The Burbs and the Bees: Improving Native Bee Habitat in the Suburban Landscape

by

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Abstract

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As pressures of a growing population take their toll on our environment, efforts must be made to facilitate sustainable behaviours at the neighbourhood scale. Science is demonstrating that the abundance and diversity of native bees is declining in many locales around the world. One of the major drivers of this decline is the loss and fragmentation of habitat, caused in part by suburban expansion. This emerging landscape is dominated by a garden typology not beneficial to bee populations. Using the principles and theories of Community-Based Social Marketing (CBSM) and a survey of Guelph gardeners and homeowners, effective program strategies are outlined for implementation by Pollination Guelph, and target the behaviours and barriers associated with activities that negatively impact native bees. A CBSM based program will encourage bee-friendly gardening, promote the aggregate changes needed to alter the individuals gardening behaviours, and potentially increase native bee populations in the suburban neighbourhoods of Guelph.

Key words: native bees, private land management, community-based social marketing.
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CHAPTER ONE: INTRODUCTION

1.1 PROLOGUE

As the Earth’s resources become more and more strained and anthropogenic landscape change alters ecological systems, there is a need to develop effective and lasting change to reverse this trend at the community level. Community is defined as a group of people living together in the same place or having a particular characteristic in common (New Oxford American Dictionary, 2001). Often this ‘in common’ is just a street or a development, but in some cases involves a rich network of engaged individuals. The North American approach to community building has followed a predominant typology of single family detached residences surrounded by a private yard space with little regard for ecosystem function. The yard has come to be understood as a social reflection of the individual who resides there, demonstrating cues of socio-economic status, values, and care for the community. The historical foundations of residential landscape aesthetics has resulted in a space that is homogeneous in character, and does not benefit biodiversity. At the community level, pro-environmental behaviour change has been shown to be extremely effective, as well as being long lasting. To improve biodiversity at the suburban scale, there is a need to build a supportive and knowledgeable network of individuals who choose to maintain yard spaces that are ecologically sensitive.
1.2 RESEARCH RATIONALE

As an ardent environmentalist, I have observed my own challenges to act the right way, to make sure that my actions have minimal impacts on the space I live. I find myself talking a great deal about the same issues to the same circles of people, often with limited tangible results. I tend to gravitate towards initiatives that are based in the community around me, action that is grassroots in nature, and on issues that I deem to directly affect me. Based on this, and my personal interest in urban sustainability, I have chosen to explore the ways that behaviours can be altered and influenced at the community level.

1.3 THESIS ROAD MAP

This thesis is divided into 7 chapters that endeavour to achieve the research goals and objectives. Chapter Two examines the pertinent literature of the importance of biodiversity, the residential yard, behaviour change theory, and the forage and nesting needs of native bees. Chapter Three examines the methodology that was used to achieve the research goal and objectives. Chapter Four reveals the results survey designed to discover the behaviours and barriers to bee-friendly gardening in suburban areas. A discussion of the survey results as they apply to the behaviours and barriers to bee-friendly gardening is covered in Chapter Five. Chapter Six outlines recommended strategies to implement through a Community-based Social Marketing program. Finally, Chapter Seven presents conclusions of the thesis, recommendations for future research and applications for the landscape architecture profession.
1.4 GOALS AND OBJECTIVES

The goal of this research is to (a) gain an understanding of the barriers that suburban home owners face in implementing ecologically-sound gardening practices, with a specific emphasis on providing forage and habitat for native bees, and (b) to develop strategies that will build support for bee-friendly gardening at the community level in the City of Guelph.

To reach this goal, the following objectives were established:

1. To review pertinent literature that:
   a. provides an understanding of the status of native bee abundance and diversity in North America.
   b. provides an understanding of the forage and nesting needs of native bee populations in an urban environment.
   c. provides an understanding of neighbourhood normative aesthetics.
   d. provides an understanding of behaviour change theory, Community-Based Social Marketing and the steps recommended to develop a successful program.

2. To discover the behaviours and barriers to bee-friendly gardening practices by surveying a sample of residents in the City of Guelph.

3. To explore the potential difference in barriers that affect two neighbourhoods in the City of Guelph.

4. To provide approaches for piloting a program in the City of Guelph by outlining which strategies to employ, communities to target and methods of evaluation.

5. To provide approaches for implementation of a program in the City of Guelph by suggesting how to advertise the program and effectively monitor it.
CHAPTER TWO: LITERATURE REVIEW

2.1 THE FRAGMENTED LANDSCAPE

Some time in late October of 2011 the world’s population reached 7 billion; some projections estimate that by the end of the century the global population will exceed 10 billion. Coinciding with this growth is the increase of urban and the decrease of rural populations, resulting in the need to build new housing networks and extensive supporting infrastructure. This anthropogenic landscape change has resulted in the fragmentation and loss of habitat, leading to a dramatic reduction in biodiversity and the extinction of species (Daigle, 1996; Fahrig, 2003; Lindenmayer & Fischer, 2006).

Diverse flora and fauna are responsible for the continuance of ecosystem services such as fresh water, food, air, climate and pest regulation, as well as the aesthetic and spiritual services that a connection with nature provides (Hoffmann, 2005). Biodiversity defines the interaction and continuance of all living things on earth and is the key to the maintenance of the world as we know it (Wilson, 1992). The negative consequences of the degradation of biodiversity in the suburban landscape will become increasingly more pronounced if interventions are not made.

As suburban developments push further into the urban/rural fringe, the existing habitat areas are lost and become increasingly fragmented. Habitat is a widely used term to define the “environments suitable for a particular species” (Lindenmayer & Fischer, 2006, p. 4). The term ‘habitat fragmentation’ is used to describe the process of breaking habitat into smaller pieces, resulting in the simultaneous loss and subdivision of habitat (Fahrig, 2003; Lindenmayer & Fischer, 2006). Habitat fragmentation has a varying impact on species of different trophic levels, as all species have different
requirements for food, shelter and space. To generalize across species, fragmentation exists along a gradient from continuous, natural or semi-natural habitat to a landscape dominated by a non-habitat matrix with highly fragmented habitat patches. This process is illustrated in the following diagram.

![Figure 1: Landscape Fragmentation (Adapted from Fahrig, 2003)](image)

The resulting habitat is smaller in size, and at the same time habitat fragments are highly isolated from one another (Franklin, Noon, & George, 2002).

As habitat fragments diminish in size and quantity, the context of the non-habitat area becomes as important to local habitat as the fragments (Steffan-Dewenter, 2003). In suburban developments, roads, shopping areas and predominantly turf grass lawn cover dominate the non-habitat matrix. The opportunity to bring back natural or even semi-natural habitat is not possible in the suburban context, but aggregated improvements can improve habitat capacity and connectivity. By re-imagining the non-
habitat matrix, it is possible to reconnect and reinvigorate biodiversity in suburban spaces.

2.2 URBAN ECOSYSTEMS

It is important to look at the anthropogenic landscape change occurring at the suburban development scale, because it is here that the individual can make a difference and influence change. In the decisions of how ecosystems will function across large scales, at the city or development scale, there is little input from those who will ultimately be living there. Change occurs when the homeowner begins to exert his or her own preferences upon the space.

To give a sense of the scale of the sprawling low density development in Canada, 992,778 new homes were built between 2006 and 2011, and 1,028,267 between 2001 and 2006. Urban sprawl, or the “excessive spatial growth of cities” (Brueckner, 2000 p. 161), is a major driver of anthropogenic landscape change in and around urban centres. Suburban developments are characterized by primarily detached or semi-detached residences, surrounded by yard, gardens, and vehicular parking and existing on the urban-rural fringe (DeStefano, Deblinger, & Miller, 2005). There is approximately 69 million acres of land that is privately managed as urban or suburban landscapes in the United States (Kiesling, 2010). Within this landscape there does exist remnant habitat, as well as altered habitats such as parks, streetscapes, and backyards, providing essential food and shelter to wildlife (DeStefano et al., 2005).

Evident in the suburbs is the desire of the individual to exert dominion over their property, reflected in the weed-free, manicured lawn (Clayton, 2007). Despite its
prevalence in the suburban landscape, there is an emerging aesthetic taking root. The idea of ecological gardening has grown in the past several years with people understanding the importance of their yards in the wider urban ecosystem, as well as understanding the need to reduce energy inputs. These gardens are generally too small to function on their own, but a mosaic of environmentally beneficial yards can, in the aggregate, contribute to ecological health in suburban neighbourhoods (Helfand, Park, Nassauer, & Kosek, 2006; Kiesling, 2010). Lawn alternatives are becoming more prevalent in the suburban landscape which is improving the quality of available resources for species (Henderson, Perkins, & Nelischer, 1998; Hunter & Brown, 2012; Kiesling, 2010). The challenge is how to engage the individual in the adoption of behaviours that will build this beneficial landscape.

2.3 PEOPLE AND THEIR RESIDENTIAL YARDS

The front yard is a semi-private space that conveys the gradient between the public street and the private home; how it is treated is an expression of the homeowners personal and social identity. (Fuller & Irvine, 2010; Kiesling, 2010). The typology of the manicured, weed-free lawn, peppered with ornamental trees and foundation plantings has come to define the American and Canadian home (Grampp, 2008; Henderson et al., 1998). Central to this typology is the homogeneous lawn which covers an estimated 32 and 40 million acres across the United States (Tallamy, 2009). Lawns require a great deal of energy inputs, an increased potential for herbicide or pesticide use, a reliance on non-native, exotic plant species, and an over-use of fertilizers which can cause nutrient
overloading in water systems and a dependence on fresh water for watering (Clayton, 2007; Kiesling, 2010; 1993).

Homeowners are pressured by advertising and popular culture telling them a green, weed-free and meticulously-manicured lawn is the aesthetic to strive for and, in the pursuit of this, homeowners in the United States use 10 times more pesticides than farmers (Shern, 1994). Life magazine stated in 1969, that America “judges the moral fitness of citizens on the basis of lawn mowing” (Clayton, 2007 p.216). The lawn has come to communicate homeowners’ social identity, values and conformity to societal norms (Clayton, 2007).

Traditionally, an unkempt or messy yard is considered undesirable in most urban and suburban neighbourhoods, viewed as reducing property values and usually ordered managed by local bylaws (Clayton, 2007). Nassauer’s (1993; 1995; 2009) studies into the attitudes towards messy yards reiterates the idea that neatness is indicative of a cared for community (see also Henderson et al., 1998). Alternatives to the traditional lawn and foundation plantings of many sub-urban homes will likely be accepted if there is a semblance of care communicated (Henderson et al., 1998; Nassauer et al., 2009). Using design cues in a planting, such as focal points, colour or movement, is a way of communicating a message of care in unconventional yard treatments (Henderson et al., 1998). These cues to care are instrumental in overcoming the individual’s preference for canonical planting styles, dominant in suburban neighbourhoods. Further, there is a correlation between the surrounding neighbourhood’s treatment of yards and its preference as a landscape aesthetic (Nassauer et al., 2009). Nassauer, in a study of exurban neighbourhoods in Michigan, determined that both cultural norms and
neighbourhood norms have an effect on the individuals yard treatment preference (Nassauer et al., 2009). It was discovered that neighbourhood norms often exert more influences than cultural norms:

… individual homeowners deeply value having a front yard that matches a consistent neighborhood appearance, but that neighborhood appearance does not need to conform to broader cultural conventions (Nassauer et al., 2009, p. 290).

Unfortunately, with the preference of expansive turf grass lawns, many homeowners view native plants as messy and a naturalized landscape as undesirable. Kiesling (2010) states the motivation for these individuals to garden is predicated on seven factors:

• Creative expression and personal meaning
• Health promotion
• Production
• Skill-building and knowledge enhancement
• Feelings of connection to nature
• Perceived social benefits
• An expression of faith through caring

These are a mix of personal, social and ecological factors, illustrating that the gardening behaviours of the individual are challenged by a gap between their personal environmental values and the social norms of the neighbourhood.

2.4 GARDENING

The value of sales of horticultural products in Canada is estimated to be over 6 billion dollars annually, and it is estimated that the baby-boomer generation will spend between 7.8 and 14.4 billion dollars annually on gardening and gardening related
activities in their retirement (Touche, 2009). This illustrates a segment of the population that has a keen interest and devotion to gardening.

2.5 ENVIRONMENTAL BEHAVIOUR

The knowledge that the Earth’s resources and the fragility of ecosystems is well ingrained into North American society with individuals engaging in varying degrees to some sort of pro-environmental behaviour and action. Kennedy et al. (2009) discovered that 72.3 percent of Canadians see a gap between their actions and their intentions. This environmental values-behaviour (EVB) gap reflects that, although large portions of the population have expressed commitment to improving the environment, actions rarely manifest (Kennedy, Beckley, McFarlane, & Nadeau, 2009). There is an internal struggle to choose the ‘right thing to do’ when weighing choices in actions. For example the three tenets of the environmental movement, Reduce, Reuse, Recycle, have varying degrees of participation; curbside recycling has become a normative community behaviour, yet waste reduction has not yet become something that people actively endeavour towards (Barr, 2003).

The EVB gap in ecological gardening behaviours is illustrated in the community norm of garden aesthetics contrasted against the individual’s values of building a space that is ecologically substantial (Kiesling, 2010). Keisling and Manning argue that people are choosing to garden differently, that choices to use more sustainable practices is growing from a postmodern desire to connect with nature, rather than dominate it (2010). The desire to garden in a sustainable and ecological manner is present in society, yet the motivation to build ecologically healthy landscapes in suburban yard
spaces will take more than simple education; there needs to be a fundamental shift in the gardening behaviours that are currently employed to fit the desired behaviour.

2.6 THE COMMUNITY AS CATALYST FOR CHANGE

Engaging communities in the process of environmental change has been shown to be a powerful and effective strategy (Carrigan, Moraes, & Leek, 2011). Within communities, there exist social networks that allow for the diffusion of ideas, a process that will see the idea evolve and be altered to support the desired behaviour (Carrigan et al., 2011). The diffusion of ideas can positively affect the neighbourhood norms, strengthening the hold that pro-environmental behaviour will have in a particular community. A study in Ann Arbor, Michigan found that properties were 2.4 times more likely to have an easement garden if a property within 30m had one (Hunter & Brown, 2012). The authors termed this spatial contagion, where social networks at the neighbourhood level encourage the proliferation of ideas that support ecological gardening practices (Hunter & Brown, 2012). There is a potential for residential neighbourhoods to build healthy and productive habitat, and encourage its spread through existing social networks at the neighbourhood level.

