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Tenley M. Conway
University of Toronto- Mississauga, tenley.conway@utoronto.ca

Kyle Brannen
University of Toronto- Mississauga, kyle.brannen@utoronto.ca

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Who is Tending Their Garden? Edible gardens as a residential landscaping choice

Urban residential yards collectively have a significant influence on urban ecosystem conditions. The growing body of research examining residential yards has explored landscaping preferences, presence of different landscape styles, general gardening activity, and the extent and management of lawn grass. To date home-based edible gardens have received little attention within this literature, while the urban agriculture literature that has primarily focused on community garden space, yet many households grown fruits and vegetables at home. This study explores residential (i.e. home-based) edible gardens in relation to household characteristics from the perspective of edible gardens representing one way urban households' can allocate resources in their yard, among an array of different land covers and activities. Specifically, we examined basic characteristics of home-based edible gardens and identified socio-demographic and property-level factors associated with presence of those gardens in four neighborhoods within the City of Mississauga (Ontario, Canada). Our statistical analysis drew on a household survey that inquired about edible garden presence, basic characteristics of edible gardens, and household characteristics. We found that just over half of survey respondents tend a home-based edible garden, with approximately one-third of growers starting their edible garden within the last five year. Households living in fully-detached, owner-occupied houses on larger lots were more likely to have edible gardens. There were also differences in participation by ethnocultural origin and residency length. Unlike many other residential landscaping features and activities, income was not significantly related to edible garden presence, suggesting the participation barriers and benefits associated with edible gardens may different from other residential landscaping activities.

Keywords
Home-based edible gardens, Residential Landscaping; Households, Urban agriculuture

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INTRODUCTION

Discussions among food activists, urban planners, and community groups have recently considered not only the potential of urban agriculture to help overcome shortfalls in our current food system but also its contribution to green infrastructure (Colassanti et al. 2012). Many urban municipalities are supporting the growth of urban agriculture by adopting regulations enabling different types of food production, while a growing number of non-governmental organizations provide support to urban residents interested in growing their own food (Newman 2008; Goldestein et al. 2011). In the U.S., the Department of Agriculture and local groups have launched a variety of efforts to inform Supplemental Nutrition Assistance Program (SNAP, formally known as food stamps) participants that they can purchase food producing plants and seeds with SNAP benefits, while also providing gardening information to support edible gardening by SNAP participants (Simon 2012). Although urban agriculture endeavors can include large-scale and/or commercial ventures, most urban agriculture occurring in the U.S. and Canada is conducted by individuals and households for personal consumption.

Use of community gardens to grow food for individual consumption has received significant consideration within the academic literature (Baker 2004; McCormack et al. 2010; Guitart et al. 2012; Svendsen et al. 2012). On the other hand, food grown in private residential yards, hereafter referred to as home-based edible gardening, has received less attention. The lack of attention is likely due to a variety of reasons, including the less visible nature of home-based edible gardens, which are often located behind fences or in backyards, and the variety of basic characteristics associated with such gardens (Taylor and Lovell 2014). Yet, Kortright and Wakefield (2011) found that 54% of residents in two Toronto neighborhoods were growing food at home. Ghosh (2014) concluded that the potential of home-based edible gardens to provide produce in Australia and New Zealand cities is significant, while Taylor and Lovell (2012) found there is substantially more home-based edible garden space than the better studied community gardens in Chicago. At the same time, basic information about who participates in home-based edible gardens has not been a focus of study. To fully understand home-based edible gardens' potential to provide benefits like increasing food security, fruit and vegetable consumption, and/or sustainability of local food systems more information is needed on the basic characteristics of such gardens and the types of households who tend them. This knowledge can also support hypothesis development for why some households invest in home-based edible gardens while others do not.

Although home-based edible gardens have received limited attention, emphasis on urban residents' decisions regarding landscaping styles, general yard care, and lawn grass management have been growing foci of research within geography, environmental studies, and ecology (Roy Chowdhury et al. 2011). The emphasis on residential landscaping is, in part, a recognition of the significant cumulative effects numerous household-level decisions have on broader urban ecosystem conditions and processes (Kendal et al. 2010). Households' decisions to invest yard space, time, and money in various landscaping activities are thought to be influenced by a suite of factors such as cultural and neighborhood norms, environmental attitudes, basic household demographics, and property characteristics (Zagorski et al. 2004; Larson et al. 2010). It is unclear if the household and property characteristics related to maintaining a home-based edible

garden are the same as those linked with other landscaping activities, or if the factors related to the decision to tend an edible garden is distinct.

This study examines the relationship between home-based edible garden presence and specific household and property characteristics. The key questions examined are: (1) what are the basic characteristics of home-based edible gardens? and (2) are household socio-demographics and property-level physical space characteristics' relationship to presence of home-based edible gardens the same as with other residential yard characteristics and activity? These questions are considered from the perspective of edible gardens representing one way households can allocate resources in their yard, among an array of other land covers and activities. The study area is four neighborhoods within the City of Mississauga (Ontario, Canada). The following sections review recent research on residential landscaping preference, conditions, and activities; describe our methods and results; and discuss these results in the context of other landscaping choices and efforts to support urban agriculture.

