definitions of "rural" (du Plessis, *et al.*, 2001, 2002).

Previous research (Galster, *et al.*, 2001; Mendelson, 2001; Talen, 2003; Torrens, 2008) has indicated that measuring urbanization requires careful attention to methodological issues, even for relatively simple calculations like the ones proposed for this project. Some interesting approaches to the measurement of suburbs have emerged recently (Bagley, *et al.*, 2002; Forsyth, 2012; Parr, 2007; Song and Knapp, 2007), but they deal mostly with survey data collected for specific areas, rather than census information that could be used across a diverse country, such as Canada. Statistics Canada developed a variety of techniques for estimating the size of the rural population using census data, recommending that policy analysts use the definition that most closely fits the problem they are addressing (du Plessis, *et al.*, 2001, 2002).

Some initial methodological considerations were extracted from the literature. Using political boundaries of urban and suburban municipalities did not look promising due to varying municipal governance structures and annexations (Parr, 2007). Instead, the CT program is the ideal level of analysis for urban-planning purposes at the neighborhood level (Leung, 2003:Ch. 4). The 1951 start for CTs fits the postwar era's rapid expansion of suburban development (Harris, 2004; Hodge and Gordon, 2013:Ch. 5) and allows for time-series analysis of some variables. Although there may be small variations within CTs, the boundaries have been carefully selected to fit relatively homogeneous neighborhoods, with an average population of about 5,000. The CT boundaries are also stable — they may split after growth, but they rarely change, making time-series analysis much easier (Mendelson, 2001).

Although classifying suburban neighborhoods has its difficulties, other imprecise concepts such as "urban," "inner city," and "downtown" have been measured and compared for years, as discussed above. Ley and Frost's (2006) definition of inner city provides several lessons. It is based on a comparison of the proportion of pre-1946 dwellings in a CT to the proportion of pre-1946 dwellings in the entire CMA.[1] In their study, if an individual CT had a larger proportion of older buildings than the CMA average, it was classified as inner city. This definition produced credible results for both large and small CMAs because it did not try to force one threshold across cities of all sizes. Similarly, it produced good results in most parts of Canada because it used the local proportion of older buildings as the criterion. Many older eastern cities have a larger proportion of pre-1946 housing stock. Finally, the local proportion of older buildings dropped with each census, as more new housing was built. Since the classification was based on the proportion of older housing, the inner city was allowed to expand over time, and some older streetcar suburbs like Ottawa's Westboro were added to the inner-city classification in a manner that seemed credible.

Density and built-form variables have been used in many studies. Researchers have found gross density and distance from the city center to be important variables in suburban transportation analysis (Boarnet and Crane, 2001; Ewing and Cervero, 2001, 2010; Filion, *et al.*, 2006; Levinson and Kumar, 1997; Muller, 2004). However, gross population density is difficult to measure in a comparable manner due to the presence of employment areas, water bodies, and environmental protection areas (Gordon and Vipond, 2005). It is not entirely clear why density has performed so well in these analyses, but it appears to be representing a composite of urban-form variables. Other analysts have attempted to classify neighborhoods more directly using urban morphology concepts, such as street connectivity, intersection density, and building types, converted for measurement in GIS systems (Song and Knapp, 2007). However, meta-analyses have indicated that urban design variables have little correlation to vehicular travel for the journey to work (Crane, 2000; Ewing and Cervero, 2001, 2010).

Starting from these previous attempts to define the inner city and suburbs, the research team for this project developed simple models to classify and map definitions of suburbs at the CT level using spreadsheets and GIS. The first step was a pilot study that tested many of these variables for the Ottawa-Gatineau CMA, as described below. The study team then tested several promising definitions of suburbs in 10 CMAs. Next, we used expert judgment to refine and adjust several working definitions of suburbs. A panel of six expert geography and planning researchers discussed the definitions and suggested ways to improve alternative definitions applied in six CMAs during an intensive workshop in a GIS laboratory.

After three potential definitions were identified, the study team used them to classify most of the CMAs. CT data were extracted and sorted to calculate the size of the suburban population and its growth rate from 1996-2006 for all 33 CMAs using the two most reliable families of models. Unfortunately, CT data were not available for many census areas (CAs) (communities with populations over 10,000 and less than 100,000). We tested the most reliable model on a sample of the larger CAs to allow some inferences about the extent of suburban development in the towns and smaller cities.

TABLE 1. Classification criteria for the built-form methods.

Characteristics	Criteria	Included or Excluded in Suburban Area?
Inner city	CT's pre-1946 housing stock is greater than CMA average	Excluded
Rural	Population density is less than or equal to 105 people/km^2	Excluded
Unit-mix ratio	66% or more of a CT's dwellings are single-family detached, semidetached, or attached units	Included
Post-WWII (1945) ratio	25% or more of a CT's dwellings were built post-1945	Included
Homeownership ratio	55% or more of a CT's dwellings are owned	Included

Pilot Study Results from the Ottawa-Gatineau CMA

A pilot study of this technique was completed using the Ottawa-Gatineau CMA (Gordon and Vandyk, 2010). Ottawa was a particularly useful site because it has a continuous greenbelt about 5 km (3.1 mi) from the city center. All of the development outside the greenbelt dates from after 1960, and most of it would be considered suburban. We mapped the expansion of the suburban neighborhoods from 1951-2006 using several classification schemes and an iterative process to determine the schemes' effectiveness in identifying suburban development. We used aerial photo interpretation of typical 2006 suburban characteristics to identify anomalies and compare the various classification schemes.

The results of the comparisons revealed that a built-form classification scheme provided a more accurate and intuitive representation of typical postwar suburban development in the Ottawa CMA than the method suggested by early Statistics Canada proposals (Turcotte, 2008a, 2008b, 2009). We tested several classifications based on built form. Inner-city neighborhoods were identified using Ley and Frost's (2006) definition: CTs with a higher proportion of houses built before 1946 than the CMA average. Rural neighborhoods were classified as CTs with a population density of less than or equal to 105 people/km^2 based on a previous research study (The Ohio State University, 2002). After excluding the inner-city and rural areas, the remaining suburban neighborhoods were identified by a combination of age of housing (the percentage of homes built after 1945); proportion of single-family detached, semidetached, and attached units (unit-mix ratio); and homeownership ratios (Table 1).

By iteration we produced a 2006 classification that matched the Ottawa aerial photo interpretation for suburbs, but none of the definitions we tried produced stable results for earlier census years in the Ottawa-Gatineau CMA. This was because the presence of higher density building types such as apartments and townhouses might have precluded an area from being considered a suburb in a built-form classification. These units were found in many neighborhoods outside the Ottawa greenbelt (such as Kanata and Orleans) that few observers would consider anything but suburban. It was easy to overlook these CTs on first examination because most of their land area is consumed by low-density detached housing on curvilinear streets. However, a cluster of townhouses and apartments in one corner might exclude the entire CT from a suburban classification, even if the transportation data for the CT indicated that the area was almost entirely automobile dependent.