2.7 SOCIAL MARKETING

Social marketing is the theory and practice of marketing an idea, cause or behaviour (Kotler & Zaltman, 1971). The concepts of social marketing are rooted in the rise of advertising consumer products, and have been employed in campaigns for changing social behaviour such as health, the environment, and education (Andreasen,
In 1952, Sociologist G.D. Wiebe asked, “Why can’t you sell brotherhood like you can sell soap?” (Kotler & Zaltman, 1971, p. 3). Wiebe studied four social campaigns to determine their effectiveness and found that there was a higher success rate for social campaigns that resembled traditional product marketing (Kotler & Zaltman, 1971).

Andreasen offers a definition that attempts to define the core principles:

Social marketing is the adaptation of commercial marketing technologies to programs designed to influence the voluntary behavior of target audiences to improve their personal welfare and that of society of which they are part (1994, p.110).

In order to achieve this improvement, social marketers attempt to alter the publics beliefs, attitudes and values (Andreasen, 1994). Using traditional marketing techniques, social marketing implies that the desired behaviour is the product to be sold and engages the use of media, such as television, radio, and print advertising (Hastings, 2007). Unfortunately these social marketing techniques are information-intensive, focusing only on providing information to the consumer and hoping that knowledge alone would affect change (Andreasen, 1994; Kennedy et al., 2009; McKenzie-Mohr, 2011).

Information-intensive campaigns are often based on two perspectives in changing behaviours. The first perspective is the attitude-behaviour approach where assumptions of changing behaviour are brought about by increased public knowledge of an issue, such as climate change, and fostering attitudes that will support a desired behaviour, such as increasing public transit usage (McKenzie-Mohr, 2011). Often these campaigns are supported by traditional marketing strategies of media advertising and the distribution of pamphlets, brochures or flyers (McKenzie-Mohr, 2000a, 2011). The second perspective of information-based campaigns is the economic self interest
approach, where people make decisions based on what is in their financial best interest (McKenzie-Mohr, 2011). Social marketing has also been viewed as a downstream approach that simply targets people with bad habits (Andreasen, 2006).

2.8 COMMUNITY-BASED SOCIAL MARKETING

In reaction to the deficiencies of information-intensive approaches, Dr. Doug McKenzie-Mohr has developed strategies that target the routines, habits, norms, barriers and incentives of environmental behaviours, in what he has termed Community-Based Social Marketing (CBSM) (Carrigan et al., 2011; McKenzie-Mohr, 2011). CBSM aims to foster sustainable behaviour by challenging traditional information intensive campaigns - those that hope that education alone will bring social change (McKenzie-Mohr, 2000b). While knowledge is an important element of CBSM, reliance on this alone does not guarantee that pro-environmental behaviour will be adopted (McKenzie-Mohr, 2011). CBSM theories suggest that behaviour change is most effective through initiatives delivered at the community level. CBSM is an attempt to take campaigns beyond the pamphlet and the pocketbook, and remove the barriers that prevent people from participating in sustainable behaviours.

The individual's decision-making process towards pro-environmental behaviour, or "behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and built world", is extremely complex (Kollmuss & Agyeman, 2002, p. 240). Pro-environmental behaviour is shaped by both external and internal factors. External factors include institutional, economic and social/cultural factors while internal factors include motivation, knowledge, values, attitudes, environmental awareness,
emotional involvement, locus of control, and responsibility (Kennedy et al., 2009; Kollmuss & Agyeman, 2002). Individuals are not often rational in their decision-making processes, but rather are locked in behaviour patterns that are shaped by restricted choice, inequality of access, institutional barriers, prevailing cultural values, and societal and personal norms (Carrigan et al., 2011).

CBSM starts by identifying the behaviours that are causing unsustainable behaviours and works backwards to select an approach that will target that particular behaviour. CBSM is composed of five steps identified by Doug McKenzie-Mohr (2011); each will be discussed in turn:

- Selecting behaviours
- Identifying barriers and benefits
- Developing strategies
- Piloting
- Broad scale implementation and evaluation

Selecting Behaviours

Before a program is developed it is important to choose the behaviours to be targeted carefully. It is important to target specific behaviours that will contribute significantly to the issue that is trying to be solved. To ensure this, targeted behaviours should be indivisible and end state. An indivisible behaviour cannot be distilled down into multiple behaviours, each with its own barriers; for example, adding insulation to a house can be divided into adding insulation into the walls, attic or basement (McKenzie-Mohr, 2011). An end-state behaviour reaches its ultimate target. For example, purchasing and installing a programmable thermostat is not an end-state if it is not programmed (McKenzie-Mohr, 2011). Further, determining the impact of the behaviour,
the probability of the new behaviour being adopted and the existing penetration of the behaviour into the target audience will assist in choosing the right behaviours to target.

Identifying Barriers and Benefits

The barriers for people not engaging in pro-environmental behaviour are diverse and complicated, but there are three reasons people generally have for not engaging in pro-environmental behaviour: 1) they do not know about the activity or its benefits, 2) they perceive barriers to the activity, or 3) they assign value to the incorrect behaviour (McKenzie-Mohr, 2011). Beliefs are the “propositions that we accept to be empirically true and that we use to prioritize conditions or behaviours” (Kennedy et al., 2009, p. 154). The rationale behind an individual’s choice of action is speculative, but there are generalizations that can be made about a specific behaviour about the barriers, as well as the benefits, or motivations, for engaging in a pro-environmental behaviour.

Environmental campaigns typically focus solely on the behaviour they want to encourage, giving little thought to the negative behaviours that are causing the undesired activity. The strength of CBSM is that it addresses two behaviours simultaneously, the behaviour that is to be encouraged and the behaviour to be discouraged (McKenzie-Mohr, 2011). Behaviours to be encouraged require the barriers associated with it to be decreased, while the behaviours to be discouraged need to have the barriers increased. At the same time, the benefits to the encouraged behaviour need to be increased, and decreased for the behaviour to be discouraged (see Figure 2) (McKenzie-Mohr, 2011).
Strategies

To ensure that individuals make short-term and long-term behavioural changes, CBSM suggests several strategic tools. The strength of each strategy will be explained in turn. Examples of the strategies are taken from McKenzie-Mohr’s book *Fostering Sustainable Behaviour* (McKenzie-Mohr, 2011).

Commitment

Having people commit to making changes in their behaviours is a powerful measure to ensure the effectiveness of a campaign over time. Commitments are the most effective when they are written, made public and made as a group. In a 1983-1984 study by Pardini and Katzev (in McKenzie-Mohr, 2011) about the importance of verbal commitments, three groups of people were asked to recycle paper in their homes. The first group was given a pamphlet, the second made a verbal commitment, and the third group made a written commitment. The groups that made a verbal or written commitment recycled more, and after a time only the group that made a written commitment were still recycling (McKenzie-Mohr, 2011).

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<tr>
<td>Discourage</td>
<td><img src="image3.png" alt="Barcode" /></td>
<td><img src="image4.png" alt="Barcode" /></td>
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Figure 2. Encouraging pro-environmental behaviour (Adapted from McKenzie-Mohr, 2011)
Further, making a public commitment will also improve the likelihood of the sustainable behaviour becoming accepted. Individuals who agreed to have their names published for a commitment to reducing energy consumption had a 15% reduction in natural gas and a 20% reduction in electricity over those who refused to make a public commitment. Making a group commitment will also solidify the resulting behaviour. McKenzie-Mohr states that “commitments are likely to be effective in well established groups in which individuals care how they are viewed by other members of the group” (2011, p. 54). These commitments become public and durable, helping to ensure that these behaviours will become normative and will diffuse into the surrounding community (McKenzie-Mohr, 2011).

Social Norms

Social norms are the “the unwritten, unspoken rules that guide our behaviour” (Smith & Louis, 2008, p. 3). Social norms can take an injunctive and descriptive form. Injunctive norms provide information on which behaviours are approved and which are disapproved of in a particular culture. Descriptive norms indicate what behaviours are normally engaged in, or what is commonly done in specific situations (McKenzie-Mohr, 2011; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Individuals are bombarded with messages that aim to alter normative behaviours, but often these messages guide people to behaviour that is opposite to what is desired (Schultz et al., 2007). The message ‘please don’t litter because many people are littering’ is inferred as ‘many people are littering’, therefore the norm is to litter (Smith & Louis, 2008). A blend of descriptive and injunctive norms can ensure that
those who are engaging in the undesired behaviour are reached, and those who are engaged in the desired behaviour are not caused to modify their actions negatively (Schultz et al., 2007). Making the desired behaviour visible will assist in it becoming normative in a community, as the behaviour will disperse out into the neighbourhood.

**Social Diffusion**

The community is a potentially powerful locus of change and the networks that exist in neighbourhoods offer the vehicle for the diffusing of new ideas (Carrigan et al., 2011). Individuals are likely to adopt behaviours that others are practicing around them. Mavens or catalytic individuals within a community usually exhibit two key attributes: they are knowledgeable of a particular idea and are regarded as reliable and trustworthy (Carrigan et al., 2011). The decisions that individuals make regarding pro-environmental behaviour are potentially shaped by their peers or neighbours. The clustering of sustainable innovations in neighbourhoods, such as rainwater harvesting or solar panels, highlights the importance of social networks in influencing behaviour (McKenzie-Mohr, 2011). The adoption of sustainable behaviours is predicated on several factors:

- **Relative Advantage:** Is the new behaviour better than to the behaviour to be replaced?
- **Perceived Risk:** Is their potential negative financial or social implications?
- **Complexity:** Is the new behaviour overly challenging?
- **Compatibility:** Will the new behaviour blend in with the existing social norms and values?
- **Trialability:** Can the new behaviour be adopted for a ‘trial’ period?
- **Observability:** Is the new behaviour visible to the target audience’s community?
**Prompts**

Humans are inherently forgetful, so creating prompts to remind the individual of the behaviours that they want to engage in can be useful. Making the prompt visible as well as physically close to the point where the negative behaviour is occurring is vital to ensuring that the prompt will be effective. For example, putting a DO NOT IDLE sticker on the inside of the windshield will help remind a driver to turn off their engine while waiting.

**Communication**

It has been indicated that knowledge is a major hurdle in an individual’s attempt of achieving pro-environmental behaviour, but unfortunately knowledge on its own does not work. Effective communication of the message of the program is essential to ensuring that it is received and acted upon, and ensuring that the communication is well timed and positioned. Individuals are inundated with messages in virtually every activity in their lives; from the overt to the subtle, there is always something trying to alter behaviours for social good or for profit. McKenzie-Mohr outlines nine elements of successful communication:

- Use captivating information
- Know your audience
- Use a credible source
- Frame your message
- Carefully consider threatening messages
- Make your message easy to remember
- Provide personal or community goals
- Emphasize personal contact
- Provide feedback
Incentives

Incentives, especially financial, are a powerful and effective means of getting individuals to act upon behaviours. Incentives have the potential to be most effective when the motivation to act is low. The use of incentives have largely been employed in waste reduction programs, such as fees for extra bags of garbage, and for bottle return programs. McKenzie-Mohr (2011) outlines six points for successful use of incentives:

- Consider the size of the incentive
- Closely pair the incentive and the behaviour
- Make the incentive visible
- Use incentives to reward positive behaviour
- Be cautious about removing incentives
- Prepare for people’s attempts to avoid the incentive

Convenience

If the positive behaviour is overly challenging to participate in, then individuals will not engage in it. The participation of Ontario residents in curbside recycling to backyard composting illustrates the influence convenience has on behaviour. 80% of Ontario homes participate in curbside recycling, which is relatively convenient to participate in and is supported by the municipality. Conversely, only 30% of Ontarians participate in backyard composting, which is not overly convenient (McKenzie-Mohr, 2011).
2.9 CBSM AND NATIVE BEE POPULATIONS

The theories and principles of CBSM can be applied to the improvement of biodiversity in suburban neighbourhoods. For the purpose of this thesis, CBSM will be applied to designing and implementing a program for the improvement of native bee species in Guelph, Ontario's suburban neighbourhoods.

2.10 POLLINATION AND POLLINATOR: A DEFINITION

Pollination is the abiotic (wind, water, gravity) or biotic (insect or animal) transfer of pollen from the male anthers of one flower to the female stigma of another, on the same plant or different, in order to produce viable seed or fruit (Kevan, 1991, 1999; Mader, 2011). Moths, butterflies, bats, and even rodents can be responsible for biotic pollination, but bees are the workhorse of the pollination world, naturally evolved to gather pollen and nectar from flowers (Mader, 2011). As bees forage, grains of pollen are picked up on their bodies and in specialized pollen baskets and moved from flower to flower, ensuring cross-pollination, reproduction and genetic diversity (Ahrn, Bengtsson, Elmqvist, & Somers, 2009; Michener, 2000). For the purpose of this thesis, the focus will be on bees native to North America, and where possible, native to Ontario. The term ‘native bee’ is very broad, used to define bees that are indigenous to a specific area. There are approximately 4,000 bee species native to North America, of which upwards of 1,000 reside in Canada, with more being discovered (Mader, 2011; Packer, Genaro, & Sheffield, 2007). Native bees can be categorized into five major families in Ontario; the Apidae (honeybees, bumble bees and carpenter bees), Andrenidae
(andrenid bees), Halictidae (sweat bees), Megachilidae (leafcutter and mason bees) and Colletidae (plasterer bees) (Michener, 2000).

### 2.11 NATIVE BEES AS A KEYSTONE SPECIES

Diverse and healthy ecosystems rely on certain species interactions, and habitat loss and fragmentation significantly affects these interactions, altering the quality of biodiversity in a given location (Lindenmayer & Fischer, 2006). These strongly interacting species are often referred to as keystone species, an analogy to the keystone in a stone archway, where its removal will instigate the collapse of the entire system (Daigle, 1996; Lindenmayer & Fischer, 2006; Tallamy, 2009). Edward O. Wilson writes:

As extinction spreads, some of the lost forms prove to be keystone species, whose disappearance brings down other species and triggers a ripple effect through the demographics of the survivors (1992, p. 348).