EDIBLE GARDENING AND RESIDENTIAL LANDSCAPING

While research has not explored who is more or less likely to allocate yard space to home-based edible gardens, a growing literature has examined factors related to different residential yard types and participation in specific yard-based activities. For example, differences in preferred landscaping style have been found in relation to socioeconomic characteristics, values, and actual yard conditions (Larsen and Harlan 2006; Larson et al. 2009). Others have analyzed the spatial patterns and correlates of distinct yard styles that differ based on characteristics like species composition, height of vegetation, and presence of non-vegetated features (Henderson et al. 1998; Zagorski et al. 2004; Daniels and Kirkpatrick 2006). There is often spatial clustering of front yard types, suggesting that close neighbors influence landscaping choices, at least in the front yard (Henderson et al. 1998; Zmyslony and Gagnon 2000). More generally, yard conditions and management activities are typically related to neighborhood characteristics (Larson et al. 2010), with Nassauer et al. (2009) arguing that residents' preferred style of yard landscaping is influenced by neighborhood norms and social pressure to have a property that looks well-cared for.

Beyond neighborhood effects and social pressure, residents' overall education-level and specific ecological knowledge appear to influence landscaping style (Head and Muir 2006). Of course, basic property characteristics are also related to landscaping. For example, the number of green landscape features present (i.e., flower beds, edible gardens, lawn, shrubs, etc.) is correlated with yard size (Loram et al. 2011), which is not surprising given that space is very limited on some urban properties.

Household characteristics typically related to residents' level of participation in yard work include gender and age of residents, cultural background, level of gardening experience, socioeconomic status, and personal attitudes (Yakibu et. al, 2008; Kendal et. al, 2010). Discussions around motivations to participate in gardening (broadly defined) have focused on gardening in relation to escapism, ownership and identity, connectedness to nature, social relationships, duty of caring, and health (Freeman et al. 2012). Women are generally more likely to participate in gardening around the home (Bhatti and Church 2000), while Loram et al. (2011)

found the length of residency in one's house influences the extent of yard work residents engage in, with activity-levels peaking in mid-length residencies (15 to 20 years) in the UK. Bhatti (2006) found that participation in yard work is most common for those between age 45 and 69, with gardening and general yard work often seen as a site of resistance to aging, as participants seek to maintain physical activeness through such activities.

In addition to landscaping style and general yard care, significant attention has been paid to the presence and management of residential lawns due to their ubiquity across North America and the often high level of inputs associated with maintaining them (Larson and Brumand 2014). In his exploration of lawns, Robbins (2007) emphasized top-down factors, in the form of pressure to consume and pressure to be responsible homeowners, as key drivers of residential lawn expansion and management. However, Harris et al. (2012) argue that it is not only top-down factors but a variety of drivers at different spatial scales, from household to region, that influence lawn management decisions, with significant heterogeneity present in the ways lawns are managed.

Larson et al. (2010) found that a larger extent of lawn is actually associated with pro-environmental orientations by residents, somewhat surprising given the level of limited (e.g., water) and potentially harmful (e.g., chemical pesticides and fertilizers) inputs often associated with lawn care, especially in their arid study area of Phoenix. A fine-scale analysis of lawn size in suburban Boston suggested that the extent of a yard covered by lawn is related to a mix of physical factors and residents' socio-demographics (Giner et al. 2013). Additionally, residents with higher incomes are more likely to make larger lawn care expenditures (Zhou et al. 2009), with wealth and education-level being the best predictors of water and chemical inputs in residential yards (Robbins et al. 2001; Zhou et al. 2008; Zhou et al. 2009).

In addition to lawn care activities, income is often positively correlated with residential yards' perennial and herbaceous plant diversity (Martin et al. 2004; Clarke et al. 2013) and tree cover extent (Talarchek, 1990; Emmanuel 1997; Iverson and Cook 2000; Luck et al. 2009). These relationships may be a result of the 'luxury effect', whereby wealthier households choose to live in more verdant neighborhoods (Hope et al. 2003) and/or the 'ecology of prestige', where residents make landscaping choices to showcase wealth and uphold group standards (Grove et al. 2006).

While the same basic factors (i.e., space, money, norms, and social pressure) associated with landscaping styles, general gardening activities, and lawns potentially influence edible garden presence, food producing gardens differ from other yard features in a number of ways. First, edible gardens provide tangible benefits in terms of fruits and vegetables for consumption. The ability to grow certain foods can be particularly important in maintaining cultural identities, particularly if those items are not readily available for purchase (Kortright and Wakefield 2011). Second, given that edible gardens are typically considered a utilitarian feature, they are usually regulated to the backyard (Seddon 1997). Given that many residential landscaping and gardening studies are limited to front yards (Henderson et al. 1998; Zmyslony and Gagnon 2000; Kirkpatrick et al. 2009; Larson et al. 2009), the spaces where home-based edible gardens are most frequently located are often overlooked. By constraining edible gardens to backyards, sufficient space to establish an edible garden is even more limited, particularly when considering

sunlight, drainage, and other site requirements. While the need to hide edible gardens is itself a result of social pressure, once the garden is in to the backyard, the influence of neighborhood and social norms on edible garden characteristics– inclusion of specific plants; tidiness of plants, fences, and other edible garden related material– may be less than their influence on more visible front yard features whose primary purpose is aesthetic.

