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Home-based Edible Gardening: Urban Residents' Motivations and Barriers

Home-based edible gardening is defined as individual households growing food on their own property. In the Global North, home-based edible gardens have recently been identified as an important part of urban sustainability initiatives, given the relatively large area of residential yard space available for food production in most cities. Yet basic questions around households' decisions to participate in home-based edible gardening have not been fully examined, making the likelihood of meeting home-based gardens' potential unclear. This study explores the motivations and barriers associated with home-based edible gardening through in-depth interviews with growers and non-growers. The study area is four neighborhoods in Mississauga (Ontario, Canada) that captures households with diverse socio-demographic backgrounds. Seven motivating themes were identified through the interviews, with food used for cooking or an enjoyable hobby the motivations most commonly given by interview participants. All motivating themes were related to personal benefits, with little mention of the broader benefits identified in the urban sustainability literature. On the other hand, lack of time and shading were the most common barriers identified, although a total of 13 different themes emerged from the interviews. Both current growers and non-growers identified barriers, with the majority of non-growers having previously abandoned home-based edible gardens. The disconnect between residents' statements and the benefits attributed to home gardens in the sustainability literature, along with the high rate of edible gardening abandonment captured in this case, identifies challenges to encouraging residents to not only start growing food, but also ensure they continue to tend edible gardens over the long-term.

Keywords
edible gardens, residents, urban sustainability, sustainable food systems, urban agriculture

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INRODUCTION

Research exploring the potential role and benefits of urban agriculture has rapidly expanded in recent years. In the urban sustainability literature, local food production is frequently framed as a key component of sustainability through three primary contributions (Alkon 2008; Holland 2004; Kenworthy 2006; Turner 2011). First, local food production can address social dimensions of urban sustainability and, more specifically, issues raised through the 'just sustainability' movement (Alkon 2008; Ferris et al 2001). In this vein, urban agriculture has been explored as a way to reduce food insecurity, positively contribute to residents' well-being, and foster strong communities (Blake and Cloutier-Fisher 2009; McClintock and Cooper 2009; Taylor and Lovell 2014). Second, critical ecosystem services that are identified as necessary to build sustainable cities can be supplied through urban agriculture initiatives (McPherson et al. 2014). In addition to provisioning services (i.e. supplying food), urban food gardens can help control storm water runoff, create habitat and regulate micro-climates (McPherson and Tidball 2013; Turner 2011). Finally, urban agriculture is presented as a pathway to achieve a sustainable food system that supports food sovereignty for urban communities (Ghosh et al. 2008; Larder et al. 2014). For these benefits to be achieved in the Global North, a significant expansion of urban agriculture would need to occur in most cities.

At the same time, several authors have questioned the necessity of local food production within an urban sustainability framework (Tonagi 2014). Critiques have primarily focused on whether self-sufficiency, or even just a simple increase in local food production, is an appropriate way to address environmental sustainability and social equity; this is often referred to as the 'local trap' (Born and Purcell 2006; Edwards-Jones et al. 2008). Additional concerns have been expressed about the types of urban form, such as low density development, that may emerge if a strong emphasis is placed on establishing land for local food production within urbanizing areas (Tonagi 2014).

While the debate continues in the literature, a number of cities have moved ahead in adopting urban agricultural initiatives as part of broader sustainability planning (e.g. City of Philadelphia 2015; City of Toronto 2014; New York City nd). If urban agriculture is going to be a component of urban sustainability policy then an evaluation of how urban agriculture can be expanded in cities is needed to better understand its likely role in addressing sustainability goals.

Recent research highlights the potential to expand urban agriculture through home-based edible gardens given the relatively large amount of available residential yard space (Ghosh 2014; Kremer and DeLiberty 2011). Home-based edible gardening is the domestic production of food in the household's residential yard (Kortright and Wakefield 2011). Such gardens typically consist of fruits and vegetables grown in the ground, portable containers, or roof gardens. There is a relatively small but rapidly growing literature examining home-based edible gardens in the Global North (Zainuddin and Mercer 2014). The lack of attention previously given to home gardens has been attributed to their isolated and often temporary nature (Gray et al. 2014); lack of visibility due to their common backyard location (Gray et al. 2014; Taylor and Lovell 2014); and a cultural bias towards production of goods and services sold rather than those consumed by households (Taylor and Lovell 2014). Yet, Taylor and Lovell's (2012) study of Chicago found that there is already significantly more edible garden space in residential yards than in

community gardens, and the additional land area available for home-based edible gardens highlights the need for more research exploring if and how their expansion can contribute to sustainable cities.