A vital interaction in an ecosystem is plant/pollinator mutualism - the relationship between a flowering plant and its pollinator, where decline occurs in the absence of the other (Lindenmayer & Fischer, 2006). Native bees are a keystone species; crucial in keeping natural communities healthy and productive, responsible for the maintenance of wild plant diversity and providing a vital service for the persistence of other species that depend on floral resources (Kevan, 1991; Mader, 2011; Potts et al., 2006). The global economic role of the insect pollinator for all ecosystem services is estimated to be over 33 trillion USD, and is responsible for the production of 75% of the crops directly used for human consumption (Kearns, 1998; Kevan, 1991; Mader, 2011; Potts et al., 2010).
Figure 3 illustrates the complex and interconnected role the pollinator plays in commercial and natural food systems.

Approximately 80% of wild plants are dependent on pollination for fruit and seed production, underscoring the importance of native bees in an ecosystem (Potts et al., 2010). As mentioned earlier, the relationship between pollinator and plant is one of mutual benefits; the plant receives reproduction services while the pollinator receives carbohydrate rich nectar, high protein pollen and, in the case of some species, materials to build their nests (Michener, 2000; Willmer, 2011).
In agricultural settings the importance of native bee populations is being understood in the growing absence of Apis malifera, the European honey bee. The honey bee, despite being a non-native species, is depended on for much of the global crop pollination due largely to their social behaviour, which makes their hives relatively inexpensive to manage and transport (Klein et al., 2007). Managed honey bee hives are transported across the country following the bloom of agricultural fields (Schacker, 2008). In recent years, apiaries have been devastated by Colony Collapse Disorder and the Varroa destructor mite, bringing attention to the role of the native pollinator in agricultural food production (Schacker, 2008). In the absence of pollination, a 90% decline in productivity of some fruit, nut and seed crops has been observed (Klein et al., 2007). Despite their relative economical service, honeybees are not the most effective pollinators on a per flower basis (Klein et al., 2007). Native bee populations have the potential to become a more sustainable solution to food crop pollination. Native bees have been employed to provide services for a wide variety of food and forage crops. For example Osmia lignaria, the mason orchard bee, has been shown to be an effective pollinator of apple flowers, and Nomia melanderi, the alkali bee, is a highly effective pollinator of lucerne or alfalfa, a forage crop for much of the beef and dairy cattle in the world (Delaplane, 2000). Further, only native bees are able to pollinate tomatoes or eggplant, and are superior to honey bees at pollinating crops such as pumpkins, cherries, blueberries, and cranberries (Moisset & Buchmann, 2011).

Bees, especially native bees, are such effective and consistent pollinators of wild flowers that their contribution to an ecosystem is extremely valuable and difficult, if not impossible, to replace (Kevan, 1991). The importance of the plant-bee mutualism is
shown in a study from Britain and the Netherlands, where the extinction of some bee species has correlated in the decline of plant-pollinated species in the same areas (Biesmeijer et al., 2006).

2.12 NATIVE BEE DECLINE

Many scientific studies are presently accumulating data in order to compile a comprehensive picture of the status of native bee species (Fetridge, Ascher, & Langellotto, 2008). The proliferation or decline of native bee populations has largely gone unnoticed, mostly due to the fact that most species are small, live solitary lives and are relatively unknown to scientists (LeBuhn, 2011). There exists comparative historical data on bumble bees which has been used to show that populations of certain species, in certain locations, are exhibiting signs of decline (Cameron et al., 2011; Colla, Packer, & Packer, 2007; Evans, Thorp, Jepsen, & Black, 2008; Potts et al., 2010). A review by the Xerces Society shows that three species of bumble bees, the Bombus affinis, the rusty patched bumble bee, Bombus terricola, the yellowbanded bumble bee, and Bombus occidentalis, the western bumble bee, are showing reductions in distribution and abundance (Evans et al., 2008). Although many studies are presently examining the distribution and abundance of native bees in North America and around the world, science lacks a comprehensive picture of the status of native bee populations in North America (Lebuhn, 2011).

It is widely agreed that the combined effects of loss and fragmentation of habitat, pesticide overuse, decreased resource diversity, invasive alien species and climate are challenging the proliferation of bee species (Kearns, 1998; Potts et al., 2010).
2.13 THE BURBS AND THE BEES

As mentioned earlier, the non-habitat matrix in suburban landscapes has the potential to be an important determinant for native bee abundance and diversity than the remnant habitat patches. The suburban landscape is characteristically devoid of abundant native plant species, leading to spaces that are generally unfavourable to bee populations. Yet despite this, there has been an indication that suburban spaces have the potential to provide better habitat opportunities in neighbourhoods with a diversity of floral and nesting opportunities (Fetridge et al., 2008). Re-imagining the suburban landscape as a mosaic of interconnected pieces, rather than disparate and fragmented, will enable native bee populations to safely move through and inhabit it.

The context of the suburban landscape matrix is of critical importance to bee populations. Bees are free to move through the suburban landscape and are highly influenced by what is occurring there. Bees will fly through the suburban landscape in search of optimal forage and suitable nesting, yet how far a bee will forage from its nest is based on a decision of energy expenditure for quality of reward. In a study of pollination in cranberry fields, it was shown that bumble bee colonies have died out if there is little forage within 100m of their nests in early spring, despite having a foraging range of up to a mile (Loose, 2005). The Xerces Society also recommends that the 100m distance from nesting site to forage be adhered to as a general rule (Mader, 2011). In the suburban matrix, if the distance between nesting sites and optimal foraging sites is degraded, this can have detrimental effects on native bee populations. Studies have explored urban bee populations and demonstrated that urban and suburban areas have the potential to support numerous and diverse populations of bees.
depending largely on the quality and quantity of habitat that is available to them (Ahrn et al., 2009; Fetridge et al., 2008; Frankie et al., 2005; Hostetler & McIntyre, 2000; Matteson, Ascher, & Langellotto, 2008; McFrederick & LeBuhn, 2006). A study of urban residential bee populations in Phoenix, Arizona determined that suburban properties that xeriscaped their yards using primarily native vegetation had more bees and more diverse species than the traditional turf grass property (Hostetler & McIntyre, 2000). The quantity or density of habitat features was not the determinate of bee diversity, but rather the quality of habitat, specifically native plant species, plant flowering diversity and ground cover (Hostetler & McIntyre, 2000). Frankie et al. (2005) found that bee diversity and abundance was increased in private gardens where a high number of bee-attractive plants flowering at the same time. Frankie refers to this as the 'mall effect', where bee floral visitation increases in a garden where there is a high variety of floral options concentrated in a small area, versus low floral options (Frankie et al., 2005). The same study observed that plants native to the area, in this case northern California, were more attractive to native and honey bees than the exotic plants in the same gardens (Frankie et al., 2005). Matteson found that the size of the gardens observed in New York City had a positive effect on the number of species, while the age of the garden and distance to large green spaces had no observed effect on diversity (Matteson, 2007; Matteson et al., 2008).
2.14 THE BEES NEEDS

For the purposes of conservation of bees in suburban environments, it is important to understand what their needs are. Of the 4,000 bee species indigenous to North America, in Canada it is estimated that bee species range between 520 to over 970 (Packer et al., 2007). With such a variety of species, sweeping generalizations about the needs of native bees are required. An understanding of the social structure, foraging habits and nesting sites of native bees is vital to contribute to the improvement of habitat.

Social Structure

A native bee can be either eusocial (two or more female bees working to prepare and provision a nest,) or solitary (female bee constructs and provisions a nest by herself) (Mader, 2011). In North America 90% of native bees are solitary (Mader, 2011). The solitary bee collects pollen and nectar to stock her nest, consisting of individual cells, in a small tunnel in the ground, hollow stem, burrow or crevice (Willmer, 2011). The bee lays a fertilized egg into this cell, seals it off and continues to build and provision another cell (Michener, 2000). A typical solitary bee will alternate foraging and cell construction, stocking 5-10 cells in their lifecycle (Willmer, 2011). The pollen and nectar in the cell will sustain the developing larvae until the following season when it will emerge to begin the cycle again (Michener, 2000; Willmer, 2011). The full lifecycle of the solitary bee lasts a year, whereas the egg, larvae and pupal stages last months, and only 3-6 weeks is spent outside the nest (Mader, 2011).
Bumble bees and some sweat bees are the only eusocial native bees in North America (Michener, 2000). Bumble bees begin their nests in the spring with a solitary female who will, after emerging from hibernation, search for a suitable nesting site, a dry, well drained and sheltered nesting site in a thatch of grass or abandoned burrow (Delaplane, 2000). The queen builds a thimble shaped beeswax honeypot that she uses to lay her fertilized eggs in (Delaplane, 2000). Once the worker females are hatched, the queen does not emerge from the nest, but focuses on producing more workers to forage for resources for the colony (Michener, 2000). At some point in the season the queen stops producing workers and produces young queens and male bees. Once these bees hatch they leave the colony and search for a mate. The new, mated queens then search for a place suitable for hibernation and the cycle continues (Michener, 2000).

**Foraging**

Certain bee species will only forage on a single plant family source, while others will forage on a wide range of plant species (Willmer, 2011). Ologolectic bees specialize in pollen from a single plant species, and can be defined as being broad or narrow in their ability to stray from that single pollen source (Michener, 2000). An example of a oligolectic bee is Andrena erigeniae (Spring Beauty Bee) which forages on Claytonia virginica (Eastern Spring Beauty) and Erigenia bulbosa (Harbinger of Spring) (Beatriz Moisset, 2009). Oligolectic bees are generally the most rare, and are at the most at risk of species decline because of the limited food supply (Mader, 2011).
Polyectic, or generalist bee species are the most common, comprising of upwards of 80% of the bee population in a given location (Michener, 2000). Bees that have a life span that is longer than a single flowering plant by necessity have to be generalists, but can specialize in a single nectar or pollen source at any given time (Willmer, 2011). Bumble bees are an example of a polyectic species, as they gather nectar and pollen from plants that bloom throughout the growing season (Michener, 2000).

Native plant species have an ecological benefit over exotic plant species because of the coevolution they experienced with indigenous fauna (Tallamy, 2009). In many cases, native plants and native fauna are dependent on one another for healthy populations (Tallamy, 2009). A comparison of suburban yards with native plant versus conventional plantings found that the overall biodiversity increased in the properties with native plants (Burghardt, Tallamy, & Shriver, 2008). In several studies, native bees have been observed to prefer native plant species to exotic species (Frankie et al., 2005; Hopwood, 2008; Kearns, 1998). Exotic and cultivated plant species often offer little or no pollen to native bees, due to sterilization (pollenless varieties) and the inability for bees to access the pollen source (Dyer, 2006). In conventional suburban developments, gardening practices favour the typology of the turf grass lawn and a preference of exotic and cultivated plant species that do not support local native bee diversity. Given the proper landscape management, bee populations in urban residential gardens can support a variety of bee species (Fetridge et al., 2008; Frankie et al., 2005; Hostetler & McIntyre, 2000). Improving the forage opportunities for generalist bee species through an increase in the use of native plants and a community based planting initiative. The
diversity of bee species found in urban residential gardens is reflective of the nature of the resources available (Fetridge et al., 2008).

Nesting

A suitable nesting situation for bees varies by species and sociality, and may consist of, but are not limited to, tree cavities, hollow plant stems, abandoned rodent burrows, small holes in wood, or soils of suitable texture, moisture, vegetation cover and depth (Cane, 1991, 2001). Most bee species are ground nesting and it has been shown that soil texture, temperature and moisture are important factors to nesting choice (Cane, 1991). The relative number of cavity nesting to ground nesting species is higher in urban landscapes, this could be attributed to the management practices of homeowners (Fetridge et al., 2008; Matteson, 2007; Matteson et al., 2008). Providing nesting opportunities in the residential gardens proves to be more difficult as the number of different nesting needs of native bees. Some bees will find opportunities to build their nests in the most unlikely areas, while others need very specific environs for nesting.
CHAPTER THREE: METHODOLOGY

CBSM describes a process to identify the barriers and behaviours for the purpose of designing strategies to assist in individuals fostering sustainable activities. Figure 4 shows how I moved through this process, and my attempt to better understand peoples’ behaviours.

![Methodology Diagram]

**Goal**

To (a) gain an understanding of the barriers that suburban home owners face in implementing ecologically-sound gardening practices, with a specific emphasis on providing forage and habitat for native bees, and (b) to develop strategies that will build support for bee-friendly gardening at the community level in the City of Guelph.

Figure 4: Methodology Diagram
3.1 IDENTIFYING BEHAVIOURS

To identify the behaviours that people engage in that negatively affect native bee populations in suburban landscapes, I first reviewed the literature to discover their habitat and nesting needs. Despite being a diverse group of insects, I was able to identify the following behaviours affecting native bee populations (Figure 5):

1. Aesthetic Preferences
   - Expansive Turf Grass Lawn Coverage
   - Immaculate Yards

2. Yard Care Behaviours
   - Non-Beneficial Plant Species
   - Extensive Mulching
   - Pesticides use

![Figure 5: Non-beneficial behaviours](image)

**Expansive Turf Grass Lawn Coverage**

The lawn is one of the largest ground covers in North America. Ubiquitous with the suburban landscape, the lawn does not provide native bee populations with beneficial habitat or forage. The lawn is an important element to the homeowner, a
space to socialize and relax, and is viewed as aesthetically beautiful and adding value to the home.

**Immaculate Yards**

Bees require spaces that are perceived, to humans, as messy or more natural in character. They require elements such as dead wood and stems, brush piles and leaf litter to nest and hibernate. Unfortunately most homeowners do not allow for these messy spaces, opting to haul away their yard detritus to landfill sites.

**Non-Beneficial Plant Species**

Selecting what plant species to put in a garden is based on a variety of choices: ecologic function, colour, site requirements, height or variety are potential factors in the choice of plants. Often the homeowner chooses plants that are available to them through convenient distributors in order to achieve the social norm of beautifying their home. Native plants are viewed by many as being messy and aesthetically unpleasing, and are not chosen to be placed in gardens. Native bees need native plants, and therefore creating healthy plant systems in suburban landscapes is dependent on their presence.