The pilot study revealed that in the 1950s and 1960s, the percentage of single-family detached dwellings was a representative characteristic of suburban development in the Ottawa-Gatineau CMA. However, we found that townhouses and apartments were much more prevalent components of typical suburban communities like Kanata, Barrhaven, Beacon Hill, Orleans, and Gatineau toward the end of the study period. Given this finding, we noted that built-form classification schemes based mainly on the percentage of single-family detached homes may not be effective for identifying more modern suburban communities.

The pilot study demonstrated one good feature of Ley and Frost's (2006) definition of the inner city. By defining the inner city as CTs that have a higher proportion of pre-1946 dwellings than the CMA average, a slow, progressive expansion of the inner city was revealed, producing a credible chronology of inner-city growth during the study period. This exclusion of inner-city areas proved to be an essential and robust component of future suburban classification schemes.

Another essential component of the built-form classification scheme was the exclusion of rural CTs within the CMA. Many of the larger CTs located on the periphery of CMAs exhibited characteristics similar to rural areas. A population density criterion produced consistent results throughout the different census years and was brought forward for classifying the rural/suburban fringe in subsequent models.

Weak Results When Built-Form Methods Applied Nationally

We tested the built-form definitions proposed by Statistics Canada (Turcotte, 2008a, 2008b, 2009) and our pilot study in 10 CMAs using 2006 data. Unfortunately, built-form definitions that produced reasonable results in our pilot site of Ottawa-Gatineau often produced suburban classifications that made little sense in other cities. In contrast, a rural classification based on population density seemed to work reasonably well in most CMAs, although there were many anomalies associated with oversized CTs, water bodies, and small residential developments. Water bodies were excluded from the area of all CT maps, but large parks and new residential development on the rural fringe that had not been given their own CT required that we carefully examine the associated aerial photography by projecting the classification maps into the Google Earth mapping service. Although the density method had some difficulties when it was used for defining a rural or an exurban area, it was a more effective classification method than establishing a limit based on the distance from the center of the CMA. A radius that was appropriate for a large CMA, such as 5 km (3.1 mi) (*ibid.*), would not work for a smaller CMA or the CAs.

Ley and Frost's (2006) inner-city definition based on the proportion of pre-1946 dwellings produced credible results for most smaller metropolitan areas. However, the definition began to break down after 1996 for the larger CMAs that were experiencing large-scale inner-city redevelopment of their waterfronts, railway yards, and brownfields. Some Vancouver, Toronto, and Montreal downtown CTs were not classified as inner city because they were composed entirely of new buildings, and other central neighborhoods began to drop out of the inner-city category because they experienced substantial infill of new apartment buildings. As the redevelopment and infill of inner cities continues, this flaw will become a more serious drawback to this method.

However, the most serious disadvantage of built-form definitions was the wide variation in building types deployed across Canadian metropolitan areas. A lower proportion of single-family detached homes did not work as an exclusion criterion because of the pockets of suburban townhouses and apartments that were identified in Ottawa-Gatineau and found in almost every Canadian city. This phenomenon is not an accident. Standard land-use planning procedures have called for a mix of dwelling-unit types in suburban communities since the 1960s (Hodge and Gordon, 2013; Leung, 2003). For example, Don Mills, the iconic suburb built in the 1950s, contains many apartment buildings in the core of the community and clusters of townhouses in most neighborhood units (Sewell, 1993).

Similarly, the presence or absence of apartments may not signal an inner-city CT. Several of Montreal and Québec's inner-city neighborhoods contain few apartments but have large concentrations of townhouses and stacked townhouses. These building-type anomalies confounded all of the classification schemes we attempted to deploy across Canada. Local and regional variations in building types and densities broke all of our attempts at a standard definition. Another problem with the built-form methods was the almost purely empirical and iterative nature of the models. In our attempts to produce a classification model that would reproduce the results on the ground, we drifted further and further from the slender theoretical bases of the built-form literature. After 18 months of experimentation with built-form methods, the research team switched to models based on transportation methods, which immediately produced more credible results.

More Credible Results with Transportation Methods

In its long-form census, Statistics Canada collects valuable information on the mode of transportation people use to get to work (Heisz and Larochelle-Côté, 2005; Martel and Caron Malenfant, 2007; Turcotte, 2008a). These data were quite useful for classifying neighborhoods according to the transportation behavior of their residents.

Active cores

Only 7.1% of the Canadian labor force uses active transportation (walking or cycling) to get to work (Turcotte and Ruel, 2008). However, we discovered that active transportation was heavily concentrated in the cores of the metropolitan areas and was the dominant transportation mode in some inner-city CTs. Active transportation was a better criterion for defining the core of a city than transit use, which should not be a surprise, since one of the principal advantages of downtown living is the ability to walk or cycle to a job in the central business district. Transit use was highest in the inner suburbs with good transit service. These neighborhoods were too far removed from employment concentrations to walk or cycle to work, but a transit pass provided a convenient alternative to commuting by automobile in congested areas (see Figure 1).

We defined an "active core" as a neighborhood that has a 50% higher rate of active transportation (walking or cycling) than the overall average for the CMA. These CTs are generally in central areas and the downtowns of cities. They also include the new infill neighborhoods not classified by Ley and Frost's inner-city definition based on pre-1946 buildings. Our definition was structured using local proportions of active transportation, which had the virtue of producing results that seemed credible across Canada in both large and small centers (Figures 2-4).[2] We also tried many combinations of active transportation with other variables such as the ratios of households without children or pre-1946 buildings, but these additional variables did not demonstrate more credible results and detracted from the simplicity of the model.

In some larger cities, active cores have begun to form in some secondary centers outside of the downtown, such as Burnaby's MetroTown and Langley within the Vancouver CMA (see Figure 3). In larger metropolitan areas, multiple active cores were also observed in the downtowns of older communities that have been absorbed into larger CMAs, such as St. Jerome in Montreal; Oakville in Toronto; and the CMA containing the cities of Kitchener, Waterloo, and Cambridge. This is one reason for using the name "active core" as opposed to "inner city." Based on our analysis, in 2006, approximately 2.6 million Canadians were living in active cores, making up about 12% of the population in metropolitan areas (see Table 2).

Exurban areas

We defined "exurban" areas as CTs that have low gross population density and mostly depend on automobile use. We prefer the term "exurban" to "rural" for these neighborhoods because the edges of CMAs are defined by the areas where over half of the labor force commutes to the central city for employment. Most of the people in these outer CTs are not engaged in rural or agrarian activities on a full-time basis (Bollman, 2007). Although exurban areas may not be entirely included in the suburban category, most residents live in single-family detached homes and commute by automobile to the central city.

We tested three different definitions of "low density" for rural/exurban areas and settled on the Organization of Economic Co-operation and Development's "rural communities" definition, which is limited to areas that have less than or equal to 150 people/km^2. This is one of the methods recommended by Statistics Canada for rural lands analysis (du Plessis, *et al.*, 2001).