This study examines motivations and barriers associated with home-based edible gardening identified by urban residents with and without edible gardens to explore the likelihood of urban food production expanding through home gardens. Through 38 in-depth interviews, three specific questions are addressed: (1) why do some residents choose to grow food, and do their stated reasons align with the benefits highlighted in the urban sustainability literature? (2) what challenges do residents experience when starting and maintaining an edible garden? and (3) what are the barrier to tending a home-based edible garden identify by growers and non-growers? The study area is located in the City of Mississauga in southern Ontario (Canada). A better understanding of motivations and barriers can help identify strategies to support residential edible gardens, while considering the likely contribution of these gardens to urban sustainability.

This study differs from other work examining home-based edible gardens (e.g. Corlett et al 2003; Kortright and Wakefield 2011; Taylor and Lovell 2015) in two ways. First, participants who do not currently have an edible garden, including those who have never tended one and those who previously abandoned home-based edible gardening, are included in the interviews. This allowed a broader examination of barriers to starting and maintaining a garden than if the study was limited to current growers. It is particularly important to consider experiences of non-growers as significantly increasing urban agricultural activity through home gardening would require numerous non-growers to start tending a garden. Understanding why former growers stopped edible gardening can potentially identify supports necessary to help residents overcome barriers beyond the initial start-up.

Second, previous studies in North America primarily focus on low income residents and/or participants from specific minority ethnic groups (Corlett et al 2003; Gray et al. 2014; Kortright and Wakefield 2011; Taylor and Lovell 2015) – this differs from recent studies of home-based edible gardens in Australia (Ghosh et al. 2008; Ghosh 2014; Larder et al. 2014). This study draws on interviews with residents from diverse socio-demographic backgrounds, including higher income households, as participation by a wide variety of households would be needed to achieve the full potential of home-based edible gardens identified in the literature (Ghosh 2014; Kremer and DeLiberty 2011). The following sections examine research exploring residential gardening, describe the methods and results, and discuss the implications of the results in light of efforts to increase urban agriculture as part of an urban sustainability agenda.

RESIDENTIAL YARDS AND EDIBLE GARDENS

To explore motivations and barriers to home-based edible gardens, this study draws on recent research examining residential yard care and gardening activities for insight into why some residents may have an edible garden in their yard. A growing literature focuses on residential yards from a sustainable urban ecosystem perspective because of the significant extent of residential land use in most cities (Cook et al. 2012). Recent research has explored residents' landscaping preferences (Larsen and Harlan 2006; Larson et al. 2009), spatial patterns of yard features (Daniels and Kirkpatrick 2006; Henderson et al. 1998; Zmylony and Gagnon 2000), and factors influencing yard management practice (Harris et al 2013; Larson et al. 2010; Nassauer et al. 2009).

Residents' level of participation in yard work is typically related to household characteristics, including gender and age of residents, cultural background, level of gardening experience, socioeconomic status, and personal attitudes (Kendal et. al, 2010; Yakibu et. al 2008). In particular, wealth and education-level are the best predictors of water and chemical inputs in residential yards (Robbins et al. 2001; Zhou et al. 2008; Zhou et al. 2009), as well as tree canopy cover and plant diversity (Pham et al. 2013). Through a series of studies in the UK, women were found to be more likely to participate in gardening around the home than men (Bhatti and Church 2000); those with mid-length residencies (15 to 20 years) engaged in the most yard work (Loram et al. 2011); and participation in yard work is most common for those aged 45 to 69 (Bhatti 2006).

Recent research has also explored the underlying motivations for general residential gardening or yard work, emphasizing the way individuals' express their identity through these activities. In this literature, the garden (or yard) has been framed as a space for religious practice, meditation, socialization, and/or cultural identity expression (Mazumdar and Mazumdar 2012), with the act of gardening often related to the making and meaning of home (Bhatti 2006). Discussions 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). Gardeners are often motivated by the pleasure of working in the garden, attachment to romance and its creation, and/or devotion to habitat preservation (Zagorski et al. 2004). Gardens are also seen as sites of resistance to aging (Bhatti and Church 2000), as participants seek to maintain physical activeness, with gardening activities evolving with different life stages (Freeman et al. 2012).

Finally, a limited but growing literature has examined urban home-based edible gardens in the Global North. Similar to participating in other types of residential yard work, home-based edible gardening can provide participants with physical and mental health benefits, serve as an expression of identity and ownership, support social interaction through the sharing of food with one's neighbours, facilitate connections with nature, and create wider awareness and support for ecological values (Gaynor 2006; Gray et al. 2014; Kortright and Wakefield 2011; Freeman et al. 2012). Additionally, growing edible plants at home has been identified as potentially reducing grocery bills, increasing fresh produce consumption, and reduce a household's carbon footprint (Hall 2011; Kortright and Wakefield 2011; Taylor and Lovell 2015).