**Extensive Mulching**

The application of mulch is a gardening practice that has gained popularity because of its ability to reduce water use, regulate soil temperature and restrict weed growth, as well as reducing the time needed for maintenance. It has also been extolled
as a practice to help keep gardens look neat and tidy by helping define plants and beds. One recommended practice of mulching garden beds is an application of wood chips 3-4 inches thick to effectively control weed growth (Alexander et al., 2008). For native bees, such as bumblebees, there is an opportunity to find space to overwinter in thick layers of mulch, but for ground nesting bees the layers present a barrier to finding suitable soil to build their nests (Dyer, 2006). As most bees are ground nesting there is a need to make sure that there accessible soil to build nests in (Cane, 1992). Frankie (helpabee.org), states that leaving 50% of garden space as bare soil would greatly benefit the many soil nesting native bees.

**Use of Pesticides**

In 2009, Ontario adopted a cosmetic pesticide ban that has made it illegal for retailers to sell chemical pesticides for cosmetic purposes, and for homeowners to apply them on their lawns and gardens. As a reaction to this, pesticide companies have released ‘green’ pesticides to assist homeowners in getting rid of unwanted pests (weeds and insects) in their gardens. Unfortunately, little is known about the effect that these products will have on native bee populations. The change in behaviour since the 2009 ban is unknown, but it is likely that there is still illicit pesticide use to achieve the desired aesthetic.
Key Informants

In order to verify what was revealed in the literature, I sent the list of behaviours to several key informants, individuals involved in bee-related research and advocacy, asking for their opinions and critiques. My key informants were:

- Sheila Colla - Bee Researcher/York University PhD Candidate
- Gretchen LeBuhn - Bee Researcher/SanFrancisco State University Professor
- Sabrina Malach - Bee Advocate/ 2010 Pollinator Advocate Award for Canada
- Thomas Woodcock - Research Associate with NSERC-CANPOLIN
- Scott MacIvor - Bee Researcher/York University PhD Candidate

There was a consensus that these behaviours were valid aspects of the improvement of native bee forage and habitat in suburban neighbourhoods. MacIvor (2012) noted that the connectivity of yards to the immediate landscape is a potential determinant of bee visitation in a garden. Thomas Woodcock (2012) echoed this sentiment, adding that a common thread to individual gardening behaviours is that they often do not recognize that their yard is connected to a greater ecosystem. Scott also noted that mulch is generally not beneficial to bees, but some pollinator species, such as moths and butterflies, benefit from it as a place to hibernate.

CBSM suggests examining the benefits of behaviours with the barriers. This is one flaw with the process, as benefits, or motivations are more closely aligned with identifying behaviours rather than benefits. There are behaviours that are understood to be beneficial in gardening, such as mulch, pesticide use, and floral use, but it depends on the individual's motivations for gardening. Changing the way that people understand the connectivity and impact their garden has on ecological systems, and the impact on
native bee populations, is vital. For this study, I have chosen to explore motivations separate from barriers.

3.2 IDENTIFYING BARRIERS

To identify the barriers that people face in bee-friendly gardening I looked to the literature and interviewed individuals involved in bee-related research and advocacy. I identified the following barriers (Figure 6):

- Availability of specific plant species at the point of purchase
- Adherence to neighbourhood/community norms
- Misconceptions towards the dangers of bees
- Access to knowledge/information

Figure 6: Barriers to bee friendly gardening
Availability of specific plant species at the point of purchase

Box store retailers, such as the Home Depot or Walmart, are fast becoming major players in the do-it-yourself garden industry (Yue & Behe, 2008). In a 2008 study of American floral retail outlet choices, the Box Store was found to be the most likely location for people to purchase garden plants, due to convenience and price (Yue & Behe, 2008). At these locations the average gardener, with limited knowledge of plant species, design and landscape maintenance, is provided with plant stock that is predicated by sale-ability, availability and perceived desire. It is difficult to create change at this level as the bottom line is profit for these companies rather than enabling ecological change.

Adherence to neighbourhood/community norms

Normative behaviour exerts a powerful influence on homeowners’ actions in order to conform to a community standard for landscape aesthetics. Naussauer’s studies revealed that in suburban neighbourhoods there are social norms that promote an unsustainable landscape aesthetic (1995; 1997). The barriers to adhere to the traditional landscape aesthetic can be overcome by applying cues to care and by illustrating that native bee-friendly gardens can be beautiful gardens.

Misconceptions towards the dangers of bees

There is a misunderstanding through much of the general public about the danger of bees to humans. Most people are unaware that half of native bees can not sting because they are male, that most native bees are solitary and therefore do not
have a colony to protect, and that many species are too small to even pierce the skin of
a human. Wasps, Hornets and Yellow-jackets are often mistaken as bees and their
aggressiveness attributed to bees.

Allergy concerns are a reality of bee-human relations. According to some
estimates, 0.3 - 3 % of the population have an allergy to Hymenoptera (bees, ants and
wasps), and in some cases this can be fatal (Reisman, 1994). Despite this relatively low
number of individuals with anaphylaxis, there appears to be a pervasive fear of bees, a
fear that can manifest as a major phobia presenting anaphylaxis-like symptoms at the
mere sight of the a bee.

Access to knowledge/information

Knowledge and information are important ingredients to making the right choices
for sustainable behaviour. In a world of increasing media, there is a danger of becoming
saturated in knowledge, which has the potential to have the adverse response of
rejecting new knowledge. Further, as media becomes increasingly accessible, creating
sources of information has become easy and the validity of the source must constantly
be questioned. Making knowledge easy and accessible, as well as being relevant, is
extremely important.

Key Informants

In order to verify what was revealed in the literature, I sent the list of barriers to
the key informants listed above, asking for their opinions and critiques. There was a
consensus that these barriers were valid, and some amendments and clarifications
were offered. Sabrina Malach and Sheila Colla noted that the plants available through the major suppliers are often hybridized for long bloom periods and vibrant colours, a process that is not beneficial to bees due to changes in pollen availability and flower structure (personal correspondence, 2012). Gretchen LeBuhn added that there might be a perceived economic barrier to implementing a bee-friendly garden (personal correspondence, 2012). Sabrina Malach expressed that there might also be a general lack of care or ethic towards pollinators in general from the public.

3.3 SURVEY

With this knowledge, a survey was designed and administered to determine the degree to which these barriers have an impact on individuals. I identified two general groups to target in order to understand what the barriers and behaviours of people are: those who are enthusiastic about gardening activities and the general homeowner (see Figure 7). The survey was to target residents of the City of Guelph, a mid-sized Canadian city of 120,000 people. Guelph has been rated as one of the most desirable cities to live in Canada, and is noted as one of the fastest growing populations in the country. The survey was delivered online, via surveymonkey.com, a web-based collection and analysis tool.
The Enthusiastic Gardener

For the enthusiastic gardener, three organizations were targeted. The Waterloo Wellington Wildflower Society and the Guelph and Wellington Master Gardeners have a membership of individuals who are knowledgeable of ecological gardening practices and of native plants. The third organization was Pollination Guelph, with a membership that is knowledgeable of the importance of pollinators in an ecosystem. These groups were targeted to discover if the behaviours and barriers identified applied to these potential catalytic individuals.
Waterloo Wellington Wildflower Society

(www.uoguelph.ca/~botcal/)

The Waterloo Wellington Wildflower Society (WWWFS) is a volunteer organization that advocates for the use and conservation of native plants in parks, gardens and other open spaces. Membership includes individuals from a wide range of backgrounds united by a common passion of Canada's native flora. There are approximately 50 members of the WWWWFS and membership is recruited through interest in their display at conferences, plant sales and events. Members of the WWWWFS were contacted through their online listserv.

Guelph and Wellington County Master Gardeners

(www.gwmastergardeners.mgoi.ca/)

The Master Gardeners is an organization started in the United States in 1979 and was initiated in Canada in 1985. Presently 38 groups exist in Canada, with 800 volunteers sharing their passion for plants and gardening. A Master Gardener is an individual who has taken courses in horticulture and successfully passed the Certification Exam delivered by the organization. Members of the Guelph and Wellington County Master Gardeners (GWCMG) are trained volunteers who offer free, non-biased, science-based horticultural information and advice to home gardeners in their community. GWCMG encourages environmentally responsible gardening practices and promotes the enjoyment of gardening. GWCMG shares information and knowledge through a variety of projects and activities. The 36 members of the GWCMG were contacted through their online listserv.
Pollination Guelph

(www.pollinationguelph.ca)

Pollination Guelph (PG) is dedicated to the conservation and development of pollinator habitat for current and future generations. PG promotes awareness and understanding of the importance of pollinators in the local and global ecosystem. PG is responsible for the 45 hectare Pollinator Park to be developed on the site of the decommissioned Eastview Landfill Site, the world’s first pollinator-specific sanctuary (Savage, 2008). PG is operated by a volunteer board of directors representing diverse interests. There are approximately 340 members of the PG listserv, who are recruited through their website, at their yearly pollination symposium and through other community initiatives. Members are not limited to Guelph and are not homogeneous in their social/ethnic/age status. PG is a charitable, federally incorporated non-profit organization. The members of PG were contacted through their online listserv.

The General Homeowner

For the general homeowner, I wanted to choose from two disparate areas of the city in regards to residential character. Guelph has been expanding mainly in the city’s south end with traditional suburban development of single family, detached residences. It was observed that Guelph’s downtown neighbourhoods and the south end developments varied in landscape typology. Field observations noted that the downtown area of the Sunnyacres neighbourhood (SA) was very different from the south end area of the Westminster Woods neighbourhood (WMW) with regards to age, housing type, and street-scape character. By using Statistics Canada census data, I was able to
gather specific information about these neighbourhoods (Statistics Canada, 2006a; 2006b). Though they do not line up directly, the census tracts encompass these neighbourhoods, giving a general sense of the neighbourhoods’ character (see Figure 8).

Figure 8: Sunnyacres and Westminster Woods location in respect to the census tract area
Census Data

• Population Change

Between 2001 and 2006 there was a population increase of the census tract that encompasses WMW of 196% and 69.4% between 2006 and 2011. This is contrasted with a 2.3% increase between 2001 and 2006 and -7.6% between 2006 and 2011 in SA census tract. For the City of Guelph the population changed 8.2% between 2001 and 2006 and 5.5% between 2006 and 2011.

• Number of Households With Children

The number of households with children also is dramatically juxtaposed between the two communities with Westminster Woods having 54% and SA having 16% in 2006. Guelph’s total percentage of homes with children in 2006 was 32%. Reflecting this is the number of one-person households, 9% in WMW, 38% in SA and 24% total in Guelph.

• Age

The median age of people in SA in 2006 was 35.5 years, while in WMW the median age was 33.2 years. Across Guelph the median age was 36.8 years. 16.5% of the population of SA was comprised of individuals over 60, while in WMW those 60 plus only comprise 8.4 percent of the population. The average across Guelph was the same as in SA at 16.5% of the population.

• Housing

The character of the housing mix is very different in the two neighbourhoods. Within WMW, 76.4% of the homes are single detached with a density of 810 people per square kilometer, while 38.2% of SA homes are single
detached with a population density of 3367 people per square kilometer. The average for the City of Guelph is 56.8% of homes are single detached. Apartments less than 5 stories comprise 0.5% of the housing stock in WMW, while in SA they comprise 36.0%. 95% of residences are owned in WMW and 5% are rented, while 53% are owned and 47% rented in SA. This is compared to 71% owned and 29% rented across Guelph.

• Mobility

Of the WMW residents 76% did not reside in their home five years prior to the 2006 census, compared to 54.5% in the SA which is close to the Guelph average of 48.9%. 77.3% of WMW residents and 76.7% of SA residents were not living in their home one-year prior to the 2006 census, below the city average of 83.0%.

Westminster Woods

(http://www.reidsheritagehomes.com/communities/overview/westminster_woods)

This neighbourhood of over a thousand detached homes was chosen because of its observed high percentage of traditional lawn coverage (turf grass/foundation plantings/ornamental trees). Homes received either a flyer in their mailbox, if they had one, or a door hanger if they did not. The flyer and door hanger identified the student researcher and the purpose of the research, and invited the homeowner to complete the survey by providing them with a url (see Appendix 1). Three hundred flyers and door hangers were distributed throughout the neighbourhood and only 4 people responded to the survey. Additionally, 25 individuals were contacted at their door and a request was
made to participate in the survey. No homeowners agreed to participate at that time, and all were given the flyer requesting participation.

**Sunnyacres Community**

Sunnyacres (SA) is a loosely-defined community around the Sunnyacres city park at the corner of Edinburgh Road North and Robinson Avenue in Guelph, Ontario. The residential fabric around the park is made up of century-old homes on mature tree-lined streets. The Sunnyacres Community was reached through their listserv compiled by Village Toolbox inviting them to participate in the online survey. Village Toolbox is a web based tool for building communities by providing an online space for individuals to connect and share. There are 185 people who subscribe to the listserv and the only prerequisite to belong to the group is to be interested in what is happening in the Sunnyacres Community, according to the Village Toolbox administrator.
CHAPTER FOUR: SURVEY RESULTS

4.1 THE RESPONDENTS FROM PG, WWWFS, AND WGMG

These groups were targeted because they are potential early adopters of a program that encourages bee-friendly gardening practices. They are also potential catalytic individuals, or influential individuals, in existing social networks who can facilitate the idea of bee-friendly gardening practices into the community. I will refer to this group of respondents as the target group. The survey was completed by 175 people, 128 who lived within the geographic boundaries of Guelph and 46 lived outside the city boundaries. Guelph is divided into 6 wards, and some generalizations about their residential character can be made (Figure 9 and 10):

- **Ward One - East:** This Ward encompasses the downtown of Guelph and the neighbourhoods to the East. Predominantly older homes closer to downtown, with some newer developments to the East. 21.1% (36) of the respondents were from this ward.
- **Ward Two - North:** Predominately mature single detached residential subdivisions with newer developments to the North. 12.3% (21) of the respondents were from this ward.
- **Ward Three - Centre:** Older, single detached residences, mixed with townhouses and apartments. 14.6% (25) of the respondents were from this ward.
- **Ward Four - West:** Mixed age of subdivision developments, townhouses and apartments. 1.2% (2) of the respondents were from this ward.
- **Ward Five - University:** Predominately mature single detached residential subdivisions 18.7% (32) of the respondents were from this ward.
- Ward Six - South: Predominantly newer, single detached subdivision developments. A great deal of residential development is presently occurring in this ward. 7.0% (12) of the respondents were from this ward.

- Outside the City of Guelph: No generalizations can be made about the residential character of these respondents. 25.1% (43) of the respondents were from outside Guelph.