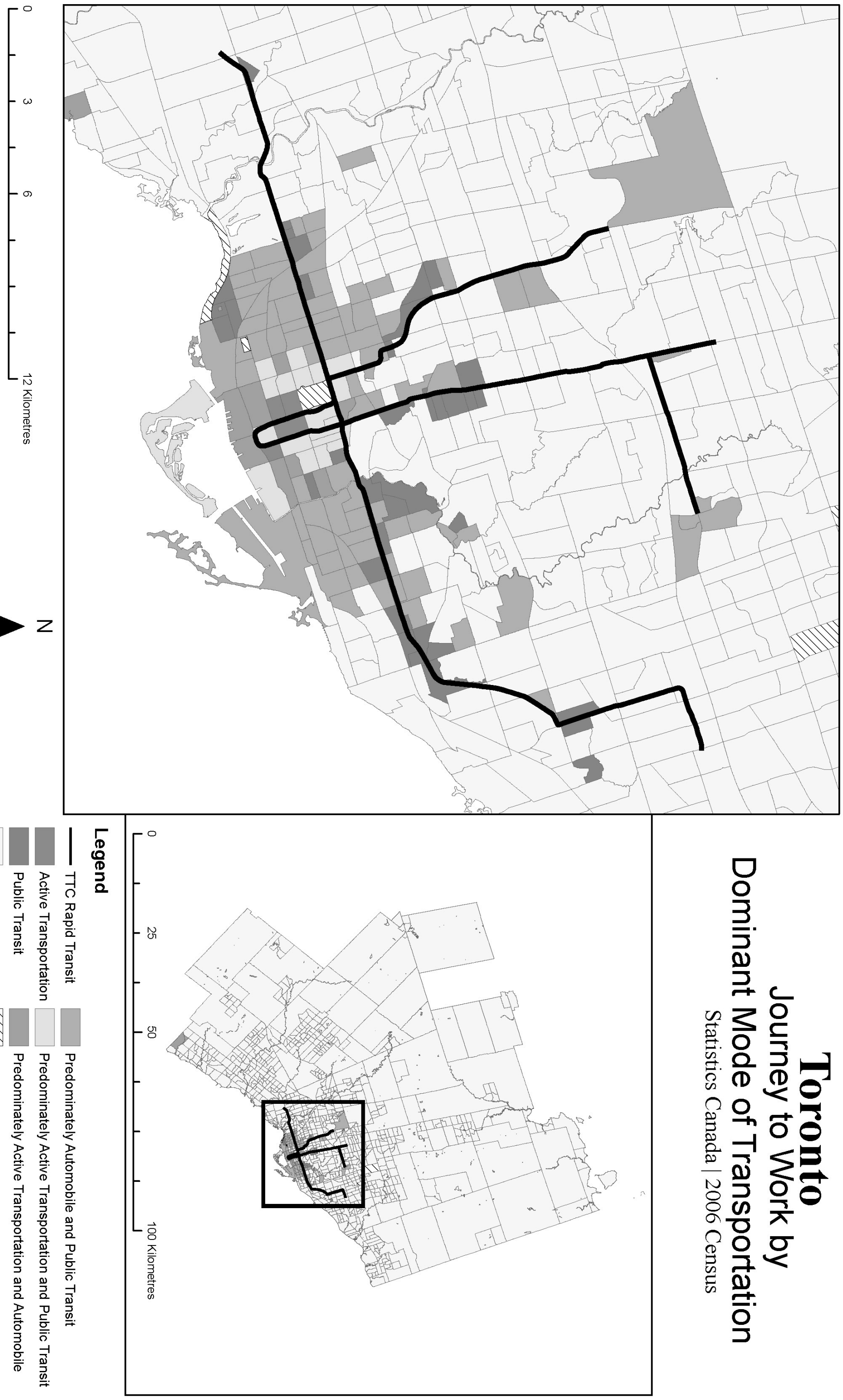

FIGURE 1. Toronto: dominant modes for traveling to work.

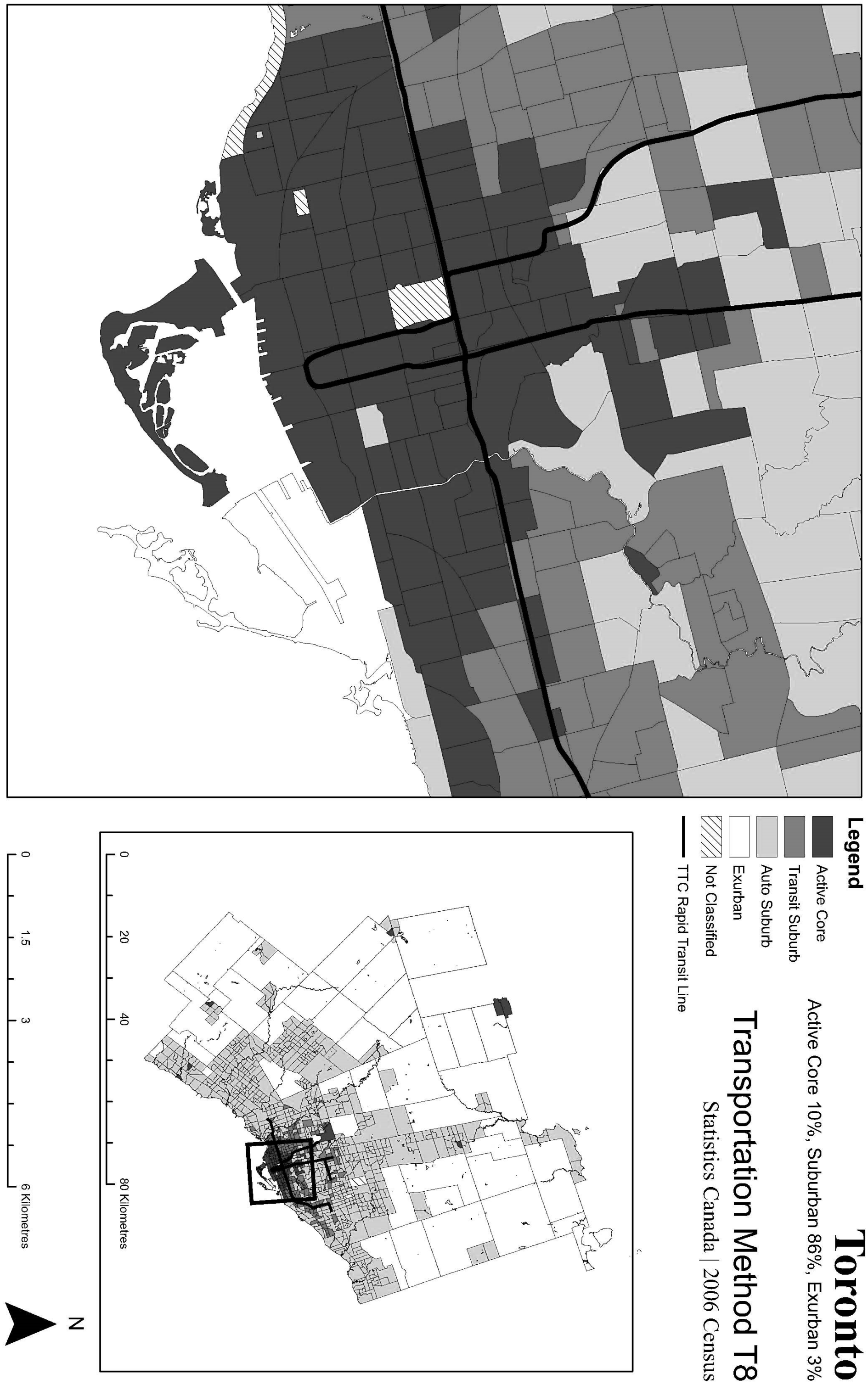

FIGURE 2. Toronto: transportation model T8.