Similar to many other landscaping features, edible gardens have a number of potential start-up and on-going costs, including construction of garden beds, increased water use, seeds and plant material, soil, and tools (Beck and Quigley 2001). Having a successful edible-garden also requires specific knowledge (Newman 2008), with significant time, money, and knowledge investments potentially required before any benefits associated with food production are experienced. Furthermore, pests, poor weather, and other uncontrollable factors hold the potential to reduce the benefits produced by even the most skilled edible gardeners.

While there have been numerous studies examining who and why people grow fruits and vegetables in community gardens (Armstong 2000; Wakefield et al. 2007; Draper and Freedman 2010), it remains unclear why a household may allocate yard space and other resources for home-based edible gardening; if there are specific characteristics associated with households who do grow fruits and vegetables; and whether those characteristics differ from factors related to general landscape styles, other gardening activities, and lawn grass management. An understanding of who engages in home-based edible gardening can help situation the decision to have an edible garden into broader yard use and landscaping decision-making frameworks, illuminating the types of households willing and able to make the investment. This study specifically examines if physical space and socio-demographic factors, like income, have a similar relationship with edible gardening as other landscaping features and activities.

METHODS

Study Area

The study area is comprised of four neighborhoods in the City of Mississauga (Figure 1), located in the Greater Toronto Area (Ontario, Canada). The city experienced rapid growth over the last 60 years, and now has a population of 713,443 (Statistics Canada 2011). Mississauga contains a mix of residential neighborhoods (ranging from large apartment towers to fully detached homes), shopping complexes, employment centers, industrial areas, and historic town centers.

In choosing our study neighborhoods, we wanted to capture neighborhoods with different income levels and building construction ages, as these variables are typically related to neighborhood norms, level of residential landscaping investment, and extent and types of vegetation present. By focusing on four neighborhoods, it allowed us to explore household-level factors that are significant when neighborhood-factors are held constant, while also enabling comparisons between households across neighborhoods that varied in potentially meaningful ways.

Each of our four study neighborhoods is defined by two contiguous Statistics Canada census dissemination areas, representing between 200 and 600 households (Table 1). To select

the neighborhoods, all dissemination areas with at least 80% of households living in on-the-ground homes (i.e., detached, semi-detached, and/or town-homes) were identified, ensuring that most households have access to a yard. From this set, we identified neighborhoods whose average household income represented the 20th percentile of the region's average household income and neighborhoods with average household income in the 80th percentile. Within each of these income groups, one neighborhood with at least 80% of houses built either before 1960 and one with at least 80% of the houses built after 1970 were selected. The specific neighborhoods chosen are generally representative of other neighborhoods in the city with similar incomes and building ages, in terms of housing prices and ethnocultural composition.

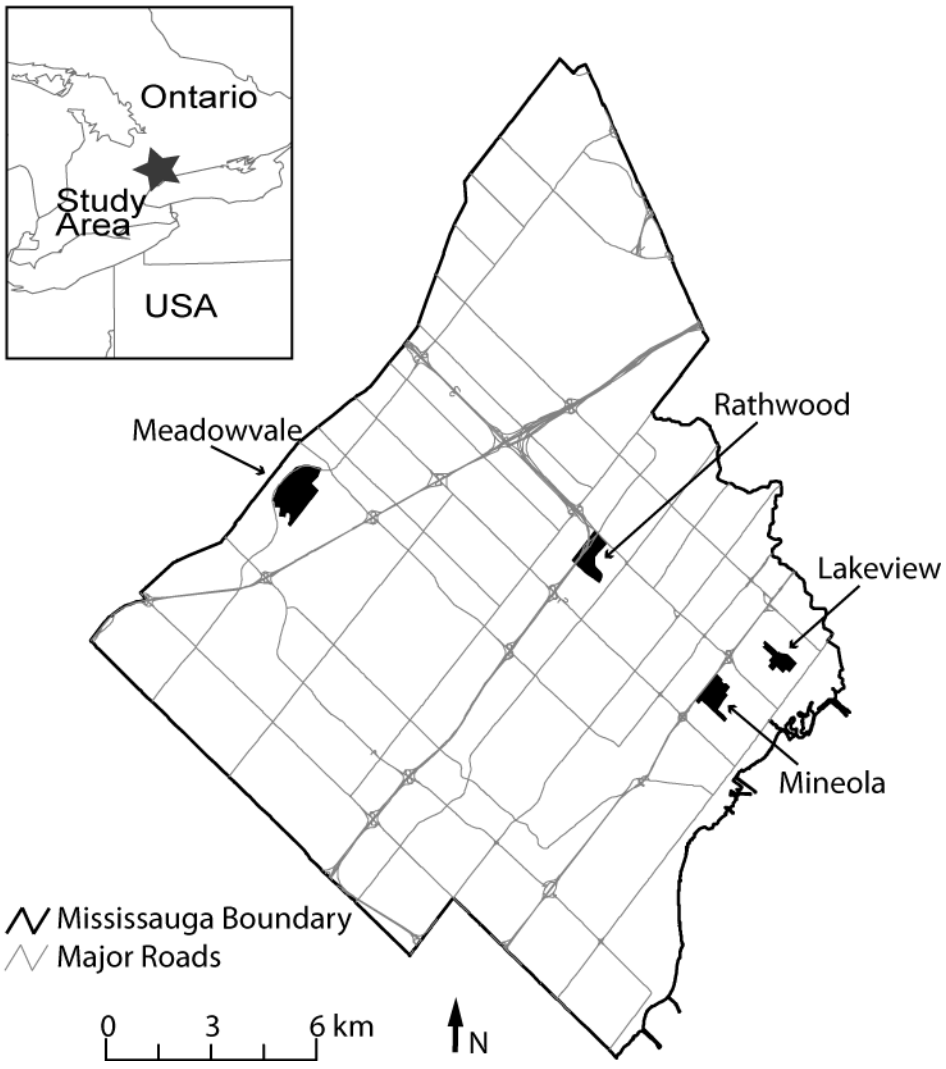

Figure 1. The four Mississauga (Ontario, Canada) neighborhoods included in the study.