While many tangible and intangible benefits are possible, there are start-up costs associated with growing edible plants at home. Garden plots often take a few seasons of work before the soil is productive enough to yield a substantial amount of food (Beck and Quigley 2001), and even established gardens require time, money, and knowledge to be productive (Brown and Carter 2003; Kortright and Wakefield 2011; Newman 2008). While not unique to home-based edible gardens, these costs may serve as a barrier to edible gardening participation, and have been associated with the relatively low production-levels of existing home gardens (CoDyre et al. 2015).

To date, home-based edible garden research has emphasized the amount of land area currently under production and the potential to meet fruit and vegetable dietary needs through home gardens (Ghosh 2014; Kremer and DeLiberty 2011; Taylor and Lovell 2012); production levels of existing gardens (CoDyre et al. 2015); the role of businesses or non-profit organizations in creating and maintaining home-based edible gardens (Gray et al. 2014; Naylor 2012; Newman 2008; Wekerlea and Classens 2015); the ecosystem services provided by such gardens (Calvet-Mir et al. 2012); and the level of biodiversity within home-based edible gardens, and the relationship between species diversity and those tending the gardens (Corlett et al. 2003; Galluzzi et al. 2010).

Which households participate in home-based edible gardening and why is still unclear. Several studies have focused on ethnic minorities, examining the ways edible gardening can help support and is part of traditional cultural practices (e.g. Corlett et al 2003). A study based on two lower income Toronto neighbourhoods (Ontario, Canada) drew on interviews to create a typology of home-based edible gardens (cook's garden, teaching garden, environmental garden, hobby garden and aesthetic garden), with each type serving a different purpose with its own set of characteristics (Kortright and Wakefield 2011). Because these studies focus on minority ethnic populations or low-income neighborhoods, the motivations and type of edible gardens identified may not necessarily apply to other ethnic groups and/or wealthier households.

Conway and Brannen (2014) examined households with diverse socio-demographics and property-level characteristics (i.e. available space) and found neither set of factors are strong predictors of home-based edible garden presence. In particular, household income was not related to having a home-based edible garden. These results differ from the well-documented positive relationship between income and yard inputs, herbaceous plant diversity and tree canopy cover (Pham et al. 2013; Zhou et al. 2008), as well as the assumption that lower income residents would be more likely to engage in edible gardening as a way of increasing their own food security. This study of motivations and barriers is an extension of Conway and Brannen (2014) to better understand why residents do and do not participate in this activity, and if those experiences can inform urban agriculture initiatives addressing the sustainability of cities.

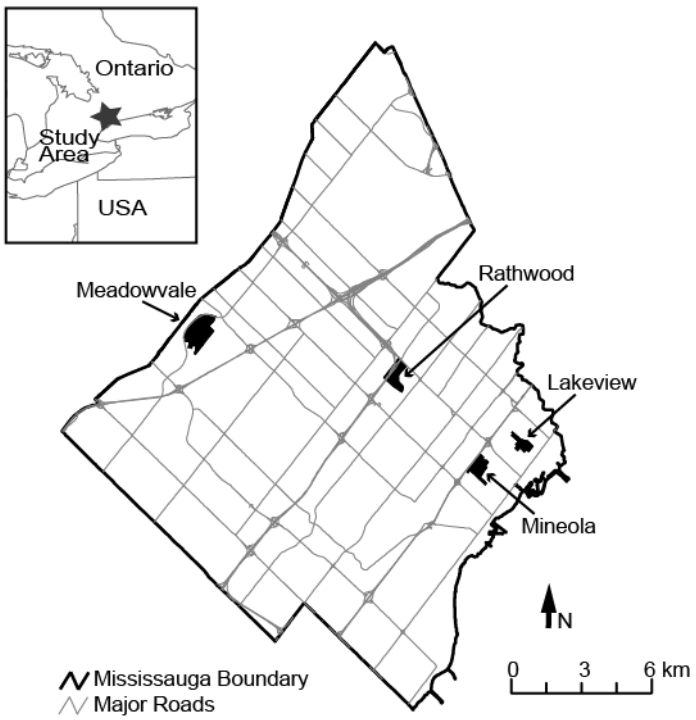
METHODOLOGY

Study Area

The study area is comprised of four neighbourhoods in the City of Mississauga (Ontario, Canada; Figure 1). The city's population, approximately 700,000 people, is relatively diverse along a number of socio-demographic dimensions. For example, fifty-three percent of residents were born outside of Canada and less than half of residents' Mother tongue is English or French (Canada's two official languages), with English the only language representing the Mother tongue of more than 6% of the population (Statistics Canada 2011). The median household income was 71,393 CAD in 2011, with 26% of the adult population completing university and a home ownership rate of 75% (Statistics Canada 2011).

