

**WHERE DID THE NEIGHBOURHOOD GO?
A LOOK INTO THE SPATIAL DISTRIBUTIONS OF STUDENTS ACROSS ONTARIO MID-SIZED CITIES**

Matthew Lauzon

A Master's Report submitted to the School of Urban and Regional Planning in partial fulfilment of the requirements for the degree of Master of Urban and Regional Planning

School of Urban and Regional Planning

Department of Geography and Planning

Queen's University

Kingston, Ontario, Canada

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A Look Into The Spatial Distributions of Student Housing Across Ontario Mid-sized Cities

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Executive Summary

Enrollment in higher educational institutions (HEI) has been steadily increasing across Canada, while on-campus accommodation provided by the HEI has plateaued. As a result, a majority of upper-year students now turn towards near-campus neighbourhoods for accommodation, displacing many long-term residents and occupying many low-income units. This process, by which residential neighbourhoods become dominated by student occupation, is known as studentification. Surprisingly, municipalities and HEIs collect little information about the locations of student dwellings. Fortunately, the Canadian Census does not classify students living away from their parents' home as occupants of a dwelling, so we can assume that "unoccupied" dwelling units near an HEI are filled with students. This report estimates unoccupied dwellings as potential student dwellings to provide a picture of the geographies of studentification in eleven mid-sized university cities in Ontario.

This report addressed the following questions:

1. Has there been a decline in occupied dwelling units surrounding universities in mid-sized Ontario cities since 2006?
2. Are the changes in occupied dwelling units, population, and total units consistent throughout and between cities?
3. Is there a relation between the number of beds provided by the university and the changes seen in occupied dwellings?

Methods

Using Canadian census data, this report answered these questions by demonstrating a novel method to identify the spatial distributions of students at the census tract (CT) level. Although researchers in Canada cannot reliably identify student living accommodation distributions, the method developed in this report takes advantage of the Canadian Census definition for unoccupied dwellings to approximate the geographies of student accommodation at the CT level. Population and total dwelling units are also used as indicator variables. Newspaper articles, as well as visual clues taken from on-street images, were used to supplement findings from the quantitative analysis.

An increase in occupied units and total dwelling units paired with a decrease in population is indicative of a studentifying CT. The report studied eleven mid-sized census metropolitan areas (CMAs) in Ontario

that included at least one higher educational institution (HEI). Using this definition will allow researchers to approximate the geographies of studentification using free, publicly available data.

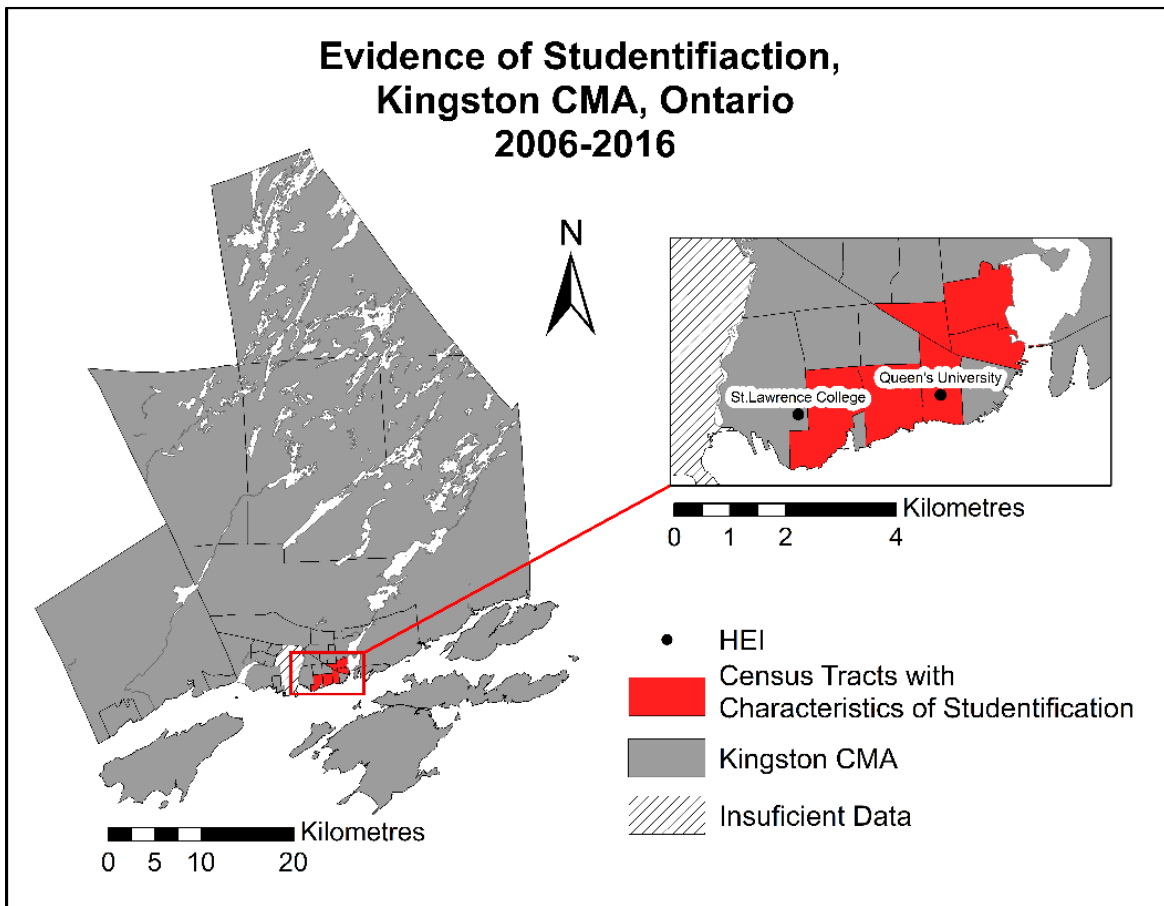


Figure 1: Sample map of evidence of studentification in the Kingston CMA

HEI Enrollment Data and Spatial Distribution of Studentified CTs

Enrolment growth over the period from 2006-2016 across all universities in this study averaged 28%. Furthermore, across all universities, on-campus student accommodation increases were not sufficient to meet the expansion in enrollment (see Table 1). This enrollment growth then becomes absorbed into surrounding communities thereby displacing long-term residents and increasing tensions with those remaining. A measure that was used to show the gap between student population and beds on campus was the ratio of students to beds. Nearly every school saw an increase in this ratio, meaning increases in enrollment outpaced increases in on-campus accommodation.

CTs showing characteristics of studentification were generally clustered around HEIs, with the CTs showing the largest signs of studentification close to universities. The Hamilton, Kingston, and London

CMAAs showed the strongest patterns of studentification, with over 2500 units converting to student dwellings from 2006-2016. These CMAAs in particular all had a single CT close to or containing the university that had high numbers of unoccupied units. There were also several CMAAs where patterns of studentification were not as strong. The Oshawa, Peterborough, and Thunder Bay CMAAs did not see a large conversion of units to unoccupied from 2006 to 2016. Colleges also seemed to influence studentification in the CTs surrounding them – the pattern is most visible in Mohawk College, in Hamilton and St. Lawrence College in Kingston. No positive relationship between university enrollment increases and the number of studentified units surrounding the HEI could be ascertained.

Greater Sudbury, Thunder Bay, and Windsor all saw population declines, which may have affected the accuracy of the results in these CMAAs. The method may be capturing housing abandonment or foreclosures in these CMAAs, highlighting the need for contextual analysis when applying this method. Another four CTs were found to be anomalous, all located next to Great Lakes, possibly alluding to the conversion of units to cottages or short-term rentals.

Recommendations & Limitations

Studentification often reshapes the fabric of neighbourhoods, removes low-income units from the dwelling stock, and disproportionately affects long-term residents. It is recommended that institutions and municipalities consider this method as a low-cost, easily accessible way to approximate the geographies of studentification to better predict where students are finding accommodation. Understanding the spatial distribution of students and their migration within cities is invaluable for planners and policymakers to develop policy in response to anticipated patterns in student accommodation locations.

There are certain limitations present in using this method, and its observations should be interpreted with caution. The method employed in the report is a working method and has not been thoroughly tested. This method should not be applied exclusively when studying the geographies of studentification. Different processes may present similar influences on the variables, as such a more nuanced approach should be taken when applying this method. Qualitative analysis should also be conducted to improve accuracy and validate results.

Table 1 Summary of Data collected on universities included in case studies.

CMA	University	Enrollment (2006)	Enrollment (2016)	University Growth (2006-2016)	University Student Accommodation (number of beds)		Number of new beds on campus (2006-2016)	Ratio of Students to Beds (2006)	Ratio of Students to Beds (2016)	Number of CTs Showing Studentification Characteristics		Estimated Units Converted (2006-2016)	
					2006	2016				University Adjacent	Rest of City	University Adjacent	Rest of City
Greater Sudbury	Laurentian	8,726	9,603	877	1271	1507	236	6.9	6.4	2	5	354	462
Guelph	Guelph	21,656	28,748	7092	4625	4625	0	4.7	6.2	3	0	318	0
Hamilton	McMaster	24,265	30,368	6103	3686	3686	0	6.6	8.2	2	9	473	810
Kingston	Queen's	18,249	23,559	5310	3886	4436	550	4.7	5.3	5	1	1135	166
K-C-W	Wilfrid Laurier	14,275	17,880	3605	2495	2823	328	5.7	6.3	2	1	239	11
	Waterloo	25,910	36,665	10755	5724	5724	0	4.5	6.4				
London	Western	25,923	29,990	4067	4316	5303	987	6.0	5.7	4	7	872	510
Oshawa	Ontario Tech	4,299	9,931	5632	1320	1536	216	3.3	6.5	1	0	106	0
Peterborough	Trent	7,475	8,816	1341	1343	1523	180	5.6	5.8	0	2	0	157
St. Catharines	Brock	17,145	17,998	853	2407	2407	0	7.1	7.5	2	4	312	98
Thunder Bay	Lakehead	7,342	7,806	464	N/A	N/A	N/A	N/A	N/A	1	3	20	185
Windsor	Windsor	16,340	15,314	-1026	928	928	0	17.6	16.5	6	1	418	27

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- Matthew Lauzon

1 Introduction

1.1 Statement of General Problem

Increasing student enrollment in HEIs has been a long-standing trend in Ontario (CMHC, 2017).

However, universities have failed to provide adequate accommodations for this influx of students, relying on the private market to fill demand (Frierson, 2005). Concerns over this increase of students in residential neighbourhoods stemming from social, cultural, economic, and physical differences between students and local residents have increased tension between “town and gown” institutions (Anderson, 2013). This struggle between Higher Educational Institutions (HEI’s) and the cities and towns in which they are located can be traced back to the 1355 St. Scholastica Day riot (Hundscheid, 2010). While the discourse of this struggle has evolved over the centuries, it still persists.

Studentification is broadly defined as “the process by which specific neighbourhoods become dominated by student residential occupation” (Anderson, 2013, pg. 1). This term describes neighbourhoods near universities that are characterized by high growth of students in concentrated areas leading to a displacement of long-term residents. Ultimately, this leads to a reshaping of neighbourhoods, in which only the needs of students are cared for (Donaldson *et al.* 2014). Many universities have shifted away from a commuter focus to one of a residential campus model, however, they have failed in increasing their accommodations alongside this shift (Ehlenz, 2019b). Consequently, this shift has stimulated private investment in purpose-built student accommodation (PBSA) resulting in the commodification of student living (Holloway *et al.* 2010; Smith and Hubbard, 2014; Smith *et al.*, 2014).

Despite this persistent struggle, very little research has been done on studentification in a Canadian context. Much of the early body of research on the subject is confined to the U.K. (Smith, 2005; Smith and Holt, 2007). Studentification undoubtedly exists in Canada (Fox, 2012; Smith & Fox, 2019) yet what little research has been done seems to be centred on the City of Waterloo (Charbonneau *et al.*, 2006; Moos *et al.*, 2019; Revington, 2020; Revington *et al.*, 2020). Several local Town and Gown Committees and the Town and Gown Association of Ontario (TGAO) have been created in response to the issues surrounding studentification. These committees bring stakeholders together to develop strategies for addressing conflict and negative associations between town and gown (Fox, 2012). Since their establishment in 2006 the TGAO’s focus has been on improving relations between HEI’s and communities, however, little is known about the spatial distributions of students in these cities. Identifying emerging spatial patterns of studentification across cities is an important first step for

policymakers and planners to proactively enact policies in newly studentifying areas and adjust policy in places where heavy studentification is occurring.

1.2 Increasing Enrollment

University enrollment has been steadily increasing since the 1950s, with post-secondary education enrollment exploding in the 1960s due to the Baby Boom and an unprecedented investment in Canadian education (Statistics Canada, 2014). University enrollment increased from 63,500 in 1951 to 371,000 in 1975. As of 2020, that number has reached a staggering 1.4 million students due to a much higher participation rate (Friesen, 2020; Statistics Canada, 2014). Universities are openly chasing students and have invested more in attracting higher enrollments as well as international students (Macintyre, 2003). Policies in Ontario have been directed towards enrollment growth, with Provincial funding directly tied to enrollment (Jones and Field, 2013). With a focus on increasing enrollment, a shift in priorities occurred in universities; instead of focusing on a collegial environment, universities began emphasizing study spaces on campus (Earl, 2016). With a lack of beds to compensate for this growth, on-campus accommodation is generally reserved for first-year students, leaving the private market as the only option for many upper-year and graduate students.

1.3 Effects of Studentification

Municipalities have long favoured establishing HEIs in their boundaries, as they often employ large segments of the population (Sen, 2011), and can contribute to successful downtowns (Charbonneau et al., 2006; Filion *et al.* 2004). Universities can act as engines of economic growth in a region, introducing new research and development-based start ups and causing an in-migration of highly skilled graduates (Drucker & Goldstein, 2007). However, there are negative aspects that can come from growing universities, primary of which stem from conflicts between long-term residents and students. These aspects do not exist independently and can be summarized into four broad categories: social, cultural, physical, and economic (Anderson, 2013).

Social Impacts

Studentification brings a decline in 'neighbourhood connections' associated with a reduction in social interactions between long-term residents as they get displaced. There is a gradual erosion of the established residents by students who are often associated with loud parties, messy, unkempt homes, and increased refuse or fly-tipping (Anderson, 2013; Smith et al., 2014). The streetscape is effectively changed once a certain 'tipping point' is reached. This occurs when the neighbourhood no longer suits the needs of long-term residents creating a feedback loop, further perpetuating the studentification

process (Munro et al., 2009; Smith, 2005) so established residents begin to leave *en masse*, further feeding into the character of a student neighbourhood. Associated with studentification is the reduction in local services, especially schools, which experience a gradual reduction in their catchment areas (Smith & Fox, 2019). Additionally, there tends to be a proliferation of establishments catering to student needs, increasing nighttime activity, and reducing residential amenity (Smith & Fox, 2019). A high concentration of students may also lead to an increase in crime because student households often have high-value goods and low security (Munro et al., 2009). An increase in crime may also be attributed to the students themselves as they perpetuate relatively minor, often inebriated-induced crimes (Selwyn, 2008).



Figure 1- 1: Kingston Collegiate and Vocational Institute (KCVI) a historic school in the heart of Kingston closed its doors in late 2020 over 225 years after it first welcomed students in its neighbourhood. Image source: Davis, D. (2019) Global News , retrieved from <https://globalnews.ca/news/5174027/transitioning-kingston-secondary-school-kcvi-memorabilia/>

Cultural Impacts

Many of the resultant challenges associated with studentification can be traced back to differences in culture between established residents and students (Anderson, 2013). The proliferation of young students with similar cultures and lifestyles in neighbourhoods engenders community cohesion (Anderson, 2013; Smith & Fox, 2019). Near campus neighbourhoods attract students an inevitable occurrence that will remain as long as the HEI's remain (Allinson, 2006). Conflicts between established

residents and students stem from different perceptions on neighbourhood obligations (Smith & Fox, 2019), late night social gatherings and parties are viewed by long-term residents – with early morning work and school commitments – with disdain.



Figure 1- 2: Around 20,000 students in London On, gathered on Broughdale Avenue for Western’s FOCO (Fake homecoming) celebration in 2018. Image source: London Police Service (2018). Retrieved from <https://globalnews.ca/news/5203671/western-universitys-board-approves-penalties-for-student-misconduct-during-fake-homecoming/>

Physical Implications

A reduction in the physical attractiveness of neighbourhoods is often associated with studentification. For instance, a decline in long-term residents can lead to the degradation of the streetscape. These neighbourhoods are often characterized by unkempt properties, increased refuse, dereliction of homes, and neglect or replacement of gardens (Anderson, 2013; Smith & Fox, 2019). There can also be negative impacts on transportation, congestion on public transport lines heading to HEI’s, increased on-street parking pressures, and increased congestion around move-in and graduation (Smith & Fox, 2019).



Figure 1- 3 Unkempt lawns, driveways, and garbage left out by the road and in-between houses in a studentified neighbourhood near McMaster university. Image source: Google Street View. Retrieved August 13, 2020.

Economic

One of the most detrimental aspects of studentification in neighbourhoods is the increase in house prices. An influx of demand for units close to the HEI drive up prices which tends to change the balance in the housing stock “resulting in neighbourhoods becoming dominated by private rented accommodations and houses in multiple occupation and decreasing levels of owner-occupation” (Queen’s Housing & Ancillary Services, 2015, pg. 14). Rising home prices and willing students also remove many affordable rental housing units in the community that formerly served low-income households (Ehlenz, 2019a: Smith & Fox, 2019). Student dormitories on campus lands tend to be exempt from local taxation, thereby increasing the strain on municipal servicing in some areas.

It may be easy to conclude that students are then enemies of local residents and should be kept out at all costs. This, however, is a naive judgment as having students in neighbourhoods can contribute to positive community outputs. Beyond this, universities themselves can contribute to positive communities. Universities are often major employers of both high and low wage jobs and stimulate the

local economy through purchases and from the students who spend money locally (Allinson, 2006; Revington, 2020). The rise in purpose-built student accommodation (PBSA) offers an attractive alternative to students, these developments can offer amenities that cannot be offered by the general housing market (Hubbard, 2009). Furthermore, maintaining student enclaves has a positive effect on students' ability to socialize as well as their overall well-being. (Rugg et al., 2004). These PBSA can draw students away from residential neighbourhoods into more 'appropriate' locals, in doing so it may reduce the concentration and therefore the detrimental effects on established residents (Smith, 2008; Hubbard, 2009).

It can be easy to vilify students and place blame on them for the disruption of near-campus neighbourhoods. However, these negative effects can be attributed, in part, to the failure of HEIs. Universities and colleges should be more responsible for accommodating students. Although municipalities and local planning departments have often addressed this challenge, as Revington *et al.* (2020) argue, studies observing studentification often view planning as reactionary to new concentrations of students. However, over a long timeframe, planning has responded to external influences on the student housing market and anticipated changes in the development market (Revington *et al.*, 2020). Planning policy will continue to evolve to meet the housing needs of students, however, it becomes much easier to develop these policies if one understands the spatial distribution of the student population and can observe newly studentifying areas.

1.4 Research objectives

This report employed a novel method adapted from Gordon and Janzen (2013) and Smith et al., (2014) on mid-sized university cities across Ontario using an unusual characteristic from the Canadian Census. Full-time students living in a student dwelling unit are counted as living in their parents' home, leaving the student dwelling unit "unoccupied". Data from the 2006 and 2016 Canadian Census to address the following research questions:

1. Has there been a decline in occupied dwelling units surrounding universities in mid-sized Ontario cities since 2006?
2. Are the changes in occupied dwelling units, population, and total units consistent throughout and between cities?
3. Is there a relation between the number of beds provided by the university and the changes seen in occupied dwellings?

1.5 Report Structure

Methods are discussed in Section 2 of the report. This section outlines an unusual characteristic in the Canadian Census and how it is employed to identify the geographies of studentification as well as secondary data and methods used. Section 3 of this report presents background on the case studies and primary results from the methodology. Section 4 elaborates on these findings. It begins by analyzing patterns between enrollment growth and scale of studentification observed, then moves to analyzing spatial patterns – including a comparison with a 2008 student accommodation report – and ends with analyzing anomalies observed. Section 5 presents primary findings and conclusions for the report and outlines several limitations of the report. To guide the method forward, future research is suggested. Appendices present additional maps and tables referenced and used in the analysis, but not included in the main body of the report.

2 Methods

2.1 Overview

This report addressed questions surrounding the geographies of studentification in mid-sized cities in Ontario and the degree to which higher educational institutions (HEI) providing accommodation for students can affect the extent of studentification. In the UK where the majority of studentification research is being conducted, they do not have a reliable way to count students and identify their place of residence (Smith, et al., 2014). Researchers in the UK cannot rely on the census to accurately record student living situations. This is paralleled with the Canadian census, where many students are identified as living in their parents' home. To undertake such a study would require a reworking of the census and new datasets, which is out of the scope of this research report. Instead, this report aims to provide a rough estimate of the scale of studentification. Using indicator variables will give a rough indication of the spatial concentrations of students in university towns. This report should act as a starting point for future research to delve deeper into individual communities.