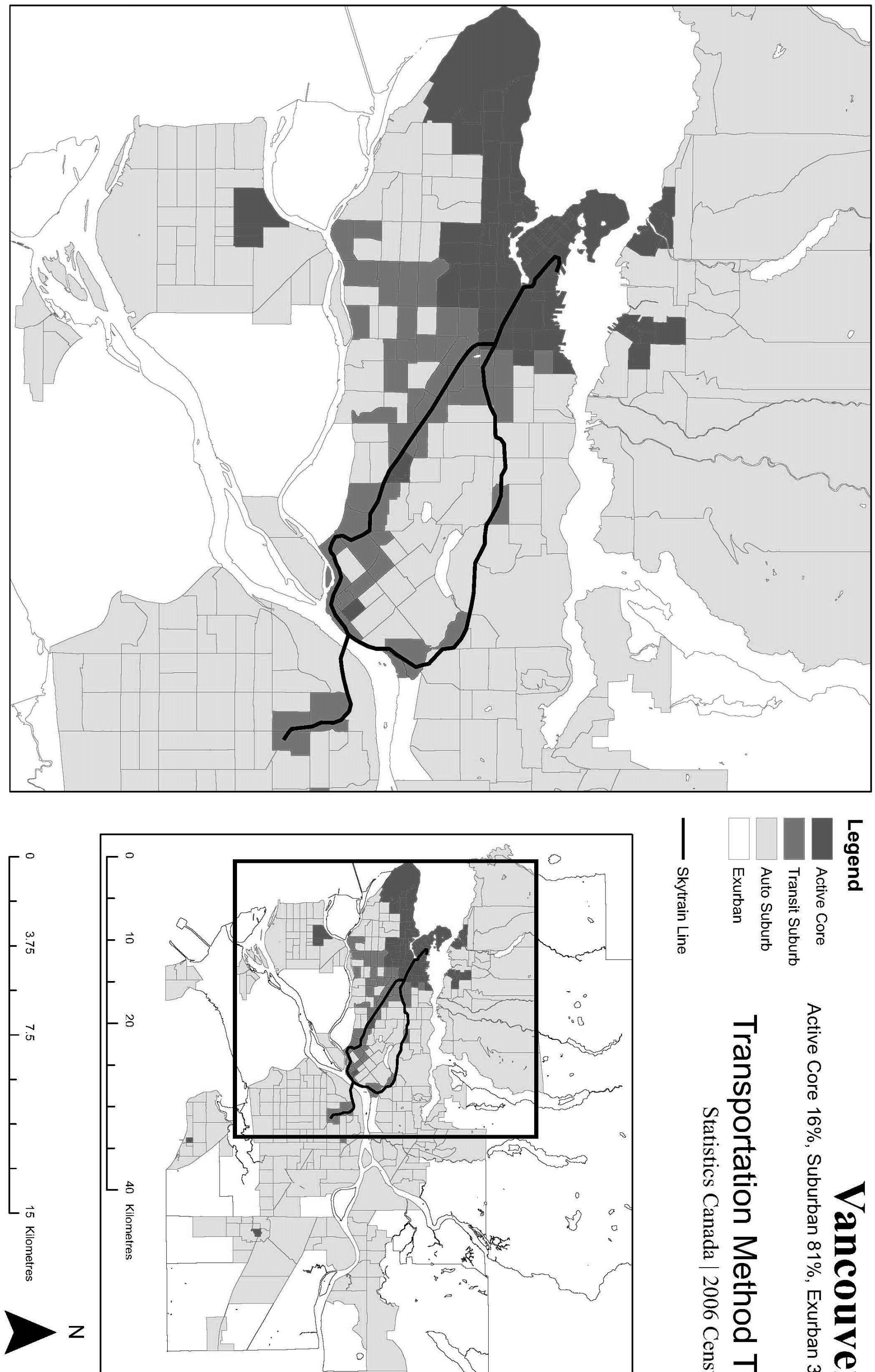

FIGURE 3. Vancouver: transportation model T8.

FIGURE 4. Montreal: transportation model T8.

TABLE 2. Active core, suburb, and exurban proportions in Canadian CMAs based on the 1996 and 2006 censuses using transportation model T8 (data source: Statistics Canada, 1996, 2006).