The two older construction neighborhoods (Mineola and Lakeview) primarily contain fully detached homes with a median construction date of 1954 (Table 1). Mineola has a relatively high average household income of 138,103 CAD and is the neighborhood with the largest average property size. Lakeview is occupied by households whose average income is in the region's 20th percentile (66,447 CAD). The first newer development neighborhood, Meadowvale, has an average household income just above Mineola (152,765 CAD) and the highest rate of university

completion (40%). The median house construction age is 2001, and approximately half of the dwellings are semi-detached houses while the other half are fully-detached. The other newer neighborhood, Rathwood, has a mix of housing types (fully detached, semi-detached, townhouses), with a median construction age of 1978, small lots, and occupants that are part of relatively low income households (63,520 CAD). This neighborhood also differs from the other three neighborhoods as more than 50% of households are renters.

Table 1. Characteristics of the four study area neighborhoods. Values for median construction year and average property size only include properties of households that responded to the survey. Percent of university degrees, home ownership-level, and average household income are from the 2006 census.

Neighborhood	Households Contacted (response rate)	Median Construction Year	Average Property Size (m^2)	University Degree (%)	Home Ownership (%)	Average Household Income (CAD)
Mineola	252 (50%)	1954	1,202	28	92	138,103
Lakeview	255 (50%)	1954	596	13	95	66,447
Meadowvale	582 (37%)	2001	535	40	90	152,765
Rathwood	305 (38%)	1978	226	16	44	63,520

Survey Collection and Other Data

This study combines survey data, remote sensing imagery, and other spatial GIS data to better understand physical space and socio-demographic factors associated with edible gardening. Use of these varied data sources allowed us to gather information about not only households but also conditions on private yards that are not easily visible from the street. In particular, using remote sensing data allowed us to characterize conditions on the entire property, including the backyards where edible gardens are often located but a space that is frequently excluded from residential landscaping studies because it is not easily accessible.

Information about home-based edible gardens and household characteristics were collected through a mail-based survey sent to all 1,349 households living in on-the-ground homes during the summer of 2011. An up-to-date address list was acquired for the four study neighborhoods, with all apartments excluded from the survey. A multiple contact approach was used to increase the response rate (Dillman 2007). Before the survey was mailed out, a recruitment letter was sent to all households informing them of the coming survey and providing residents with the option to complete the survey online. Shortly after, the complete survey package was sent. For those who did not return the first survey, a reminder letter and, if needed, a final mailing with a second copy of the survey was sent. Each survey had a code to keep track of the respondents. This also allowed us to link survey responses with specific property-level characteristics.

The survey asked residents a range of questions about home-based edible gardening and some basic socio-demographic information, as well as other questions about trees that were not examined in this analysis. Specifically, respondents were asked if they grew fruits and vegetables. If they answered yes, they were then asked questions about where they grew edible plants, how long they had been maintaining a home-based edible garden, what they were

growing, and how their edible garden had changed over time. The socio-demographic information collected includes the number, education-level, age, and ethnocultural origins of all household residents. Questions also inquired about the length of time lived in the house, the type of house (e.g., detached, semi-detached), ownership of the house, and household income.

In addition to survey data, we gathered information about basic property characteristics. Property boundaries and building footprints (house, garages, etc.) were available for all properties in the study area. A cloud free IKONOS satellite image was used to calculate tree canopy extent on each property (Shakeel 2011). These additional sources of data allowed use to examine the relationship between physical space constraints and edible garden presence.

Analysis

First, simple summaries of survey responses were completed. Second, the survey socio-demographic data was compared to 2006 census data to determine how representative the survey sample is. Third, the survey and property data were used to create 14 variables for inclusion in the analyses to determine if household characteristics differed between those with and without home-based edible gardens (Table 2). We examined the amount of available planting space, defined as the area of the property minus the building footprint of the house, garage, and/or other structures present. Housing type was included based on the assumption that it would influence the location of yard space, with townhouses lacking side yards and detached houses potentially having yard space on all sides. The percent of the property covered by tree canopy was examined, since tree canopy can further limit planting space as a result of shading.

We investigated the effect of residents' owning or renting their houses, because past research has suggested that resident-owners are more likely to invest in landscaping activities (Perkins et al. 2004), while renters often do not have permission to alter their yards' landscaping, including creating an edible garden. Income, education, length of residency, and age of household members were also included in the analysis as involvement in general gardening activity and presence of other landscaping features are clearly correlated with these factors (Loram et al. 2011). Several binary variables representing the different ethnocultural origins of residents were examined to determine if the presence of an edible garden reflects cultural norms associated with growing some of one's own food.