Existing census data from the 2006 and 2016 Statistics Canada census provided the majority of data for this report. This data had been sorted and managed using Microsoft Excel from previous research. Using methods in Gordon and Janzen (2013), Smith et al. (2014), and Wilms (2019) this report analyzed unoccupied dwelling changes at the census tract level in mid-sized Ontario cities. Once spatial patterns were considered, effects on student accommodation were explored concerning the extent of studentification shown in the respective cities.

2.2 Rational for Exploring Medium-Sized Cities

Ideally, a study – which would be conducted across Canada – could use alternative methods to identify studentification in university cities, such as the criteria listed in Table 2-1 (Smith et al., 2014). However, a study with that much detail is not feasible for this report, especially during a global pandemic, such as the COVID-19 pandemic occurring when this research was undertaken. Instead, this report aims to shed light on the current geographic extent of studentification in Ontario mid-sized university cities by focusing on student dwellings using free and widely available census data. In the interest of this report, a CMA was considered mid-sized if it contained a population of 100 000 to 1 000 000 in 2016, to be considered in the study it must also contain an HEI.

Table 2- 1: Criteria for identifying evidence of studentified neighbourhoods.

Changes in...	Evidence/effects on a neighbourhood
Local populaion	<ul style="list-style-type: none"> • High proportion of student residents • High levels of annual in- and out- migration of students • Replacement and/or displacemnt of established residential populations • High levels of population density • High levels of population transience • Depopulation between July and September
Local housing markets	<ul style="list-style-type: none"> • Reduction in owner-occupied family housing • Increase in shared private-rented housing • Increase in short-term rented tenancies • Changed fabric and internal structure of housing • Escalation of property prices
Residential environments	<ul style="list-style-type: none"> • Increase in domestic refuse and litter • Fly-tpping of unwanted household items • Lack of parking spaces for private vehi • Changing visual appearance of streetscapes and residential environs • Proliferation of 'to-let' boards • Unkempt gardens and
Local services and culture	<ul style="list-style-type: none"> • Closure of nurseries and schools • Reorientation of retail, leisure and recreational services for student market • Closure of public and private services between July and September • Relatively high levels of burglary and crime • Perception of 'student' sense of place

Source: Smith et al., (2014)

While time had a measurable effect on the decision to focus on mid-sized cities it was not the only motivation; mid-sized cities are different from their much larger and smaller counterparts, and therefore should be studied separately. The spatial concentration of students is the most defining characteristic of university students, except in very large cities with tight rental markets (Charbonneau et al., 2006). Only the largest metropolitan areas in Canada can sustain effective rapid transit to

disperse HEI student populations, mid-sized cities fall short of this mark mainly due to their low-density profiles and dispersed land use and travel patterns (Bunting *et al.*, 2007). As Allinson (2006) found, along with proximity to their place of study, students tend to favour locations with access to public transit when making housing decisions, this can lead to clustering around well-serviced neighbourhoods, creating segregated 'cultural enclaves' (Dorling & Rees, 2003; Munro et al., 2009; Smith & Hubbard, 2014). Given the limited capacity of mid-sized cities transportation infrastructure and the fact that public transportation factors into student housing choices, it is important to separate mid-sized cities from larger ones as this may have an impact on the spatial distribution of students.

Smaller communities may feel the effects of a large student population more directly, things such as downtown revitalization and studentification are amplified when dealing with smaller populations (Charbonneau et al., 2006; Filion et al., 2004). For example, the effects of studentification will be more

prominent in Kingston – a city where students make up 25% of the city’s total population during the school year – than in Toronto – where students only make up 5% of the total population during the school year (CUDO, 2020). There is also a pattern of downtown collapse in mid-sized cities across Canada. Universities in mid-sized cities have a greater capacity to affect the community where the “walls between the universities and the community [are] dismantled...” (Charbonneau et al., 2006, pg. 282). Working together, universities in mid-sized cities have the opportunity to address the challenges of core area deterioration and student housing by incentivising students to live downtown (Charbonneau et al., 2006). These partnerships between universities and the communities require vastly different policy measures in mid-sized cities than large ones. Focusing on mid-sized cities and recognizing that there are inherent differences between them, and large cities can allow for more personalized policy to be developed, rather than a scaled-down version of “big city” solutions (Bunting *et al*, 2007).

2.3 Data Sources

Data collected from the 2006 and 2016 Statistics Canada Census of Population were used to inform this research. Data was collected at the census tract level of geography in mid-sized Ontario CMAs. The census is held every 5 years and provides information on the demographic, social, and economic characteristics of Canadian households. In census years, Statistics Canada releases two separate questionnaires: the long-form and the short-form. These questionnaires combined with robust data quality assessment ensure the quality and reliability of the data and allow for reliable geographical and longitudinal comparisons across the country. The 2011 National Household Survey (NHS) was not used for this research, for multiple reasons. The NHS was a voluntary survey that served as a replacement to the mandatory long-form census. However, due to the voluntary nature of the NHS, the survey suffered from non-response bias, reducing the reliability of the data at lower levels of aggregation (Hulchanski et al, 2018; Statistics Canada, 2015).

Data were examined at the CT level. Several factors make examining census data at this level optimal. Census data at the CT level is reliable and easily available for public download on the Statistics Canada website. CTs remain relatively stable between census years with a population between 2500 and 8000 persons while also respecting CMA boundaries (Statistics Canada, 2018). Changes to CT boundaries are discouraged to allow for maximum compatibility between census years, however, they do occasionally split to maintain a consistent population or undergo revision due to changes in municipal annexations or community development (Statistics Canada, 2018). This poses a fundamental challenge when undertaking a longitudinal comparison of spatial data, one must ensure the boundaries are consistent.

Due to these splits, new CT names are added, and old names are retired. To rectify this challenge the Canadian Longitudinal Tract Database from Allen and Taylor (2018) was utilized. Their work created a series of tables that can be used to transfer data across census years using a common set of boundaries. These tables were used to estimate data for 2006 from 2016 CT boundary definitions to be used in the temporal analysis.

To identify the geographies of studentification, this report will use unoccupied dwellings as an indicator variable of student dwellings. This census variable will be suitable to approximate student dwellings due to the way Statistics Canada identifies an unoccupied dwelling. Statistics Canada identifies a person's usual place of residence in Canada as the dwelling in which the person usually lives, in using this definition they identify students usual place of residence as with their parents if they return to live with their parents at some point during the year (Statistics Canada, 2017a). Statistics Canada also classifies a residence as being unoccupied if a building "meets the two conditions necessary for year-round occupancy [a source of heat or power and shelter from the elements], but in which no individual is residing on May 10, 2016." (Statistics Canada, 2017b). Using these definitions, a substantial number of student occupied dwellings will fall into the category of unoccupied dwellings. This method was adopted from Smith et al. (2014) who also used indicative variables to study the geographies of studentification in the UK.

Enrollment data from 2006 and 2016 for each HEI was collected from the Common University Data Ontario (CUDO) website, allowing for the data to be reliably compared. Additional data on the number of beds provided by the universities was found on university websites or through university housing services staff by adding the number of beds supplied by each residence hall which had been completed before or opened in 2016. To calculate a rough estimate of the number of beds provided in 2006, the beds which were added after the 2006 school year were subtracted from the 2016 total (See Table 4-1). This was compared with data compiled by the CMHC (2017) to ensure reliability.

Geographic information system (GIS) files were gathered from a variety of open sources to produce maps and analyses used throughout this report. CT and water boundary files were obtained from the Statistics Canada online database. HEI locations were estimated using the base map feature in ArcGIS, from this an approximate centre point was positioned for the HEI.

2.4 Analysis

Temporal analysis will constitute much of the formal analysis, unoccupied dwellings will be compared from the 2006 and 2016 censuses at the census tract level. Change in occupied dwellings was also

compared with the change in population and change in total dwellings. These changes were then combined with local knowledge of the area to inform and provide context for the patterns observed. Increases in unoccupied dwellings and total units with a decline in CT population may indicate the conversion of single-family homes into student apartments. The data were then visually presented in maps created in ArcGIS software for each city. Methodology prepared by Allen & Taylor (2018) allows for the data to be compared temporally.

Firstly, data were analyzed in Excel by sorting for CTs which showed characteristics of studentification: negative population change, positive total dwelling unit change, and negative occupied dwelling unit change (negative occupied dwelling unit changes < 9 was used as a cut off to account for any errors in the datasets). Once CTs were filtered by these characteristics it was then pertinent to identify their location in the city and proximity to the HEI. A student housing survey conducted by Charbonneau *et al.* (2006) identified that students without access to a vehicle overwhelmingly identified their preferred distance to campus as 10 minutes or less (72%). While a further 26% of respondents without access to a vehicle cited their preferred distance to campus as 11-20 minutes. These findings are mirrored by numerous other authors which also found that students preferred to live close to campus (Rugg *et al.*, 2002; Allinson, 2006; Charbonneau *et al.*, 2006; Donaldson *et al.*, 2014).

Alongside proximity, local knowledge of the cities and school helped to identify where students were living while attending school and if a majority of students commuted or lived on/near the HEI. Using the CTs which were proximate to the HEI, it was then possible to estimate the number of dwelling units that were converted to student units from 2006-2016; this figure was estimated by using the difference between occupied dwelling unit change and total dwelling unit change. The calculation will provide a rough estimate of the number of units converted to student dwellings as it can be reasonably assumed that the increase in unoccupied dwelling units was caused by students (see Statistics Canada definition) and that the increase in total dwelling units can be attributed to a supply of units for students due to the proximity to the HEI.

CT boundary files were imported into ArcGIS from the Statistics Canada website where they were then isolated by CMA, separated into individual layers, and where necessary, water features were erased. The CT data were then projected using the national georeferencing standard in Canada: North American Datum of 1983 (NAD83) in which Canada is split into sixteen zones (Natural Resources Canada, 2016; Natural Resources Canada, 2020). To ensure the proper projection was used UTM zone designations were taken from the Canada Land Use Monitoring Program (Canada Land Use Monitoring Program,

1999). Data from the 2006 & 2016 Statistics Canada Census of Population were then imported from Excel into ArcGIS and then joined to the CMA layers with consideration to match the CT identifiers in the two layers. The joined layer was then used to visually represent the areas that showed characteristics of studentification. For further clarification locations of HEI's were added to the maps, these were created using the base map feature in ArcGIS. A point was selected which was the approximate centre of the HEI.

Secondary analysis involved the exploration of enrollment data and university supplied living accommodations. Subtracting the number of beds from the total enrolment revealed the additional students which overflow into the community. A tabular representation of the discrepancies between increases in student enrollment and the number of beds provided from 2006 through 2016 was created in Excel (see Table 4-1).

2.5 Limitations

The main limitations of this research come from a lack of time and research funds. A full study of each city with field visits and key informant interviews would remedy many of the issues in using this method. Using a set of criteria (see Table 2-1) would offer a more complete picture of the location of students surrounding an HEI. The method for this study only works to capturing change, it is unable to detect the process of studentification due to the availability of student data. Ideally, each HEI would also have a reliable set of student living accommodation data by which this method could be compared, however, only one HEI in the study had this data. The methodology is unable to untangle the effects of short-term rentals, which present similar characteristics to a studentifying area.

There are limitations when it comes to using the census to study geographical phenomena. First and foremost is the issue with scale. Statistics Canada releases data publicly at the census tract level to protect the identity of individuals, however, this results in issues of aggregation. Where data is aggregated to a larger geographical area, one stands to lose individual variability that could be vital in understanding the patterns and processes that are occurring (Marans and Stimson, 2011). At such a coarse scale it is often hard to obtain a complete picture of what is occurring in those neighbourhoods. Other limitations stem from the census data, it may underrepresent the issue of studentification as there is no direct measure to locate students in the Canadian census. Using the definitions provided above, a number of student dwellings will be left out, using this method will conflate the effects of houses with different numbers of students. Additionally, using an indicator variable to locate student

dwelling will inevitably under-count student dwellings and may not portray the exact extent or locations studentification is taking place.

3 Case Description and Results

Case study results and maps are derived from tables in Appendix A. Additional data on CMA population and university enrollment can be found in Appendix B.

3.1 Greater Sudbury

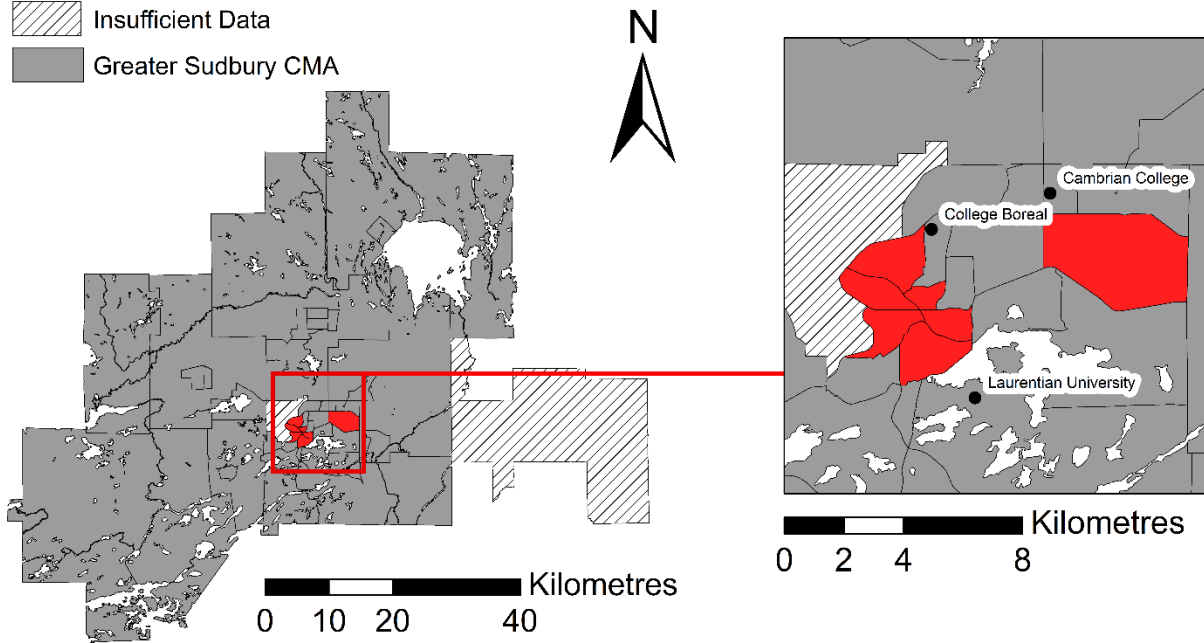
The Greater Sudbury CMA is unique in its position, it is the largest city in Ontario by land area and the largest city in Northern Ontario by population; Greater Sudbury had a population of 165,000 as of 2016. With three post-secondary institutions – Laurentian University, Collège Boréal, and Cambrian College – Greater Sudbury has a large student population, and many of these students are not local (SHS Consulting, 2013). Laurentian University expanded its enrollment by 10%, up from 8700 in 2006 to 9600 in 2016 (CUDO, 2020). Unlike many other institutions, Laurentian reduced its ratio of students to beds from 6.9 to 6.4. This reduction is a result of an additional 236 beds added to Laurentians student accommodation, the second highest increase in beds across schools studied.

Evidence of studentification in Greater Sudbury CMA was concentrated in the urban parts of the metropolitan area; unlike several other CMAs, there were no false positives in the rural periphery census tracts. Seven census tracts were identified as studentifying, all of which were close to HEI's. Due to the concentration of HEIs within Sudbury, it was not as clear as to which institutions acted as the driving force behind the studentification that was observed. It can be postulated that Laurentian University with the largest student population is the driver behind much of the effects we have observed.

The greatest evidence of studentification can be seen in the two census tracts closest to Laurentian University: the city centre and downtown south. These two census tracts alone saw over 350 units converted in the ten-year period, with unoccupied units totaling 752 in 2016. The Donovan and Little Britain are synonymous with student living in Sudbury, and unsurprisingly the method identified these two CTs. The Donovan's location in downtown Sudbury, its proximity to all four HEI's and its abundant stock of single-family dwellings make this census tract ideal for student living. The city is also seeing adaptive reuse of many of the downtown buildings for student residences. In 2012 a downtown office building was converted into 50 units for student accommodation (White, 2017). These two census tracts had 275 units convert between 2006 and 2016 and a total of 652 units listed as unoccupied. In total Sudbury saw over 800 units converted, with nearly 2000 units listed as unoccupied.

Evidence of Studentification, Greater Sudbury CMA, 2006-2016

- HEI
- Census Tracts with Characteristics of Studentification
- ▨ Insufficient Data
- Greater Sudbury CMA



Map 3- 1: Map of the Greater Sudbury CMA depicting CTs with characteristics of studentification.

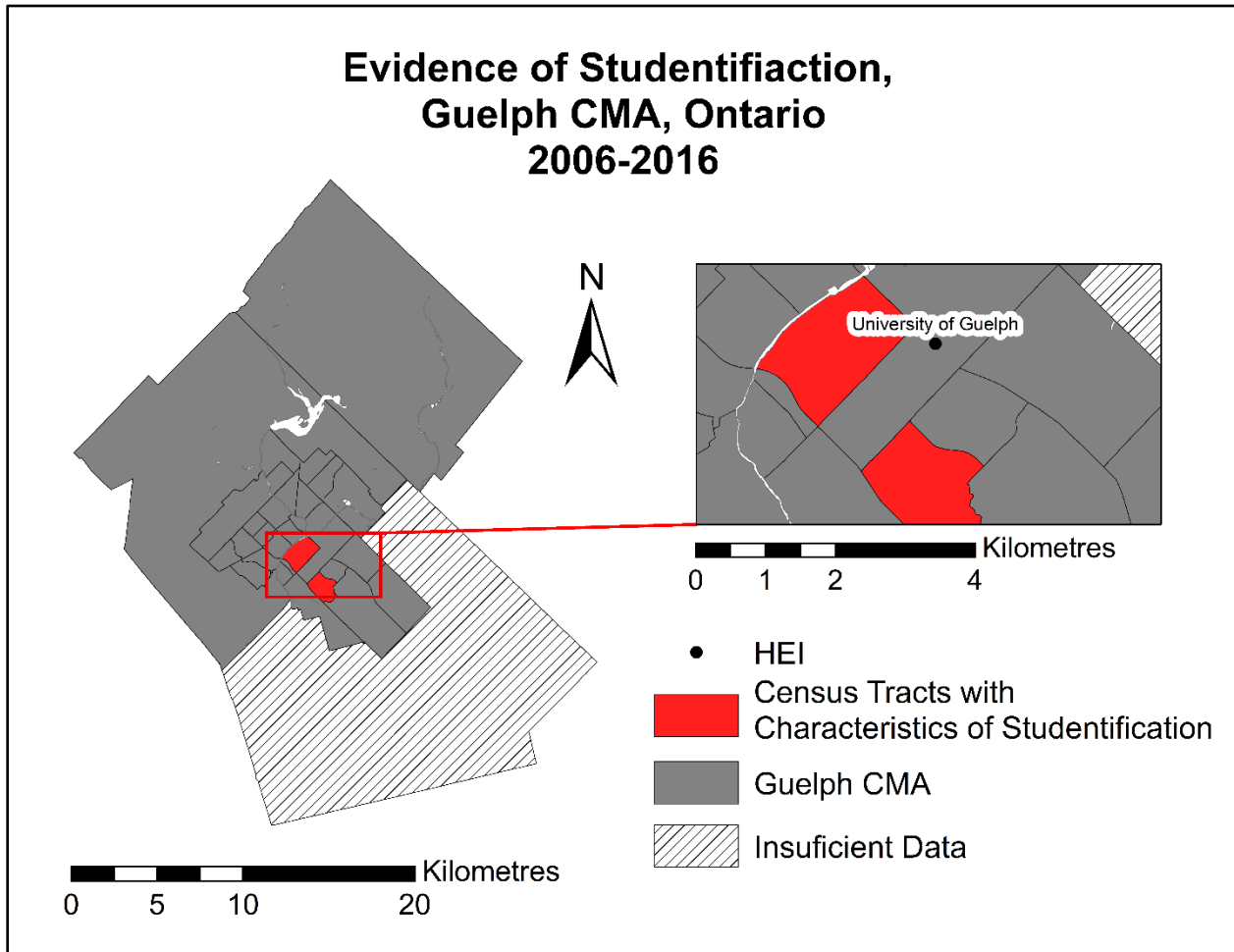
3.2 Guelph

The Guelph CMA is situated in the heart of Southern Ontario, located 70 km west of Downtown Toronto and 30 km east of Kitchener. The CMA had a population of 150,000 in 2016, 86% of which were residing in the City of Guelph. The City of Guelph hosts a Conestoga College campus and the University of Guelph. Although originally established in the farmland surrounding Guelph, the university now sits at the urban periphery. The University of Guelph is one of the largest post-secondary schools in Ontario with an enrollment of 29,000 in 2016. This enrollment total is up over 33% from 21,600 in 2006 (CUDO,2020). Although the University increased its enrollment by 33%, it did not add a single new bed during the same period. Consequently, the University's student to bed ratio increased from 4.7 to 6.2.

Two census tracts in the Guelph CMA were identified as studentifying, the Hanlon Creek and Old University neighbourhoods, both neighbouring the University. These two tracts had nearly 200 units convert to unoccupied from 2006 to 2016 and a total of 759 units listed as unoccupied. These 759 units represent nearly 20% of the housing stock in these census tracts, a considerable proportion of which are likely to be student rentals. Guelph is in the midst of a purpose-built student accommodation boom with the epicenter being the junction of Gordon Street and Edinburgh Road South, this junction lies in the CT adjacent to the Hanlon Creek neighbourhood (Warren, 2015).