Figure 9: Guelph Ward Map
Expansive Turf Grass Lawns

Lawn coverage had a great deal of variety in responses from the target group, with the majority of respondents stating that they had some lawn, but that it did not cover the majority of their properties (Figure 11). 67.4% (113) of the total respondents had lawn on under 50% of their yard, and the remaining 42.6% (62) stated that they have lawn on more than 50% of their yards. Properties with expansive lawns, or lawns on over 75% of the yard, represented 14% (25) of respondents.
Filtering the responses by Ward, the biggest difference existed with 83% of respondents from Ward Three and only 41.6% of Ward Six respondents having lawn covering less than 50% of their yards.

The target group does not perceive their lawns as being overly important to the home landscape with 37.1% (65) stating not important, 31.4% (55) stating slightly important and 25.7% (45) stating moderately important. Only 4.0% (7) responded that their lawn was very important and 1.7% (3) responded extremely important.

**Immaculate Yards**

The most important use of the yard for respondents was as wildlife habitat and nature observation with 38.1% (67) and 33.7% (59) stating extremely important respectively. Kids play area and pet play area were perceived as the least important uses of the yard by respondents (Figure 9).

<table>
<thead>
<tr>
<th></th>
<th>Not Important</th>
<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
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<tbody>
<tr>
<td>Relaxation</td>
<td>4.0%</td>
<td>10.7%</td>
<td>15.8%</td>
<td><strong>41.8%</strong></td>
<td>27.7%</td>
</tr>
<tr>
<td>Socializing</td>
<td>8.6%</td>
<td>16.7%</td>
<td>29.9%</td>
<td><strong>31.6%</strong></td>
<td>13.2%</td>
</tr>
<tr>
<td>Kids Play Area</td>
<td><strong>44.4%</strong></td>
<td>17.5%</td>
<td>14.0%</td>
<td>15.2%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Nature Observation</td>
<td>1.7%</td>
<td>11.4%</td>
<td>20.0%</td>
<td>33.1%</td>
<td><strong>33.7%</strong></td>
</tr>
<tr>
<td>Pet Play Area</td>
<td><strong>44.9%</strong></td>
<td>13.2%</td>
<td>17.4%</td>
<td>15.0%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Home Value Improvement</td>
<td>20.8%</td>
<td>15.6%</td>
<td><strong>32.4%</strong></td>
<td>23.7%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Leisure</td>
<td>5.7%</td>
<td>9.1%</td>
<td>26.9%</td>
<td><strong>37.1%</strong></td>
<td>21.1%</td>
</tr>
<tr>
<td>Wildlife Habitat</td>
<td>4.5%</td>
<td>6.8%</td>
<td>22.2%</td>
<td>28.4%</td>
<td><strong>38.1%</strong></td>
</tr>
</tbody>
</table>

Figure 9: How would you rate the following uses of your yard?
Gardens were viewed as being important to the home’s landscape with 33.7% (60) responding very important and 51.7% (92) responding extremely important. There was an overwhelming enjoyment of gardening as an activity amongst the respondents (Figure 10).

![Bar chart showing the level of enjoyment of gardening.]

**Figure 10: Do you enjoy gardening?**

Of the respondents, 79.1% (136) stated that their yards had some degree of naturalization, 15.7% (27) did not and 5.2% (9) were unsure. Of the 50 respondents that perceived barriers to naturalizing part of their yard, 40% noted that the biggest barrier would be neighbour disproval, 36% stated lack of knowledge of how to care for it, 34% believed that it would look messy (Figure 11).
Figure 11: What would prevent you from naturalizing part of your yard?

Non-Beneficial Plants

The perception of native plant knowledge among the respondents was very high, with 10.4% (17) stating expert knowledge, 28.8% (47) stating knowledgeable and 38.7% (63) stating some knowledge. Only 1.8% (3) respondents stated that they had no knowledge of native plants. 85.9% (152) of respondents had native plants in their yards, while only 4.0% (7) stated they did not, and 10.2% (18) were unsure. The quantity of native plants in yards was high, with 51.4% (91) of respondents stating over 11 native plants in their yards, 15.8% (28) stating 6-10, 16.9% (30) stating 1-5, and only 3.4% (6) stating that they did not have native plants in their yard. 84.7% (150) of respondents stated that they had flowering perennials throughout the entire growing season.
**Extensive Mulching**

50.6% (90) of respondents stated that they only mulched ‘some’ of their gardens, 33.1% (59) stated they mulched all of their gardens, and 14% (26) said that they do not mulch at all. Of the respondents, 66.7% (118) stated that they had bare soil areas in their gardens.

**Availability of Plants**

Responses for where the individual will purchase plants, trees, or shrubs was varied. There was a high response for neighbours, friends, and family with 72.7% (125), nurseries with 69.8% (120), plant sales with 64.5% (111), start from seed with 61.0% (105) and specialty nursery with 55.8% (96) of respondents. Among this group, box store retailers and grocery stores received the lowest responses with 37.8% (65) and 26.2% (45) respectively (Figure 12).

![Figure 12: Where do you obtain plants, trees or shrubs?](image-url)
Respondents stated that if they were unable to find a plant they were looking for, 57.1% (92) would ask a staff member in order to make an alternative choice, 52.2% (84) would trust their own knowledge, 44.1% (71) would read labels on plants, and 44.1% (71) stated that they would go to another store. The lowest responses were attributed to not purchasing with 19.9% (32) and using a smart phone application with 5.0% (8).

**Plant Choice**

Ecological function, how it will look, when it flowers and care requirements were the most influential factors for plant choice. Trends and how it compared to other gardens in the neighbourhood received were the least influential on the individual (Figure 13).

![Figure 13: What is likely to influence your plant choice decision?](image-url)
The biggest perceived barriers to achieving an ideal landscape were time and money with 76.7% (124) and 67.5% (110) of responses respectively. Site constraints and lack of knowledge were also notable as perceived barriers (Figure 14).

![Figure 14: What prevents you from achieving your ideal landscape?](chart)

Connectivity

The importance of yards being connected to the natural areas of the city was perceived to be important to the respondents with 17.8% (30) stating moderately important, 37.9% (64) stating very important, and 32.0% (54) stating extremely important. Only 4.1% (7) stated that it was not important ad 8.3% (14) stating slightly important (Figure 15).
Figure 15: How important is it to you that your yard is connected ecologically to the natural areas of the city?

Misconceptions of Bees

The perception of the danger of bees was rated low among the respondents, with 60.5% (104) stating no threat and 37.2% (64) stating slight threat. 1.7% (3) of respondents stated the bees were moderately threatening and 0.6% (1) perceived bees to be extremely threatening. Conversely, respondents perceived bee value to humans as extremely high, with 82.6% (142) stating extremely important, 16.9% (29) stating very important and 0.6% (1) stating moderately important (Figure 16 and 17).
No respondents viewed bees as either not important or slightly important. Respondents reported that they enjoyed seeing bees in their yards, with only 5 respondents stating that they or someone in their home was allergic to bees. 60.7% (105) perceived not enough bee abundance in their yards, 27.7% (48) stated that there was enough, and 1.2% (2) responded too many.

**Access to Knowledge**

The means by which individuals obtain information about plants and landscape maintenance were very similar, with the internet and books being the most common and smart phone applications being the least used (Figure 18).
Engagement

The likelihood of the individual engaging in an environmentally significant activity that a neighbour was engaged in was high, with 24.6% (42) stating that they were moderately likely, 36.8% (63) stating very likely, and 32.2% (55) stating extremely likely. Very few people believed that their likelihood of engagement would be low, with 1.8% (3) stating not likely and 4.7% (8) stating slightly likely (Figure 19).
4.2 THE RESPONDENTS FROM SUNNY ACRES

Thirty individuals responded to the survey from the SA listserv. They all revealed that they lived in Ward Three. The responses will be presented in the same way that the data from the target group for clarity and ease of comparison.

Expansive Turf Grass Lawns

Of the SA respondents 33.3% (10) stated that their yards were covered with less than 75% of lawn, 30.0% (9) less than 50%, and 26.7% (8) less than 25%. Two respondents stated that they had no lawn on their property. The SA respondents viewed the lawn as having little importance to the home landscape with 26.7% (8) stating not important, 33.3% (10) stating slightly important and 23.3% (7) stating moderately important. Only 13.3% (4) stated very important and 3.3% (1) stated extremely important.
**Immaculate Yards**

Respondents revealed that relaxation, kids play area, socializing, leisure and nature observation were perceived as important uses of the yard. Pet play area was viewed as the least important, and home value improvement was viewed as fairly low (Figure 20).

<table>
<thead>
<tr>
<th>Uses of Yard</th>
<th>Not Important</th>
<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation</td>
<td>3.3%</td>
<td>3.3%</td>
<td>16.7%</td>
<td>56.7%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Socializing</td>
<td>6.7%</td>
<td>6.6%</td>
<td>20.0%</td>
<td>46.7%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Kids Play Area</td>
<td>10.0%</td>
<td>0.0%</td>
<td>13.3%</td>
<td>50.0%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Nature Observation</td>
<td>6.7%</td>
<td>3.3%</td>
<td>36.7%</td>
<td>36.7%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Pet Play Area</td>
<td><strong>46.7%</strong></td>
<td>20.0%</td>
<td>13.3%</td>
<td>10.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Home Value Improvement</td>
<td>6.7%</td>
<td><strong>36.7%</strong></td>
<td>20.0%</td>
<td>23.3%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Leisure</td>
<td>6.9%</td>
<td>6.9%</td>
<td>27.6%</td>
<td><strong>44.8%</strong></td>
<td>13.8%</td>
</tr>
<tr>
<td>Wildlife Habitat</td>
<td>10.0%</td>
<td>16.7%</td>
<td><strong>36.7%</strong></td>
<td>23.3%</td>
<td>13.3%</td>
</tr>
</tbody>
</table>

**Figure 20: How would you rate the following uses of your yard?**

There was a mixed response of enjoyment of gardening from the SA respondents; 3.3% (1) do not enjoy gardening, 13.3% (4) enjoy a little, 36.7% (11) enjoy and enjoy a lot, and 10.0% (3) are passionate. The garden was perceived as having importance to the home’s landscape, with 46.7% (14) stating very important and 26.7% (8) stating extremely important.
53.3% (16) of respondents stated that their yards had some degree of naturalization, 26.7% (8) did not and 20.0% (6) were unsure. Of the 15 respondents that perceived barriers to naturalizing part of their yard, 40% (6) believed that it would look messy and that they lacked the knowledge of how to care for it (Figure 21).

![Bar Chart](image)

**Figure 21: What would prevent you from naturalizing part of your yard?**

**Non-Beneficial Plants**

Of the SA respondents, 83.3% (25) of gardens have perennials blooming throughout the entire season. There was a low perceived knowledge about native plants with 7.7% (2) stating no knowledge, 34.6% (9) stating little knowledge, and 42.3% (11) stating some knowledge. Only 11.5% (3) stated knowledgeable and 3.8% (1) stated expert knowledge. 76.7% (23) of respondents claimed that they had native plants and 23.3% (7) were unsure, no respondents stated that they did not have native plants.
**Extensive Mulching**

Among the SA respondents, 36.7% (11) stated that they mulch all of their gardens, and an equal number said that they only mulch some, while 26.7% (8) stated that they do not mulch any of their gardens. 60.7% (18) of respondents stated that their yards had areas of bare soil.

**Availability of Plants**

Individuals largely obtained their plants from neighbours, friends or family, and from nurseries (Figure 22).

![Figure 22: Where do you obtain plants, trees or shrubs?](chart)

If the individual was unable to find a specific plant, 56.7% (17) would most likely ask a staff member, and 40.0% (12) would read the labels on plants, while 30.0% (9) would trust their own knowledge, 23.3% (7) would not purchase, 20.0% (6) would go to another store and 10.0% (3) would use a smartphone application.
Plant Choice

What influences people's plant decisions is largely based on aesthetics with 83.3% (25) stating that their choice is based on how it will look, and 63.3% (19) stated when it flowers. Of the respondents, 60% (18) stated how much care it would require, 56.7% (17) stated the cost, 46.7% (14) stated its ecological function and its colour, and 40.0% (12) stated that the height would influence a plant decision. Neighbourhood comparison received and trends the lowest responses with 3.3% (1) and 0% (0) respectively (Figure 23).

Figure 23: What is likely to influence your plant choice decision?

Barriers to achieving an ideal landscape were time and money with 79.3% (23) and 82.8% (24) responses respectively. Site constraints and lack of knowledge were also notable as perceived barriers with 55.2% (15) and 44.8% (13) respectively (Figure 24).
Connectivity

The importance of yards being connected to the natural areas of the city was perceived to be important to the respondents with 33.3% (10) stating moderately important, 43.3% (13) stating very important, and 13.3% (4) stating extremely important. 6.7% (2) stated that it was not important and 3.3% (1) stated slightly important (Figure 25).

![Figure 25: How important is it to you that your yard is ecologically connected to the natural areas of the city?](image)
**Misconceptions of Bees**

The perception of the danger of bees was rated low, with 63.3% (19) stating no threat and 36.7% (11) stating slight threat, and conversely their value to humans was perceived to be high, with 76.7% (23) stating extremely important and 10.0% (3) of respondents equally stating moderately and very important (Figure 26 & 27).

![Figure 26: How much of a threat are bees to humans?](image)

![Figure 27: How important are bees to humans?](image)

Respondents reported that they enjoyed seeing bees in their yards, with 1 respondent stating that they or someone in their home was allergic to bees. 46.7% (14)
of respondents perceived that there are not enough bees in their yards and 36.7% (11) stated that there was enough.

**Access to Knowledge**

Individuals predominantly use the internet to access information about plants, trees and shrubs, as well as about landscape maintenance. Books and neighbours rated high as well for access to information (Figure 28).

![Figure 28: Where do you obtain information about plants/maintenance?](image-url)
Engagement

The likelihood of the individual engaging in an environmentally significant activity that a neighbour was engaged in was somewhat high with 43.3% (13) stating that they were moderately likely, 23.3% (7) stating very likely, and 20.0% (6) stating extremely likely. Very few people believed that their likelihood of engagement would be low, with 3.3% (1) stating not likely and 10% (3) stating slightly likely (Figure 29).

Figure 29: Are you likely to engage in an environmentally significant activity that your neighbours are engaged in?