Each of the four study neighborhoods is defined by two contiguous Statistics Canada census dissemination areas, representing between 200 and 500 households (Figure 1). The neighborhoods were selected for having at least 80% of households living in on-the-ground homes (i.e. detached, semi-detached and/or row homes) representing the types of housing highlighted for urban agriculture expansion (Ghosh 2014). Participation was further limited to homeowners to ensure interviewees had access to and control over yard space at their homes.

Figure 1 The four study neighborhoods in the City of Mississauga, Ontario, Canada.



Neighborhoods were also selected to represent a range of incomes (either the 20th or 80th percentile of the region's average household income) and construction ages (either >80% of houses built before 1970 or >80% built after 1970). Capturing a range of incomes was important as wealthier households, which have typically not been examined, would need to engage in urban agriculture to achieve ecosystems service provision and local food production goals. A range of housing ages was incorporated as construction date is likely correlated the level of tree cover and other vegetation maturity, which may limit available space for edible gardens.

The first older construction neighborhood, Mineola, has a relatively high average household income (138,103 CAD), with property size typically double the average size found in the other three neighborhoods (Table 1). Lakeview is the other older neighborhood, but represents a lower income neighborhood in the study (66,447 CAD average). Both older neighborhoods are dominated by fully detached homes primarily built in the 1950s. The first newer development neighborhood, Meadowvale, has an average household income of 152,765 CAD. Just over half of the dwellings are semi-detached houses, with most structures built in the 1990s and 2000s. The fourth neighborhood, Rathwood, has a mix of housing types (fully detached, semi-detached, row houses) built in the 1970s and 1980s that are occupied by households with relatively low average income (63,520 CAD). Rathwood differs from the other three neighborhoods as more than 50% of households are renters– the other neighborhoods each have more than 90% owner-occupied dwellings– and properties are the smallest.

Table 1 Basic characteristics of the four study area neighborhoods and interviewees.

Neighborhood	Median year house built	Average property size (m^2)	Census Data (2006)			Interviews (2011)			
			Median household income (CAD)	Univ. degree (%)	Home Ownership (%)	Number	Median household income (CAD)	Univ. degree (%)	Home ownership (%)
Mineola	1954	1,202	138,103	28	92	17	90,000 - 119,000	44	100
Lakeview	1954	596	66,447	13	95	7	60,000 - 89,000	14	100
Meadowvale	2001	535	152,765	40	90	12	90,000 - 119,000	50	100
Rathwood	1978	226	63,520	16	44	2	60,000 - 89,000	50	100

Resident Interviews

This analysis draws on in-depth interviews with residents from the four study neighborhoods. As part of a larger project, surveys were mailed to all 1,352 households living in on-the-ground homes in the neighborhoods during the summer of 2011. The survey posed a range of questions about residential landscaping, including basic questions addressing edible garden presence and characteristics. A resident was classified as an edible gardener if they grew any plants in the form of vegetables, fruits, herbs, or nut-bearing herbaceous plants or trees for the purpose of consumption. Survey questions asked about the size and location of the space(s) allocated to edible plants, recent changes in the size allocated, specific food items grown, length of time tending edible plants, and future gardening plans. The survey also asked if residents would be willing to participate in follow-up interviews that are the basis of this study. By soliciting interview participants through a broader survey, not all interviewees had an edible garden. This selection approach enabled an exploration of edible gardeners, as well as those who have abandoned or never tended one, which facilitated the identification of challenges or barriers to participation.

Of the 580 survey respondents (43% response rate), 113 volunteered to participate in an interview. Potential participants were contacted up to three times in an attempt to schedule an interview. Interviews occurred at a time convenient for the participant, including evenings and week-ends, in the interviewee's yard, which facilitated questions about particular features. Thirty-eight residents across the four neighborhoods were included in the analysis (Table 1), representing 34% of the people who volunteered. Those who were not included did not own their house, were never successfully contacted to schedule an interview, or for whom there was no convenient time to hold an interview. Additionally, since a large number of potential participants came from the higher income neighborhoods (Mineola and Meadowvale), not all of those volunteers were contacted in an effort to have even participation from the four neighborhoods.

The interviews were semi-structured, with open-ended questions focused on a number of landscaping and yard work topics, including edible gardening. Specifically, participants were asked why they did or did not have edible plants, challenges and benefits of edible gardening they had experienced, and sources of information supporting their edible gardening activity (where applicable).

All interviews were conducted by the same person for consistency and then recorded and transcribed by a second person using NVivo 9. A coding scheme– focused on motivations or benefits of having an edible garden and barriers or limitations of edible gardening– was iteratively developed in conjunction with the interviewer. A third person then reviewed all transcripts and coding to identify transcription errors or coding problems.