As series of cross-tabulation tables were then created to identify if any of the categorical household variables (e.g., presence of children) significantly differ between households with and without edible gardens. We used Cramer's V as the test statistic because several of the categorical variables had more than two possible values. For continuous household variables (e.g., available planting area), non-parametric ANOVAs were conducted, using the Kolmogorov-Smirnov test statistic to account for differences in either median value or range. We examined households from all neighborhoods together to see if there were differences between the neighborhoods. This also allowed us to explore the effects of a broader range of values than found within the more homogenous neighborhoods. We then analyzed each neighborhood individually to see if household characteristics play a role when factors like neighborhood norms and income are relatively consistent.

Table 2. Household variables included in analysis.

Variable	Description	Percent Yes or Median (range)
Neighborhood	Categorical: Mineloa, Lakeview, Meadowvale, Rathwood	See Table 1
Available planting space	Continuous: property size minus building footprints (m^2)	478 (20 – 3,277)
House type	Categorical: fully detached, semi-detached, townhouse	Fully detached: 64%
Tree canopy	Continuous: percent of property under tree canopy	27 (0 – 98)
Owner-occupied	Categorical: yes/no	87%
Income, in 1,000s of CAD	Categorical: 7 categories each representing a range of 30,000 CAD	Cat. 3: 60,000-89,000 (cat. 1 – cat. 7)
University Education	Categorical: yes/no	40%
Years in house	Categorical: 6 categories representing increasing length of residency in current house	Cat. 4: 10 – 14 yrs (cat. 1 – cat. 6)
Under 18 present	Categorical: yes/no	45%
Over 65 present	Categorical: yes/no	26%
British	Categorical: yes/no	27%
European	Categorical: yes/no	39%
South Asian	Categorical: yes/no	7%
East and Southeast Asian	Categorical: yes/no	11%

RESULTS

The survey response rate was 43%, with higher participation rates in the older neighborhoods (Table 1). The demographics of the survey respondents were generally in line with the broader neighborhood demographics identified from census data (Table 3), suggesting that the survey respondents are representative of the neighborhoods as a whole. The biggest differences between the two are for income in the wealthier neighborhoods (Mineola and Meadowvale), which may be partially a result of the different dates of the datasets that capture income before and after the 2008-2009 recession.

Overall, the survey responses indicate a diversity of residents participated. Survey participants include respondents in all seven household income categories, which ranged from '0 to 29,000 CAD' to 'above 180,000 CAD'; all five of education categories, ranging from 'did not graduate high school' to 'completed a post-graduate degree (i.e., Masters or PhD)'; and all six of the residency length categories, ranging from 'one year or less' to '20 years or more'. Three of the ethnocultural origins were identified by at least 10% of the respondents and no ethnocultural group was identified by more than 40%. In addition, there were also variations in available planting space and tree canopy (Table 2).

Fifty-three percent of survey respondents indicated that they had home-based edible gardens in 2011. Only two percent of survey participants grew fruits or vegetables in their front yard, while nearly all growers had fruits and/or vegetables in their back yards. The older neighborhoods (Mineola and Lakeview) had higher rates of participation (Table 4) and a higher

average number of years that residents had been growing. However, across all neighborhoods, 36% of growers had started their home-based edible garden in the last five years, indicating many households had recently adopted this activity (Figure 2). Most edible gardeners in the study grow their plants directly in the ground, which is not surprising given that all survey participants have access to a yard (Table 4).