The Guelph CMA was puzzling, over 13,000 students from the University of Guelph alone reside in off campus housing, yet the effects of studentification observed using this method were negligible. One factor which may be obscuring this method from identifying studentifying neighbourhoods is the rapid growth – and subsequent dwelling unit increases – seen in Guelph in the last decade. Guelph was one of only seven CMAs to experience accelerating growth between 2011 and 2016. The suburban development and urban infill due to this growth can dramatically raise the number of occupied units in a CT, thereby removing it from the studentified classification using the current method. Qualitative analysis, as well as interviews with planners, should be coupled with this method to gain a more accurate picture of studentifying neighbourhoods in Guelph.

Evidence of Studentification, Guelph CMA, Ontario 2006-2016



Map 3- 2: Map of the Guelph CMA depicting CTs with characteristics of studentification.

3.3 Hamilton

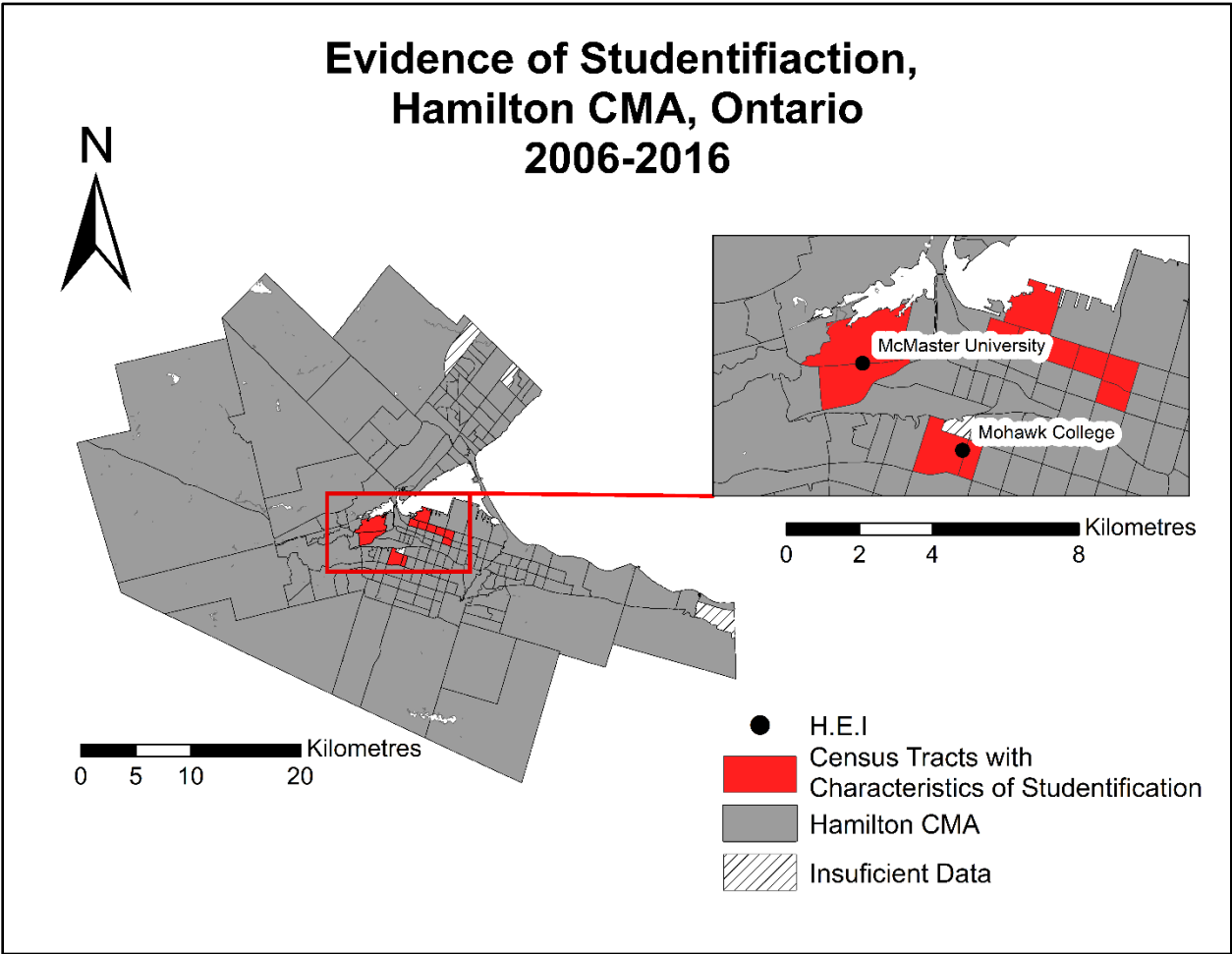
Hamilton is located in Southern Ontario close to the GTA on the southern shores of Lake Ontario.

Hamilton has the largest CMA population among the CMAs selected for this research, with a population of nearly 750,000 as of 2016. It hosts the main campuses of McMaster University and Mohawk College; Hamilton also supports several satellite campuses from outside schools. Unsurprisingly, there is a large student population living in the city, the majority of which are enrolled at McMaster University.

McMaster had just over 30,000 students enrolled as of 2016, a 25% increase from a decade earlier (CUDO, 2020). Over this same period, McMaster added zero new beds to its existing student accommodation stock, resulting in a 25% increase in its student to bed ratio (up from 6.6 to 8.2).

Studentifying neighbourhoods were concentrated primarily within the downtown and highly urbanized areas of Hamilton. It was found that 11 census tracts in the Hamilton CMA exhibited signs of studentifying, all of which were either located in proximity to an HEI or downtown. The two census tracts with the largest number of unoccupied units were both proximate to McMaster University; between the two, over 1700 units were listed as unoccupied, or around 40% of the total dwelling units, meaning that nearly half of the units in these census tracts surrounding McMaster may be occupied by students. In a decade, these two census tracts saw 473 units converted to unoccupied, with the majority – around two-thirds – occurring in the census tract containing the Westdale neighbourhood.

Another cluster was observed near Mohawk College; the census tract containing Mohawk College and the census tract immediately to West both showed signs of studentifying. However, the signs were not as pronounced as those seen around McMaster. Nearly 100 units were converted between these two census tracts, with around 200 units listed as unoccupied. While not as significant, around 10% of the units in these census tracts may be occupied by students. Across all census tracts observed to be studentifying nearly 1300 units were converted for a total of over 3500 units listed as unoccupied. This number may be an overestimation of units potentially occupied by students since many of the census tracts downtown are far from either HEI. Future studies should be conducted to fully identify what may be causing the high numbers of unoccupied units in downtown Hamilton.

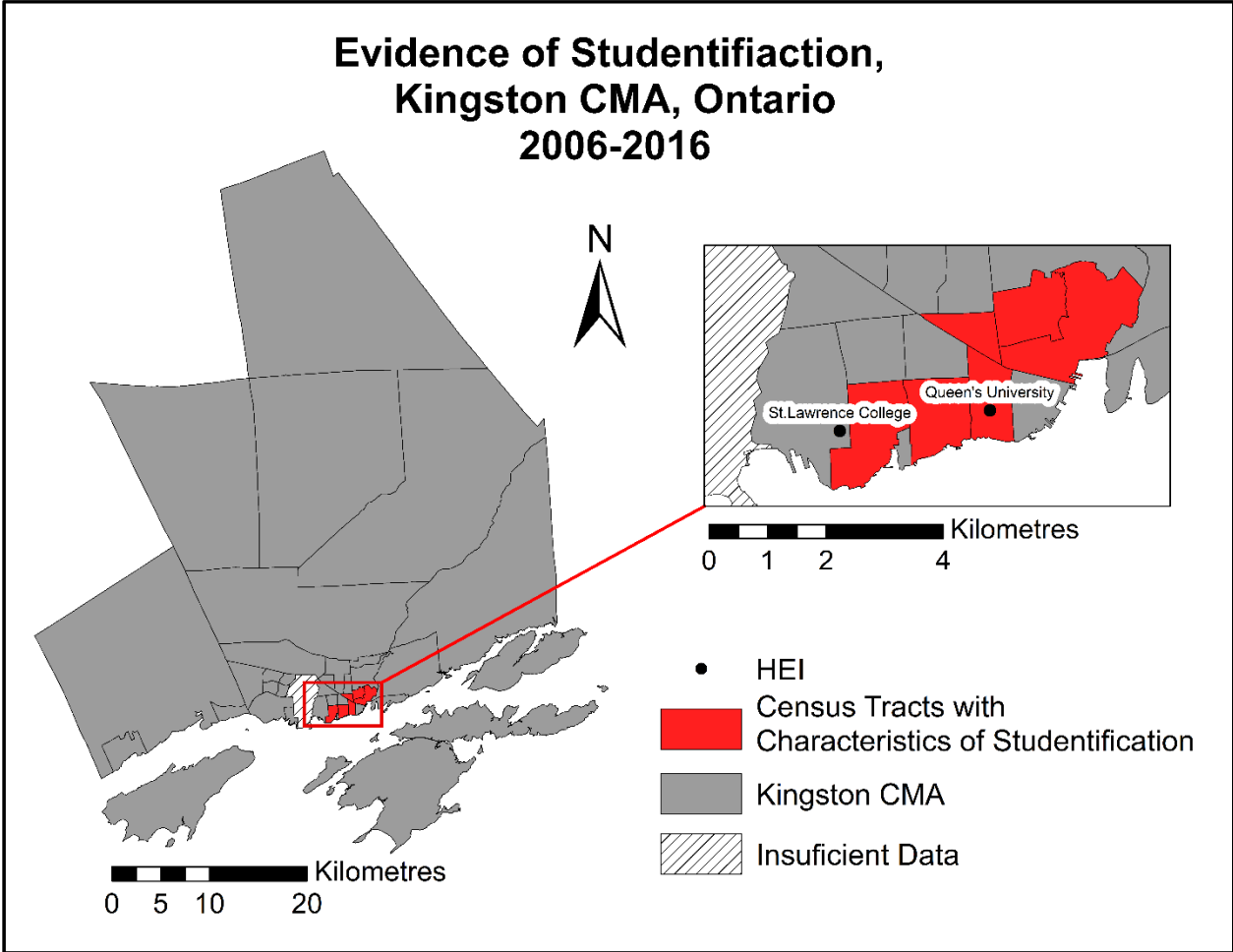


Map 3- 3: Map of the Hamilton CMA depicting CTs with characteristics of studentification.

3.4 Kingston

The Kingston CMA is in Eastern Ontario on the northern edge of Lake Ontario. It supports Queen's University, the Royal Military College, and St. Lawrence College. The Kingston CMA is home to 160,000 residents as of 2016. Queen's University is located near the shores of Lake Ontario. The school is in the heart of Kingston just south of the downtown. Kingston's student population makes up a considerable percentage of the city's population with over 30,000 students enrolled in post-secondary institutions (Queen's University, 2021). As of 2016, just over 23,000 of these students are at Queen's University the majority of which come from out of town, resulting in high demand for rental units. Queen's has increased its student enrollment from 2006 to 2016 by 29% while only increasing the number of beds on campus by 14% (CUDO, 2020). This creates a situation where most of the university's enrollment growth is absorbed by the surrounding community; an estimated 14,000 full-time students were living in private or company-owned houses and apartments across the city in 2015, up from roughly 5500 in 1973 (SURP, 2009; Queen's Housing & Ancillary Services, 2015).

Filtering the Census data by the indicative variables revealed 6 census tracts that showed characteristics of studentification. Of these census tracts, all were in proximity to HEI's, with five close to Queen's and one close to St. Lawrence College. In these six census tracts, there are over 3,500 unoccupied units with 1301 of those units becoming unoccupied between 2006 and 2016. Those 3500 units represent around 33% of the total dwelling units, an astounding number of units to be left unoccupied if no other process were taking place. The five census tracts surrounding Queen's saw over 1100 units change to unoccupied over the 10-year period, with 3300 units in total being listed as unoccupied. One census tract stands out, the campus CT has a staggering 73% of its units listed as unoccupied, with 250 becoming unoccupied between 2006 and 2016. The Williamsville North CT saw the greatest increase in unoccupied units, with 320 converting, close to half of all unoccupied units in this CT converted between 2006 and 2016. Studentification has long been an issue in Kingston but the expansion north of Princess Street is now reducing the rental housing stock available to low-income households. The results paint a clear picture of studentification in the city and exhibit its expanding influence further away from the university.

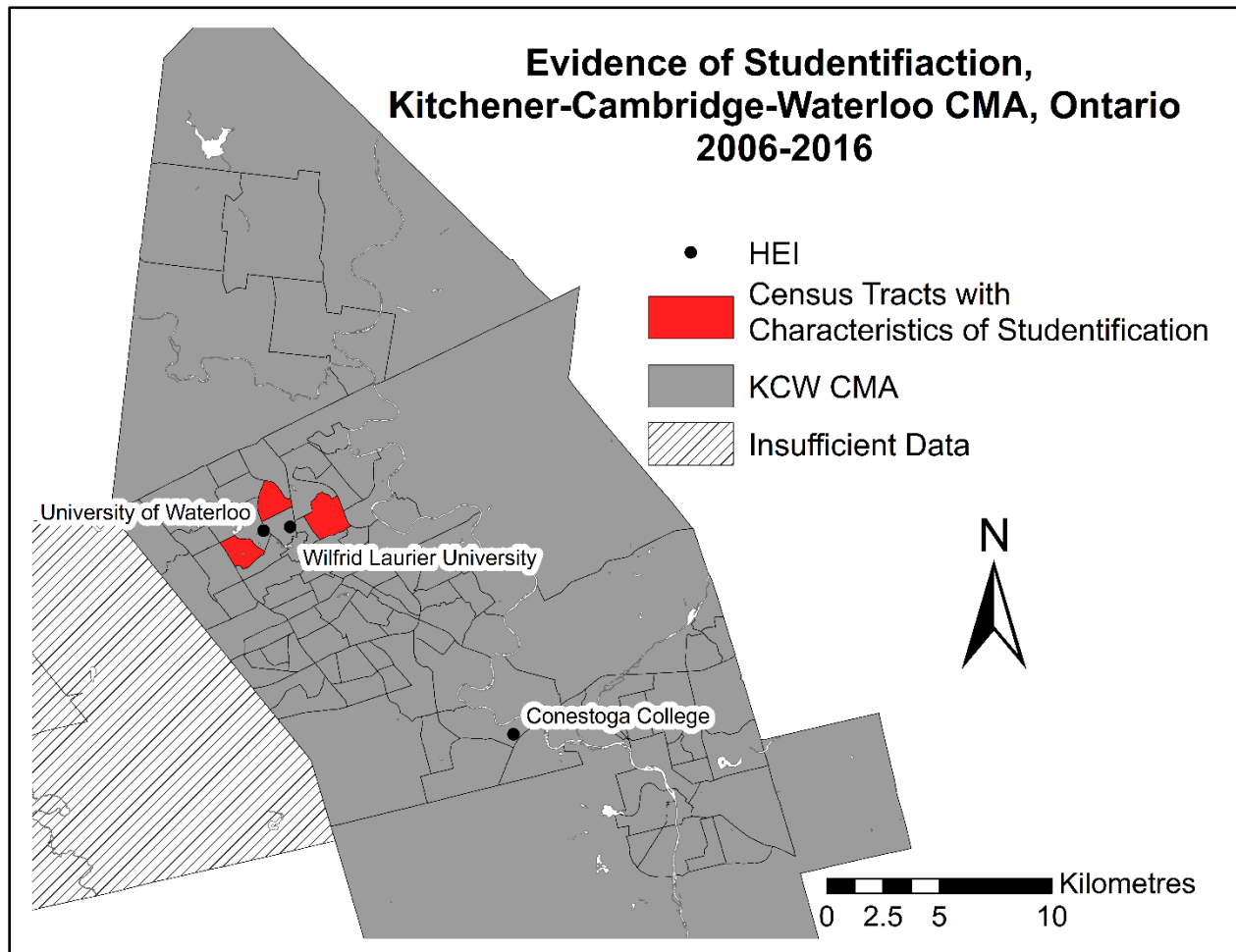


Map 3- 4: Map of the Kingston CMA depicting CTs with characteristics of studentification.

3.5 Kitchener-Cambridge-Waterloo

The Kitchener-Cambridge-Waterloo (KCW) CMA is situated immediately to the west of Guelph and lies 100km west of Downtown Toronto. The CMA had a population of 525,000 people in 2016 mainly spread out across three cities: Kitchener (235,000), Cambridge (130,000), and Waterloo (105,000). The CMA hosts many universities and colleges as well as multiple satellite campuses. The main campuses of the University of Waterloo (UW) and Wilfrid Laurier University (WLU) are in the City of Waterloo, Conestoga College is situated in the peri-urban area between Kitchener and Cambridge. Both UW and WLU saw major enrollment growth between 2006 and 2016. UW has a student population of 36,600, an increase of over 10,000 students from 2006 to 2016. WLU also saw increased enrollment over this period, reaching 18,000 students in 2016, up 25% from a decade earlier. Despite this massive increase in students, UW did not add any additional beds on campus, and WLU added a nominal 330 beds. Both universities saw their ratio of students to beds increase, UW's increased from 4.5 to 6.4 and WLU's increased from 5.7 to 6.3. The universities failed to match on-campus student accommodation with enrolment growth, adding additional pressure to the already stressed student rental market.

KCW has seen its student population explode over the study period and with such a drastic change in the student population, one would have expected to see greater signs of studentification, but the City of Waterloo approved almost 4400 units of private student housing between 2007 and 2016 (Revington et al., 2020). Only three census tracts were found to be studentifying, all of which were neighbouring either the UW or WLU. In total, the method found 250 units were converted from 2006 to 2016, with almost 900 units listed as unoccupied in these census tracts. The largest confluence of student dwellings is centred in the Northdale neighbourhood. The Northdale neighbourhood was not caught by the current method, because it has already undergone the process of studentification. In the Northdale census tract alone, over 2300 units are listed as unoccupied which represents over 60% of the total units. The census tract immediately north of Northwood has begun to show signs of studentification, which should concern the City of Waterloo. This census tract has seen the largest conversion of units out of the three studentifying census tracts; almost 200 units were converted between 2006 and 2016, with 560 units potentially occupied by students.



Map 3- 5: Map of the K-C-W CMA depicting CTs with characteristics of studentification.

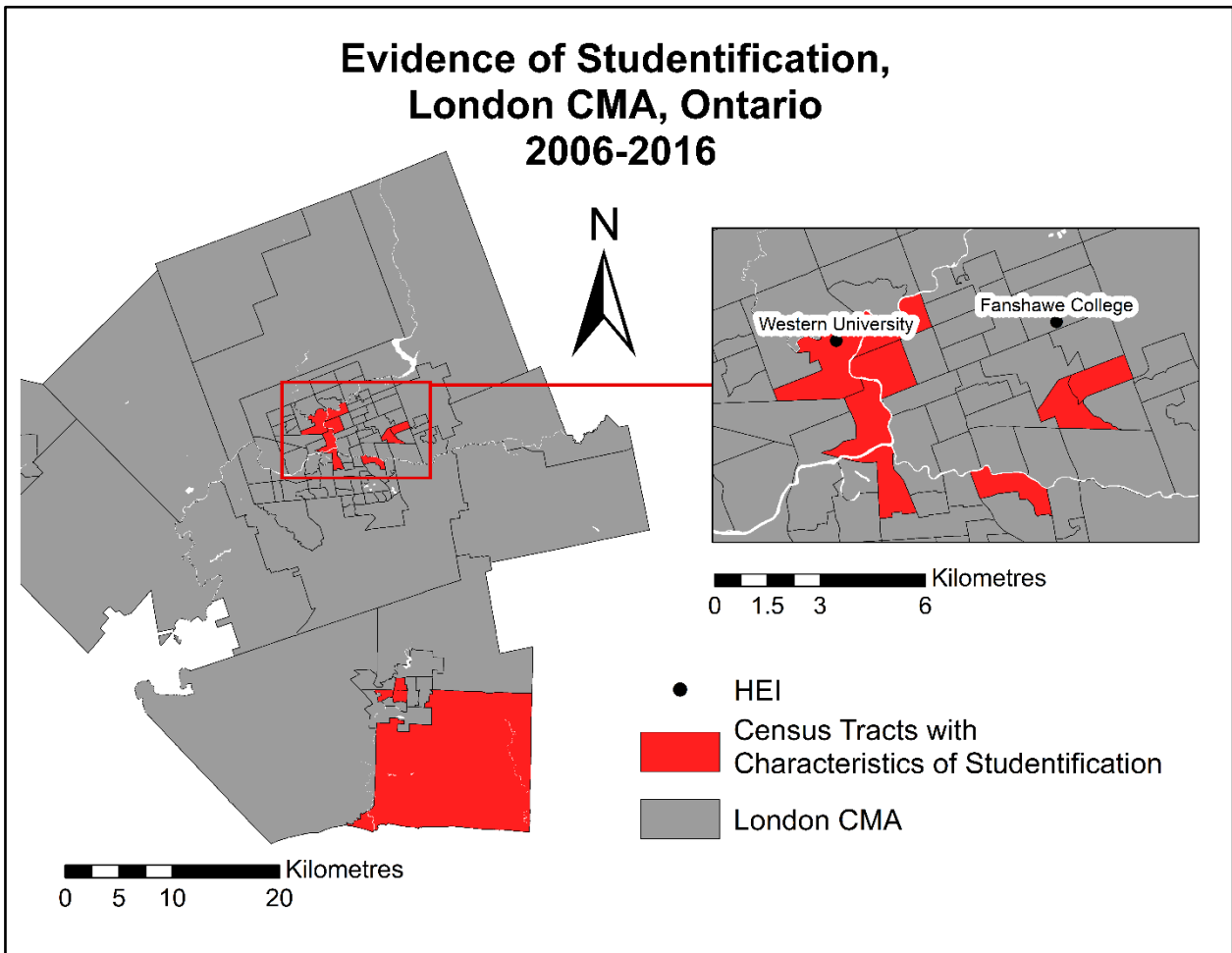
3.6 London

The London CMA is located in Southern Ontario, approximately 175 km southwest of Downtown Toronto. The CMA had a population of nearly 500,000 in 2016, with around 77% of this population living within the City of London. The City of London is home to the main campus of Western University and Fanshawe College. London also supports many satellite campuses. Western University increased its enrollment by over 4000 students from 2006 to 2016, an increase of 16%. Western also increased its number of beds over this period, which in fact, outpaced enrollment growth. Western added nearly 1000 new beds to their campus, an increase of 23%, which had the effect of lowering their ratio of students to beds from 6.0 in 2006 to 5.7 in 2016. When looking at raw numbers, even with their additions of nearly 1000 new beds on campus, they did not match their enrollment growth which increased by over 4000 students. The effect could have been much worse on the surrounding neighbourhoods had Western not increased student accommodation on campus.