RESULTS

Based on their written survey responses, interview participants were generally reflective of people living in each neighborhood (Table 1), although the relatively small sample should not be considered fully representative. Given that participants volunteered, there is potential selection bias. This is most evident in the lower number of participants in the Lakeview and Rathwood neighborhoods. However, since the interview request was presented as a discussion about all characteristics of residents' yards, a range of attitudes towards edible gardening was captured.

Overall the 38 participants were a diverse group based on ethnic, education and income measures. For example, at least one interviewee identified with each of the following ethnocultural groups: South Asian, East or Southeast Asian, European, British Isles, and Latin American. Highest educational attainment ranged from no high school diploma to Masters or Doctoral degree, with a university degree the most common education-level. The average household size was 2.5, with 10 participants' households including seniors and 10 having children under 18. The most common household income bracket was 60,000 to 89,000 CAD, but interviewees represented households with incomes less than 30,000 CAD through to households with an income over 180,000 CAD. The median length of residency was 10 to 14 years, with a range of less than five years to more than 20. An equal number of interview participants were men and woman.

Twenty-three of the 38 interview participants grew edible plants in their yard at the time of the interview. An additional 13 interviewees had previously tended a home-based edible garden, while only two participants had never grown edible plants at their house. Of the participants who currently tend edible plants, 12 grew them in the ground, nine grew edible plants both in the ground and in containers, and two only had portable containers. In-the-ground and container gardens were located in the backyard in all but one case, where an in-ground plot was present in the front yard. Most gardeners grew multiple types of edible plants, although tomatoes were present in 16 of the 23 gardens. Zucchini and peppers were the next most common vegetables, while berries, rhubarb and apples were the most commonly grown fruits. Several interview participants grew nut-bearing trees for the purpose of consumption.

Those participants currently tending an edible garden are generally seasoned gardeners. The median length tending an active edible garden was eleven years, with only six of the 23 current gardeners having their garden less than five years. Nine current growers had increased their garden's size in the last five years, while five had reduced the area allocated for edible plants. Twelve of the 23 current growers indicated they wanted to grow more fruits and vegetables in the future, but there was no relationship between those who wanted to increase production and recent size changes (Pearson Chi-square = 1.059, p-value = 0.589).

Motivations

All interview participants growing edible plants identified at least one motivating reason, and most growers identified several factors that were coded under multiple themes. Not surprisingly, eight of the 15 non-growers did not identify any motivating reason, focusing more on barriers or lack of interest when edible gardens were discussed during the interviews. In all, seven broad

themes were identified as the motivation or reason residents currently had, and in some cases previously had, edible gardens (Table 2). The most common motivations given by current gardeners were that they grew produce to use in their cooking (14 interviewees) and working in the garden was an enjoyable hobby (13 interviewees). For those who identified the cooking garden theme, it was the convenience of fresh produce or ability to grown hard to find ingredients, rather than a cost savings that was motivating them: "Convenience you know, you want a tomato you just go to your backyard and grab one, just that sort of thing" said one participant (female, age 41). Another interviewee (female, age 33) stated, "I don't know if it reduced my grocery bill or not. I do sort of plan my meals… like once you have vegetables we definitely eat them."

Those who tend an edible garden as a hobby were also not motivated by cost savings: "It's not a cost thing by any stretch of the imagination but it's just kind of fun to do it I guess, and yeah they usually taste really fresh and it's easy to do (male, age 55)." Reducing food costs by growing your own food was actually only identified by one participant focused on the high costs of buying tomatoes versus growing your own. The two most common motivating factors for growers were also the most common factors identified by non-growers; the non-gardeners who identified edible gardening as a good source of food for cooking (4 interviewees) or as an enjoyable hobby (4 interviewees) had all previously tended their own home-based edible garden.

Table 2 Motivating themes for having a home-based edible garden identified by participants with and without edible plants.

Theme	Grows Edible Plants	No Edible Plants	Total
Cooking	14	4	18
Hobby	13	4	17
Better than Alternative	9	1	10
Teaching Garden	4	1	5
Already Present	4	1	5
Tradition	3	1	4
Lower Cost	1	0	1

The third most common motivating theme identified by growers was that their own food was better than store bought produce (9 interviewees). This was usually framed in terms of taste or freshness, and often included discussions about knowing the methods used to grown their own. In response to why she grew tomatoes, one 32 year old participant said, "The organic vegetable factor. We know what we're growing. We try to buy organic seeds if we can… I can

keep them [tomatoes] throughout the season, I can freeze them and use them and I know they're from my garden." Alternatively, differences in freshness, taste, and/or production methods of home grown products were mentioned by only one non-grower.