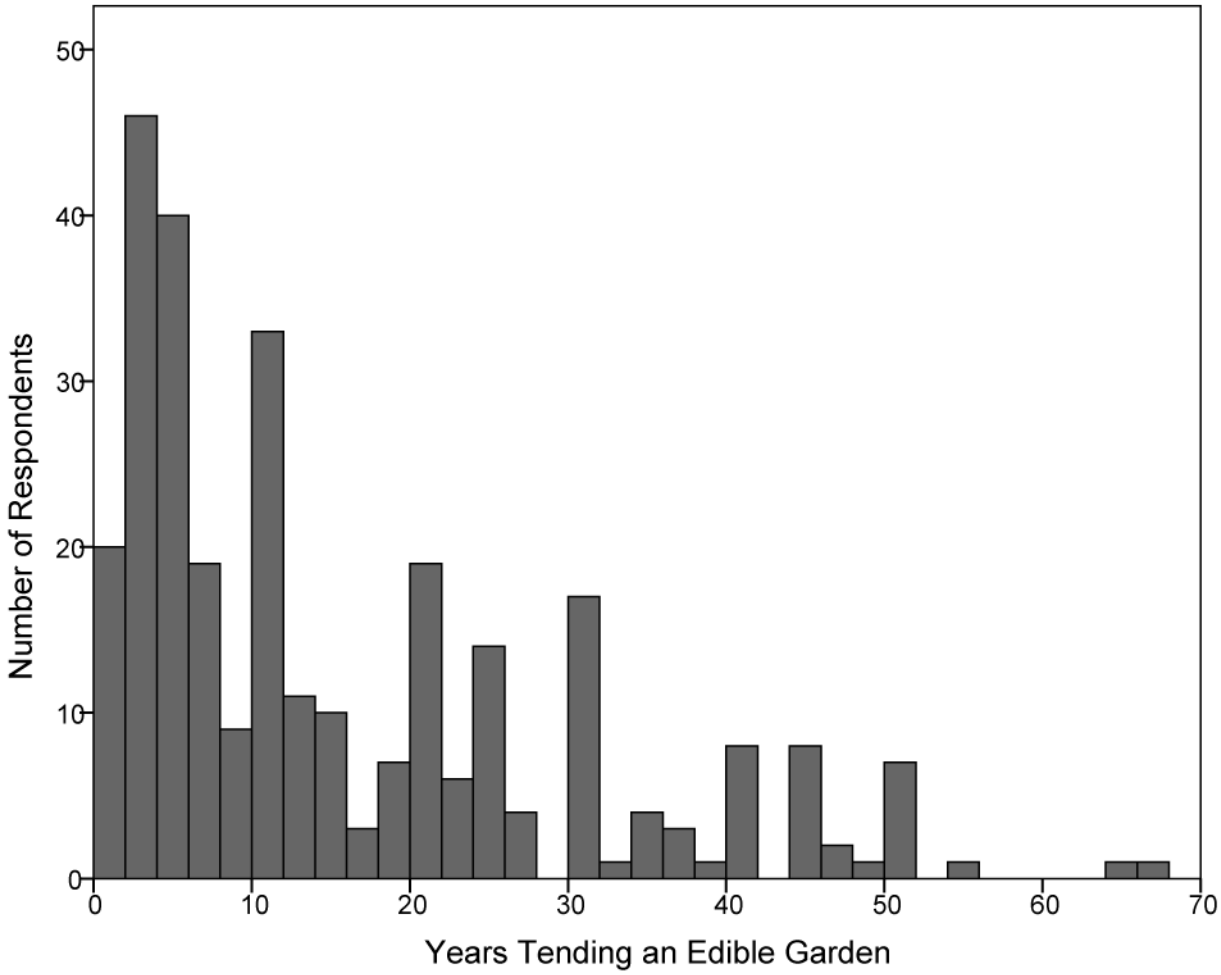

Figure 2. Histogram of the number of years households have tended an edible garden. Only those households who indicated they currently had an edible garden are included.

When participants were asked to identify the fruits and vegetables grown, tomatoes were the most popular plant but many other vegetables such as cucumbers, peppers, zucchini, and lettuces were common responses. Most of the fruits mentioned by growers were berries, while tree-grown fruit such as plums, peaches, and different types of apples are also present. While we specifically asked about fruits and vegetables, many identified herbs and a few noted nut trees.

The responses from participants living in the older and newer neighborhoods differed when asked if their edible garden area had increased or decreased over time (Table 4): in the older neighborhoods of Lakeview and Mineola a higher percentage of respondents said their edible garden had decreased in size, while in the newer neighborhoods of Meadowvale and Rathwood more household had recently increased the growing area. The newer neighborhoods also had a

higher percent who wanted to further increase the area dedicated to edible plants in the near future (Table 4).

When all the neighborhoods were grouped together, the analysis yielded six categorical variables significantly associated with the presence of home-based edible gardens (Table 5). Specifically, households in the older neighborhoods, living in detached homes, who own their own home, have lived there 15 years or more, and are of European or South Asian ethnicity are relatively more likely to engaged in home-based edible gardening. In the Mineola-specific analysis, only length of residence is significant, while completion of university was associated with higher likelihoods of growing in Lakeview (Table 6). In the newer, high income neighborhood of Meadowvale, households with children under 18, and people who identified as South Asian had higher rates of edible gardens. Alternatively, in lower income Rathwood living in a detached home was significantly related to higher rates of edible gardening.

For the continuous variables, when all neighborhoods were combined and in the Rathwood-specific analysis, available planting space was significantly correlated with edible gardens (Table 7). More specifically, residents with little planting space had very low rates of home-based edible gardening. Although not statistically significant, this same pattern was present in the high income neighborhoods (Mineola and Meadowvale), while an opposite relationship was present in Lakeview. Percent tree canopy was not significantly related to edible garden presence in any neighborhood.

Table 3. Neighborhood census and survey data comparison. The average household income is given for the 2006 census data, while the median category is given for the survey responses.

Neighborhood	Census Data (2006)			Residents Survey (2011)		
	Household Income (CAD)	Highest Education: University Degree (%)	Home Ownership (%)	Household Income (CAD)	Highest Education: University Degree (%)	Home Ownership (%)
Mineola	138,103	28	92	90,000-119,000	30	92
Lakeview	66,447	13	95	60,000-89,000	14	95
Meadowvale	152,765	40	90	90,000-119,000	40	94
Rathwood	63,520	16	44	30,000-59,000	16	59

Table 4. Percent of respondents with home-based edible gardens and location of those plants. Average years, location of plants, and size changes are based on only those respondents who have an edible garden. Indicating 'no size change' was an option in the survey, but those responses are not shown here.