A clear pattern emerged in the London CMA, a significant number of census tracts surrounding both HEI's were subject to studentification. Of the 12 census tracts found to exhibit characteristics of studentification, 7 of them were neighbouring an HEI and the remainder were mainly found in the downtown. Much of the growth in unoccupied units occurred in census tracts surrounding Western University, with the 4 CTs bordering the university having 872 units converted between 2006 and 2016. Unsurprisingly, the largest increase in unoccupied units came from the census tract containing Western University. This census tract saw 345 units converted in the ten-year span, or around 20% of the total units in the census tract. As of 2016, this census tract had 63% of its units listed as unoccupied, however, it is clear from visual inspection that housing abandonment is not the principal cause.

A similar story plays out across the other census tracts surrounding the university, in total all four CTs saw 872 units converted and over a third of all units listed as unoccupied. One census tract neighbouring Fanshawe College was identified as studentifying; 44 units were converted between 2006 and 2016 and in total the census tract had 105 units listed as unoccupied. A cluster of CTs was observed to be studentifying in the Town of St. Thomas, close to the Fanshawe satellite campus. Data shows over 100 units converted over the study period, with nearly 300 units unoccupied in total. A single census tract in the rural part of St. Thomas, on Lake Erie, also showed significant numbers of unoccupied dwelling units, although it is unlikely that studentification is the cause. There is another process occurring in the CT causing high levels of dwelling unit growth and unoccupied units. Further study should be done to determine the cause.

Evidence of Studentification, London CMA, Ontario 2006-2016



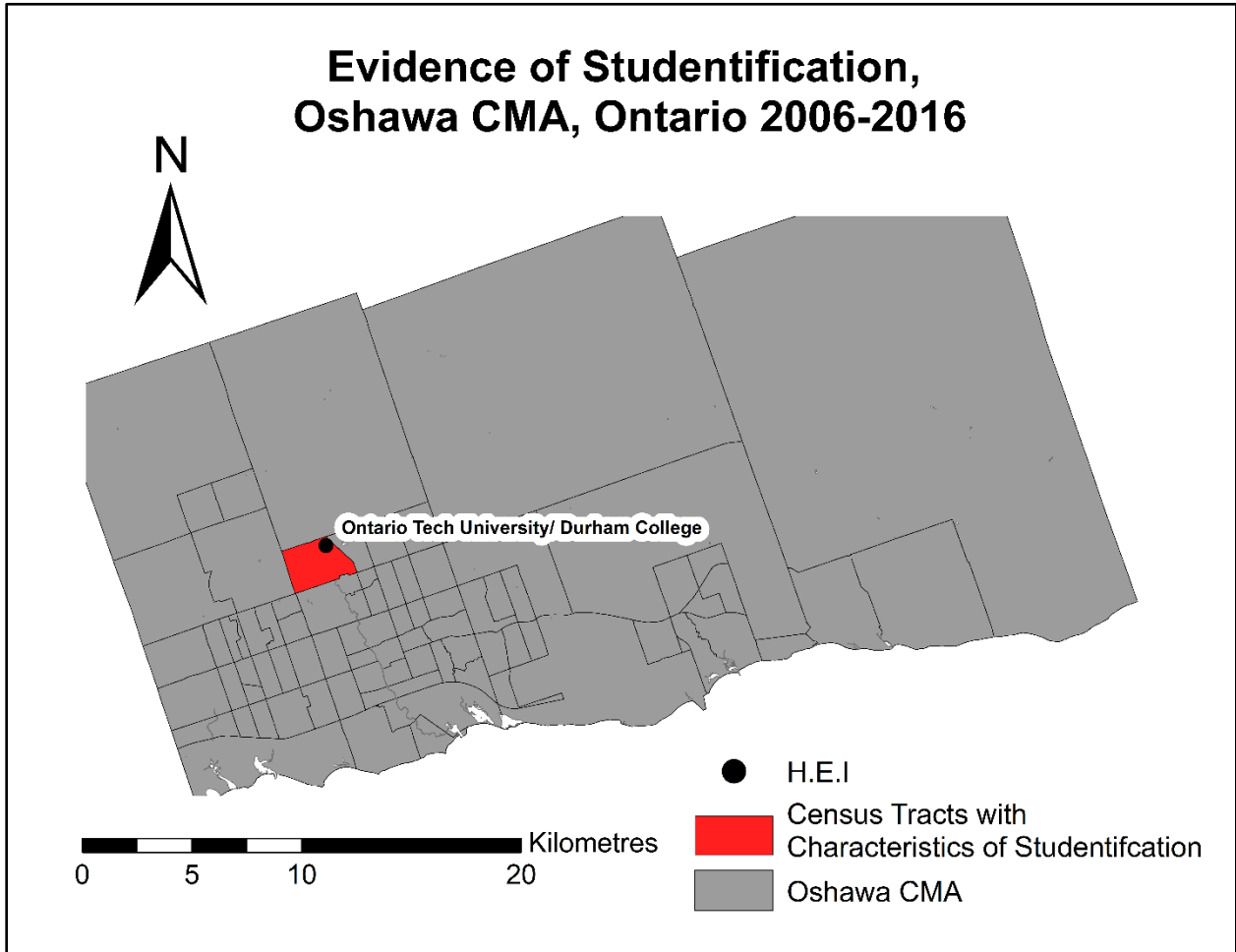
Map 3- 6: Map of the London CMA depicting CTs with characteristics of studentification.

3.7 Oshawa

Oshawa is located on the shores of Lake Ontario, about 60 km east of Downtown Toronto. The Oshawa CMA had a population of 380,000 people in 2016. The main campus of Ontario's newest university, Ontario Tech (formerly known as the University of Ontario Institute of Technology) founded in 2002 is stationed within the Oshawa CMA. Additionally, Oshawa hosts Durham College and satellite campuses for Trent University and Queen's University. Ontario Tech University and Durham College essentially share a common campus ground in North Oshawa; thereby making it difficult with the current method to isolate the studentification effects to one institution. Ontario Tech University is one of the smallest schools in this study with a 2016 enrollment just below 10,000 students. Nonetheless, it saw the highest enrollment increase during the study period at 131% (an increase of 5600 students) (CUDO, 2020). Over the same period, Ontario Tech increased student accommodation on campus by 216 beds, an increase of 16% to a total of 1536 beds. However, due to their massive increase in enrollment Ontario Tech saw its student to bed ratio nearly double from 3.3 to 6.5.

Only one census tract in the Oshawa CMA showed characteristics of studentification, unsurprisingly, in North Oshawa in the census tract which contains the campuses of Ontario Tech and Durham College. The extent to which the effects of studentification are seen are not as extreme as in other CMAs; this may be due to the age of the university, construction of new PBSA, and the large student commuter population. However, further study is needed. The census tract saw 106 units converted and had a total of 144 units listed as unoccupied. These 144 units potentially occupied by students represent just over 15% of the total number of dwellings in the census tract. Observing the future geographies of studentification in Oshawa should yield interesting results, further study should be conducted using the 2021 Canadian census.

Evidence of Studentification, Oshawa CMA, Ontario 2006-2016



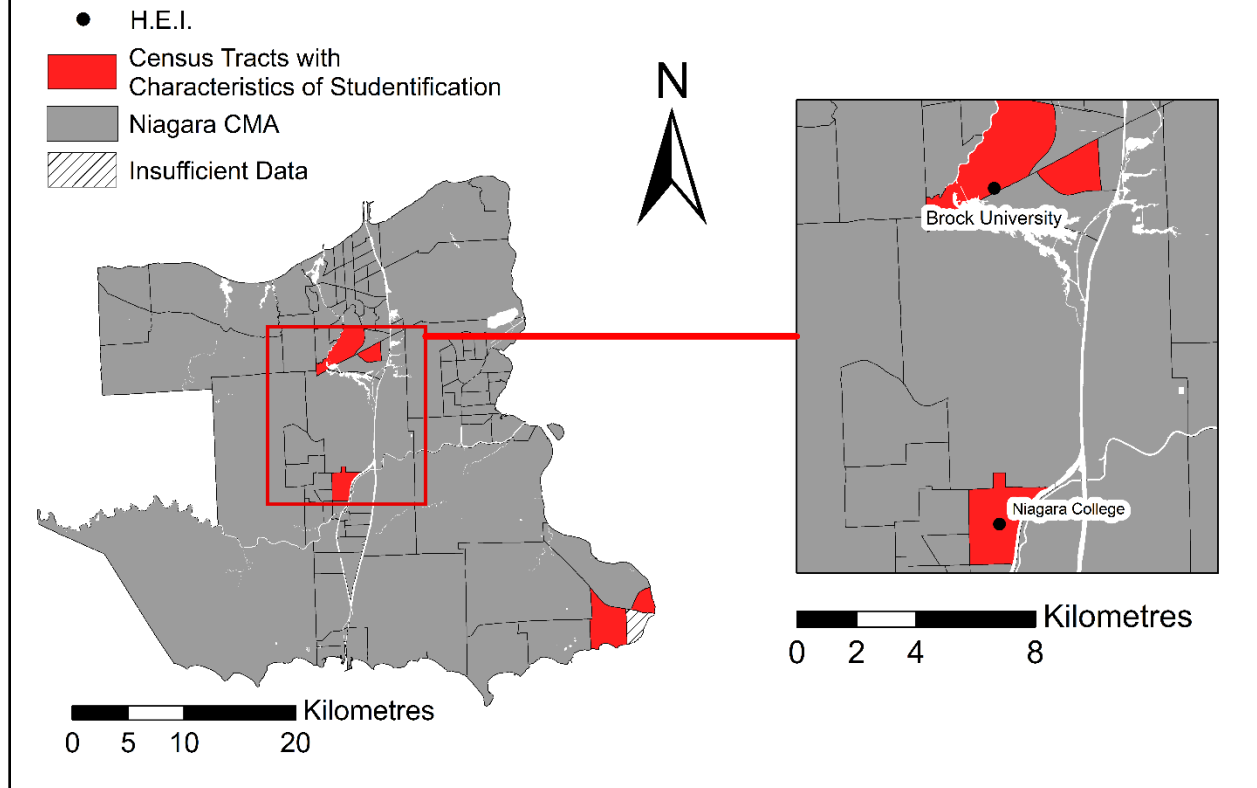
Map 3- 7: Map of the Oshawa CMA depicting CTs with characteristics of studentification.

3.8 St. Catharines - Niagara

The St. Catharines - Niagara CMA, situated in Southern Ontario, is straddled by Lake Erie to the south and Lake Ontario to the North. It sits on the far eastern edge of the Greater Golden Horseshoe Region and shares a border with New York. In 2016, the CMA had a total population of just over 400,000 people. The CMA is home to the main campus of Brock University, St Catharines - Niagara also supports several other satellite campuses and Niagara College. Brock University was established on the urban fringe of St. Catharines, which has consequently grown to surround the school. Brock had an enrollment of 18,000 students as of 2016, a modest increase of 5% from 17,100 a decade earlier (CUDO, 2020). The campus did not add any beds to its student accommodation stock over this decade, thereby increasing its ratio of students to beds to 7.5, up from 7.1.

The method identified 5 census tracts within St. Catharines – Niagara that showed characteristics of studentification. Interestingly, two of the census tracts that saw an increase in unoccupied dwellings were in rural parts of the CMA near Fort Erie, nowhere close to an HEI. Clearly, another process is occurring in these places other than studentification. These census tracts warrant further study to identify mechanisms causing increases in unoccupied dwellings. A single census tract showing signs of studentification neighbours the Niagara College campus; similar to other census tracts near college campuses, this census tract exhibited limited characteristics of studentification with 40 units converted and 120 units listed as unoccupied. The remaining two census tracts were identified near Brock University: the census tract consisting of Brock University and the Marsdale Glenridge neighbourhood and the Thorold census tract. These two census tracts alone made up 77% of all converted units in studentifying census tracts. They saw a total of 312 units converted, with 912 units listed as unoccupied in 2016. While 912 is a considerable number of units to be listed as unoccupied, they only constitute about 15% of the total number of dwellings. These areas still have a large established resident population; inevitably, conflicts will arise if this area continues to be studentified.

Evidence of Studentification, St. Catharines - Niagara CMA, Ontario 2006-2016

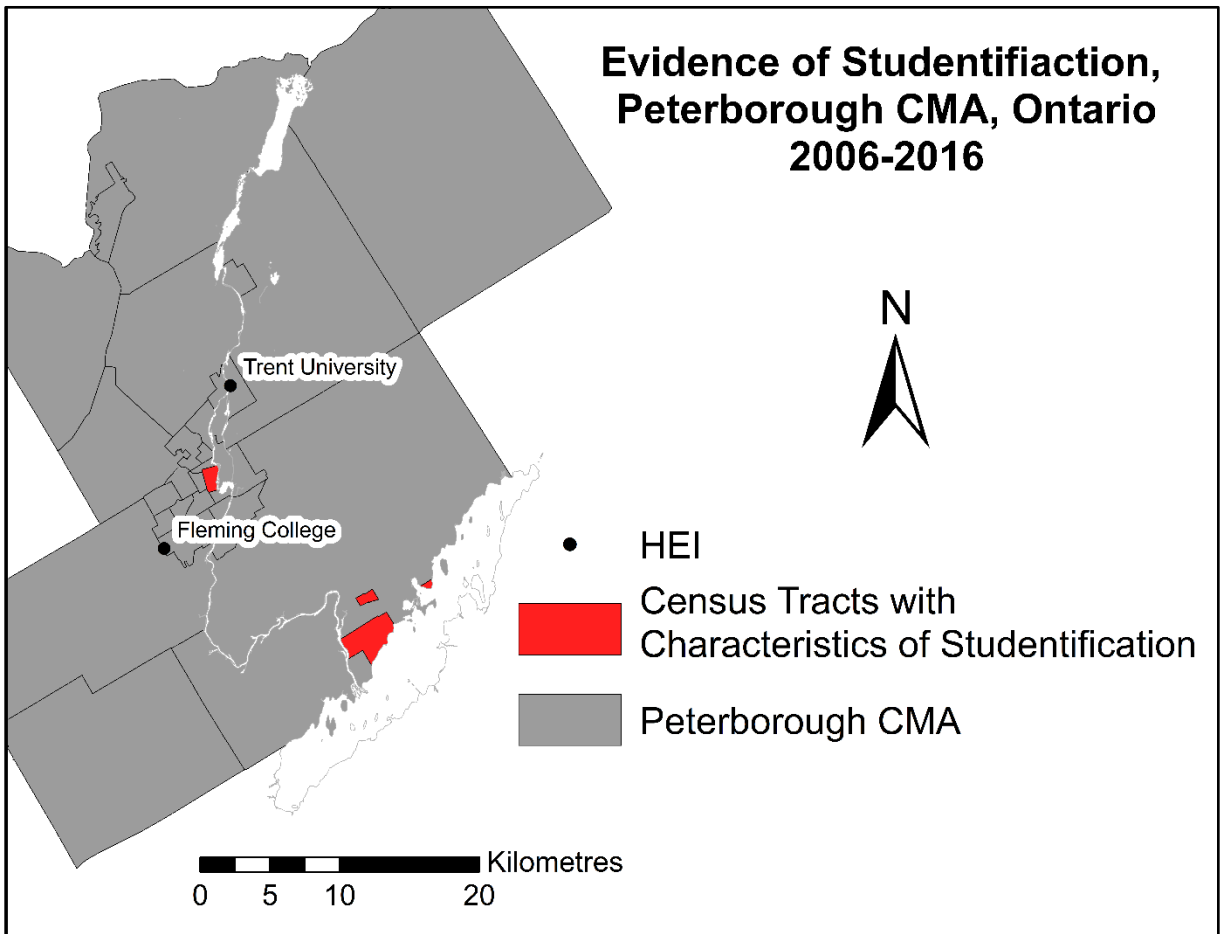


Map 3- 8: Map of the St. Catharines-Niagara CMA depicting CTs with characteristics of studentification.

3.9 Peterborough

The Peterborough CMA is located in the Kawartha Lakes region of Central Ontario, and the City of Peterborough is 120 kilometres northeast of Toronto. Peterborough is one of the smallest CMAs included in the study by population, with around 120,000 residents as of 2016. The main urban area in the CMA is the City of Peterborough, where around three-quarters of the CMAs population resides. Peterborough supports the main campus of Trent University and Fleming College, as well as other satellite and regional campuses. Located on the banks of the Otonabee River, Trent University sits at the northern periphery of the city mainly surrounded by farmland. Trent University has a relatively small student population, with just under 9000 students enrolled as of 2016, and an 18% increase from 7,500 in 2006 (CUDO, 2020). Over the same period, Trent added 180 new beds to reach a total of over 1500 beds on campus. This growth in beds at 13% was outpaced by student enrollment, and so Trent's ratio of students to beds increased from 5.6 to 5.8.

Trent University was the only university where no studentifying census tracts were observed in proximity to its campus. There were, however, two census tracts that did have increased unoccupied dwellings, one in the downtown and one on First Nation reserve lands in rural Peterborough. Of the two, the downtown census tract showed much stronger signs of studentifying. In this census tract, encompassing the downtown, 110 units were converted to unoccupied between 2006 and 2016 resulting in a total of 531 units listed as unoccupied in 2016. As this census tract is in the downtown there may be other forces acting upon it that cause some of the observed conversions. However, this coupled with population loss and total dwelling units increasing point to something besides downtown hollowing out. Stewart Street, in downtown Peterborough, does in fact have a large student population, so it can be postulated then that these studentifying characteristics are indeed caused by students (Active Neighbourhoods Canada, 2016). The reserve lands saw the conversion of 47 units to unoccupied during this period, however, these are not due to studentification, and further study should be done to determine the cause. Peterborough lends itself to be an interesting temporal study, several recent newspaper articles cite rising concerns of students in new residential developments near the university (Peterborough Examiner, 2014; Peterborough Examiner, 2015). Using the current method and the 2021 census data, one would expect to see this census tract exhibit characteristics of studentification.