4.3 RESPONDENTS FROM WESTMINSTER WOODS

There were 4 responses to the online survey from the Westminster Woods area. This is too few responses to make any conclusions about the neighbourhood. This low participation could be attributed to:

- Ease of Participation - The listserv respondents were presented with a linked url address, while the homeowners in Westminster Woods had to manually enter the address. Also, for the listserv recipients the message was received while they were at their computer, making the medium for completing the survey readily available.
• Interest in Topic - As a gardener or as an environmental or pollinator advocate, the
members of the listserv were contacted because they have an interest in this topic.
The recipients of the flyer may have had a much lower interest or knowledge of
gardening or of pollinators than the listserv members.

• Time - The recipients of the flyers in Westminster Woods are potentially reluctant to
participate in any door-to-door solicitation. It is believed that the burden of interviewing
in everyday life as a means of data collection has left people overly selective in their
choice of participation (Fontana & Frey, 2005). This reluctance to participate limits the
effectiveness of the survey, but illustrates the importance of the number of responses
that were received in the other groups. The target group and the Sunnyacres group
showed that they are interested in the topic and willing to participate.

• Time it was delivered - When the survey requests were delivered it was in the month
of February, and was extremely cold.
CHAPTER FIVE: DISCUSSION

5.1 REVISITING THE BEHAVIOURS AND BARRIERS

The survey results were consistent with many of the behaviours and barriers pulled from the literature and from key informants. In the next section I will revisit the behaviours and barriers that were outlined in Chapter Three.

Expansive Turf Grass Lawns

Having lawn covering less than 50% of an average-sized yard would greatly increase the capacity of forage and of nesting sites. The target group and the SA group both showed a trend towards a reduction in lawn coverage, yet the turf grass lawn is still a valued element of the yard. Though the majority of respondents did not perceive their lawns as having much importance to the home landscape, there are some uses of the yard that turf grass is correlated with, such as kids or pet play area, and socialization. Among the SA respondents, kids play was expressed to be an important use for the yard. Turf grass is a durable and forgiving surface for children to play on, reflecting the perceived need to have lawn for the purpose of play space. Lawns have their place in the home landscape, yet it is the expansive nature of its use that needs to be altered.

In a 1998 field study in the city of Guelph, it was discovered that the older core areas of the city had the highest number of alternative front yard gardens, while the newer suburban areas of the city had the fewest number (Henderson et al., 1998). In the suburban areas there is an overwhelming sense of uniformity of house size, street width and yard size. This homogeneous form is a potential cause for the prevention of lawn alternatives being adopted by suburban homeowners (Henderson et al., 1998).
these areas there is a potential to encourage “transitional lawn” alternatives, a hybrid
design that better fits with the suburban landscape form (Henderson et al., 1998 p.143).

Lawns are intertwined with the understanding of residential landscape form, a
complex and intricate relationship that was not explored in great detail. Encouraging
people to abandon their lawns will not be effective; rather, working around the lawn and
building the connectivity of gardens will be a successful approach to strengthening
native bee habitat in suburban landscapes.

**Immaculate Yards**

The definition of the term ‘naturalized’ was not given to the recipients of the
survey. A naturalized garden can be understood as an effort to utilize regionally-
appropriate plants to mimic natural ecological processes (Johnson, 2001). Whether this
is what the individual recipient understood as naturalization is unknown, but from the
literature and from the respondents there is a perception of messiness and untidiness to
naturalized areas. Common landscape maintenance, or the immaculate yard, can be
thought of as being the opposite of naturalized.

It is encouraging to see that there was a perception of having naturalization in
136 of the 175 target group yards, and that the respondents correspondingly viewed the
use of their yards for nature observation and wildlife habitat. As wildlife habitat is
important to these respondents, there will be a willingness to uptake gardening
practices that will benefit native bees in their gardens. Among those who would not
naturalize part of their yards, the perceptions of neighbourhood norms were reflected
with neighbour disapproval being the biggest barrier for the target group and messiness for the SA group.

The front yard is the public face of the home, believed to be reflective of the values and beliefs of the homeowner. The backyard is more private, and used for a variety of purposes, such as food-production, socializing, or relaxation. Both the target group and the SA respondents viewed socializing as an important use of the yard, and as people inherently care what people think of them, this is tied to yard care. If natural areas of the yard can exhibit *cures to care* (Nassauer, 1995), then they have the potential to fit a social norm of yard care as well as the desire to show a caring for the environment.

The perception of a more natural garden taking more time and financial investment will need to be dispelled. A garden that utilizes more natural elements will require less time and money over time. The time and financial investment to start a garden from scratch is high, as removing turf is labour intensive, plants can be expensive and planning can take time. There is also a paralysis in attempting to try something different for people who are unfamiliar with plant design or care. Tying back into the transitional yard, the promotion of gradual removal of lawn and the slow and purposeful growth of bee friendly gardens will assist people in overcoming the perception of an intensive investment.
Non-beneficial Plants

It was unsurprising, due to the character of the target group organizations that participated in the survey, that there was a high knowledge and use of native plants among the target group respondents. SA respondents stated a moderate knowledge of native plants, illustrating a need for the general homeowner to be provided with tools to choose the right kinds of plants. The effort to have continuous bloom in gardens was high in both groups, illustrating a network of existing gardens that offer potential quality forage for native bees. The ecological function of plants was also deemed to be an important factor in the choice of what plants to use from both groups, demonstrating that if the benefit to nature is provided to the individual this will assist in choosing the right plants. Among the target respondents, there was a high quantity of native plants in yards with the majority of individuals stating that they had over 11 planted. It is difficult to know precisely the character of these gardens, but there is an indication from the survey that there is a network of yards that have the potential to be beneficial to native bee populations.

Extensive Mulching

Mulch has been extolled as the environmental champion of the suburban garden, as to mulch is to conserve water and reduce reliance on pesticides. While this is important, spaces must be made to ensure that native ground-nesting bees can find adequate substrates in order to build their nests. This dichotomy, advantages versus disadvantages of the application of mulch, shows the need for education on proper application. Education can be effective to assist people in mulching their gardens in
order not to impact ground nesting native bees, as well as maintaining the other benefits of using mulch on gardens.

**Pesticide use**

Inquiring if people used chemical pesticides on their gardens would be asking if they were taking part in an illegal activity. This behaviour is difficult to determine in suburban landscape but, because of its major impact upon native bees, it must be addressed. The implementation of cosmetic pesticide bans has created a market for eco-pesticides that are acceptable under these bans. The effects of these organic compounds on bees is unknown, so ensuring proper pesticide use needs to be encouraged, for example, to not apply while flowers are in bloom and not to apply when and where bees are active.

Though not directly explored through the survey, there is a potential understanding that by utilizing naturalized areas and native plants there is a reduced need for pesticides. Also, the low response for the importance of the lawn potentially shows that individuals are becoming less obsessed by the weed free lawn as an important part of their home landscape.

**Availability of specific plant species from nurseries or box stores**

With the rise of the box mall store as a preferred location for plant material comes a potential deterioration of what is available to the consumer. As a barrier this will be challenging to overcome. What will be required is to develop a normative behaviour of choosing stores that stock appropriate plant material, and sourcing plants from
increasingly uncommon outlets. It is encouraging to see that the large percentage of the catalytic individuals are obtaining their plants from nurseries and from plant sales, illustrating an opportunity to promote these as preferred locations. There is a potential to attempt to build a relationship with the large box store outlets, to pressure them to carry the plants that are missing from their stock. When individuals are needing to make an alternative choice, they stated that they would defer to a staff member. This illustrates the need to help improve the knowledge of people and tools involved in the decisions made at the point of purchase.

Adherence to neighbourhood/community norms

Among the major reasons to not naturalize part of the yard was the perceived disapproval of neighbours, illustrating the influence of normative barriers on creating alternative lawn spaces. On the other hand, for both groups plant choice did not correlate with neighbourhood aesthetics, which is interesting as aesthetics have been shown to greatly influence decisions on how to maintain yard spaces. There is an opportunity to build upon social networks that exist in communities, as neighbours, friends and family were the highest plant source for the respondents rather than solely from retail outlets.

The mobility of individuals has a potential effect on the willingness of individuals to tackle a change in their gardening approach. People see the visual quality of their garden as an improvement to the value of their homes, and the willingness to do something unconventional is therefore more difficult. Homes are a major investment,
and if individuals are worried about the value of this investment, making alternative alterations to the garden spaces will be potentially difficult to promote.

Mobility of people is also an issue for the adherence to community norms. Being new to a home, and a neighbourhood, potentially will impact on the amount of change that will be exercised in a homogeneous landscape. The census data illustrated a mobile population in the WMW area, while the core neighbourhood had a slightly more stable population.

In these new neighbourhoods there is a strong correlation between what the neighbourhood looks like and the willingness to change the appearance of front yard gardens. Nassauer (2009) found that what the neighbours prefer was a stronger determinant than what the homeowner wanted. In a landscape where conventional yards prevail, there is more pressure for the individual homeowner to adhere to that typology. There is the potential of worrying what the neighbours will think if major alterations are made to a home's front yard which is perceived as a part of the collective streetscape. Promoting changes to gardens that are not viewed as detracting from the value of a home or the neighbourhood but, rather, are viewed as value added will likely be adopted.

**Misconceptions towards the dangers of bees**

Both the target group and the SA group understood the dangers of bees to be low, and conversely their importance to be high. This is positive for implementing a program specifically for native bees through catalytic individuals. They are likely to adopt bee-friendly planting without having to overcome the barrier of bee fear, which for
many is a paralyzing fear. The perception that the Pollination Guelph members had of bees is not overly surprising, but from the other groups it was encouraging to see that knowledge of the actual dangers and the importance of bees is getting out among gardeners.

**Access to knowledge**

People are getting their information largely from online sources, which presents some problems. The internet is innately fraught with inaccuracies, due to the fact that anyone can post a list of plants or strategies for native bees landscaping. Ensuring that information is regionally specific is also a concern, as what works for California bees will not necessarily benefit Ontario bees.

Neighbours also accounted for a great deal of access to knowledge, presenting an opportunity for social diffusion, but also might present the diffusion of negative behaviours. Ensuring that the catalytic individuals have access to the right knowledge, from the right sources will be instrumental in making sure that positive behaviours are implemented on the ground.

**5.2 CHARACTER OF THE NEIGHBOURHOOD**

The age of the neighbourhoods that the respondents live in potentially has an effect on the acceptance of alternative lawn treatments. Older, more established neighbourhoods are more likely to adopt; rather than newer developments that are purchased from the developer with turf grass installed. The WMW area is very new, as shown by the nearly 200% population change between 2001 and 2006 (Statistics
Canada, 2006a). This is a short amount of time for a neighbourhood to develop a sense of character, while the core neighbourhoods have had decades to build and evolve a unique character.

Diversity of the neighbourhood, in age, socio-economic status, housing type or ownership, has the potential to effect the willingness to challenge social norms. There was some indication in the census data of the difference in diversity between the SA neighbourhood and the WMW neighbourhood. Further, the census data showed that there were more older individuals of retirement age in the SA neighbourhood, illustrating a segment of the population that potentially has more time to spend on gardening.

5.3 COMMUNITY ENGAGEMENT AND CONNECTIVITY

The strength of CBSM is the ability to engage people at the community level through hands-on strategies. There was a perceived willingness to participate in a community-based initiative among the target group respondents, reinforcing the effectiveness of a CBSM program. As well, the target group responded that they believe that it is important to have their yards ecologically connected to the natural areas of the city. This shows that a program can diffuse the ideas of bee friendly gardening by utilizing the existing neighbourhood social networks, exploiting the desire of people to connect with neighbours in doing something for the environment, as well as showing that they are part of building connectivity through the city.
5.4 THE CATALYTIC INDIVIDUAL

The survey illustrated that at the community level there is an existing social network that influences plant use, gardening techniques and aesthetics. Changing behaviours and reducing the barriers towards bee friendly gardening will best be facilitated through these networks. These catalytic individuals possess a passion for gardening, an interest in ecology and natural systems, and a desire to take action that will influence change. Further, these individuals do not seem overly influenced by neighbourhood norms of yard aesthetics, and choose to manage their properties based on personal norms. Exploiting and encouraging this individual to facilitate the diffusion of ideas will enable a grassroots change for the native bees in the suburban landscape.
CHAPTER 6: DEVELOPING STRATEGIES

The strategic tools for behaviour change blend together when targeting a specific barrier. For example, a sticker on the windshield might serve as both a prompt and a commitment, or a sign on the front yard might serve as a prompt and as a commitment but also assist in social diffusion. As I explore the strategies that will assist in the improvement of native bee habitat in Guelph, I will identify how the CBSM strategic tools that were outlined in Section 2.8 apply to each strategy, and illustrate how each will be effective in changing behaviour. Each strategy attempts to follow the guidance of CBSM principles and theories. As well, I will support each strategy with information pulled from the literature review as well as from the survey data.

6.1 THE COMMITMENT

The program should have a simple and clear commitment statement with regard to what is hoped to be achieve: the increased forage and habitat for native bees in the suburban landscape. Pollinators such as birds and butterflies are an easy sell, but bees are a bit more difficult. It would be easy to centre the program around birds and butterflies and hope that bees can find space within an improved landscape, but native bees have much different, and varied, habitat requirements, and people need to understand the irreplaceable role that they play in a healthy and functioning ecosystem. The other pollinators play an important role, but it is bees that are at an elevated risk of disappearing from our landscapes. As well, native bees are, as a group, more effective at pollinating a wide variety of food crops as well as native plants.
The word ‘bee’ conjures up different emotions for people. The fear of being stung as well as the dangers of anaphylaxis should not be taken lightly. Simply substituting ‘pollinator’ for ‘bee’ masks the fear of bees, but dilutes the importance that bees play in our environments.

Behaviours need to be ranked based on their potential impact and probability for adoption. Tier 1 behaviours would have a high impact as well as a high probability of being adopted, and Tier 2 behaviours would have a high impact, but a low probability of them being adopted. Based on the behaviours outlined in Section 3.1, the impact and probability of each behaviour is tiered as follows:

![Figure 33: Tiered Behaviours](image)

Focusing first on the Tier 1 behaviours will make sure that the strategies have the most effect. Once these behaviours have been addressed, the program can move onto Tier 2 behaviours that present more difficult barriers to overcome. The commitment that the
program will be hinged upon will be based on the Tier 1 behaviours and would entail three points to improve gardening for native bees:

- Provide abundant floral diversity
- Provide space for bees to nest and hibernate
- Eliminate the use of pesticides

6.2 STRATEGIES

CBSM states that commitments must be made public and durable in order to be effective (McKenzie-Mohr, 2011). From the literature and the survey data, it is suggested that utilizing the catalytic individual at the community level is an extremely effective and influential way to diffuse ideas through a neighbourhood. The following are strategies to help the individual homeowner achieve their commitment to building bee-friendly habitat in their gardens.