A total of five participants indicated that a motivation for growing fruits or vegetables was to teach their own children where food comes from, helping them engage with nature and/or hoping to spark an interest in gardening and growing one's own food. As one 45 year old man said, "I find that it's great for the kids. The kids love to see where the food comes from. And I find that they'll eat it easier if they picked it themselves. My youngest wouldn't touch a raspberry until she picked it from her own bush." Finally, four current growers and one non-grower stated that an edible garden was already present in the yard when they moved to the house; those still tending the garden also identified other reasons for having an edible garden, suggesting they likely would have started one anyway.

Barriers

Thirteen themes were identified when residents discussed the barriers or challenges of growing edible plants in one's yard (Table 3). Two growers and three non-growers were not coded as including any barriers in their interviews, with the growers not able to identify a barrier or challenge and the non-growers stating they just were not interested in growing edible plants. Among interviewees with and without edible plants the most frequently identified barrier was time (17 interviewees). In some cases this was framed as the reason the participant never began growing fruits and vegetables: "My mother had a very large vegetable garden and I know they're extremely time consuming and I have a full time job, plus the dogs, plus my life ... the garden that I have, and my friends, and I run, and there's just no more time (female, age 46)." It was also given as reason for the limited size of current gardens: "[the garden has] decreased actually. I used to do a lot more….you just get busy", said one man (age unknown).

Among those currently tending a garden, attraction of unwanted animals, shading, lack of knowledge and space concerns were commonly identified challenges and barriers (Table 3). These factors were actually identified at higher rates among the 23 growers than the 15 non-growers. For example, eleven gardeners noted that their edible plants attracted unwanted racoons, rodents, or insects into their yard, while this issue was only mentioned by seven non-growers. This is highlighted by a female (age 34) grower's assessment: "The main concern is again the animals because… for the fruit trees if you don't pick the fruit or if they're overripe they fall on the ground and it attracts a lot of animals, which we already have a lot of problems with in this area because we're near a ravine."

Shading from trees and other vegetation was identified by 10 current gardeners and six participants without edible plants, with trees often the reason edible plants were not worth the effort: "last year we didn't get a really good crop and I think it is mainly because of the shade. Vegetables really need a lot of sun…. but am I willing to cut down the tree [to help the vegetables]? No (male, age 49)." Structures or vegetation on neighboring properties that created shade was coded as a separate theme because it represented a barrier that the interviewee did not control. As one former edible gardener noted, even if they want to remove the shade producing feature, they are not able to: "the neighbour's [cedar trees]. When they were small I'd beg them

to cut them down... but they wouldn't do it. That was conflicting with the garden (female, age unknown)." However, if on-property and off-property sources of shade are combined, 12 growers and eight non-growers identified one or both as a barrier, making it more common than time constraints.

Shading and sufficient space were also often related, as shady locations further limit possible spaces where edible plants can be located: "One of the reasons why we can't grow a decent garden is because of the trees and because of the fact I don't want to garden in the middle of the property (male, age unknown)."

Table 3 Barrier to having a home-based edible garden identified by participants with and without edible plants.

Reason	Grows Edible Plants	No Edible Plants	Total
Too Much Time	10	7	17
Shading	10	6	16
Attracts Animals/ Insects	11	4	15
Space Required	9	4	13
Lack of Knowledge	9	2	11
Previous Crop Failure	5	5	10
Neighboring Property	6	3	9
Climate/ Weather	6	1	7
Age of Residents	3	4	7
Too High Yield	3	3	6
Cheaper/ Convenient Alternative	2	3	5
Soil Quality	1	1	2
Lack of Help	0	2	2

Five current growers and five non-growers identified crop failure as a barrier. While an equal number, this represents a lower rate among current growers since more growers were

interviewed. In many cases, previous attempts to grow edible plants were limited to one or two very common varieties and/ or were the first attempt by the residents to grow edible plants. When these efforts failed, all edible gardening stopped. One male (age unknown) expressed this pattern in response to the question "do you currently grow any fruits or vegetables": "No. We tried a tomato plant. It didn't do well."

While lack of knowledge was not frequently cited by non-growers, it is likely some of these crop failures could have been avoided if the resident was better versed in edible gardening. Interestingly, residents who currently have edible gardens were more likely to identify a lack of knowledge as a barrier. This was often phrased in terms of the time-consuming nature of knowledge acquisition; using trial and error methods when knowledge was hard to come by; and uncertainty about where to acquire knowledge.

Nearly in opposition to crop failure was the theme of overproduction. This theme was identified by three current and four former growers. Several interviewees indicated that because the entire crop would ripen at the same time, even when they gave extra items to friends and neighbors some of their crop still went to waste. As one female interviewee (age unknown) said, "I mean you can only eat so many zucchinis. And I'm hanging over the fence yelling at my neighbour 'Hey, you want some more zucchini' and she goes 'No, No!'" Over-production was also often mentioned in relation to cheaper or more convenient alternatives being abundant during the same time that the home gardens were at their height of production, reducing the need to grow one's own: "at the time of course, because it's in season, all that stuff is cheap in the stores. So it's like you know, it doesn't really make it worthwhile (male, age 49)."