Neighborhood	Growing Edible Plants	Average Years	Location of Edible Plants			Size Change Over Last 5 Years		Would Like to Increase Size in Future	
			Containers	In Ground	Community Garden	Increased	Decreased	Yes	No
Mineola	57%	20	39%	82%	0%	11%	24%	35%	41%
Lakeview	61%	22	19%	95%	1%	17%	18%	42%	51%
Meadowvale	48%	8	35%	86%	0%	36%	5%	72%	15%
Rathwood	44%	12	33%	84%	0%	27%	13%	65%	27%

Table 5. Cross-tabulation results for home-based edible gardening and categorical household variables for all neighborhoods combined. Variables are only included in the table if their relationship with home-based edible garden presence has a p-values less than 0.05. Bolded numbers indicate p-values less than 0.01.

Variable	Cramer V	More likely to grow
Neighbourhood	0.128	Mineola, Lakeview
House type	**0.154**	**Detached**
Owner-occupied	**0.129**	**Yes**
Years in house	0.146	16-20, 20+ yrs
European	0.087	Yes
South Asian	**0.106**	**Yes**

Table 6. Cross-tabulation results for home-based edible gardens and categorical household variables. Variables are only included in the table if their relationship with home-based edible garden presence has a p-values less than 0.05. Bolded numbers indicate p-values less than 0.01.

Variable	Mineola		Lakeview		Meadowvale		Rathwood	
	Cramer V	More likely to grow	Cramer V	More likely to grow	Cramer V	More likely to grow	Cramer V	More likely to grow
House type							**0.388**	**Detached**
Education			0.170	University degree				
Years in house	0.333	2-5, 6-10, 16-20, and 20+ yrs						
Under 18 present					0.146	Yes		
South Asian					0.149	Yes		

Table 7. ANOVA results, based on the Kolmogorov- Smirnov test, for home-based edible gardens and available planting space.

	p-value	Grower's Average	Non-grower's Average
All Neighborhoods	0.017	500 m^2	461 m^2
Mineola	0.795	948 m^2	1041 m^2
Lakeview	0.089	413 m^2	454 m^2
Meadowvale	0.996	376 m^2	380 m^2
Rathwood	0.045	171 m^2	99 m^2

DISCUSSION

Our study of urban residents in Mississauga found that just over half of households are growing edible plants in their own yards. Edible gardening is occurring at significantly higher rates in the older construction neighborhoods and by longer-term residents, while household income was not significantly related to presence of an edible garden. We believe there are two likely explanations for why home-based edible gardening rates are higher in areas with older development and longer residency. First, planting an edible garden may not be a landscaping priority when people move to a new home, but rather a secondary investment that occurs after several years of residence. This is possibly a result of multiple factors, potentially including (1) the time and money required to have an edible garden, which may be scarce early on, especially for first time home buyers, and (2) an initial focus on visible and/or aesthetic parts of the yard over utilitarian uses.

Residents in our older construction neighborhoods had lived in their houses longer, on average, than in our newer neighborhoods –in Lakeview and Mineola 57% of respondents had lived in their house 15 years or more, while only 15% had in Meadowvale and Rathwood – thus older neighborhood residents are more likely to have had the time to meet all of their yard use/landscaping goals. Over time, more residents in the newer neighborhoods may start, and then expand, edible gardens. This is supported by the finding that in the newer neighborhoods twice as many residents with edible gardens said the size of their garden had expanded in the last five years, as compared to the older neighborhoods, and higher numbers also wanted to further expand their edible garden in the future. The broader gardening literature has also found a positive relationship between length of residency, number of landscaping features, and overall level of yard work (Loram et al. 2011). While there has been a substantial increase in edible gardening over the last few years, suggesting that the recent popularity of local food and urban agriculture may have encouraged some residents to start edible gardens, half of growers had been tending an edible garden more than 14 years, indicating this was a long-term pursuit for many.

A second possible explanation for the differential presence of edible gardens is that the older neighborhoods, on average, have older residents. Previous studies have suggested that gardening activity, broadly defined, peaks between 45 and 69 years olds (Bhatti 2006). While we considered the effects of children and seniors on presence of edible gardens, it may be that our age-classes did not capture the increase in edible gardening by older working-age residents (i.e., 45 to 65), who are more common in the older construction neighborhoods of Mineola and Lakeview.

The cross tabulation results found that the only age variable to be significantly related to edible gardening was households with children under the age of 18 in Meadowvale. This neighborhood has the largest percent of households with school-aged children. It may be that families with school-aged children are most interested in creating edible gardens for their educational potential; Rathwood has the highest percentage of children under six, but fewer homes with school-age children. Since tending an edible garden for educational purposes was one of five reasons people gave for having a home-based edible garden in two Toronto neighborhoods (Kortright and Wakefield 2011), a similar motivation may be present in Meadowvale.

There was no significant relationship between income and edible garden presence across the study area or within any neighborhood. These results differ from most studies of residential landscaping activities and vegetation conditions, with greater levels of activity, tree canopy extent, and species diversity associated with higher household income (Zhou et al., 2009; Clarke et al. 2013). These positive income relationships are attributed to barriers associated with basic costs of materials for lower income households, as well as higher income households choosing to live in more verdant neighborhoods, and then tending their yards as a way to showcase their wealth (Clarke et al. 2013). We believe edible gardens are not viewed as a luxury feature or showcase of wealth akin to a diverse perennial garden or weed-free, emerald green lawn because of their utilitarian nature. As a result, edible gardens are not more plentiful in yards of higher income households.