6.2.1 Catalytic Communities and Individuals

Strategy used: Social Diffusion

Behaviour or Barrier targeted: adherence to neighbourhood/community norms, access to knowledge

There are certain neighbourhoods in Guelph that communicate and interact more than others. Enabling these communities to become identified as bee-friendly will help raise the profile of the program initiative (e.g. Sunnyacres). A community with established networks of communication and an enhanced definition of identity is an advantageous place to implement and pilot a CBSM initiative. McKenzie-Mohr believes that communities can also take their efforts out beyond the yard and into parks,
businesses and municipal lands to build better habitat cohesion for environmental initiatives (2011). With a committed population, there is an opportunity to create gardens that exhibit bee friendly gardening that are built and maintained by the community and that will help the ideas diffuse through the neighbourhood and the city.

Often in environmental movements there is the problem of ‘preaching to the choir’, where those who are listening are the converted and those who are not listening need to have their behaviours changed. In this case, the catalytic individual has the opportunity to be in a position where he/she is being listened to and observed, through his/her choice of yard care. The potential catalytic individuals were well spread out through Wards One, Two, Three and Five, yet are largely missing from wards Four and Six. It will be important to assist individuals in neighbourhoods where there are few others who are likely to engage in bee-friendly activities, to help these people change the behaviours of others and strengthen a neighbourhood norm that accepts bee-friendly property management. One way of doing this would be to showcase the individuals who have bought into the program, ensuring that people see what they are doing and will allow for people to see the variety and value of possibilities. The following strategies will assist with this diffusion of ideas.

6.2.2 Signage

Strategy used: Commitment, Prompt, Social Diffusion, Communication

Behaviour or Barrier targeted: adherence to neighbourhood/community norms

The environmental movement is as much about branding as it is about saving the planet. From re-usable bags to hybrid vehicles, the action of choosing the right thing is
validated by a sign or label that identifies the user as committed to pro-environmental behaviour. These become visual cues to who we are, and how we want to be viewed by others.

A sign on the front yard identifies the homeowner as belonging to a group that believes that bees are important to the health of the city. On the sign there is an opportunity to identify the participant further as they might be adopters of other parts of the program such as observation, increased habitat, using only native species, etc. Signs have the potential to publicize the efforts of the homeowner, and bring greater awareness to the program. With a high number of people responding that neighbours would disapprove of the naturalization of part of one’s property, a sign will provide the rationale behind the aesthetics of a garden and convey a message of purpose, akin to the cues to care (Nassauer, 1995). Signs can also help communicate additional efforts by the homeowner. Space for ‘merit badges’, to show that the homeowner is also involved in efforts such as observation or certification, or could communicate specific elements of their yard such as using only native plants.
6.2.3 Website

*Strategy used: Commitment, Prompts, Social Diffusion, Communication*

*Behaviour or Barrier targeted: non-beneficial plant species, access to knowledge*

Of the respondents from the target group 94.8%, and 93.1% of the SA group stated that they used the internet to obtain information about plants, and 84% of the target group and 85.7% of the SA group stated that they used it to get information about
landscape maintenance. With such a high percentage of individuals using the internet as a source of information, it is essential to build a strong online presence. The use of the internet presents an opportunity to communicate information, but also solidify commitment, help serve as a reminder, and assist in the diffusion of the initiative. The following elements will prove effective.

**Plant lists**

Access to plant information online was very prevalent among the respondents. There is a great deal of information available online about native plants but, like many topics on the web, finding out what is appropriate and what is good is difficult due to the overwhelming quantity of sites. A Google search of the words “Ontario native plants” yielded 15,300 results. Providing a trustworthy, regionally specific, and program specific plant database will assist individuals in making decisions on what is recommended to improve native bee forage. This database needs to be easy to search, and users must be able to define their searches based on plant traits, such as bloom time, colour, sun/shade requirements and soil type. As there are thousands of plants native to Ontario, it would be helpful to observe what plants are available from the retailers throughout Guelph and inform the plant lists based on this information. For the more informed and active gardener, the native plant database like the one available from Evergreen (evergreen.ca) will offer a nation-wide, searchable native plant database, enabling the user to define characteristics such as ecoregion, growing conditions, flower colour and wildlife attraction. Ontario Wildflowers (ontariowildflowers.com) also has a considerable
amount of information available, yet is not as easy to narrow the search options. Until Pollination Guelph compiles its own database, these sites could be utilized.

**Commitment map/plant map**

There was a high likelihood of individuals engaging in environmentally significant activities that their neighbours were engaged in, as well as an elevated perception of ecological connectivity. People often have a difficult time visualizing how their yard, and their actions, contribute to a city-wide or neighbourhood-wide ecosystem. Respondents illustrated an understanding and appreciation of the ecological function of their gardens. In order to help define commitment to the initiative, there needs to be a visual representation of its diffusion through neighbourhoods and throughout the city. In its simplest incarnation, a map of Guelph with pinpoints noting the location of individual yards that have made a commitment to the initiative will show clustering as well as missing locations.

The map also has the potential to convey a great deal more information about the individual yards (while being sensitive to privacy issues); information about specific plant communities as well as which yards are providing habitat can be communicated. This will illustrate what deficiencies exist in a neighbourhood, as well as the opportunities and constraints that a neighbourhood possesses. For example a neighbourhood might be strong in bee-friendly species that bloom in the spring, but weak in fall-blooming species. This drop in forage is detrimental for generalist bee species, such as the bumble bee, that need plants that bloom throughout the entire season. There would be a constant updating required, or monitoring of this information.
When people move or cease to manage their gardens to benefit native bees, the information illustrating commitment might be misleading.

**Helpful hints/scheduled reminders**

With the high percentage of respondents that stated that they used the internet for maintenance information, a list of helpful hints for individuals to access when they are planting or maintaining their gardens will assist in their decision-making process. Respondents perceived that the major barriers to implementing a naturalized garden were an inability to care for it and that it was too much work. Providing the knowledge that is easy to follow and implement, as well as being time economical, will greatly assist individuals who are wary of naturalized gardens in their yards.

A schedule of reminders can either be emailed out or be a part of a downloadable program that gives important dates for maintenance of gardens that will assist in proper decision making. This would also help in overcoming the barrier of not knowing how to care for a naturalized garden.

**Links**

There is an opportunity to help people to make the right decisions by giving them information on where to buy plants, and what other things they can do. There are a lot of great native bee initiatives occurring across North America and the world, and linking in to these will both raise awareness of these efforts but also motivate participants further in improving their gardens.
6.2.4 Point of Purchase Plant Lists

*Strategy used: Convenience, Prompts*

*Behaviour or Barrier targeted: access to knowledge, availability of specific plant species, non-beneficial plant species*

The choosing of plants needs to be easy for individuals. 57.1% of the target group responded that they would ask a staff member at the retailer to get plant suggestions if they could not find a specific plant species. For non-specialized retail locations, such as grocery stores or hardware stories, the knowledge of plant alternatives lies with seasonal workers who may or may not be able to offer adequate information. As noted above, a list of plants that are beneficial to native bees needs to be easily searched, but access at the point of purchase is essential to assisting in the right plant purchase.

**Smartphone Applications**

At the point of purchase the individual is faced with an overwhelming selection of plants, from perennials and annuals, exotics and natives, spring to fall bloom, and colours, textures and varieties abound. For the rushed, or unacquainted, choosing the right plants to benefit bees is a daunting and frustrating task.

There are an estimated 8 million smartphone users in Canada, 40% of those using mobile technology. Of those 8 million users, 84.2%, or 6.7 million users, used a downloaded application on their phone (comScore, November 2011). A quick scan of Apple’s App Store (http://www.apple.com/ca/mac/app-store/) under the tags “garden” revealed only two applications to help gardeners choose plants. One cost $5.99 and the
other $17.99. There are other native plant apps available but none specific to Ontario. Making the app inexpensive, reliable and relevant will be important if this technology is adopted. The Pollinator Partnership recently released a smartphone application, Bee-Smart, that enables the user to search for native plants that benefit pollinators in the user’s region. The plants can be searched by pollinator type, colour of bloom, sunlight, soil type and plant type.

Despite having a low response in the survey, smartphone applications are an emerging tool that can reduce the barriers to knowledge for the consumer. The convenience of an application for bee friendly plants will enable those individuals who have little time to purchase plants to make the right choice rather than the easy choice while at the point of purchase.

Guides

There are many guides available to help individuals pick plants for a variety of environmental initiatives. It would be beneficial to the program to develop a guide that is specific to the commitment and simple to use, assisting the individual to choose the right plants, and how to care for their yard that will benefit native bees.
6.2.5 Designs

*Strategy used: Convenience, Incentive*

*Behaviour or Barrier targeted: expansive turf grass lawn coverage, immaculate yards, adherence to neighbourhood/community norms*

For many individuals, the process of re-imagining their yards is a difficult process.

There should be two sets of designs for assisting people to begin the process of building proper bee habitat in their yards: the inspiration and the replication. The first design offers the gardeners inspiration to implement bee-friendly gardens in their yards. This would cater to gardeners who have a proficiency, or desire to learn, in design, knowledge of native plants as well as the conditions of their site. The second set would be designs that could be replicated in the garden. This set of designs would cater to the gardener that has little knowledge, skill and time to implement their own native-bee garden.

**Design Guidelines and Recommendations**

In a discussion with bee scientist Gretchen Lebuhn, she proposed the landscape architect and garden designer’s role in improving bee habitat could come in designing small, implementable garden plots that in the aggregate would improve bee abundance and diversity in urban areas (2011). Native bees have habitat needs that are not being fulfilled in traditional gardens. The aesthetics of the suburban garden do not need to be altered dramatically, but specific elements need to exist for native bees. All of the design recommendations should contain (Mader, 2011):
• sunlight
• diversity of flowers with sequential blooming (three species per season minimum)
• clustering of species
• variety of colour
• nesting spaces (either nest boxes or natural substrates)

Nassauer’s (1993; 1995; 2009) research into landscape aesthetics revealed that neighbourhoods are likely to accept a more natural planting design if it exhibits cues to care. There are not a lot of good, executable planting designs specifically for attracting and sustaining native bees. Efforts to build a database of such designs, to fit various types of yards, would be extremely valuable. Encouraging people to get on the right track to building bee friendly habitat in their yards will be strengthened by giving bee friendly plants to individuals and allowing them to see that they can be beautiful, easy to care for and beneficial to bees.

Homeowners have an attachment to their lawns that has been shown to be difficult to break. An effort to reduce the amount of lawn, rather than trying to replace it outright, will prove to be an effective approach. Encouraging the idea of transitional yards - spaces that incorporate turf grass lawn but build on the garden space for habitat and forage - will satisfy both the community’s desire for a tidy aesthetic and the need for forage and nesting space for bees.
6.2.6 Partnerships

Partnering with a local nursery and having them create a section of their retail space to showcase bee friendly plants will further help individuals make proper choices at the point of purchase, but will also help diffuse and raise the profile of the initiative. This could be accompanied by educational material to foster the growth of the program. This can be linked to the buying club strategy (see Section 6.2.7).

Building a relationship with box store retailers will improve the availability of native plants in the city. The impact of this would be great given the number of people who shop at these locations. It would be of great interest to the program to explore the potential partnership with larger retail outlets.

Other partnerships that should be strengthened are with local horticultural societies, clubs or interest groups. These could include, but should not be limited to, the Master Gardeners, the Wildflower Society, Transition Guelph, etc. Partnering with these groups will build visibility for the program; it will also gain valuable allies for facilitating diffusion of bee-friendly gardening through the city.

6.2.7 Native Plant Suppliers

Strategy used: Convenience

Behaviour or Barrier targeted: availability of specific plant species

Of the respondents who stated that they have expert knowledge of native plants, the location of purchase was largely from nurseries, as well as from plant sales. There needs to be a reliable supply of native plants to make a program encouraging the use of these plants successful. There is an economic opportunity for some of the native plant
growers to partner with a local nursery or group to get their plants to the public. As the choice of plants was predicated on its ecological function, if individuals are made aware that native plants are beneficial to ecosystem function there needs to be the plants available for purchase.

There is an opportunity also for Pollination Guelph to partner with local high schools that offer horticultural programs to grow plants and supply them to local plant sales. This would improve the supply for both the demonstration gardens as well as for the residential homeowner.

6.2.8 Buying Club

*Strategy used: Commitment, Incentives*

*Behaviour or Barrier targeted: Availability of specific plant species*

A buying club will assist members of the program to purchase their plants from retail outlets that stock species that are beneficial to bees. Partnering with local businesses and having them offer a discount on native, bee friendly plants can be purchased by individuals who have bought into the program. This would benefit both the program and the businesses, as the plants that are needed to be purchased are being encouraged. The business’ benefit as the consumer likely will purchase other items for their gardens not covered by the buying club program. This effort could also take the form of coupons for retailers for a percentage off the specific plants’ prices.
6.2.9 Certification

Strategy used: Commitment, Social Diffusion, Incentives

Behaviour or Barrier targeted: expansive turf grass lawn coverage, immaculate yards, adherence to neighbourhood/community norms, non-beneficial plant species

There is an opportunity to encourage people to take further ownership in improving their properties, but also validating what they have already done. The Canadian Wildlife Federation’s Back Yard Habitat Certification Program encourages people to build landscapes that have food sources, water sources, cover and places to raise young for a variety of species (www.cwf-fcf.org). The program is free to join and assists CWF conservation efforts by compiling data on yards across the country. The application process is filling out a number of checkboxes and requests to describe the character of the property.

Certification is a potential way of commending and publicizing the efforts of individuals as well as making the program more visible by combining with signage. There is also an opportunity to certify neighbourhoods, or sections of the city, and possibly the entire city of Guelph. The CWF uses the minimal 30% of yards participating to qualify a town for certification (Powell, 2011).