City	Pop. in 1996	Pop. in 2006	Pop. growth	Active Core					Suburbs					Exurban				
				Pop. in 1996	%	Pop. in 2006	%	Gr.	Pop. in 1996	%	Pop. in 2006	%	Gr.	Pop. in 1996	%	Pop. in 2006	%	Gr.
Toronto	4,262,045	5,111,310	19.9%	359,010	8%	530,285	10%	48%	3,748,980	88%	4,410,425	86%	18%	154,055	4%	170,600	3%	11%
Montreal	3,326,410	3,634,115	9.3%	334,615	10%	384,275	11%	15%	2,842,365	85%	3,119,090	86%	10%	149,430	4%	130,750	4%	-13%
Vancouver	1,831,675	2,116,620	15.6%	259,635	14%	346,275	16%	33%	1,502,225	82%	1,710,300	81%	14%	69,815	4%	60,045	3%	-14%
Ottawa	1,010,500	1,129,780	11.8%	127,775	13%	143,155	13%	12%	733,320	73%	838,795	74%	14%	149,405	15%	147,830	13%	-1%
Calgary	821,595	1,079,315	31.4%	123,175	15%	152,690	14%	24%	659,495	80%	874,445	81%	33%	38,925	5%	52,180	5%	34%
Edmonton	862,565	1,034,690	20.0%	96,080	11%	122,905	12%	28%	646,945	75%	787,460	76%	22%	119,540	14%	124,325	12%	4%
Québec	671,905	712,570	6.1%	96,630	14%	114,870	16%	19%	499,885	74%	512,535	72%	3%	75,390	11%	85,165	12%	13%
Winnipeg	667,220	694,850	4.1%	78,800	12%	86,220	12%	9%	540,350	81%	552,860	80%	2%	48,070	7%	55,770	8%	16%
Hamilton	624,320	693,185	11.0%	89,165	14%	79,670	11%	-11%	485,675	78%	561,695	81%	16%	49,480	8%	51,820	7%	5%
London	398,615	457,775	14.8%	56,705	14%	66,605	15%	17%	293,970	74%	323,375	71%	10%	47,940	12%	67,795	15%	41%
Kitchener	382,960	449,990	17.5%	56,350	15%	49,050	11%	-13%	302,625	79%	376,885	84%	25%	23,985	6%	24,055	5%	0%
St. Catharines	372,415	390,600	4.9%	51,925	14%	59,385	15%	14%	266,035	71%	275,585	71%	4%	54,455	15%	55,630	14%	2%
Halifax	332,545	372,765	12.1%	43,665	13%	51,485	14%	18%	218,345	66%	231,845	62%	6%	70,535	21%	89,435	24%	27%
Oshawa	268,755	330,695	23.0%	13,580	5%	12,870	4%	-5%	232,030	86%	286,825	87%	24%	23,145	9%	31,000	9%	34%
Victoria	304,330	329,995	8.4%	58,560	19%	59,300	18%	1%	224,395	74%	257,185	78%	15%	21,375	7%	13,510	4%	-37%
Windsor	278,690	323,460	16.1%	29,930	11%	49,855	15%	67%	215,580	77%	234,835	73%	9%	33,180	12%	38,770	12%	17%
Saskatoon	219,045	233,820	6.7%	25,850	12%	31,285	13%	21%	167,740	77%	170,915	73%	2%	25,455	12%	31,620	14%	24%
Regina	193,640	195,010	.7%	21,725	11%	31,720	16%	46%	153,240	79%	145,925	75%	-5%	18,675	10%	17,365	9%	-7%
Sherbrooke	147,390	186,890	26.8%	20,155	14%	19,825	11%	-2%	97,570	66%	129,165	69%	32%	29,665	20%	37,900	20%	28%
St. Johns	174,045	181,025	4.0%	25,010	14%	22,815	13%	-9%	123,705	71%	129,325	71%	5%	25,330	15%	28,885	16%	14%
Barrie	118,700	177,020	49.1%	13,620	11%	15,925	9%	17%	80,295	68%	133,470	75%	66%	24,785	21%	27,625	16%	11%
Kelowna	136,535	162,265	18.8%	20,655	15%	28,175	17%	36%	85,500	63%	108,790	67%	27%	30,380	22%	25,300	16%	-17%
Abbotsford	136,475	158,875	16.4%	4,825	4%	0	0%	n/a	104,925	77%	135,450	85%	29%	26,725	20%	23,425	15%	-12%
Sudbury	160,490	158,240	-1.4%	23,960	15%	23,645	15%	-1%	101,020	63%	100,080	63%	-1%	35,510	22%	34,515	22%	-3%
Kingston	143,430	152,330	6.2%	25,910	18%	22,335	15%	-14%	78,855	55%	92,880	61%	18%	38,665	27%	37,115	24%	-4%
Saguenay	160,460	151,655	-5.5%	13,905	9%	13,580	9%	-2%	95,095	59%	86,565	57%	-9%	51,460	32%	51,510	34%	0%
Trois-Rivières	139,940	141,395	1.0%	15,055	11%	18,345	13%	22%	95,815	68%	88,940	63%	-7%	29,070	21%	34,110	24%	17%
Guelph	105,410	126,975	20.5%	15,815	15%	23,060	18%	46%	77,885	74%	91,860	72%	18%	11,710	11%	12,055	9%	3%
Moncton	113,490	126,405	11.4%	14,370	13%	18,065	14%	26%	69,200	61%	76,615	61%	11%	29,920	26%	31,725	25%	6%
Brantford	100,250	124,745	24.4%	11,420	11%	11,490	9%	1%	81,730	82%	88,970	71%	9%	7,100	7%	24,285	19%	242%
Thunder Bay	125,565	122,820	-2.2%	22,960	18%	13,790	11%	-40%	73,200	58%	76,160	62%	4%	29,405	23%	32,870	27%	12%
Saint John	125,700	122,280	-2.7%	15,590	12%	12,650	10%	-19%	69,230	55%	67,745	55%	-2%	40,880	33%	41,885	34%	2%
Peterborough	100,185	116,595	16.4%	18,330	18%	23,275	20%	27%	51,195	51%	51,640	44%	1%	30,660	31%	41,680	36%	36%
TOTAL	18,817,295	21,500,060	14.3%	2,184,755	12%	2,638,875	12%	21%	15,018,420	80%	17,128,635	80%	14%	1,614,120	9%	1,732,550	8%	7%

Note. Percentages may not add up to 100 due to rounding.

In 2006, about 1.7 million Canadians were living in the exurban districts of CMAs, where they comprised perhaps 8% of the total metropolitan population (see Table 2). This lifestyle appears to be harder to achieve in the largest cities; the exurban populations in Toronto, Montreal, and Vancouver were between 3-4%, perhaps because of the difficulty of long-distance commuting into metropolitan traffic congestion. However, most of the smaller CMAs have exurban populations of 15-36%, comprising a substantial proportion of their metropolitan populations. Commuting from rural areas to employment in the central city appears to be substantially easier in areas like Thunder Bay and Saguenay.

Once the active cores and exurban areas are excluded, the remainder of the metropolitan population comprises some form of suburb. Suburbs are areas that have low rates of active transportation and generally high rates of automobile use.

Classification of suburbs by density

We considered two main methods for classifying the suburbs. In the density family of definitions, CTs are classified by their potential for transit use based on population density. In the transportation family of definitions, CTs are classified based on people's actual behavior in using transit or automobiles to get to work. We tested four density definitions and eight transportation definitions, as shown in Table 3.

The four density models (D1-D4 in Table 3) were based on criteria from a classic transit-planning reference (Pushkarev and Zupan, 1977) that are still used as a threshold for transit use (Litman, 2010). The three suburb categories proposed were transit-supportive suburb, transition suburb, and auto suburb. Transit-supportive suburbs require a gross residential density greater than 17 housing units per hectare (uph), which is the requirement for an intermediate level of bus transit service. Transition suburbs require between 10-17 uph. A threshold of 10 uph is required for a minimum level of bus transit service. In this method, auto suburbs are defined by a threshold of less than 10 uph.

However, even though this method only required the gross residential density considered necessary to support intermediate transit service (17 uph), few Canadian neighborhoods had the density to justify this classification. Only 15% of the metropolitan population lived in suburban neighborhoods that met this threshold, and many smaller CMAs did not have any CTs in this category. Over 42% of the metropolitan population lived in CTs that did not even meet the density threshold for a minimum level of bus service and were therefore classified as auto suburbs. This led to some strange comparisons with the transportation models discussed below because many neighborhoods with some transit use did not appear to have the minimum density levels needed for economical bus service. The analysis from the density models may contribute to the debate about why most Canadian transit services lose money.