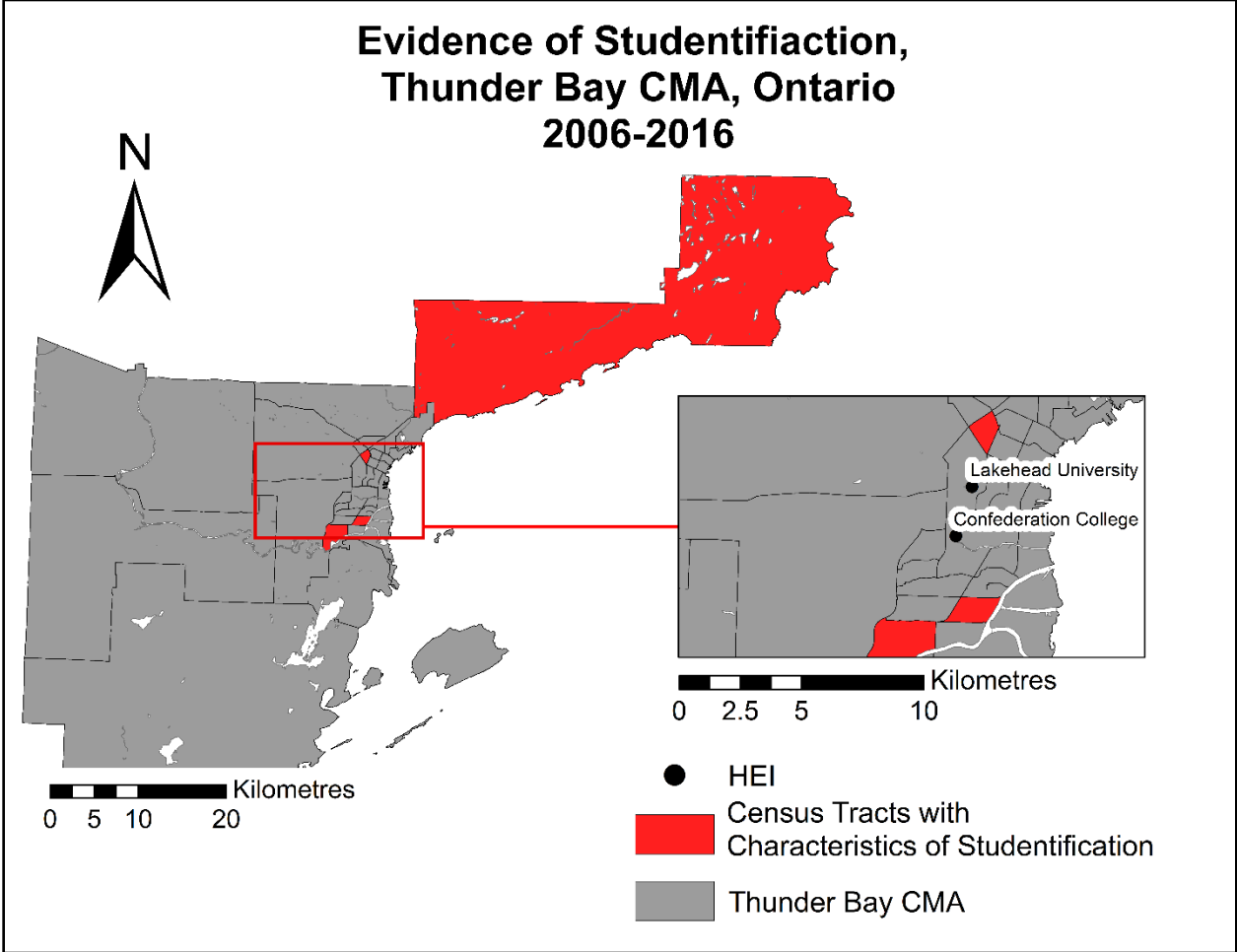


Map 3- 9: Map of the Peterborough CMA depicting CTs with characteristics of studentification.

3.10 Thunder Bay

Thunder Bay is the most northern CMA in the study, located on the shores of Lake Superior in Northwestern Ontario. The CMA is approximately the same size as Peterborough with a population of 120,000 in 2016. The main urban centre, Thunder Bay, accounts for around 90% of the CMAs population, and the remainder of the population is scattered throughout the CMA in smaller towns, hamlets, and farms. The City of Thunder Bay is home to Lakehead University and Confederation College. Lakehead University is situated just north of the downtown near the urban periphery. It had the smallest student population in the study at 7800 in 2016, up from 7300 a decade earlier (CUDO, 2020). Lakehead University did not supply information on bed counts; therefore, the researcher was unable to determine the ratio of students to beds to gain insight on the number of students that may be finding accommodation within the surrounding community.

Thunder Bay saw five CTs that had high unoccupied dwelling units, four of which were in the urban area. Between these four CTs over 150 units were converted, and 452 units were listed as unoccupied in 2016. Only one CT showing signs of studentification was close to Lakehead University, over the ten-year period it only saw 20 total units converted to unoccupied and 61 units overall listed as unoccupied in the CT. The CT which saw the most units convert to unoccupied between 2006 and 2016 is just west of Mission Island, about 4 km south of Lakehead. While it may not seem likely that students are living in this area, a quick tour of apartment rental websites reveals that rental units are, in fact, being targeted towards students. Around 10% of units in this CT are listed as unoccupied, a paltry number compared to other CTs, however temporal analysis should be continued to determine if the neighbourhood is becoming a student enclave or just showing effects of downtown decline. The CT with the largest number of unoccupied units was in rural Thunder Bay. The CT saw 51 units converted between 2006 and 2016 with nearly 1000 units listed as unoccupied. This puzzling result is clearly the result of some different process, conversion of units to cottages may offer an explanation, but further study should be conducted to determine the cause of the unoccupied units.



Map 3- 10: Map of the Thunder Bay CMA depicting CTs with characteristics of studentification.

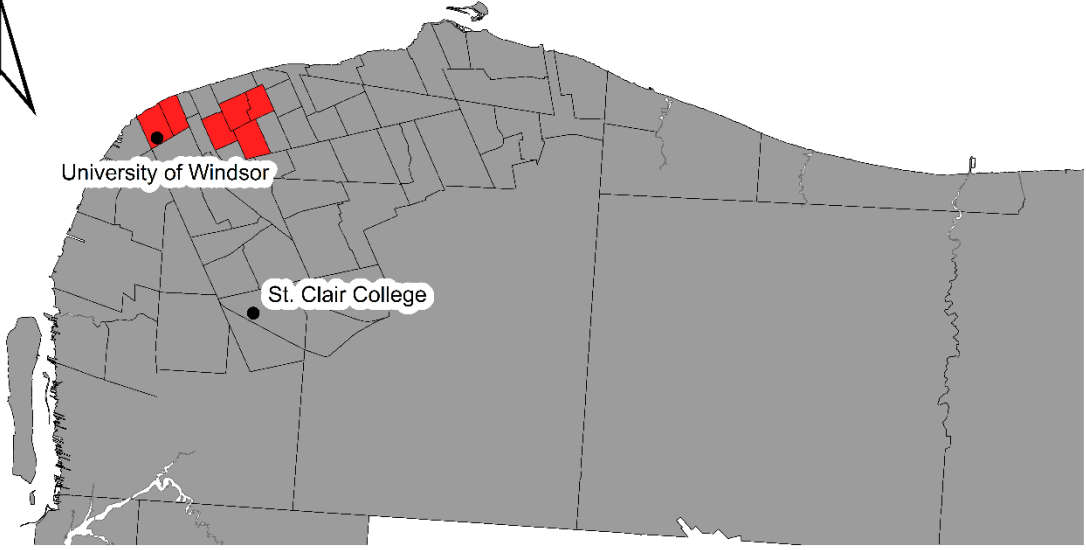
3.11 Windsor

Windsor is the southernmost CMA in all of Canada, with its neighbour to the north being the City of Detroit. The CMA touches Lake St. Clair and is bordered by the Detroit River. Windsor had gone through a period of decline during the 10-year study period, mainly due to the collapse of the automotive sector. As a result, the CMA had a modest population increase from 2006 to reach 330,000 inhabitants in 2016. The University of Windsor and St. Clair College are both located within the Windsor CMA, with the University of Windsor situated downtown, close to the Detroit River and Ambassador Bridge. The University is the only school in the study to have lowered enrollment totals over the study period. Enrollment decreased from nearly 16,300 in 2006 to 15,300 in 2016, a loss of 6% (CUDO, 2020). While enrollment decreased, the number of beds on campus stayed the same for the University, this reduced their ratio of students to beds from 17.6 to 16.5 – the highest ratio of any school by far. The University of Windsor is known as a commuter school, with a large proportion of its students choosing to live at home¹. Regardless, Windsor still saw several census tracts exhibiting characteristics of studentifying.

A total of six census tracts were observed to be studentifying in Windsor, all of which were in the downtown. Two of the six census tracts abutted the University, the two exhibited the strongest signs of studentifying with 161 units converted to unoccupied and a total of 866 units listed as unoccupied between them. These unoccupied units represent around 24% of the total units in these census tracts, meaning a considerable number of students may occupy these tracts. Across all studentifying census tracts, a total of 418 units were converted to unoccupied for a total of nearly 1900 units listed as unoccupied in 2016. Of note is the census tract surrounding St. Clair College, this census tract saw population and occupied dwellings decline, however, total dwelling units also declined in this period as many homes were demolished due to the expansion of Highway 401. Cross (2018) notes students do, in fact, reside in this census tract, had it not been for the housing demolition the CT most likely would have been observed using our method. This highlights the need for qualitative study alongside the quantitative census data analysis. Windsor is an interesting case, due to the economic crisis which plagued the city in the late 2000s. An exodus of residents from Windsor's blighted downtown to the suburbs resulted in many abandoned homes and high vacancy rates (Cross, 2017; Hollander *et al.*, 2018). Therefore, the studentifying characteristics that are observed in Windsor may, in fact, be amplified by true housing abandonment and unoccupied units during the study period.

¹ The author's family resides in Windsor. Personal knowledge informs some of the observations in this section.

Evidence of Studentification, Windsor CMS, Ontario 2006-2016



- HEI
- Census Tracts with Characteristics of Studentification
- Windsor CMA

Map 3- 11: Map of the Windsor CMA depicting CTs with characteristics of studentification.

4 Analysis

4.1 Summary of HEI Enrollment Data

Nearly every case study in this report observed student enrollment growth between 2006 and 2016, with an average enrollment growth of 28%. The only exception to this pattern of increasing enrollment was the University of Windsor. Table 4-1 provides a summary of enrollment totals, number of beds provided by the university, and their respective ratio of students to beds. From this table, it becomes apparent that no university included in this study has enough beds on campus to accommodate its students. In many cases, percent enrollment growth outpaces percent growth in beds. This leads to an increase in the ratio of students to beds, a ratio that identifies the number of students enrolled at a university per bed they have available on campus.

Just over half of the universities included in the study added to their supply of beds on campus, and of those Queen's, WLU, Ontario Tech, and Trent still saw their ratio of students to beds increase. This means that the increase in beds was still insufficient to offset the increase in enrollment. Laurentian, Western, and Windsor all saw declines in their ratios, however, Windsor's only decreased because of declining enrollment. Laurentian and Western were the only two schools to increase on-campus accommodation faster than overall enrollment rates. This, however, was still not adequate to cover the entire increase in enrollment because the new beds were typically only for first-year undergraduates.

The remainder of the schools all saw an increase in their ratios, with the largest increase coming from Ontario Tech. Guelph, McMaster, and UW also saw substantial increases in their ratio due to massive increases in enrollment and no additional beds. This pattern in enrollment growth not being met by on-campus accommodation puts universities on an unsustainable trajectory if they are interested in improving 'town and gown' relations. This enrollment growth becomes absorbed by the surrounding communities, increasing established resident and student tensions as an increasing student body looks to the private market for accommodation.

4.2 Increasing Enrollment

One expected result at the beginning of this project was to find an interrelationship between the increase in enrollment and the number of studentified units surrounding the HEI. The early conjecture was that the larger the increase in enrollment a school had, the more studentified units or CTs would be observed in proximity. However, this was not found. There did not seem to be a strong relationship between enrollment increases and studentification numbers (See Table 4-1). Wilfrid Laurier University and the University of Waterloo combined saw enrollment jump by over 14,000 students. It would be

plausible to think that this would be met with increases in family housing being converted to student use, but it was not captured using the current method. In fact, KCW had one of the lowest totals in studentified units and in total CTs showing characteristics of studentification. This may have been caused by Waterloo's policies actively encouraging new private student rental apartments (Revington et al., 2020).

In contrast, Queen's and Western which saw average enrollment growth – in comparison to universities in the study – also saw the largest increases in studentified units in CTs surrounding the university. So, it would seem that other factors, such as new private construction, new PBSA, or different proportions of local students may affect studentification.

This method only captures CTs that are still undergoing the process of studentification. CTs that have already reached an equilibrium with long-term residential development and student conversions – in other words, already undergone the process of studentification – are characterized by high percentages of unoccupied units, but little change in unoccupied units such as Northdale in Waterloo or Woodfield in London. However, usually there is already an institutional knowledge of students in CTs that have undergone the process of studentification (as was the case with the Northdale CT in Waterloo). Identifying the newly studentifying neighbourhoods can better prepare universities and municipalities to introduce policies that ensure a proper balance of students and established residents. This interpretation of the data should be followed up by a regression analysis to determine the statistical correlation of these variables.

Table 4- 1: Summary of data collected on universities included in case studies. All data on student enrollment was obtained from Common University Data Ontario & Council of Ontario Universities. (2020). A6 Total Enrollment by Program. Retrieved from <https://cudo.ouac.on.ca/>. All data on beds was obtained from university housing websites or through housing services staff and is accurate to the 2016 school year.

CMA	University	Enrollment (2006)	Enrollment (2016)	University Growth (2006-2016)	% Growth (2006-2016)	University Student Accommodation (number of beds)		Number of new beds on campus (2006-2016)	% Change in Beds	Ratio of Students to Beds (2006)	Ratio of Students to Beds (2016)
						2006	2016				
Greater Sudbury	Laurentian University	8,726	9,603	877	10%	1271	1507	236	19%	6.9	6.4
Guelph	University of Guelph	21,656	28,748	7092	33%	4625	4625	0	0%	4.7	6.2
Hamilton	McMaster University	24,265	30,368	6103	25%	3686	3686	0	0%	6.6	8.2
Kingston	Queens University	18,249	23,559	5310	29%	3886	4436	550	14%	4.7	5.3
KCW	Wilfrid Laurier University	14,275	17,880	3605	25%	2495	2823	328	13%	5.7	6.3
	University of Waterloo	25,910	36,665	10755	42%	5724	5724	0	0%	4.5	6.4
London	Western University	25,923	29,990	4067	16%	4316	5303	987	23%	6.0	5.7
Oshawa	Ontario Tech University	4,299	9,931	5632	131%	1320	1536	216	16%	3.3	6.5
Peterborough	Trent University	7,475	8,816	1341	18%	1343	1523	180	13%	5.6	5.8
St. Catharines	Brock University	17,145	17,998	853	5%	2407	2407	0	0%	7.1	7.5
Thunder Bay	Lakehead University	7,342	7,806	464	6%	N/A	N/A	N/A	N/A	N/A	N/A
Windsor	University of Windsor	16,340	15,314	-1026	-6%	928	928	0	0%	17.6	16.5

4.3 Spatial Patterns in Studentified Census Tracts

4.3.1 Universities

When viewing studentifying CTs in CMAs a general trend appears to emerge, consistent across most of the case studies. Studentified CTs tend to cluster around HEI's, but even beyond this, the CTs showing the strongest signs of studentification were, generally, in proximity to or contained a university. These CTs of concentrated student dwellings are consistent with much of the literature on students and student housing. Student neighbourhoods are expected in cities with significant higher educational provision and tend to be concentrated as students often trade-off similar factors when selecting their accommodation (Rugg et al., 2002; Charbonneau et al., 2006; Munro et al., 2009). Understanding the magnitude at which these CTs are exhibiting the characteristics of studentification derives perspective on the state of studentification in the neighbourhood.

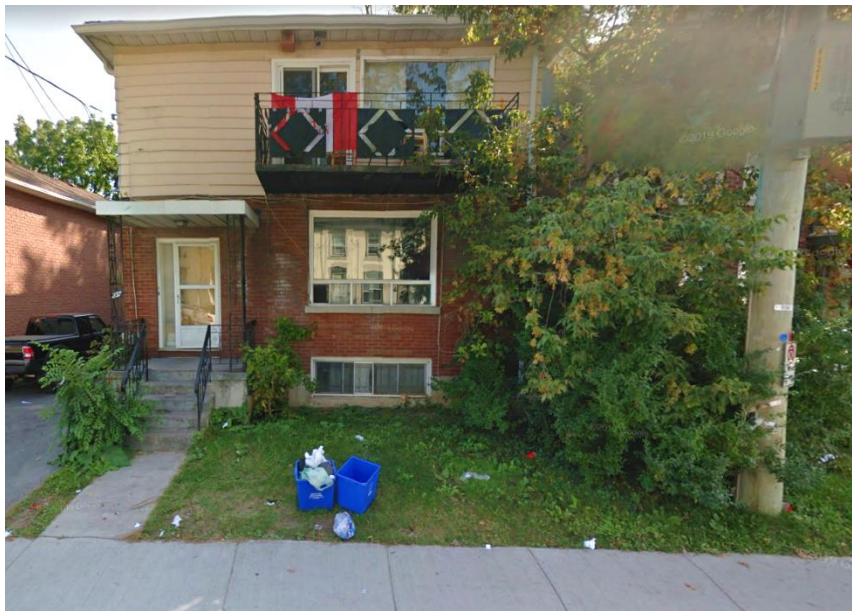


Figure 4- 1: Evidence of studentification in the Queen's University district in Kingston. Note the unkept gardens, garbage scattered around the lawn. Image Source: Google Earth Street View, retrieved August 25, 2020.

In the Hamilton, Kingston, and London CMAs, the CTs closest to or containing the university identified as studentifying had 40%, 73%, and 63% of their units listed as unoccupied, respectively. This pattern was also observed in Greater Sudbury, Guelph, KCW, St. Catharines – Niagara, and Windsor. However, it would not be pragmatic to go over each individual CMA in detail here, full results can be found in Appendix A. It is specifically in

these CTs where one can easily find visual cues of student dwellings consistent with the criteria set out in Smith, et al. (2014). Using Google Street View, a tour of these CTs reveals many properties identified

as student dwellings, in several cases it is possible, using older Street View images, to ‘see’ the transition from an established resident dwelling to that of a student dwelling.



Figure 4- 2: Image captured in the Ainsley Wood North neighbourhood surrounding McMaster University. This image captures the change of a dwelling from what appears to be an established resident to a student dwelling. Note the unkept gardens and lawn, garbage bins on porch, and garbage left on lawn. Additionally, the cars seen in the driveway in images are different. Image Source: Google Earth Street View, retrieved August 25, 2020.

It is in these census tracts as well where reports of community organizations condemning students appear in local newspapers. Reports of confrontations and resident frustration in the Westdale and Ainsley Wood areas around McMaster University – census tracts which saw the highest level of studentification – can be seen as far back as the early 2000s and continue to trouble the communities (Howard, 2012; Earl, 2016). Using a combination of Google Street View and local newspaper articles provides further confidence in the success of this method in identifying the geographies of studentifying CTs at the CMA scale. Interestingly, while there does seem to be a single CT that has the strongest signs of studentification, this CT is not always the one that is experiencing the greatest unit conversion over the study period. This pattern was observed in Kingston and Hamilton. In Kingston, the University district CT had the highest number of estimated units occupied by students, however, the largest number of conversions between 2006 and 2016 occurred in an adjacent census tract. A similar effect was observed in Hamilton. This strongly indicates an expansion in student accommodation locations from the older student enclaves during this period of enrollment expansion.

4.3.2 Colleges

The pattern of studentification can be seen adjacent to colleges. Initially, these institutions were not included in the study, but it does appear that they do have the same effect on student concentrations at a smaller scale. Clear studentification patterns can be seen in Greater Sudbury, Hamilton, Kingston, Oshawa, and St. Catharines – Niagara. Much of the literature on studentification focuses upon universities, however, given results from this study, colleges seem to have a similar effect on surrounding communities. As can be seen in Maps 3-1, 3-3, 3-4, 3-7, and 3-8 concentrations of studentifying CTs surround or are in proximity to colleges. This pattern is most visible in Hamilton, with Mohawk College clearly having an influence on two C's. In these two CTs nearly 100 units had been converted over the decade, with nearly 200 listed as unoccupied. These numbers are considerably smaller than what is observed surrounding McMaster University; a similar story plays out surrounding the other colleges (see Appendix). This finding presents novel insights into the effects that colleges can have on the geographies of studentification.

4.4 Comparative Case Study

In Kingston, we have a unique opportunity to compare the results of this methodology with a 2008 student living accommodation report in which student locations were mapped with data from Queen's

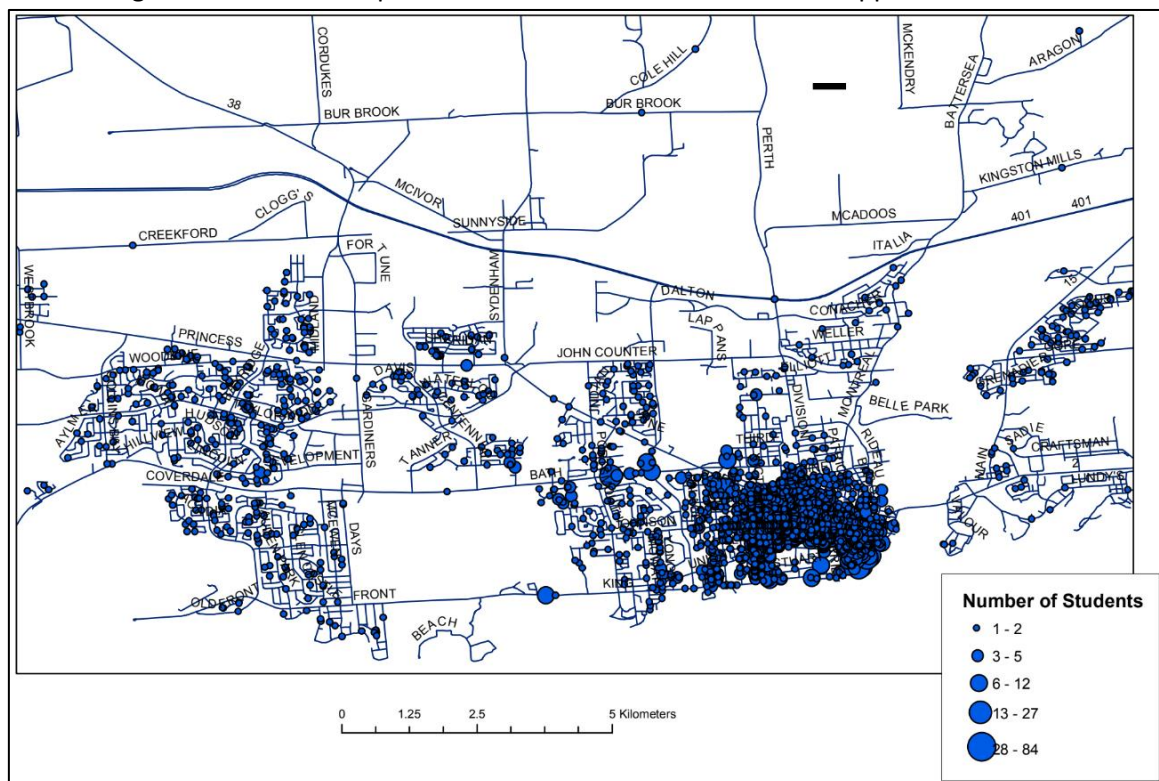


Figure 4- 3: Results from the 2008 Student Accommodation Survey depicting locations and numbers of undergraduate students attending Queen's University. Image Source: Chong, 2008.