Other examples of yard certification programs are the National Wildlife Federation’s “Garden for Wildlife” (www.nwf.org), North American Butterfly Association (www.nababutterfly.com) and Monarch Watch’s “Monarch Waystation” initiative (www.monarchwatch.org). A brief online scan of these programs illustrates that they all ensure that the site is identified with a sign, as well as ensuring that the site fits certain
species-specific requirements. The financial cost is minimal with all of these programs, ranging from free to 20 dollars.

6.2.10 Observation

Strategy used: Commitment

Behaviour or Barrier targeted: misconceptions towards the dangers of bees

Citizen Science is becoming a popular way for individuals to contribute to the scientific understanding of native bees in the urban environment. Apart from benefiting science, observation programs encourage the participant to become more intimately connected with the bees that are making use of their yard, as well as the ecological processes that are occurring there. Initiatives such as The Great Sunflower Project, TObee and Pollination Canada’s observation program. The Great Sunflower Project is an initiative by San Francisco State University bee researcher Gretchen LeBuhn. The program encourages people to grow *Helianthus annuus* ‘Lemon Queen’ sunflower in their gardens, and then twice a month to spend 15 minutes observing and recording bee visitations to that sunflower. Over 26,000 individuals have participated in the program with more every season. Pollination Guelph can either tap into this initiative or can begin their own collection program.
CHAPTER 7: CONCLUSION

7.1 SUGGESTIONS FOR PILOTTING

The piloting of the program is essentially a test run for the effectiveness of the strategies outlined in Chapter 6. A small scale pilot of the program is recommended, focusing on the neighbourhood scale, and then observing how the program is received and how it diffuses through the neighbourhood. The catalytic individual has the potential to facilitate the piloting of the program and determining its effectiveness. Individual strategies should be rolled out individually, to determine their effectiveness on combating behaviours and barriers. To start, using the website and yard signs would see the effectiveness of the strategy against the adherence to community or neighbourhood norms. As the program builds, other strategies should be added to the program and changes can be observed (Figure 35).

Figure 35: Steps for implementing strategies

There needs to be an element of data collection to determine factors influencing the uptake of the program; as well, observation by the participant will allow a better understanding of the manner in which the program is received in the neighbourhood. An understanding of how the participant came to adopt the program would help in strengthening the channels where the program is distributed. As well as having the
participant observe how the neighbourhood around them reacts to the program. For example, did they receive any negative feedback, feelings of social disapproval, or pressure to change what they are doing. On the other hand, it would be good to know about the positive interactions that they have with their neighbourhood. These observations will help to better design the program’s effectiveness.

7.2 SUGGESTIONS FOR IMPLEMENTATION AND EVALUATION

Once the program has gone through the piloting stage and strategies are tested, it will be ready for broad-scale implementation. McKenzie-Mohr suggests that local advertising outlets be employed to broadcast the message of the program. These local media, newspapers, radio or television, could be employed if the program does not seem as though the social networks of gardeners are effectively conveying the message. I am confident that social diffusion through catalytic individuals will be an effective process for the advertising of the program.

Constant evaluation and monitoring needs to occur as the program evolves to ensure its continued success. Modifying the pilot program’s evaluation tools will help in monitoring the program’s strengths and weaknesses, as well as the participation of individuals.

7.3 CBSM REFLECTION

The process of using the theories and principles of CBSM was effective in gathering information about the behaviours and barriers to native bee-friendly planting. The book *Fostering Sustainable Behaviour*, is essentially a road map to creating a
program for a specific environmental issue. The way it is laid out and organized makes it easy to see the rationale behind the principles. There were some aspects of the CBSM process that I found too rigid in application to this specific project, and an explanation of how to modify the principles to best fit the specific program would be helpful. Overall, CBSM is an effective tool to employ to encourage people to change their unsustainable behaviours, and adopt behaviours that are more sustainable and environmentally sensitive.

7.4 RELEVANCE TO LANDSCAPE ARCHITECTURE

This study is essentially about the retrofitting of the suburban landscape to improve ecological diversity. This will be essential as human populations grow and habitat is degraded. It would be an ideal situation if developers and policy makers changed the impact of the transformation of natural landscapes into suburban landscapes, but unfortunately the financial needs of human society often trumps ecological systems. Understanding how landscape architects can impact the individual homeowner in altering their landscape to better reflect the needs of ecology.

Landscape architects are involved in residential landscape design and can endeavour to design gardens and spaces for their clients that support and encourage biodiversity. Ecological design is becoming an interdisciplinary approach to changing the impact that human development has natural systems, and Landscape Architects will play an important role in re-designing the places we live.
7.5 SUGGESTIONS FOR FUTURE STUDY

The study of native bees is a fascinating and valuable discipline. Scientists are exploring the abundance and diversity of native bees in suburban landscapes, and their continued devotion to the study will uncover a picture of bees’ status. Native bees are adaptable to a degree, but have fundamental needs for their survival. The homeowner on the other hand can change their behaviours to build better habitat and forage for native bees. Possible research questions that address the behaviours of homeowners are to examine the barriers and behaviours of the homeowners in newly developed suburbs towards creating alternative gardens, the spatial relationship between alternative gardens in suburban landscape through social diffusion, and the relationship between the age of a neighbourhood and the likelihood of engaging in alternative gardening. Examining the role of the subdivision developer in providing ecologically relevant landscapes to the consumer, as a norm rather than a choice, will simplify the uptake of bee-friendly gardens in suburban landscapes.

Another topic that arose through this research, was the impact that small garden plots, and aggregate changes can make to the abundance and diversity of native bees in the suburban landscape. Also, examining the availability of plant species, bee-beneficial plants, or availability of information at the point of purchase, will be helpful in understanding what is available to the homeowner.

This thesis explored the utilization of CBSM to influence an individual's actions for native bee gardening, yet it can be applied to many different environmental issues applicable to landscape architecture. CBSM programs could be employed to encourage
gardeners to plant for specific species, use rare plants or for the reduction of water in gardens.

7.6 FINAL THOUGHTS

As biodiversity declines, human populations increase and individuals become increasingly isolated, the community, or the places we live, must become a place where we connect with others, learn new ideas, and interact with our environment. Improving the habitat and forage requirements of native bees is part of the process of encouraging people to see their yards differently, to understand that our actions are connected to ecosystem function. Native bees are an extremely important part of a healthy and functioning ecosystem. To achieve a landscape that provides bee habitat, there needs to be a fundamental shift in our understanding of how neighbourhoods are designed, and how the actions of individuals can support and encourage biodiversity.


APPENDICES
APPENDIX 1: Flyer delivered to Westminster Woods Homes

Dear Homeowner,

My name is Ben O’Hara. I am a University of Guelph student conducting research in your neighbourhood.

Please consider taking the time to complete my survey on gardening in urban residential neighbourhoods.

The survey will take approximately 10 minutes to complete.

You can find out more about my research and complete the survey at:

www.surveymonkey.com/s/guelphgardens

I appreciate your time with this.

Thank you Ben O’Hara
APPENDIX 2: Survey

Consent

Student Researcher: Ben O'Hara
Master's of Landscape Architecture
School of Environmental Design and Rural Development
519-824-4120, ext. 56576
bohara@uoguelph.ca

Advisor: Dr. Karen Landman
Landscape Architecture
School of Environmental Design and Rural Development
519-824-4120 ext. 53748
klandman@uoguelph.ca

CONSENT FORM

The purpose of this research is to gain an understanding of the barriers to pollinator
friendly gardening techniques in urban residential neighbourhoods. This research will
benefit the development of healthy and diverse natural habitat in the City of Guelph. There
is no risk attributed to your responses.

This survey will take approximately 10 minutes.

This research is approved by the University of Guelph and conforms to the principles set
out by the University's Research Ethics Board. For more information contact the REB at:
reb@uoguelph.ca
University Centre, Room 437
519-824-4120 ext. 58024

By agreeing you are consenting to have your responses become a part of this research
project.

Your participation in this survey is completely voluntary.

You do not need to answer every question.

You may discontinue your participation at any time during the survey.
If you choose to quit the survey any time before the end, your responses will automatically be deleted and not be counted in the research.

The survey does not ask for your name or address.

Your responses cannot be withdrawn after the survey is submitted and therefore your responses will remain completely confidential. This survey is subject to US privacy laws. More information can be found at http://www.surveymonkey.net/mp/policy/privacy-policy/

If you would like to know more about the results of this research, please visit the website http://guelphgardensurvey.wordpress.com after May 30th, 2012.

Please print this Consent Form for your records.

☐ Agree

☐ Disagree
What City of Guelph ward do you live in?
If unsure see map below

- Ward One - East
- Ward Two - North
- Ward Three - Centre
- Ward Four - West
- Ward Five - University
- Ward Six - South
- Outside the City of Guelph

Other (please specify)
**How much of your yard is covered by lawn?**

- [ ] 0%
- [ ] less than 25%
- [ ] less than 50%
- [ ] less than 75%
- [ ] greater than 75%
- [ ] 100%

**How important is your lawn to your home’s landscape?**

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<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
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**How important are the following uses of your yard? (gardens and lawn)**

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<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
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<td>Leisure</td>
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<td>[ ]</td>
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<td>[ ]</td>
</tr>
<tr>
<td>Wildlife Habitat</td>
<td>[ ]</td>
<td>[ ]</td>
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</tr>
</tbody>
</table>
Do you enjoy gardening?

Rate

How important is your garden(s) to your home’s landscape?

Rate

Does your garden, as it is planted now, have flowering perennials throughout the entire growing season?

Yes
No
N/A

Do you have areas of bare soil in your yard or garden?

Yes
No

Do you mulch your gardens? (excluding vegetable gardens)

Yes - all
Only Some
No
N/A
Does your yard have some degree of naturalization?
- Yes
- No
- Unsure

What would prevent you from naturalizing part of your yard?
Choose all that apply.
- Looks messy
- Too much work
- Don't know how to care for it
- City will not allow it
- De-values property
- Too much money
- Attracts wildlife
- Neighbours won't like it
- Don't know what naturalization means
- Nothing would prevent me

If you were provided a free design, with plant list, to implement a naturalized area in your yard (approximately three m2) how likely would you be to implement it?

<table>
<thead>
<tr>
<th>Rate</th>
<th>Not Likely</th>
<th>Very Likely</th>
</tr>
</thead>
</table>

If you were provided with a free plant that is beneficial to bees - how likely would you be to plant it in your yard and take care of it?
- Not Likely
- Likely
### How would you rate your knowledge of native plants?

<table>
<thead>
<tr>
<th>Rate</th>
<th>No Knowledge</th>
<th>Little Knowledge</th>
<th>Some Knowledge</th>
<th>Knowledgeable</th>
<th>Expert Knowledge</th>
</tr>
</thead>
</table>

### Do you have native plants in your yard?
- Yes
- No
- Unsure

### Can you estimate how many native plants you have growing in your garden?
- None
- 1-5
- 6-10
- Over 11
- Unsure
If you answered "Not Likely", what would prevent you from using this plant?

Choose all that apply

☐ I like to make decisions on what gets planted
☐ I have a design in mind and new plants don't fit in
☐ It would attract bees

Other (please specify)
Where do you obtain plants, trees or shrubs?

Select all that apply.

- Box Store Retailer (i.e., Home Depot, Rona, Canadian Tire, Walmart)
- Grocery Store (i.e., Metro, Zehrs, Price Chopper)
- Nursery (i.e., Meadowvale, Royal City)
- Specialty Nursery
- Plant Sales
- Neighbours, Friends, Family
- Start from seed
- Don't buy plants
- Other (please specify)

If you are unable to find a specific plant where you purchase, how would you make an alternative choice?

Select all that apply

- Ask a staff member
- Read labels on plants
- Trust own knowledge to make decision
- Go to another store
- Smart phone application
- Would not purchase
- Other (please specify)
What is likely to influence your plant choice decision?

Select all that apply.
- How it will look in my garden
- When it flowers
- Its ecological function
- The colour
- How much care it requires
- Height
- Cost
- Trends
- Recommendations
- How it compares to other gardens in neighbourhood
- Other (please specify)

Have you ever utilized one of the following for advice about plants, tree and/or shrubs?

Choose all that apply.
- Internet
- Book
- Pamphlet
- Neighbour
- Garden Centre
- Smart Phone Application
- Garden Club
- Horticulturist
- Landscape Architect
- Landscaping Company
- Television Program
- Radio Program
- Other (please specify)
Have you ever utilized one of the following for advice about landscape maintenance?

Choose all that apply.

- Internet
- Book
- Pamphlet
- Neighbour
- Garden Centre
- Smart Phone Application
- Garden Club
- Horticulturalist
- Landscape Architect
- Landscaping Company
- Television Program
- Radio Program
- Other (please specify)
If you see a bee in your yard, what comes to mind?

Choose all that apply.

- Quick - KILL IT!!!
- Get the kids inside!
- I'm allergic (or someone in my home is)
- I wonder what it is doing?
- Great to see nature in my yard.
- Ignore it and it will go away.

Other (please specify)

### How would you rate the abundance of bees in your yard?

<table>
<thead>
<tr>
<th></th>
<th>Way Too Many</th>
<th>Too Many</th>
<th>Enough</th>
<th>Not Enough</th>
<th>Absent</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td></td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

### How much of a threat are bees to humans?

<table>
<thead>
<tr>
<th></th>
<th>No Threat</th>
<th>Slightly Threatening</th>
<th>Moderately Threatening</th>
<th>Very Threatening</th>
<th>Extremely Threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
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</table>

### How important are bees to humans?

<table>
<thead>
<tr>
<th></th>
<th>Not Important</th>
<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
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</thead>
<tbody>
<tr>
<td>Rate</td>
<td></td>
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</tbody>
</table>
What prevents you from achieving your ideal landscape?

Choose all that apply.

- Time
- Money
- Too much effort
- Lack of ability
- Lack of knowledge
- Site constraints
- Other (please specify)

How important is it to you that your yard is connected ecologically to the natural areas of the city?

<table>
<thead>
<tr>
<th>Rate</th>
<th>Not Important</th>
<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
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</table>

Are you likely to engage in an environmentally significant activity that your neighbours are engaged in?

<table>
<thead>
<tr>
<th>Rate</th>
<th>Not Likely</th>
<th>Slightly Likely</th>
<th>Moderately Likely</th>
<th>Very Likely</th>
<th>Extremely Likely</th>
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