Classification of suburbs by transportation mode

In the transportation models (T1-T8 in Table 3), CTs are classified by the residents' level of transit or automobile use to get to work. Table 4 shows the suburbs divided into transit suburbs and auto suburbs. Auto suburbs exhibit very low transit-use rates, and the automobile is the dominant mode of transportation. Transit suburbs are CTs that have a higher rate of transit use than the overall average for the CMA. The most credible and consistent results emerged from a definition of transit suburbs based on a transit-use rate threshold of 150% of the 2006 CMA average transit modal split (T8 in Table 3; Table 4).[3]

Using this classification, in 2006, approximately 69% of Canada's metropolitan population lived in auto suburbs and 11% lived in transit suburbs (Table 4). While the density models may be useful for some purposes, we decided to use the transportation models to classify suburbs for the remaining analysis because they are based on residents' actual behavior in taking transit to work, rather than a more abstract measure of potential for transit use.

TABLE 3. Alternative models for classifying Canadian suburbs (active core, suburb, and exurban proportions in Canadian CMAs based on the 1996 and 2006 censuses).

T1	**ACore**	**InnerS**	**TS**	**AutoS**	**Ex**		**T7**	**ACore**	**InnerS**	**TS**	**AutoS**	**Ex**
Density	> 150	> 150	> 150	> 150	≤ 150		Density	> 150	> 150	> 150	> 150	≤ 150
Active transportation	≥ 1.5*AV	< 1.5*AV	< 1.5*AV	< 1.5*AV	--		Active transportation[a]	≥ 1.5*AV	< 1.5*AV	< 1.5*AV	< 1.5*AV	--
Transit rate	--	≥ .5*AV	≥ .5*AV	< .5*AV	--		Transit rate[b]	--	≥ 1.5*AV	≥ 1.5*AV	< 1.5*AV	--
Dwelling composition	--	<AV	>AV	--	--		Dwelling composition	--	<AV	>AV	--	--
% of all CMAs	13%	26%	34%	19%	8%		% of all CMAs	12%	9%	2%	69%	8%
T2	**ACore**	**TrS**		**AutoS**	**Ex**		**T8**	**ACore**	**TrS**		**AutoS**	**Ex**
Density	> 150	> 150		> 150	≤ 150		Density	> 150	> 150		> 150	≤ 150
Active transportation	≥ 1.5*AV	< 1.5*AV		< 1.5*AV	--		Active transportation[a]	≥ 1.5*AV	< 1.5*AV		< 1.5*AV	--
Transit rate	--	≥ .5*AV		< .5*AV	--		Transit rate[b]	--	≥ 1.5*AV		< 1.5*AV	--
% of all CMAs	13%	60%		19%	8%		% of all CMAs	12%	11%		69%	8%
T3	**ACore**	**InnerS**	**TS**	**AutoS**	**Ex**		**D1**	**ACore**	**TSS**	**TS**	**AutoS**	**Ex**
Density	> 150	> 150	> 150	> 150	≤ 150		Density	> 150	> 150	> 150	> 150	≤ 150
Active transportation[a]	≥ 1.5*AV	< 1.5*AV	< 1.5*AV	< 1.5*AV	--		Active transportation	≥ 1.5*AV	< 1.5*AV	< 1.5*AV	< 1.5*AV	--
Transit rate	--	≥ .5*AV	≥ .5*AV	< .5*AV	--		Dwelling density (uph)	--	> 17	10-17	< 10	--
Dwelling composition	--	<AV	>AV	--	--		% of all CMAs	13%	15%	22%	42%	8%
% of all CMAs	12%	27%	34%	19%	8%							
T4	**ACore**	**InnerS**	**TS**	**AutoS**	**Ex**		**D2**	**ACore**	**TSS**		**AutoS**	**Ex**
Density	> 150	> 150	> 150	> 150	≤ 150		Density	> 150	> 150		> 150	≤ 150
Active transportation[a]	≥ 1.5*AV	< 1.5*AV	< 1.5*AV	< 1.5*AV	--		Active transportation	≥ 1.5*AV	< 1.5*AV		< 1.5*AV	--
Transit rate	--	≥AV	≥AV	<AV	--		Dwelling density (uph)	--	> 10		< 10	--
Dwelling composition	--	<AV	>AV	--	--		% of all CMAs	13%	37%		42%	8%
% of all CMAs	12%	20%	12%	47%	8%							
T5	**ACore**	**InnerS**	**TS**	**AutoS**	**Ex**		**D3**	**ACore**	**TSS**		**AutoS**	**Ex**
Density	> 150	> 150	> 150	> 150	≤ 150		Density	> 150	> 150		> 150	≤ 150
Active transportation[a]	≥ 1.5*AV	< 1.5*AV	< 1.5*AV	< 1.5*AV	--		Active transportation[a]	≥ 1.5*AV	< 1.5*AV		< 1.5*AV	--
Transit rate	--	≥ 1.5*AV	≥ 1.5*AV	< 1.5*AV	--		Dwelling density (uph)	--	> 10		< 10	--
Dwelling composition	--	<AV	>AV	--	--		% of all CMAs	12%	37%		42%	8%
% of all CMAs	12%	10%	3%	67%	8%							
T6	**ACore**	**TrS**		**AutoS**	**Ex**		**D4**	**ACore**	**TSS**		**AutoS**	**Ex**
Density	> 150	> 150		> 150	≤ 150		Density	> 150	> 150		> 150	≤ 150
Active transportation[a]	≥ 1.5*AV	< 1.5*AV		< 1.5*AV	--		Active transportation[a]	≥ 1.5*AV	< 1.5*AV		< 1.5*AV	--
Transit rate	--	≥ 1.5*AV		< 1.5*AV	--		Dwelling density (uph)	--	> 17		< 17	--
% of all CMAs	12%	12%		67%	8%		% of all CMAs	12%	15%		65%	8%

Note. ACore = active core; InnerS = inner suburb; TS = transition suburb; AutoS = auto suburb; Ex = exurban; TrS = transit suburb; TSS = transit-supportive suburb; AV = CMA average; [a] = plus threshold of 1.5 times the national average (see endnote 2); [b] = plus threshold of half the national average (see endnote 3). Percentages may not add up to 100 due to rounding.

TABLE 4. Proportion of transit and auto suburbs in Canadian CMAs based on the 1996 and 2006 censuses using transportation model T8 (data source: Statistics Canada, 1996, 2006).