Another barrier that was identified at a higher rate by non-growers (4 non-growers versus 3 growers) was age-related limitations: "My husband can hardly walk and I can't dig so that's what made us stop," said one elderly woman. The current growers who did speak about aging typically talked about reducing the time or size of their edible gardening activities: "I'm getting a little older and I just don't have the stamina…When you're bending over for hours trying to pull weeds out, it gets to you after a while. So I would say that I don't have as many plants, and I don't spend as much time as I used to, mainly because I'm getting older... (male, age 75)." Related to ageing as a barrier, physical limitations were identified by two non-growers in the context of not having the ability to help they would require: "I'd consider [an edible garden] but I have, you know, the issue with bending over for myself because of my eyes and so unless somebody else in the house became really interested then I wouldn't consider it (female, age 48)."

Outside of shading, few environmental factors were identified as barriers. Soil quality was identified by two interviewees, while climate and seasonal weather patterns (i.e. extended periods of drought or unusually cold or rainy seasons) were identified by six current growers and one non-growers: "this year [there] has been a lot of rain, so I didn't start much," said one female resident (age unknown) talking about the current size of her edible garden. Another interviewee said, "at least we're getting [peaches] this year. When you get the ice storm in like the beginning of April, it kills all the buds so we didn't get peaches last year (male, age unknown)."

DISCUSSION

The results of the study identified a variety of motivations and barriers residents associate with home-based edible gardening. While benefits of edible gardens were identified by many non-growers, barriers were present for nearly all current growers, suggesting many of the participants value home-based edible gardening but experience meaningful challenges when engaging in this activity. In fact, the most commonly identified themes were the same for both growers and non-growers, suggesting that it is the magnitude of the motivation or barrier– and potentially other external factors that were not expressed by participants– that ultimately influences who tends an edible garden. The relatively high number of former growers suggests that even residents motivated to tend edible plants often face sufficiently significant barriers that they abandon the practice. Additionally, most interviewees identified more than one theme, further suggesting that decisions related to tending an edible garden occur within a broad spectrum of personal circumstances and preferences that are related to a variety of benefits and costs, as well as cultural and neighborhood norms.

Participants' discussion of experienced benefits did not match rationales for why urban agriculture is needed within a sustainability framework. For example, reduction of food costs and a greater sense of community were not common motivations or benefits expressed. On the other hand, one-sixth of the interviewees indicated that the higher cost of home grown food was actually a barrier. This differs from 'just sustainability' arguments, as well as several empirical studies focused on community gardens (e.g. Hanna and Oh 2000; Guitart et al. 2012; Algert et al. 2014), that urban food production can increase household's food security and/or strengthen communities. The divergent results of this study may reflect the household incomes of interviewees, which were nearly all above the poverty line, making food security less of a concern than in other studies that were limited to low income participants. It is also possible that home-based edible gardens incur higher monetary costs than community gardens; the greater isolation may translate to less sharing of materials and knowledge, raising monetary costs and lowering production, with previous research indicating relatively low production-levels from most home-based edible gardens (CoDyre et al. 2015).

Additionally, the ecosystem services associated with urban agriculture in the urban sustainability literature (e.g. storm water management, creation of habitat, and regulation of micro-climate) were not identified as motivating factors by growers or non-growers. Again, a nearly opposite pattern emerged, with over half of participants stating that animals and insects attracted to the edible garden represented a barrier to tending one. Moreover, the common barrier of shade, primarily from trees and other vegetation, indicates that expansion of home-based edible gardens would often need to occur through the removal of other vegetation that likely contributes its own set of ecosystem services. Research should investigate the relative ecosystem contributions associated with different types of vegetation in residential yards to determine if home-based edible garden presence is associated with higher-levels of ecosystem services, or simply replacing ecosystem service provision provided by other vegetation types.

The motivating themes closest to broader sustainability arguments were that home grown produce was convenient to use when cooking; better than the store bought alternative, in terms of taste and growing methods; and important for teaching children about where food comes from. These themes are related to discussions about local food contributing to sustainable food production and food sovereignty. However, even in these instances, the motivations were

expressed in relation to household characteristics or personal attitudes and did not explicitly connect with broader sustainability rationales.

The personal benefits, including the common theme of edible gardening as a hobby, are similar to reasons residents engage in other yard activity (Freeman et al. 2012; Zagorski et al. 2004). These results suggests that if widespread home-based edible gardening is going to be adopted, then efforts to encourage more home-based edible gardening– particularly among households with moderate or higher incomes– should start with highlighting personal benefits rather than promoting such efforts as a way of altering existing food systems, improving food security, or creating ecosystem services.