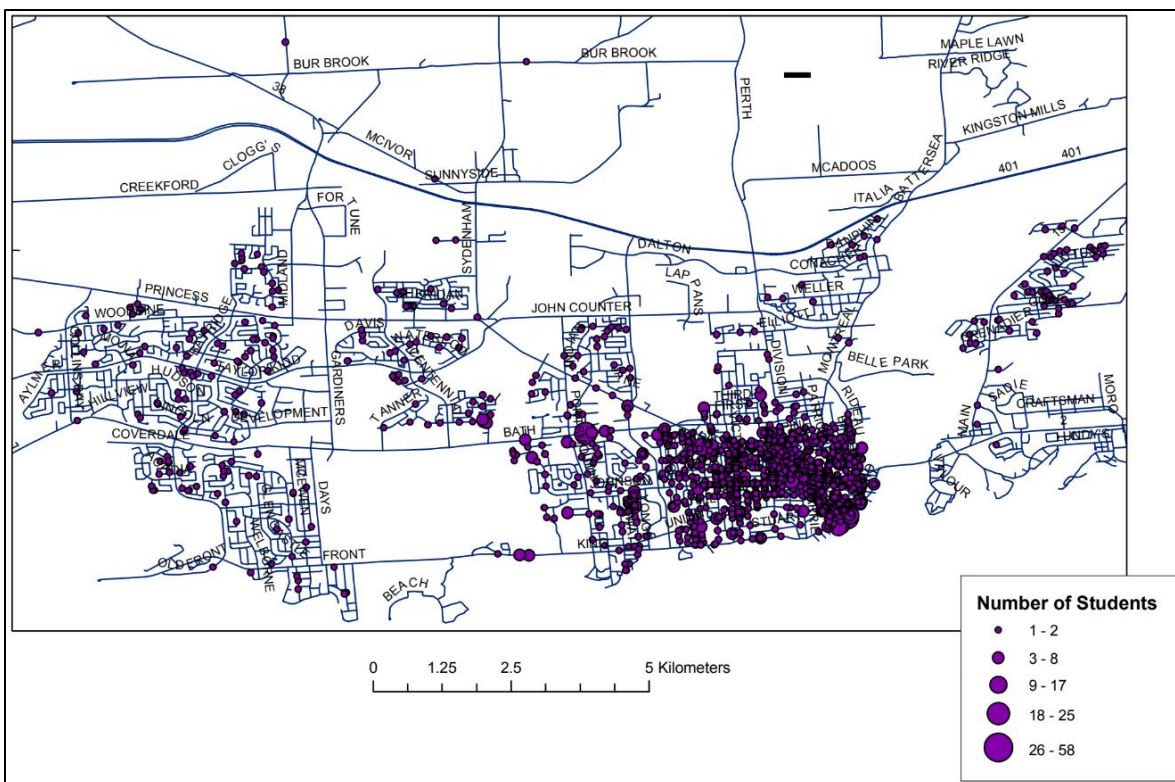


Figure 4- 4: Results from the 2008 Student Accommodation Survey depicting locations and numbers of graduate students attending Queen’s University. Image Source: Chong, 2008.

Registrar’s Office. A recommendation from this study was to conduct a time series analysis on student housing locations; this will be done by comparing the CTs identified as studentifying using the current method with the report’s data on student housing. Comparing the identified geographies of the data will provide supporting evidence for the validity of the current method and show the extent to which studentification has expanded since 2008 in Kingston.

The report found of undergraduate students who live off-campus, around 82% lived within 1.5km of University Avenue and Union Street, compared to 65% of graduate students (Chong, 2008). Figures 3 and 4 outline the locations of undergraduate and graduate student housing, respectively. Comparing this to the findings of the Kingston CMA in Map 3-4, one can see the patterns of studentifying CTs are mirrored by the locations of student housing in this report. What is especially salient in Chong’s (2008) report is the concentration of students near the university. This was also identified in the data by the high number of unoccupied units found in the university CT and the large number of conversions taking place.

It can be seen in the 2008 study that few students are living in the neighbourhoods north of Princess Street, however, these CTs (Williamsville North and McBurney) were identified using the current

method as having the two highest unit conversions from 2006-2016. Indicating that since this survey had been conducted in 2008, students have been occupying units further north of the school, thereby expanding the geographies of studentification in Kingston north. There is little evidence of Queen's students near St. Lawrence college (SLC) campus in 2008, but observations in this study reveal patterns of studentification near SLC by 2016. Further research is needed to untangle the effects of SLC on studentification in the Portsmouth area. Additionally, the 2008 report shows students living upwards of 7km away from the university on the western edge of the city. They were not identified using the unoccupied dwelling method as it is likely that any students living in these areas commute from a home that has full-time residents and any effect these students are having on the CTs dwelling units are too minimal to be identified by the method.

Having the 2008 report to compare the geographies of studentification is useful in exploring the patterns of student housing. Temporal analysis is invaluable for policymakers to identify where students beginning to find accommodation.

4.5 Irregularities in Observations

An erroneous conclusion to make when viewing the results is to believe that studentification is the lone process that can cause CTs to exhibit these characteristics. This section will attempt to unravel some of the anomalous patterns observed and offer alternative processes which can cause these same results.

4.5.1 Declining CMAs

The Sudbury, Thunder Bay, and Windsor CMAs exhibited telltale signs of studentification in multiple CTs: population decline, an increase in dwelling units, and an increase in unoccupied units. One major factor ties these CMAs together and separates them from the others in the case study – these CMAs experienced population decline or negligible growth in the ten-year study period. Most Ontario mid-sized cities also saw overall suburban growth and downtown population decline (Gordon et al., 2019), so the inner cities of CMAs which saw population decline would be under more stress. In these cases, the HEI and studentified CTs are located within a major population centre, therefore the focus will be on the decline of population in the inner cities rather than the CMAs. Sudbury did not see a decline in population over the study period, it saw modest growth of 4%. The CMA still warrants a closer examination as its population has still not returned to its peak in the 1970s. The Windsor CMA witnessed a 1.3% decline in population between 2006 and 2011, with the largest population loss occurring in the City of Windsor. From 2006 to 2011, the City of Windsor's population decreased by almost 6,000 people,

Thunder Bay experienced population decline from 2006 to 2011 with a loss of 1.1%, from the 2011 to the 2016 census the population remained stable.

While the methodology uses unoccupied units as a proxy for student dwellings, it is inevitable that some units are in fact caused by true vacancy. Using data from the 2006 and 2011 Canadian quinquennial Census, Hollander *et al.* (2018) found 28% of all addresses in their sample of Windsor’s CBD showed either partial or complete vacancy. Interestingly, the locations of high concentrations of vacant properties follows closely the spatial distribution of CTs showing signs of studentification.

The City of Thunder Bay experienced many of the challenges faced by other mid-sized urban centres in Canada: urban sprawl, decline of the manufacturing sector, and downtown decay. Unique to Thunder Bay – due to the amalgamation of two former independent cities Port Arthur and Port William – is the dual downtown core, spaced

7 km apart. Both cores are struggling (Randall et al.,2017) (see Figure 4-5). This spatial distribution of the dual downtown cores matches the distribution of the CTs with unoccupied units, with the former Fort William CBD occupying a portion of a CT with high levels of unoccupied dwellings. There is a need for further investigation to determine if the effects seen are due to studentification or downtown decline.

There are numerous studies identifying slow growth and decline, deteriorating housing stock, and high unemployment in Greater Sudbury (Hall, 2009; Leadbeater, 2008; Schatz, 2010). While these effects may have been centred around the collapse of the mining industry in the 1970s the City of Greater Sudbury continues to face issues with downtown decline (Schatz, 2010). The downtown core is where all CTs with high levels of ‘unoccupied’ dwellings are located in the Greater Sudbury CMA. Therefore, one should be

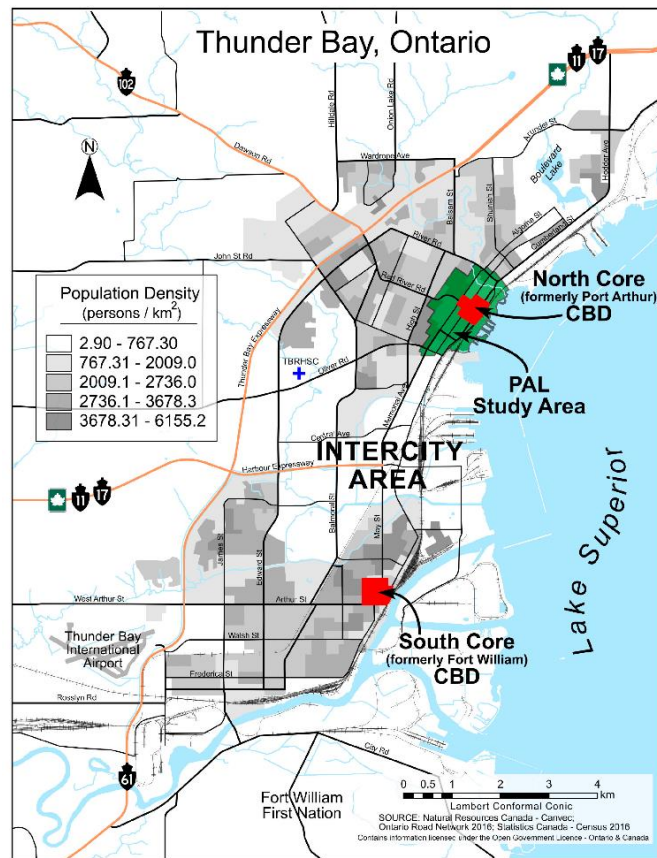


Figure 4- 5: Showing the locations of Thunder Bay’s two downtown cores. Observations in the Thunder Bay geographies of studentification mirror the locations of the downtown cores. Image source: Randall, Kavalchuk, & Nelson, 2017.

cautious when interpreting this data as some effects may be due to Greater Sudbury's downtown decline.

These unique cases highlight the need for local contextual analysis. In CMAs with declining populations and high vacancy rates, an abandonment or foreclosure variable could be useful in identifying CTs showing true signs of unit inoccupation.

4.5.2 False Positives

Several CTs across three CMAs were identified as anomalies, one CT in London, two in St. Catharines – Niagara, and one in Thunder Bay. In all three of these CMAs, the anomalous CTs were in the rural areas of the CMAs, hinting that some other process is occurring in these rural areas to create unoccupied dwelling units. A more distinct pattern appeared with these four CTs – all of them were bordering a Great Lake. While they did exhibit unoccupied dwelling units, it was at a more subdued scale than in the large urban population centres. So, what could the method be picking up if not students?

One explanation could be the conversion of family dwellings into cottages. These CTs were home to typical cottage towns of Port Stanley, Fort Erie, and Wild Goose. The time of the study period also witnessed the boom of short-term rentals which was only accelerated by the launch of Airbnb in 2008. The share of such listings continues to be overrepresented in Canada's CMAs (Combs et al., 2020). The conversion of units to cottages and short-term rentals may not explain the entire picture, but what is clear is that across these CMAs, lakeside CTs are seeing a loss in population, an increase in their dwelling unit stock, and a reduction in the number of occupied dwellings.

The effects of new student construction, CMA population decline, and lakeside anomalies all point to a need for future research to include key informant interviews with knowledgeable observers in each metropolitan area.

5 Conclusions

5.1 Study Objectives

This report sought to answer three questions regarding the extent of studentification in near campus neighbourhoods. The aim was to identify the geographies of studentifying CTs in mid-sized Ontario university cities using population, total dwelling units, and occupied dwelling units from the Canadian Census to identify CTs undergoing the process of studentification. Using unoccupied dwelling units as an indicator variable for student dwellings, it was then possible to estimate the number of student dwellings in a CT. Subsequently, this report also attempted to offer insights on the relationship between the number of beds provided by a university and the extent of studentification in surrounding CTs.

Methods and study justification were adapted from Smith et al. (2014) and Gordon et al. (2019) to estimate student dwelling numbers and were employed using the 2006 and 2016 Canadian Censuses. CTs across the CMAs were then classified as either studentifying or not. Studentifying CTs were usually identified by a decrease in population, an increase in dwelling units, and an increase in unoccupied units. CTs that did not meet these criteria were deemed not to be studentifying.

5.2 Primary Results

5.2.1 Geographies of Studentification

The general pattern of studentification found in mid-sized Ontario university cities follows an expected pattern; studentifying CTs tend to cluster around HEI's. In almost every CMA, a single CT in proximity to the university showed the greatest signs of studentification. In the most extreme case seen in the CT containing Queen's University in Kingston, an estimated 1150 units have been converted for student dwellings. This represents around 73% of that CTs total dwelling units. With 250 of those 1150 units being converted between 2006 and 2016, the conversion of units does not seem to be stopping. Additionally, emerging student enclaves were observed in Hamilton and Kingston, with large numbers of conversions taking place in additional CTs. In Kingston, this newly emerging student neighbourhood is further away from the university, indicating that the number of units close to the university is insufficient to house the growing student population. This finding would be expected in more CMAs using the 2021 Canadian Census. Further temporal analysis will provide a clearer picture on the locations of the expanding student accommodation market.

Community colleges were also seen to have some influence on the patterns of studentification in several CMAs, prompting the addition of them to the maps. Greater Sudbury, Hamilton, Kingston, Oshawa, and St. Catharines – Niagara all had CTs showing characteristics of studentification in proximity to or

containing college campuses. Mohawk College in Hamilton was observed to have the greatest effect on its surrounding CTs. Two CTs surrounding the college showed characteristics of studentification, around 200 units were estimated to be occupied by students with 50% of that occurring in the study period. Community colleges are often overlooked when studying the effects and spatial distribution of students. However, given college enrollment has been steadily increasing in Ontario – with an increasing proportion of international students – and the observations seen in this report, colleges should be included in studentification studies when viewing the issue at the CMA level (Statistics Canada, n.d.).

A surprising result from this study was in the relationship between university enrollment and number of studentified units surrounding the HEI. The findings revealed no obvious positive relationship between these two variables, in fact, a slight negative relationship seemed to be occurring (see Table 5-1). However, a full regression analysis needs to be done to confirm any correlations between variables such as enrollment, proportion of local students, new PBSA, vacant units, etc. Further patterns in the HEI data set revealed that almost every school did not increase their number of beds on campus to sufficiently meet the increased enrollment. This only increases pressure on surrounding communities as more students take up residence in near-campus neighbourhoods, thereby displacing long-term residents.

Using Waterloo as a case study, it became apparent that the method used in the report was not capturing the most significant student neighbourhood in the City. The Northdale neighbourhood had over 2300 units listed as unoccupied, however, since it saw an increase in population and an increase in occupied dwelling units it was not picked up by the method. As uncovered by this example, the method from this project cannot identify CTs that have already seen a large outflow of long-term residents and have now reached a balance between students and long-term residents. Including a variable for the proportion of units unoccupied in a CT would capture CTs that have had large numbers of family dwellings converted to student dwellings. This would then need to be followed up with qualitative research to verify the observations, future studies should incorporate this variable.

In Kingston, a comparative analysis on student accommodation was possible due to a 2008 report. In comparing the spatial patterns observed in this study to those found in the student accommodation survey it was clear that the results mirrored one another. A significant number of students were shown to be living in proximity to the university in the 2008 report, a finding that was also observed for the 2006-2016 period using this method. There were also some differences. The 2008 student accommodation report noted very few students living beyond the boundary of Princess Street to the

north. However, it was precisely in these areas north of Princess Street where the largest conversion of units was observed in 2006-2016. Comparing these two reports revealed the movement of student dwellings further north, which is a concern since the neighbourhoods north of Princess St. contained a substantial number of rental units occupied by low-income households.

5.2.2 Individual Variability

Factors at the CMA level must be accounted for when using this method to estimate the geographies of studentification. The Greater Sudbury, Thunder Bay, and Windsor CMAs have all seen decline or slow growth, meaning the declines in occupied units and population may have been subject to true housing abandonment and high vacancy rates, not resulting from studentification. Considering this method uses unoccupied dwellings as a proxy for student dwellings, vacant or abandoned units would also be caught by this method. However, in these cities, the housing abandonment may be severe enough to imitate the characteristics of a studentifying CT. The CTs with unoccupied dwellings in the downtowns of these cities need further qualitative investigation. In addition to these CMAs, several individual CTs which were identified with unoccupied dwellings require further investigation. The CTs in question were all observed to be in rural areas of their respective CMAs and bordering lakes. Several potential causes have been suggested but further investigation is required.

5.3 Assessment of Method

Confirming the results discussed in the analysis section requires further analysis. Qualitative analysis such as interviews and neighbourhood surveys are required to validate the results in several CMAs. However, the results observed are consistent with the literature and with what is understood of student accommodation behaviours (Allinson, 2006; Charbonneau et al. 2006; Dorling & Rees, 2003; Munro et al., 2009). Therefore, some confidence can be attributed to this method in identifying the geographies of studentification in mid-sized university cities. This method should not be employed exclusively when studying studentification, as has been seen it is imperfect in picking up CTs that have already undergone the process of studentification. Applying techniques such as finding evidence of students using Google Street View images and local newspaper articles assisted in confirming locations of some CTs, but these methods alone would not be sufficient in confirming or denying the geographies of studentification in every CMA. Further qualitative analysis should be conducted in concert with this method, qualitative analysis such as interviews would be invaluable for this research. Overall, this method did have some success in identifying the geographies of studentification at the CMA level and provided a baseline for future research.

Table 5- 1: Summary table of university enrollment and studentified CTs.

CMA	University	University Growth (2006-2016)	% Growth (2006-2016)	Number of Census Tracts Showing Studentification Characteristics		Estimated Units Converted in CTs Showing Characteristics of Studentification (2006-2016)	
				University Adjacent	Rest of City	University Adjacent	Rest of City
Greater Sudbury	Laurentian University	877	10%	2	5	354	462*
Guelph	University of Guelph	7092	33%	3	0	318	0
Hamilton	McMaster University	6103	25%	2	9	473	810*
Kingston	Queens University	5310	29%	5	1	1135	166
KCW	Wilfred Laurier University	3605	25%	2	1	239	11
	University of Waterloo	10755	42%				
London	Western University	4067	16%	4	7	872	510*
Oshawa	Ontario Tech University	5632	131%	1	0	106	0
Peterborough	Trent University	1341	18%	0	2	0	157*
St. Catharines	Brock University	853	5%	2	4	312	98
Thunder Bay	Lakehead University	464	6%	1	3	20	185*
Windsor	University of Windsor	-1026	-6%	6	1	418	27*

* Contains anomalies that require further qualitative research.

5.4 Limitations and Future Research

5.4.1 Limitations

There are several limitations to using this method. This method for identifying studentification is based on previous work by Smith, Sage, and Balsdon (2014) and is a working method that has not yet been widely accepted or tested. Availability of census data provides limitations in this research; Statistics Canada releases data publicly at the census tract level to protect individual's privacy. However, this results in issues of aggregation, where data is aggregated to a larger geographical area and one stands to lose individual variability that could be vital in understanding the patterns and processes that are occurring (Marans and Stimson, 2011). Second, using an indicator variable to locate student dwellings will inevitably under-count student dwellings and may not portray the exact extent of or locations in which studentification is taking place.

As mentioned above, this method does not seem to catch CTs that have already undergone the process of studentification, and it may also miss CTs that are in the beginning stages of studentification. Suppose a new housing development was developed during the study period in a CT and at the same time this CT saw conversions of units to student dwellings. This one housing development may lead to an increase in population of the CT, thereby taking it out of the group identified as studentifying. This hypothetical situation marks just one case where this method can miss a newly studentifying CT. Additionally, the characteristics of studentification can match characteristics of other processes: housing abandonment or conversion of units to short-term rentals.

Several methods were employed in mapping the distribution of studentification in mid-sized CMAs. In addition to the maps seen in Section 3, Appendix C shows the maps created with each individual variable displayed separately. This method was not deemed useful in identifying the spatial distribution of students.

Current research was limited by the effects of the COVID-19 pandemic which restricted fieldwork and in-person interviews. As such, only a single census data set were analyzed. A considerable amount of information was still able to be gleaned from this data set. However, it may seem as though certain cases were better analyzed than others. The author was able to supplement the CMAs of Hamilton, Kingston, and Windsor using personal knowledge. Ideally, the researcher would use qualitative methods such as key informant interviews for every case study.