City	Pop. in 1996	Pop. in 2006	Pop. growth	Total Suburbs					Transit Suburbs					Auto Suburbs				
				Pop. in 1996	%	Pop. in 2006	%	Gr.	Pop. in 1996	%	Pop. in 2006	%	Gr.	Pop. in 1996	%	Pop. in 2006	%	Gr.
Toronto	4,262,045	5,111,310	19.9%	3,748,980	88%	4,410,425	86%	18%	712,615	19%	763,635	17%	7%	3,036,365	81%	3,646,790	83%	20%
Montreal	3,326,410	3,634,115	9.3%	2,842,365	85%	3,119,090	86%	10%	427,850	15%	494,610	16%	16%	2,414,515	85%	2,624,480	84%	9%
Vancouver	1,831,675	2,116,620	15.6%	1,502,225	82%	1,710,300	81%	14%	228,085	15%	272,790	16%	20%	1,274,140	85%	1,437,510	84%	13%
Ottawa	1,010,500	1,129,780	11.8%	733,320	73%	838,795	74%	14%	120,015	16%	114,835	14%	-4%	613,305	84%	723,960	86%	18%
Calgary	821,595	1,079,315	31.4%	659,495	80%	874,445	81%	33%	23,095	4%	30,990	4%	34%	636,400	96%	843,455	96%	33%
Edmonton	862,565	1,034,690	20.0%	646,945	75%	787,460	76%	22%	143,335	22%	134,790	17%	-6%	503,610	78%	652,670	83%	30%
Québec	671,905	712,570	6.1%	499,885	74%	512,535	72%	3%	43,380	9%	47,360	9%	9%	456,505	91%	465,175	91%	2%
Winnipeg	667,220	694,850	4.1%	540,350	81%	552,860	80%	2%	56,430	10%	37,575	7%	-33%	483,920	90%	515,285	93%	6%
Hamilton	624,320	693,185	11.0%	485,675	78%	561,695	81%	16%	55,090	11%	75,695	13%	37%	430,585	89%	486,000	87%	13%
London	398,615	457,775	14.8%	293,970	74%	323,375	71%	10%	56,155	19%	63,410	20%	13%	237,815	81%	259,965	80%	9%
Kitchener	382,960	449,990	17.5%	302,625	79%	376,885	84%	25%	32,440	11%	37,090	10%	14%	270,185	89%	339,795	90%	26%
St. Catha-rines	372,415	390,600	4.9%	266,035	71%	275,585	71%	4%	0	0%	6,525	2%	n/a	266,035	100%	269,060	98%	1%
Halifax	332,545	372,765	12.1%	218,345	66%	231,845	62%	6%	46,130	21%	69,915	30%	52%	172,215	79%	161,930	70%	-6%
Oshawa	268,755	330,695	23.0%	232,030	86%	286,825	87%	24%	39,950	17%	43,155	15%	8%	192,080	83%	243,670	85%	27%
Victoria	304,330	329,995	8.4%	224,395	74%	257,185	78%	15%	15,470	7%	38,305	15%	148%	208,925	93%	218,880	85%	5%
Windsor	278,690	323,460	16.1%	215,580	77%	234,835	73%	9%	20,520	10%	1,100	0%	-95%	195,060	90%	233,735	100%	20%
Saskatoon	219,045	233,820	6.7%	167,740	77%	170,915	73%	2%	29,410	18%	14,980	9%	-49%	138,330	82%	155,935	91%	13%
Regina	193,640	195,010	.7%	153,240	79%	145,925	75%	-5%	15,900	10%	5,675	4%	-64%	137,340	90%	140,250	96%	2%
Sherbrooke	147,390	186,890	26.8%	97,570	66%	129,165	69%	32%	5,270	5%	25,765	20%	389%	92,300	95%	103,400	80%	12%
St. Johns	174,045	181,025	4.0%	123,705	71%	129,325	71%	5%	0	0%	9,260	7%	n/a	123,705	100%	120,065	93%	-3%
Barrie	118,700	177,020	49.1%	80,295	68%	133,470	75%	66%	2,440	3%	6,345	5%	160%	77,855	97%	127,125	95%	63%
Kelowna	136,535	162,265	18.8%	85,500	63%	108,790	67%	27%	0	0%	0	0%	n/a	85,500	100%	108,790	100%	27%
Abbotsford	136,475	158,875	16.4%	104,925	77%	135,450	85%	29%	0	0%	0	0%	n/a	104,925	100%	135,450	100%	29%
Sudbury	160,490	158,240	-1.4%	101,020	63%	100,080	63%	-1%	17,460	17%	17,330	17%	-1%	83,560	83%	82,750	83%	-1%
Kingston	143,430	152,330	6.2%	78,855	55%	92,880	61%	18%	29,215	37%	24,995	27%	-14%	49,640	63%	67,885	73%	37%
Saguenay	160,460	151,655	-5.5%	95,095	59%	86,565	57%	-9%	0	0%	0	0%	n/a	95,095	100%	86,565	100%	-9%
Trois-Rivières	139,940	141,395	1.0%	95,815	68%	88,940	63%	-7%	0	0%	0	0%	n/a	95,815	100%	88,940	100%	-7%
Guelph	105,410	126,975	20.5%	77,885	74%	91,860	72%	18%	8,985	12%	11,090	12%	23%	68,900	88%	80,770	88%	17%
Moncton	113,490	126,405	11.4%	69,200	61%	76,615	61%	11%	0	0%	0	0%	n/a	69,200	100%	76,615	100%	11%
Brantford	100,250	124,745	24.4%	81,730	82%	88,970	71%	9%	0	0%	0	0%	n/a	81,730	100%	88,970	100%	9%
Thunder Bay	125,565	122,820	-2.2%	73,200	58%	76,160	62%	4%	5,580	8%	0	0%	n/a	67,620	92%	76,160	100%	13%
Saint John	125,700	122,280	-2.7%	69,230	55%	67,745	55%	-2%	21,055	30%	10,450	15%	-50%	48,175	70%	57,295	85%	19%
Peterbor-ough	100,185	116,595	16.4%	51,195	51%	51,640	44%	1%	0	0%	0	0%	n/a	51,195	100%	51,640	100%	1%
TOTAL	18,817,295	21,500,060	14.3%	15,018,420	80%	17,128,635	80%	14%	2,155,875	14%	2,357,670	14%	9%	12,862,545	86%	14,770,965	86%	15%

TABLE 5. Active core, suburb, and exurban proportions of 10 sample Canadian CAs based on the 2006 census using transportation model T8 (data source: Statistics Canada, 2006).