On the other hand, the community gardening literature has highlighted the important role such gardens play in lower income neighborhoods (Hanna and Oh 2000; Saldivar-Tanaka and Krasny 2004; Guitart et al. 2012). Thus, our findings also differ from the community gardening literature as lower income households were not more likely to be home-based growers. However, we only include households who live in on-the-ground houses in our study to increase the likelihood that participants have a yard that could potentially include an edible garden. By excluding apartment dwellers, we were not able to focus on very low-income residents, as the majority of very low income residents live in apartment buildings within the study area. While our two low income neighborhoods have average household incomes in the 20th percentile, Mississauga is a relatively wealthy city, so that the majority of participants were considered above the poverty-line. While future work should focus on home-based edible gardens in less affluent cities, we believe lower income residents are willing to make an investment in edible gardens because of the food they produce, even if they tend to make lower investments in lawn care and have less species diversity on their property.

Households with more available planting space, detached housing styles, and resident-owners are more likely to have edible gardens. The first two variables may again indicate that edible gardens are a secondary yard use, to have when space is available, but that other yard uses and/or land covers are prioritized in small yards. With regard to ownership status, edible gardens are an investment in resources than cannot be transferred when a household moves. Renters are often restricted in their ability to alter landscaping, and may see themselves as relatively temporary residents so are less likely to invest in an edible garden even when they have permission. Thus, while household income is not a barrier to investing in edible gardening, mobility and control does appear to limit participation. In Rathwood, with the highest number of renters, we expected a higher frequency of container or community gardening participation, but that was not the case. The reasons for this remain unclear, but could reflect the lack of community garden space in the study area and other barriers (e.g., time) to participation.

We anticipated a negative relationship between tree canopy and edible garden presence, because shade producing trees and sun loving fruits and vegetables cannot easily flourish right next to each other. However, this relationship was not present in any of the neighborhoods. This may be because tree canopy was generally low enough to allow sufficient space in the yard to have full sun. It may also be that the typical location of these land covers is different enough– with trees in the front yard and along the property boundaries while edible gardens are found

primarily in the back yard– that they did not come into conflict. These findings are interesting in light of urban forestry and urban agricultural organizations increasingly joining forces to advocate for green city initiatives (e.g., Green Infrastructure Ontario Coalition and Ecojustice nd); our results suggest that a conflict does not exist between the goals of urban forestry and urban agriculture, at least in residential yards over a certain size, and advocacy groups joining forces may increase the presence of both.

Finally, we did see significant positive correlations for residents who identified as having European and/or South Asian ancestry, with participants who identified as European and South Asian more likely to have edible gardens as compared to East/Southeast Asians, British, and other less common ethnocultural group participants. These results suggest varying traditions with home-based edible gardening exists among different ethnocultural groups, and that growing some of your own fruits and vegetables may be a way for households to access culturally important foods that are not readily available elsewhere (Wakefield et al. 2007). However, we did not see higher rates of edible gardening generally in Rathwood, which has a relatively large recent immigrant population. This may reflect specific cultural norms and/or barriers to participation associated with residents in this area (e.g., renting). The enthnocultural groups specifically analyzed in this study represent the mostly common enthocultural groups within the study's region, but are not representative of the ethnic groups commonly discussed within the North American urban community gardening literature (i.e., Waliczek 1996; Saldivar-Tanaka and Krasny 2004). Thus, similar research examining participation in home-based edible gardening in other cities with different ethnocultural compositions should be conducted to provide a broader understanding of different ethnic and cultural traditions.

Future research should focus on three additional areas. First, water and other inputs of edible gardens should be examined in relationship to input requirements of alterative residential land covers to better assess the financial and environmental costs of edible gardens as a landscaping feature. Second, building on our baseline study of who has edible gardens, future research should explore why households do or do not engage in home-based edible gardening. As Kortright and Wakefield (2011) found, there are likely a variety of reasons households invest in home-based edible gardens. It is unclear if these factors are related to household socio-demographics or other factors. A better understanding of why people chose to grow fruits and vegetables and the barriers they face when deciding to start an edible garden would help situate home-based edible gardens within broader residential yard care decision-making.

Third, many of the gardeners in this study are relatively seasoned, even in the newly constructed neighborhoods. However, a third of the study participants began edible gardening within the last five years. Additional research should focus on households who have recently started edible gardens to gain a better sense of the challenges interested households face when maintaining an edible garden. In other words, are gardens frequently abandoned after just a few years, suggesting that significant barriers exist related to long-term maintenance of home-based edible gardens. A better understanding of these dynamics would help evaluate the true potential of home-based edible gardens over time and, if needed, provide information to develop supports to help residents not only start but also continue edible gardening.

In North America, most edible gardening is conducted informally by individuals. This represents a common yard activity that has not been closely examined within the context of residential landscaping options. The aim of this research was to determine the basic characteristics of home-based edible gardens, as well as explore the characteristics associated with residents who engaged in home-based edible gardening to understand if and how it may differ from other residential yard activities. There are a number of characteristics that are significantly related to home-based edible gardening. Notably, income does not appear to have the same relationship with edible gardens as it does for other types of landscaping features and activities. Building on this basic understanding of who is participating in edible gardening, future research should focus on the household resource and environmental implications of home-based edible gardens and the barriers and motivating factors facing households who do and do not participate in edible gardening.

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