The results of this study are limited temporally to one 10-year time period, 2006-2016. Ideally, this study would be conducted in 5-year intervals along with the Canadian Census. However, several factors

contributed to the study being limited to a single 10-year period: time constraints for the researcher prevented analysis of the 1996 and 2001 data and data quality issues (Hulchanski et al., 2013) prevented the use of the 2011 Canadian Census. A 5-year temporal comparative analysis will reveal more significant results. Additional time constraints limited this research, ideally, regression analysis would have been conducted on the summary table (see Table 5-1) to quantifiably determine any correlations between variables. Taking on 11 case studies also limited the amount of time the researcher could spend on an individual CMA. With more time spent on individual CMAs, local factors could be explored, site visits and informal and formal interviews could be conducted to better determine and explain the patterns observed.

5.4.2 Future Research

Continuation of this research to align with the publication of the 5-year Canadian Census would strengthen the results and enable researchers to validate the credibility of this method for identifying studentification. Temporal analysis should also be conducted using previous census data, examining the extent of studentification in CMAs prior to the post-secondary enrollment boom could offer interesting insight into how studentification has expanded in each CMA. Additional research should be conducted in other parts of the country. For instance, it would be interesting to see how the results in Ontario compare to schools in other Provinces.

A study focusing on untangling the effects of short-term rentals from studentifying areas would be a valuable addition to the current method. Future research on short-term rentals should aim to use additional data sources (such as MPAC data) to cross-reference findings against the current method.

Pairing this research with other methods is ideal to better understand studentification in each CMA. Travel data should be paired along with this method, identifying commuter schools from live-in schools could aid in understanding some of the patterns observed in the CMAs. Further than adding travel studies to the method, the method employed in this study should be evolved to provide a more nuanced approach to studying studentification. Applying qualitative studies such as a checklist using characteristics outlined in Table 2-1, or interviews with local planners, community groups, and school governments would be useful in identifying studentification. Additionally, adding a fourth variable for proportion of units unoccupied should yield a clearer picture of the geographies of studentification. A more scaled-down study using mixed methods and focused on a single CMA would reveal far more information on student living patterns and would prove more useful from a policy development standpoint for that municipality.

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Appendices

Appendix A

Data tables used in results and analysis. All data provided by and derived from the 2006 & 2016 Canadian Census.

Table A- 1: Population, dwelling unit, and occupied dwelling unit data for Greater Sudbury CMA 2006-2016

Neighbourhood	2016 Census Tract ID	2016 Population	2011 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
The Donovan	5800011.00	2,205	2,269	2,268	-63	-2.8%	1,528	1,492	36	2.4%
McKim Township	5800012.00	2,167	2,251	2,301	-134	-5.8%	1,329	1,271	58	4.6%
College Boreal West	5800014.00	3,110	3,135	3,299	-189	-5.7%	1,840	1,791	49	2.7%
Little Britain	5800003.00	3,694	3,856	3,885	-191	-4.9%	2,321	2,223	98	4.4%
City Centre	5800005.00	2,135	2,132	2,417	-282	-11.7%	1,723	1,630	93	5.7%
Barrydowne & Don Lita	5800008.00	3,869	3,985	4,185	-316	-7.6%	1,643	1,626	17	1.0%
Downtown South	5800004.00	4,512	4,688	4,985	-473	-9.5%	2,644	2,555	89	3.5%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by Students(?)	% of total Dwelling Units Unoccupied
The Donovan	1,251	1,349	-98	-7.3%	-134	277	18%
McKim Township	1,132	1,151	-19	-1.7%	-77	197	15%
College Boreal West	1,527	1,555	-28	-1.8%	-77	313	17%
Little Britain	1,946	1,989	-43	-2.2%	-141	375	16%
City Centre	1,337	1,411	-74	-5.2%	-167	386	22%
Barrydowne & Don Lita	1,573	1,589	-16	-1.0%	-33	70	4%
Downtown South	2,278	2,376	-98	-4.1%	-187	366	14%

Table A- 2: Population, dwelling unit, and occupied dwelling unit data for Guelph CMA 2006-2016

Neighbourhood	2016 Census Tract ID	2016 Population	2011 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Hanlon Creek	5500001.05	3,878	4,039	4,349	-471	-10.8%	1,839	1,798	41	2.3%
Guelph-North West	5500002.00	3,997	4,000	4,158	-161	-3.9%	2,112	2,051	61	3.0%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by students(?)	% of total Dwelling Units Unoccupied
Hanlon Creek	1,451	1,509	-58	-3.8%	-99	388	21%
Guelph-North West	1,741	1,778	-37	-2.1%	-98	371	18%

Table A- 3: Population, dwelling unit, and occupied dwelling unit data for Hamilton CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2011 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Mohawk College- West	5370012.00	1,524	1,512	1,533	-9	-0.6%	765	737	28	3.8%
Mohawk College	5370013.00	2,818	2,816	2,885	-67	-2.3%	1,126	1,121	5	0.4%
South Westdale/McMaster Innovation	5370043.00	3,587	3,977	3,633	-46	-1.3%	2,413	2,374	39	1.6%
McMaster/Westdale	5370045.00	2,936	3,014	3,351	-415	-12.4%	1,944	1,759	185	10.5%
Downtown-Sherman & Gage	5370052.00	3,549	3,772	3,778	-229	-6.1%	1,935	1,920	15	0.8%
Downtown- Sherman & Barton	5370060.00	2,629	2,770	2,694	-65	-2.4%	1,119	1,099	20	1.8%
Downtown- Wentworth, Sherman	5370061.00	3,012	3,151	3,196	-184	-5.8%	1,468	1,401	67	4.8%
Downtown- Wellington & Wentworth	5370062.00	3,312	3,395	3,538	-226	-6.4%	1,613	1,559	54	3.5%
Downtown- James & Wellington	5370063.00	2,705	3,381	3,182	-477	-15.0%	1,483	1,382	101	7.3%
Downtown- Queen & James St N	5370064.00	1,689	1,658	1,821	-132	-7.2%	797	777	20	2.6%
Industrial A- Barton & Wellington	5370066.00	4,965	5,189	5,252	-287	-5.5%	2,306	2,241	65	2.9%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by Students(?)	% of total Dwelling Units Unoccupied
Mohawk College- West	627	665	-38	-5.7%	-66	138	18%
Mohawk College	1,073	1,095	-22	-2.0%	-27	53	5%
South Westdale/Mac Innovation	1,493	1,595	-102	-6.4%	-141	920	38%
Mac/Westdale	1,157	1,304	-147	-11.3%	-332	787	40%
Downtown-Sherman & Gage	1,622	1,720	-98	-5.7%	-113	313	16%
Downtown- Sherman & Barton	1,020	1,037	-17	-1.6%	-37	99	9%
Downtown- Wentworth & Sherman	1,169	1,217	-48	-3.9%	-115	299	20%
Downtown- Wellington & Wentworth	1,345	1,387	-42	-3.0%	-96	268	17%
Downtown- James & Wellington	1,142	1,228	-86	-7.0%	-187	341	23%
Downtown- Queen & James St N	702	713	-11	-1.5%	-31	95	12%
Industrial A- Barton & Wellington	2,055	2,128	-73	-3.4%	-138	251	11%

Table A- 4: Population, dwelling unit, and occupied dwelling unit data for Kingston CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2011 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Queen's Campus	5210002.00	853	1,219	1,254	-401	-32.0%	1,590	1,513	77	5.1%
Sunnyside	5210003.00	2,592	2,817	2,877	-285	-9.9%	1,445	1,442	3	0.2%
Williamsville North	5210008.00	2,295	2,323	2,478	-183	-7.4%	1,850	1,647	203	12.3%
McBurney	5210009.00	3,008	3,094	3,200	-192	-6.0%	2,373	2,158	215	10.0%
Regiopolis	5210010.00	3,803	4,177	4,179	-376	-9.0%	2,169	2,122	47	2.2%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by Students(?)	% of total Dwelling Units Unoccupied
Campus-	434	606	-172	-28.4%	-249	1,156	73%
Sunnyside	964	1,127	-163	-14.5%	-166	481	33%
Williamsville North	1,175	1,292	-117	-9.1%	-320	675	36%
McBurney	1,660	1,739	-79	-4.5%	-294	713	30%
Regiopolis	1,893	1,952	-59	-3.0%	-106	276	13%

Table A- 5: Population, dwelling unit, and occupied dwelling unit data for Kitchener-Cambridge-Waterloo CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2011 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Beechwood	5410101.04	3,490	3,652	3,733	-243	-6.5%	1,413	1,410	3	0.2%
Weber & Erb St	5410104.00	6,376	6,129	6,514	-138	-2.1%	3,055	3,047	8	0.3%
Columbia & Albert	5410106.02	3,449	3,230	3,619	-170	-4.7%	2,114	1,989	125	6.3%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by Students(?)	% of total Dwelling Units Unoccupied
Beechwood	1,268	1,305	-37	-2.8%	-40	145	10%
Weber & Erb St	2,877	2,880	-3	-0.1%	-11	178	6%
Columbia & Albert	1,554	1,628	-74	-4.5%	-199	560	26%

Table A- 6: Population, dwelling unit, and occupied dwelling unit data for London CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Chelsea Green	5550014.00	-231	-5.1%	2,184	2,176	8	0.4%
South London	5550018.00	-345	-6.8%	2,695	2,651	44	1.7%
W. London UWO	5550021.00	-257	-5.7%	3,171	3,138	33	1.1%
Pottersburg	5550029.00	-226	-7.3%	1,475	1,444	31	2.1%
East London	5550030.00	-273	-6.6%	2,102	2,093	9	0.4%
Bishop Helmuth	5550043.00	-209	-5.8%	1,933	1,896	37	2.0%
University Heights & Western University	5550044.01	-364	-9.6%	2,130	2,130	0	0.0%
UWO	5550045.00	-14	-1.2%	1,692	1,349	343	25.4%
St Thomas	5550202.00	-69	-2.8%	1,105	1,096	9	0.8%
St. Thomas	5550203.00	-289	-8.2%	1,524	1,490	34	2.3%
St Thomas	5550205.00	-310	-10.3%	1,344	1,322	22	1.7%
Union & Lawton's Corner & Dexter	5550220.00	-489	-6.3%	3,356	3,327	29	0.9%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied By Students (?)	% of total Dwelling Units Unoccupied
Chelsea Green	2,029	2,057	-28	-1.4%	-36	155	7%
South London	2,421	2,509	-88	-3.5%	-132	274	10%
W. London UWO	2,283	2,432	-149	-6.1%	-182	888	28%
Pottersburg	1,370	1,383	-13	-0.9%	-44	105	7%
East London	1,987	2,013	-26	-1.3%	-35	115	5%
Bishop Helmuth	1,437	1,562	-125	-8.0%	-162	496	26%
University Heights & Western University	1,384	1,567	-183	-11.7%	-183	746	35%
UWO	625	627	-2	-0.3%	-345	1,067	63%
St Thomas	1,022	1,043	-21	-2.0%	-30	83	8%
St. Thomas	1,440	1,444	-4	-0.3%	-38	84	6%
St Thomas	1,249	1,275	-26	-2.0%	-48	95	7%
Union & Lawton's Corner & Dexter & Sparta	2,971	3,029	-58	-1.9%	-87	385	11%

Table A- 7: Population, dwelling unit, and occupied dwelling unit data for Oshawa CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2011 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
North Oshawa	5320015.04	2,245	2,204	2,455	-210	-8.5%	952	942	10	1.1%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by Students (?)	% of Total Dwelling Units Unoccupied
North Oshawa	808	903	-95	-10.6%	-106	144	15%

Table A- 8: Population, dwelling unit, and occupied dwelling unit data for Peterborough CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Downtown	5290007.00	4,409	4,715	-306	-6.5%	2,765	2,736	29	1.1%
* Reserve Lands	5290105.01	362	481	-119	-24.7%	211	186	25	13.2%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006- 2016)	Units Occupied by Students (?)	% of Total Dwelling Units Unoccupied
Downtown	2,234	2,315	-81	-3.5%	-110	531	19%
* Reserve Lands	154	177	-23	-12.8%	-47	57	27%

* Denotes First Nation reserve lands, different processes may be causing the population and occupied unit loss.

Table A- 9: Population, dwelling unit, and occupied dwelling unit data for St. Catharines-Niagara CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
Brock	5390002.00	6,363	6,572	-209	-3.2%	3,375	3,306	69	2.1%
Brock-East St. Davis Road & 58	5390101.00	5,624	5,890	-266	-4.5%	2,647	2,575	72	2.8%
Crescent & Waverly Beach	5390331.01	4,809	4,815	-6	-0.1%	2,115	2,112	3	0.2%
Old Fort Erie	5390330.00	4,600	4,718	-118	-2.5%	2,123	2,104	19	0.9%
Niagara College-East	5390311.02	5,508	5,862	-354	-6.0%	2,368	2,345	23	1.0%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Change in Occupied Units (2006-2016)	Units Occupied by Students(?)	% of Total Units Unoccupied
Brock	2,760	2,911	-151	-5.2%	-220	615	18%
Brock-East St. Davis Road & 58	2,350	2,370	-20	-0.8%	-92	297	11%
Crescent & Waverly Beach	1,904	1,913	-9	-0.5%	-12	211	10%
Old Fort Erie	1,973	1,996	-23	-1.2%	-42	150	7%
Niagara College-East	2,247	2,264	-17	-0.8%	-40	121	5%

Table A- 10: Population, dwelling unit, and occupied dwelling unit data for Thunder Bay CMA 2006-2016

Neighbourhood	2016 Census Tract ID	2016 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
West Fort William	5950003.00	4,914	5,081	-167	-3.3%	2,436	2,420	16	0.7%
Former Fort William	5950005.00	4,577	4,603	-26	-0.6%	2,202	2,114	88	4.2%
John St & Algonquin Ave	5950012.00	3,043	3,174	-131	-4.1%	1,366	1,359	7	0.5%
Rural Thunder Bay	5950101.00	2,798	2,913	-115	-3.9%	2,130	2,106	24	1.1%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Net Change in Units	Units Occupied By Students(?)	% of Total Units Unoccupied
West Fort William	2,258	2,271	-13	-0.6%	-29	178	7%
Former Fort William	1,989	2,006	-17	-0.8%	-105	213	10%
John St & Algonquin Ave	1,305	1,318	-13	-1.0%	-20	61	4%
*Rural Thunder Bay	1,196	1,223	-27	-2.2%	-51	934	44%

Table A- 11: Population, dwelling unit, and occupied dwelling unit data for Thunder Bay CMA 2006-2016.

Neighbourhood	2016 Census Tract ID	2016 Population	2006 Population	Population Growth 2006-16	Population Growth % 2006-16	2016 Total Dwelling Units	2006 Total Dwelling Units	Total DU Growth 2006-16	Total DU Growth % 2006-16
University of Windsor	5590029.00	2,343	2,503	-160	-6.4%	1,584	1,574	10	0.6%
University of Windsor-East	5590030.00	3,359	3,400	-41	-1.2%	2,044	2,015	29	1.4%
Downtown Windsor- Giles & Moy	5590034.00	4,141	4,357	-216	-5.0%	2,140	2,118	22	1.0%
Downtown Windsor- Giles & Ouellette	5590033.00	4,755	4,974	-219	-4.4%	2,887	2,868	19	0.7%
Downtown Windsor- Ellis & Ouelette	5590026.00	3,742	4,096	-354	-8.6%	1,950	1,903	47	2.5%
Downtown Windsor - Techumseh & Marentette	5590025.00	2,124	2,264	-140	-6.2%	1,138	1,124	14	1.2%

Neighbourhood	2016 Occupied Dwelling Units	2006 Occupied Dwelling Units	Occupied DU Growth 2006-16	Occupied DU Growth % 2006-16	Net Change in Units	Units Occupied by Students (?)	% of Total Units Unoccupied
University of Windsor	1,073	1,148	-75	-6.5%	-85	511	32%
University of Windsor-East	1,689	1,736	-47	-2.7%	-76	355	17%
Downtown Windsor- Giles & Moy	1,808	1,839	-31	-1.7%	-53	332	16%
Downtown Windsor- Giles & Ouellette	2,560	2,598	-38	-1.5%	-57	327	11%
Downtown Windsor- Ellis & Ouelette	1,709	1,760	-51	-2.9%	-98	241	12%
Downtown Windsor - Techumseh & Marentette	1,014	1,049	-35	-3.3%	-49	124	11%

Appendix B

Table B- 1: Full Population and Enrollment Data for Mid-Sized Ontario CMAs Used in Study.

Higher Educational Institution	CMA	Population (CMA) - 2016 ¹	Total Enrollment		Percent Change	Percent Increase	Average Increase
			2006 ^{2†}	2016 ^{2†}			
Laurentian University	Greater Sudbury	164,689	8,726	9,603	877	10%	
University of Guelph	Guelph	151,984	21,656	28,748	7,092	33%	
McMaster University	Hamilton	747,545	24,265	30,368	6,103	25%	
Queen's University	Kingston	161,175	18,249	23,559	5,310	29%	
Wilfred Laurier University	Kitchener-Cambridge-Waterloo	523,894	14,275	17,880	3,605	25%	
University of Waterloo			25,910	36,665	10,755	42%	28%
Western University *	London	494,069	25,923	29,990	4,067	16%	
UOIT	Oshawa	379,848	4,299	9,931	5,632	131%	
Trent University	Peterborough	121,721	7,475	8,816	1,341	18%	
Brock University	St. Catharines-Niagara	447,888	17,145	17,998	853	5%	
Lakehead University	Thunder Bay	121,621	7,342	7,806	464	6%	
University of Windsor	Windsor	329,144	16,340	15,314	-1,026	-6%	

¹ Statistics Canada. 2017. Focus on Geography Series, 2016 Census. Statistics Canada Catalogue no. 98-404-X2016001. Ottawa, Ontario. Data products, 2016 Census.

² Common University Data Ontario & Council of Ontario Universities. (2020). *A6 Total Enrollment by Program*. Retrieved from <https://cudo.ouac.on.ca/>

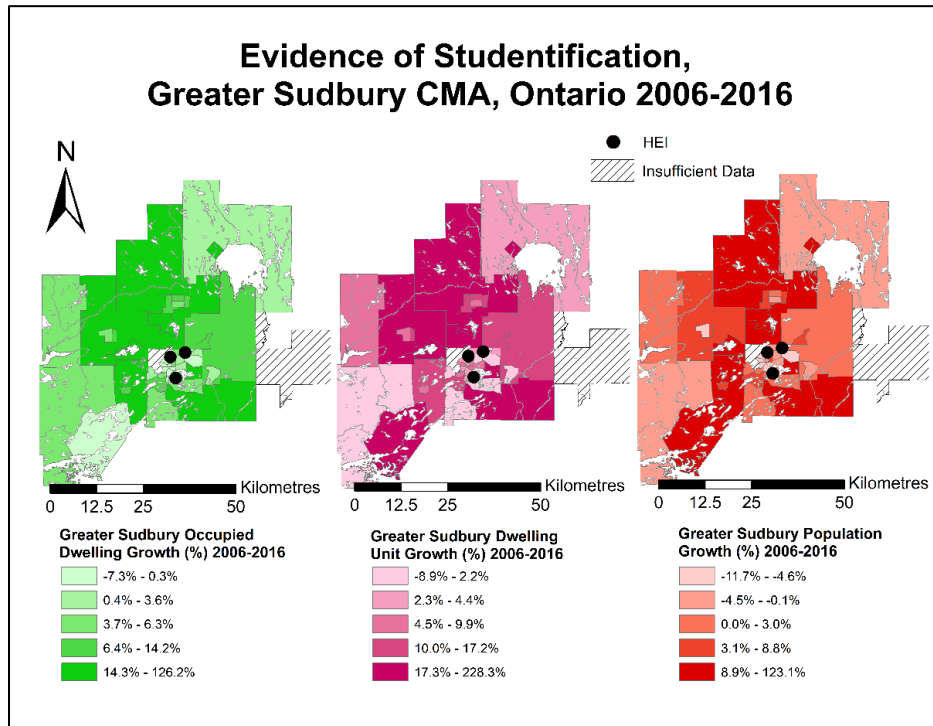
* Enrollment totals for University of Western Ontario Main Campus

†The figures exclude students in certificate and diploma programs

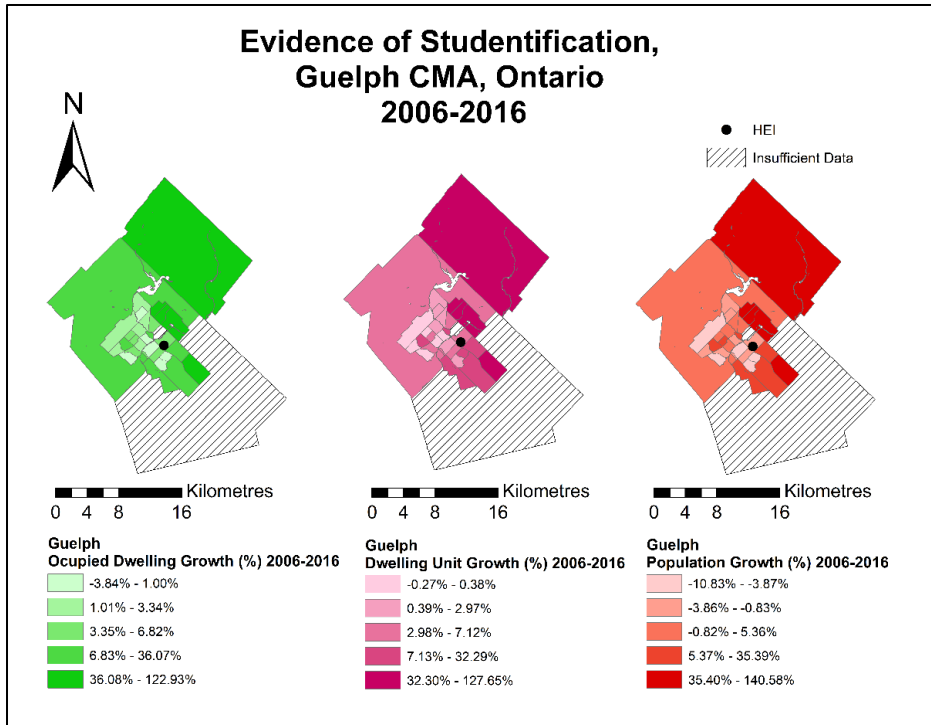
†The figures do not necessarily include co-op enrolment and work term enrolment

Appendix C

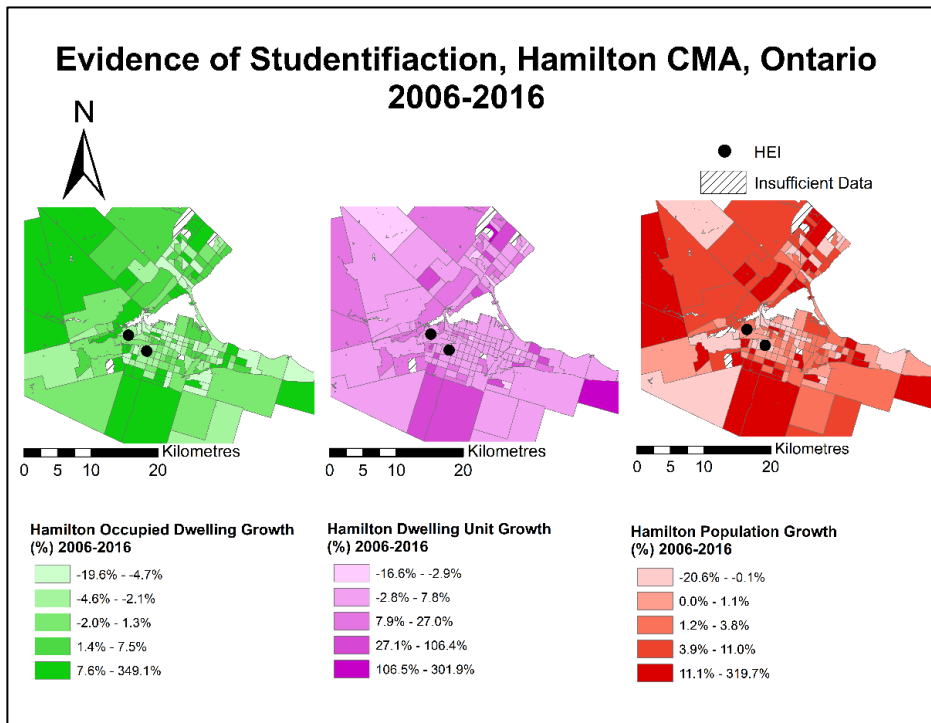
Small Multiple Maps of Indicator Variables for all Mid-Sized CMAs included in the Study.