City	Pop. in 2006	Active Core		Total Suburb		Transit Suburb		Auto Suburb		Exurban	
		Pop.	%*	Pop.	%*	Pop.	%**	Pop.	%**	Pop.	%*
Kamloops	92,735	16,675	18%	46,325	50%	6,535	14%	39,790	86%	29,735	32%
Belleville	91,380	22,170	24%	41,835	46%	0	0%	41,835	100%	27,375	30%
Fredericton	85,725	13,025	15%	42,575	50%	7,435	17%	35,140	83%	30,125	35%
Prince George	83,275	19,170	23%	39,615	48%	0	0%	39,615	100%	24,490	29%
Red Deer	82,750	10,635	13%	72,115	87%	0	0%	72,115	100%	0	0%
Sault Ste. Marie	80,135	8,815	11%	57,525	72%	7,065	12%	50,460	88%	13,795	17%
Drummond-ville	78,080	15,255	20%	46,155	59%	0	0%	46,155	100%	16,670	21%
Medicine Hat	68,805	0	0%	56,580	82%	0	0%	56,580	100%	12,225	18%
Granby	68,280	20,970	31%	33,955	50%	0	0%	33,955	100%	13,355	20%
North Bay	63,460	6,115	10%	41,390	65%	3,675	9%	37,715	91%	15,955	25%
Sample totals	794,625	132,830	17%	478,070	60%	24,710	5%	453,360	95%	183,725	23%
Estimated totals for all CMAs	4,150,095	693,732	17%	2,496,820	60%	129,053	5%	2,367,767	95%	959,542	23%

Note. * = percentage of total population; ** = percentage of total suburban population. Percentages may not add up to 100 due to rounding.

Suburbs in smaller cities — census agglomerations

CMAs accounted for 21.5 million people in 2006, or 68% of Canada's population. However, another 4.1 million Canadians live in smaller cities classified as census agglomerations (CAs). The populations of these settlements range from 10,000-100,000 people, but only the larger CAs have the CTs needed for our analysis. We took a sample of 10 CAs to estimate the proportion of suburbs in this category using transportation model T8. The sample was not random; to control for regional variations, we deliberately selected CAs from each region of the country except Northern Canada (one from the Atlantic region, two from Québec, three from Ontario, two from the Prairies, and two from British Columbia).

The CAs we analyzed displayed characteristics similar to the smaller CMAs: a higher exurban population (23%), very little transit use, and a high proportion of auto suburbs. Extrapolating the sample forward, we estimate that another roughly 2.5 million Canadians live in the suburbs of smaller cities (see Table 5).

FINDINGS AND CONCLUSION

Canada is a suburban nation. In 2006, about 80% of the residents of Canadian metropolitan areas lived in suburbs, while only 12% lived in active core areas (Table 2). Moreover, this result probably underestimates the proportion of suburban residents, since at least half of the exurban residents commute to central city jobs by automobile and live in single-family detached houses.

The proportions were relatively similar in 1996, but the growth rates were slightly different. The active cores of the CMAs grew by 21% from 1996-2006. At the same time, the suburbs grew by 14%, the same rate at which the CMAs grew overall. The exurban areas grew by only 8%, somewhat less than the CMA average. We should not infer too much from these growth rates, but it appears that the downtown building boom in the larger metropolitan areas may be growing at a slightly faster rate than greenfield suburban development. However, we should also note that the active cores, which are promoted as offering a sustainable lifestyle, still only comprise perhaps 12% of the metropolitan population. Almost 80% of the metropolitan growth in the previous decade took place in the suburbs, as more than 2 million Canadians moved into these areas.

The results show that the characteristics of an active core may not be confined to the geographic center of metropolitan areas. By detaching the concept of the active core from the spatial classification of the inner city, we allow for the possibility of other cores embedded in a polynuclear metropolitan structure. This flexibility fits more modern models of urban geography (Bunting, *et al.*, 2002; Yang, *et al.*, 2012) and recent planning movements to create suburban town centers and transit-oriented developments (Filion and McSpurren, 2007).

To estimate the proportion of Canadians who lived in suburbs in 2006, we start by adding the suburban populations of the CMAs and CAs from Tables 2 and 5:

CMA suburbs + CA suburbs = Total suburbs
17,128,635 (87%) + 2,496,820 (13%) = 19,625,455 (100%)

One could argue that at least half of the exurban population is essentially very low density suburban, since the periphery of the metropolitan area is defined by the area where more than 50% of the labor force is commuting to the central city and few are engaged in agriculture (Bollman, 2007). These trips are overwhelmingly taken by automobile, and housing in the exurban CTs mostly consists of single-family detached dwellings. Thus, it seems reasonable to allocate at least half of the exurban population of the CMAs and CAs to the total suburban population:

CMA exurban areas + CA exurban areas = Total exurban areas
1,732,550 (64%) + 959,542 (36%) = 2,692,092 (100%)

50% exurban areas + Total suburbs = Total estimated 2006 suburban population
1,346,046 + 19,625,455 = 20,971,501

The total national population in 2006 was 31,612,897 (Statistics Canada, 2006). Therefore, suburbs accounted for 66% of the Canadian population in 2006. Even if we assume that the remaining Canadian population is rural, Canada's suburban population must be approximately 21 million people, or two-thirds of the total national population. This is a conservative estimate because many small town (less than 10,000 people) residents also live in suburban areas with extensive automobile use and low-density, single-family detached dwellings.

If two-thirds of Canada's population currently lives in suburban neighborhoods, then plans for infrastructure programs, environmental sustainability, public health, land use, and community design should take this phenomenon into account. Future researchers of these issues may wish to use a more refined understanding of the active core, suburban, and exurban components of metropolitan areas.[4] Even if urban development trends were to become significantly more intense, the current suburban neighborhoods will comprise the bulk of the housing stock well into the 21st century. Thus, it appears that Canada is destined to remain a suburban nation in the decades ahead.

NOTES

1. The age of the dwelling is self-reported by the occupants, which can lead to some errors in the data (Baer, 1990). Thanks to an anonymous reviewer for pointing this out.

2. However, since active transportation use in some smaller Canadian cities is quite low, this proportional method allowed the possibility of nonsensical results in some CMAs. For example, only 3.9% of all employees in Abbotsford, British Columbia, use active transportation to get to work. Thus, using this threshold, an Abbotsford neighborhood that showed 6% active transportation and 94% auto use would be considered an active core.

To avoid the anomalies created by this condition, we only classified a CT as an active core if its active transportation rate was also at least 50% higher than the national average in 2006, or 10.65% (Turcotte and Ruel, 2008).

3. Transit-use rates are usually fairly low in many smaller Canadian cities. In several of the smaller CMAs, the transit-use rates in proposed transit suburbs may be absurdly low using this classification. For example, the 2006 transit modal split in the Abbotsford CMA was 1.8%. Therefore, using this threshold, CTs with transit-use rates of just 2.7% (150% of the CMA average) could be classified as transit suburbs. This could lead to a neighborhood with over 97% automobile use being obviously misclassified as a transit suburb. To avoid this difficulty, we only classified a CT as a transit suburb if its transit modal split also exceeded 50% of the national average, or 7.5% (Turcotte and Ruel, 2008). Unlike with the active core threshold, there are few CTs with high rates of the variable; therefore, 50% was not too restrictive and still had the desired effect of requiring the CT to reach a certain threshold.

4. Future researchers who wish to use the CT classifications discussed in this paper may download the spreadsheets from links provided at the Atlas of Suburbanisms website (http://env-blogs.uwaterloo.ca/atlas/?page_id=4027). We hope these classification models may yield more refined analyses of the urban/suburban differences than the previous practice of using municipal political boundaries or the first half of the postal code.

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