When comparing current growers and non-growers the barriers identified were relatively similar, suggesting that successfully addressing these barriers could expand both production by current growers and increase the number of households tending edible gardens. However, the common barriers identified by the participants– lack of time, too much shading, lack of space– will likely be difficult to overcome.

To further facilitate knowledge sharing and address time and physical limitations, projects that paired homeowners with volunteer gardeners could be initiated, expanding on the project paring a senior homeowner with volunteer youth who wanted to learn about edible gardening documented by Blake and Cloutier-Fisher (2009). Organizations in several cities already provide services to start and maintain edible gardens in residents' yards (Newman 2008; Naylor 2012), but these services often cost money[1]; while reducing the time barrier they may raise monetary ones. Research should examine the relative monetary and non-monetary costs of home-based edible gardens in comparison to community gardens and purchased food, and ways different supports could reduce those costs. For example, would neighborhood collectives that provide shared equipment reduce a meaningful barrier to participation?

The issues of shading and space could partially be addressed by altering the location of edible gardens, which are typically found in back yards. Space constraints have previously been shown to influence presence of edible gardens and other vegetation in residential yards (Pham et al. 2013; Conway and Brannen 2014). Increasing openness to also locating edible gardens in front yards may expand suitable sites for growing sun-loving fruits and vegetables. A shift to a more visible location may also increase neighbor interactions for home-based edible gardeners, providing another level of support and knowledge. However, this will require a change in residential landscaping norms, with utilitarian uses like edible gardens usually limited to back yards (Seddon 1997). One approach to facilitate a shift is to start visible edible gardens in volunteers' front yards, as previous research has suggested that yards types are spatially clustered, with non-traditional alternatives spreading to neighbors through informal diffusion processes (Henderson et al. 1998).

The high level of edible gardening abandonment among study participants suggests edible gardening differs from other residential gardening and yard activity. Experienced maintenance costs extend beyond an initial start-up phase, and may be greater than perennial

[1] Exceptions include some NGOs, for example Cultivate TO, http://cultivatetoronto.com/join-the-harvest/share-your-yard/.

gardens, trees and shrubs. The goal of an edible garden (food production) is also different that for other vegetation, where basic plant survival and aesthetics are likely the primary goals. Thus, it may be easier to fail at edible gardening. Finally, the social pressure to maintain lawns, whether residents want to or not (Robbins 2007), does not exist for the utilitarian edible garden. Thus, when garden maintenance becomes a burden or the plants do not produce the right amount of food it is relatively easy to abandon edible gardening.

Ensuring residents do not stop growing edible plants could be addressed through education and access to knowledge. Yet very few former gardens identified lack of knowledge as a barrier, suggesting that reaching non-growers with information that could increase success will be a major challenge. Additionally, while strategies to address knowledge and resident identified barriers are likely a necessary step in any effort to expand home-based edible gardening, it does not address the gap between the experiences residents' in this study expressed and the benefits of home-based edible gardens that are discussed in the sustainability literature.

CONCLUSION

Ultimately does it matter if residents' stated motivations differ from sustainability rationales for home-based edible gardening? Identification of personal benefits does not mean that the sustainability benefits cannot be achieved through expansion of home-based edible gardening. But the disconnect highlights a major challenge: identifying ways to address immediate barriers to participation, while also convincing residents that urban sustainability requires widespread, long-term participation in home based edible gardening to ensure that residents not only start a garden but continue it season after season. Thus, while communicating personal benefits may be useful to encourage more participation, in many cases those benefits appear to be insufficient to ensure the potential of residential edible gardens can be met and sustained over the long-term.

Finally, while the participants in this study represented a relatively diverse group that has not typically been the focus of edible gardening studies, future research should explore larger populations located in a variety of regions to better understand the ways different household circumstances and environments influence motivations and barriers. In particular, this study was limited to single family home-owners, as they represent households who have access to yards where considerable edible garden potential exists. But renters and/or those living in multi-family dwellings likely face different barriers and may have an alternative set of perceived benefits.

This study identified a variety of motivations and barriers related to home-based edible gardening that residents' experience. Primary motivations were to have food for cooking and gardening as an enjoyable pastime, while lack of time and shade were key barriers. These themes were typically expressed in personal ways, not explicitly related to broader ideas associated with urban sustainability, although that literature has recently emphasized the importance of home-based edible gardening. As a result, efforts to expand this activity should focus on personal benefits. Recruiting experienced residents to create visible home-based gardens and pairing knowledgeable volunteers with residents will likely overcome some barriers identified in this study. However, unless tending an edible garden becomes an expected social norm, the multiple barriers that exist will likely still lead to many interested edible gardeners

reducing the amount of food produced or abandoning efforts all together over time, raising questions about home-based edible gardens long-term contribution to urban sustainability.

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