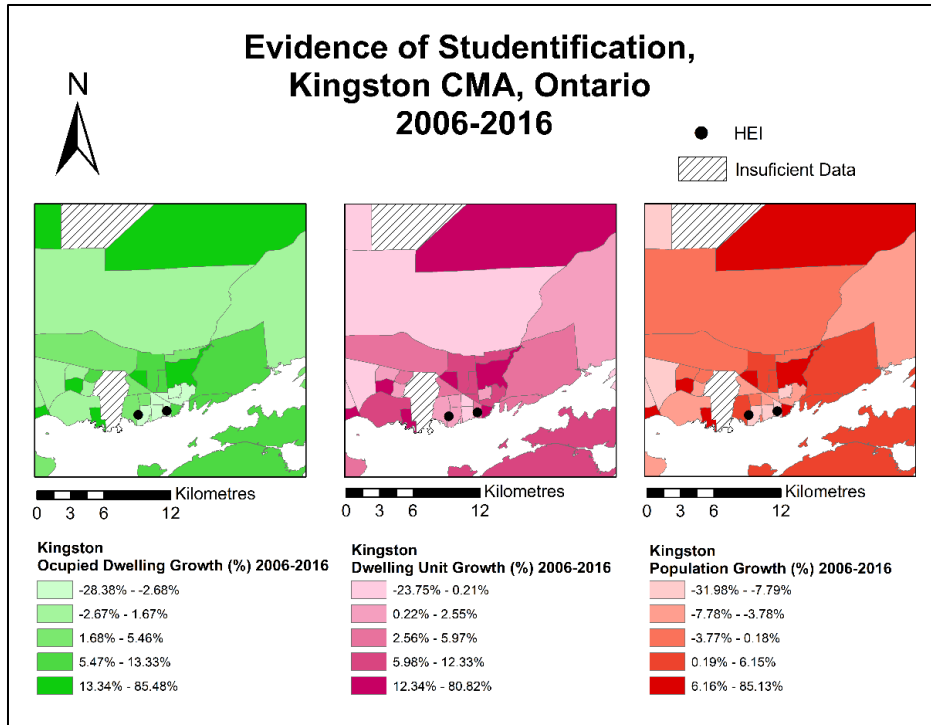
Map C- 1: Small multiples map of indicative variables in the Greater Sudbury CMA.



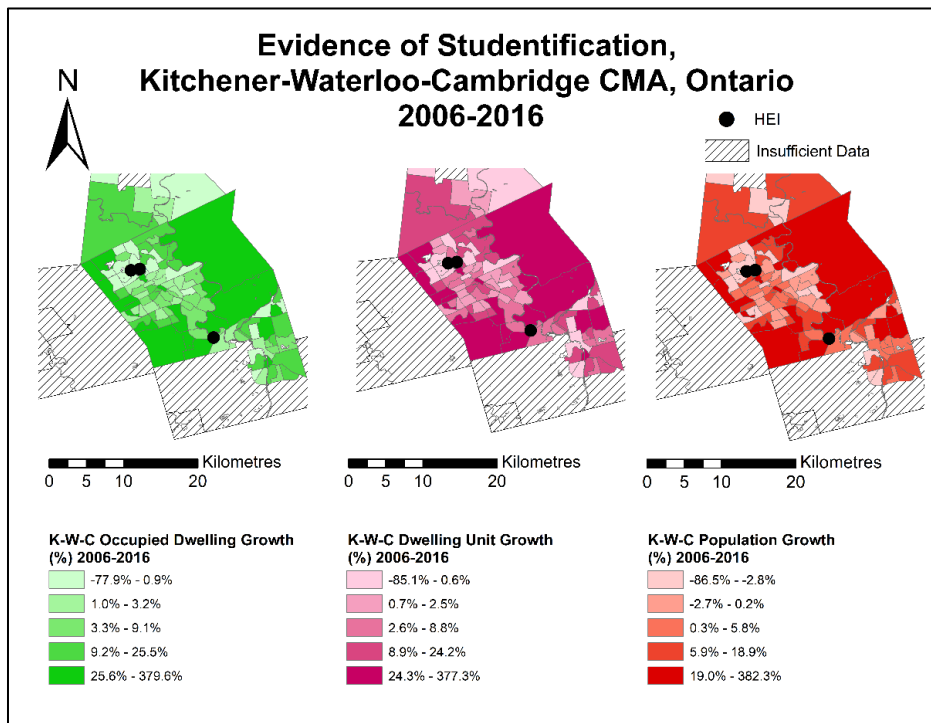
Map C- 2: Small multiples map of indicative variables in the Guelph CMA.



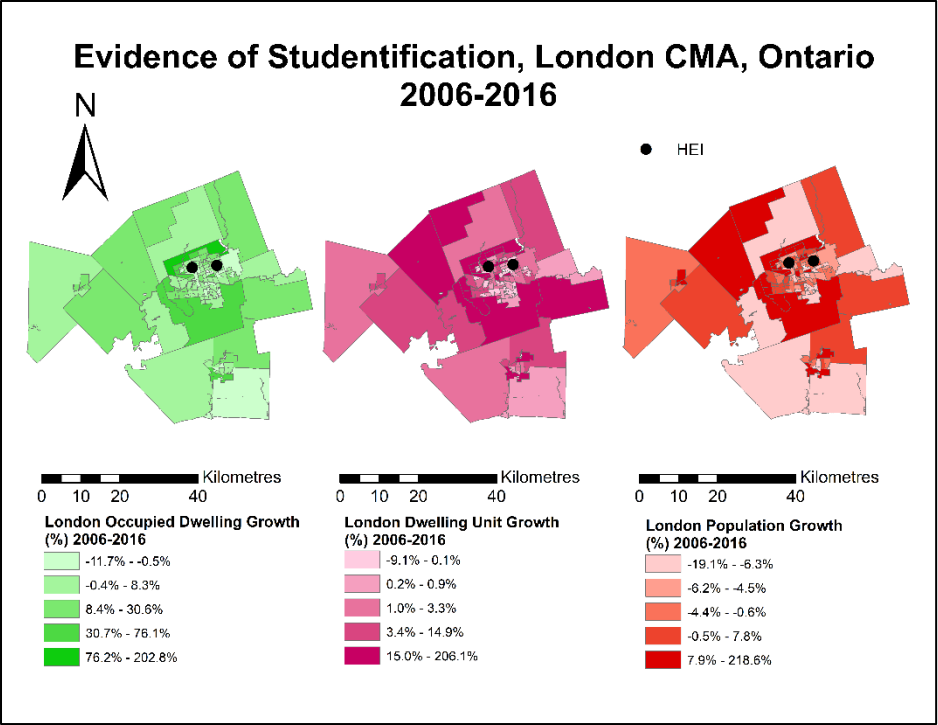
Map C- 3: Small multiples map of indicative variables in the Hamilton CMA.



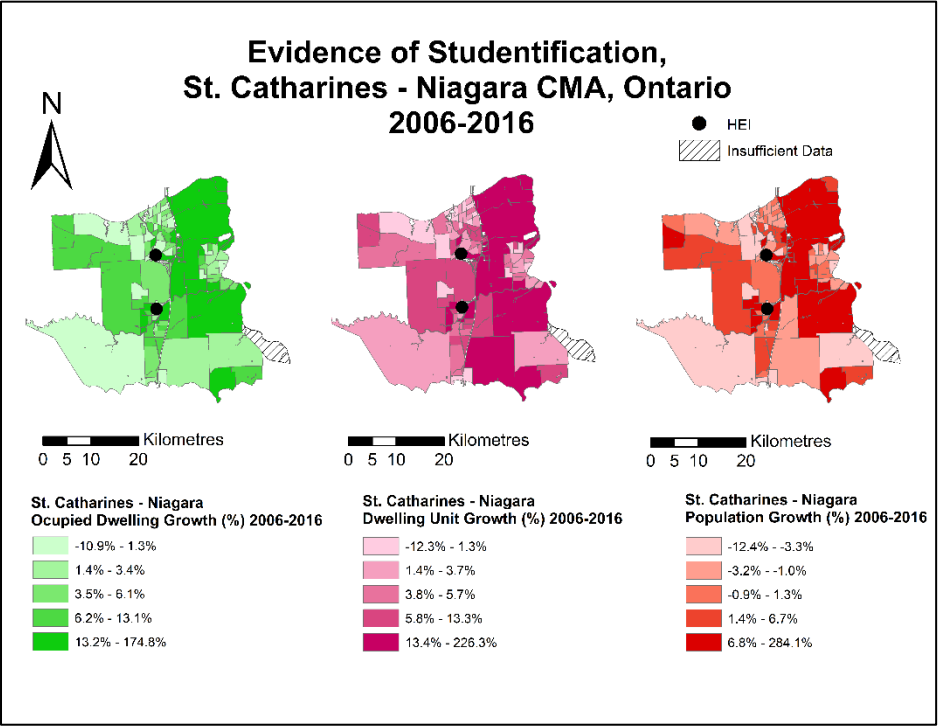
Map C- 5: Small multiples map of indicative variables in the Hamilton CMA.



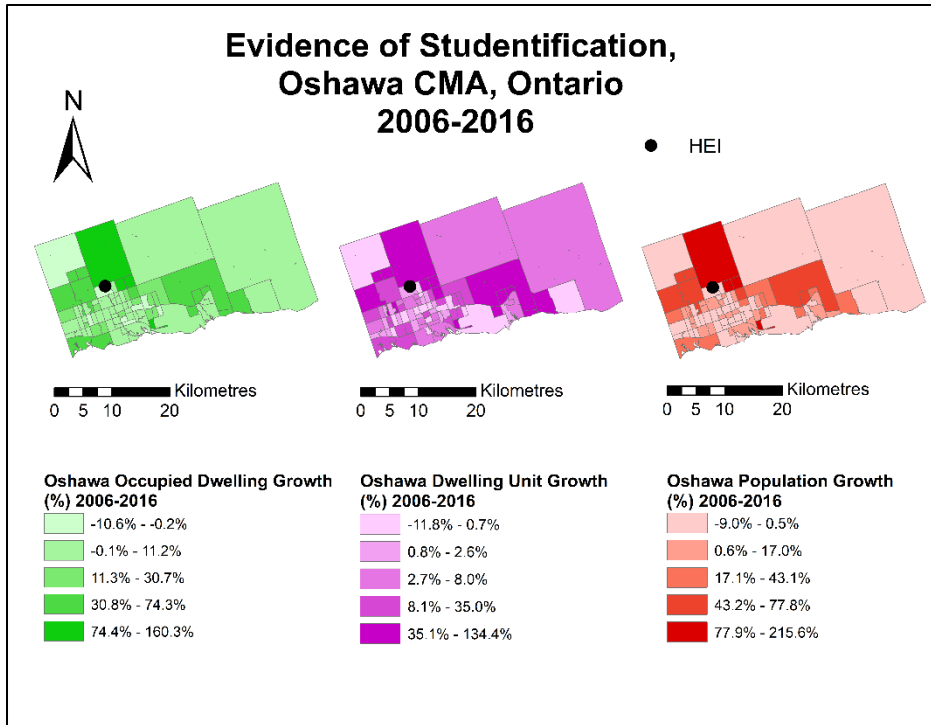
Map C- 4: Small multiples map of indicative variables in the Kitchener-Waterloo-Cambridge CMA.



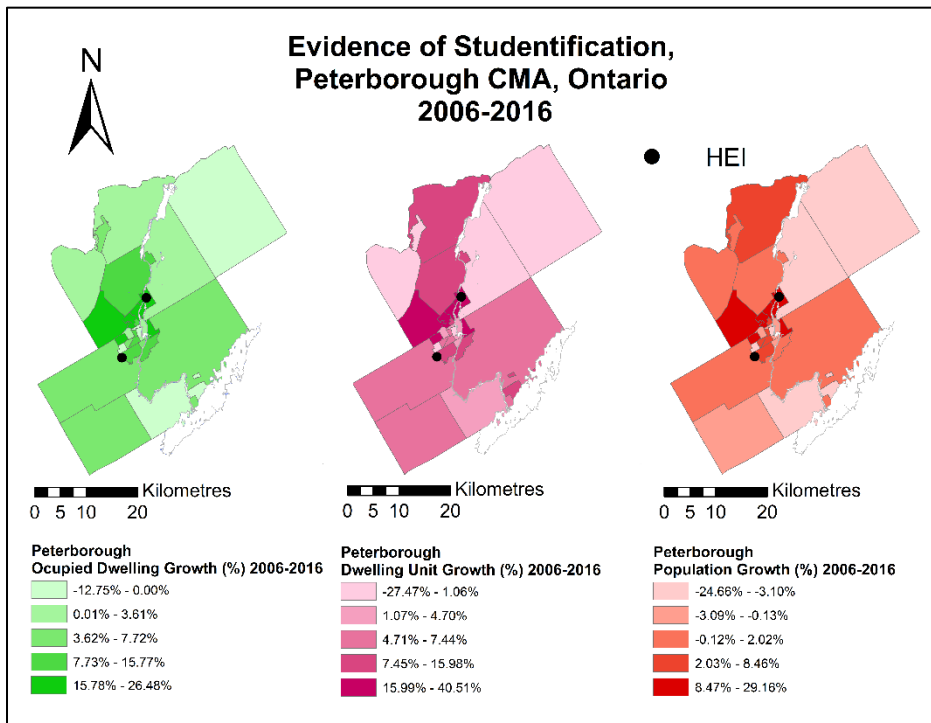
Map C- 6: Small multiples map of indicative variables in the London CMA.



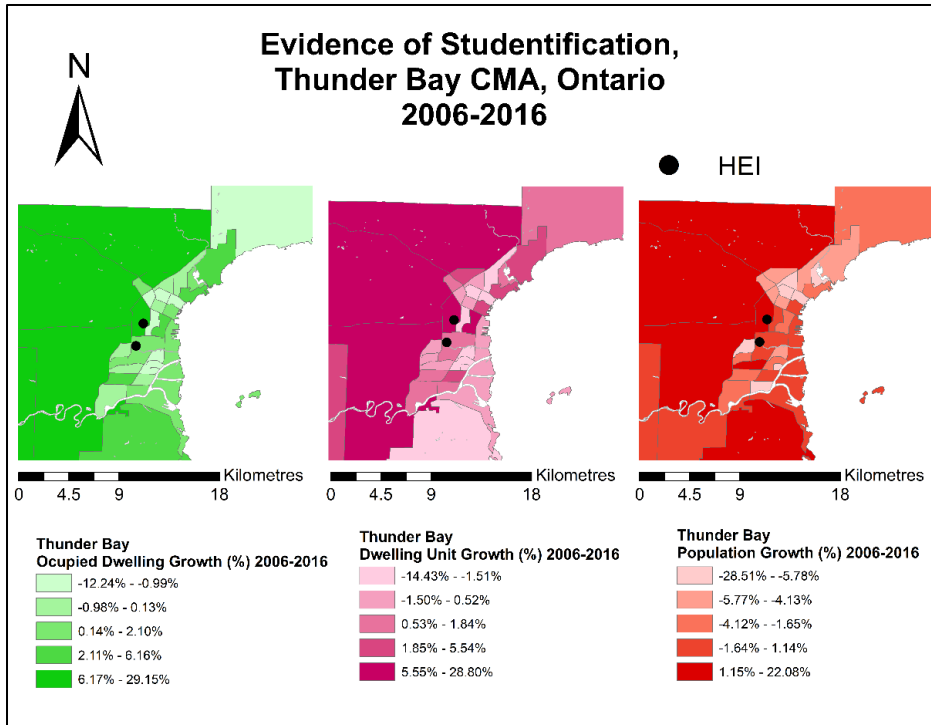
Map C- 7: Small multiples map of indicative variables in the St. Catharines-Niagara CMA.



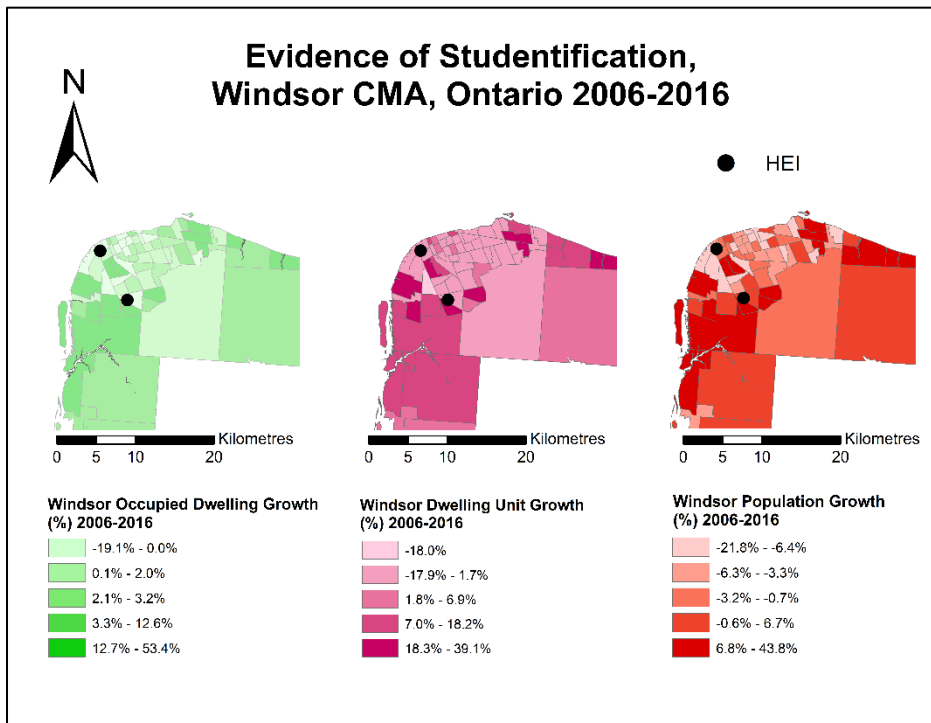
Map C- 8: Small multiples map of indicative variables in the Oshawa CMA.



Map C- 9: Small multiples map of indicative variables in the Kitchener-Waterloo-Cambridge CMA.



Map C- 10: Small multiples map of indicative variables in the Thunder bay CMA.



Map C- 11: Small multiples map of indicative variables in the Windsor CMA.