How Ontario's urban householders manage their ecosystem: A ten-year study in Kitchener-Waterloo

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

As much of the growing population of North America is accommodated within cities or on their fringes, one needs to understand how these people are managing their private outdoor space. Within the cities of Kitchener and Waterloo, Ontario, Canada a randomly selected set of residential occupancies were surveyed in 1994 and 2004 about their yard landscaping and maintenance practices. Parallel mail-out questionnaires were delivered to more than 1,000 randomly selected addresses in both 1994 and 2004. Approximately 30 percent of surveyed occupancies completed the questionnaire in both years. Over one-third of respondents from both 1994 and 2004 were matched together based on individual, household, or address information. The matched respondent results were used to validate similarities and identify any inconsistencies between survey years. In general, matched respondent trends did not differ substantially from the overall study trends.

This study found that much of the outdoor space on residential properties consists of turfgrass lawn. Lawns were the dominant form of landscaping in both 1994 and 2004. Although respondents' attitudes towards lawns shifted slightly in favour of more gardens in the 2004 survey compared to 1994, respondents' actual landscaping styles and behaviours did not follow suit. Regardless of minor differences in attitudes between survey years, turfgrass was reported to be present in more than 85 percent of respondents' yards. On average, lawns were estimated to cover more than half of respondents' total private outdoor space in both 1994 and 2004. Likewise, more than 60 percent of respondents in both survey years indicated that their yard reflected a monoculture lawn. When compared with five other styles of landscaping, the monoculture lawn was found attractive and well-liked by approximately half the respondents in both survey years. In addition to the prevalence and preference for lawns, lawns were seen as practical to maintain as: the majority of respondents had a lawnmower – mostly gas-powered; respondents were willing to spend almost $200 a year to water their lawn, on average; the application of chemicals, particularly fertilizers, was common with approximately half the respondents; and more than 40 percent of respondents were willing to pay lawn-care professionals to look after their yards. Lawns were also perceived to be the landscaping style most acceptable to neighbours. Thus, given the ubiquitousness of lawns in urban residential environments, the presence of lawns not only represents the yard design preferences of homeowners, but is part of deeply entrenched societal norms.

With assistance from the media and advertisements, these implicit societal norms were found to influence household attitudes and preferences towards what is dubbed ‘lawn-scaping’. As confirmation of these subtle norms, more than 60 percent of respondents in both survey years agreed that ‘a yard has to have a lawn’. However, these landscaping norms are also explicitly established in municipal property regulations and lot-maintenance by-laws. Hence, the lawn landscape is implicitly linked with social norms and explicitly articulated in legal agreements, making it the unquestioned standard of landscaping styles. It is concluded that a change in local policies and regulations, along with greater education and awareness, will lay the foundation for more alternative styles of landscaping within urban residential areas.

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Chapter 1.0 - Introduction

1.1 Introduction

Throughout history, humans have interacted with the natural environment in a way that has drastically changed natural places into built environments, places where human-made structures dominate the landscape. As urbanization outpaces the preservation of natural areas, urban areas are also bringing about many changes in natural environments on local, regional and global scales. These changes have seen recent attention in literature and the media. 'Urban ecology' is comprised of the many dimensions of the ever-changing relationship between the natural and built environments. Collins *et al*. (2000) questions how ecology, the study of natural systems at the community level, fits with the urban dynamics of human populated areas. The authors suggest ways of modifying ecological theories to include human behaviour from different social science perspectives. Urban ecology is an interdisciplinary attempt at linking human behaviour characteristics in urban areas with ecological theories in natural environments. While ecology and its processes have long been studied in isolation from urban environments, human behaviour and attitudes have also been studied independently from their environmental setting until very recently.

This study proposes to further understand the human behavioural characteristics common in urban residential areas and to link these traits with current environmental knowledge, understanding, and responsibility. My research will employ a longitudinal approach to understanding residential behaviour and environmental attitudes in a typical North American mid-sized city. In 1994, a mail-out questionnaire on yard landscaping and maintenance practices was distributed to a random heterogeneous sample of households in Kitchener and Waterloo, Ontario, Canada. In 2004, a matching mail-out questionnaire was distributed to the same sample of households in Kitchener and Waterloo, with additional households added to the sample based on urban/suburban growth throughout both cities. As there are considerable environmental implications from private yard management, this work will significantly expand the body of knowledge on the relationship between social behaviour and attitudes and urban ecological issues in residential areas.

1.2 Problem Statement

The ecological function of urban areas has recently received attention from scientists (In particular researchers from the Baltimore Ecosystem Study including: Costanza 2003; Pouyat 2003; Pickett *et al*. 2001; Breslav *et al.* 2000; Grimm *et al*. 2000; Zipperer *et al*. 2000; Nilon, Berkowitz, and Hollweg 1999; and Flores *et al.* 1997) because of the unique interactions between the natural and urban environments. However, environmental research in urban areas often lumps aspects of the city into one 'urban' variable or may separate the components into industrial, institutional, and commercial areas.

Residential areas tend to be overlooked as they are generally seen as less environmentally degraded than other important land uses in a city. In addition, residential neighbourhoods are often politically sensitive areas when discussing environmental regulations, controls, and other major proposals or neighbourhood changes. For example, NIMBY (Not In My Back Yard) is the acronym often used to describe residents and neighbourhood associations that fight politically and legally to prevent unwanted projects in the vicinity of residential areas. Despite the political sensitivity of residential areas, until recently, little research has been conducted to prove or disprove whether these areas are less environmentally degraded than their other urban counterparts.

In general, there is limited information on the relationship between residential areas and the natural environment even though low density residential areas typically account for upwards of 50% of most land in urban municipalities (Ingram 1999). In terms of planning, there is relatively little public direction on environmental awareness about how urban households should manage their lots, despite the substantial fraction of each city that is 'residential'. Except through a few older ordinances in Canada such as the Ontario Weed Act and regional by-laws, homeowners are given wide reign on their style of yard management. It has now been recognized that residential yard management practices are responsible for degrading air, and surface- and ground water in urban areas. Moreover, water usage and public health (i.e. mosquito control) implications stem from lot maintenance practices. Therefore, urban planning departments are often without quantified, reliable, and local datasets to aid in understanding this complex relationship between natural and urban residential environments. A longitudinal study of urban residential attitudes and behaviour towards yard maintenance practices will provide key insights into further understanding the environmental and social implications of yard management. This information will be valuable for identifying social behaviour and environmental attitude trends over a decade, especially when residential lot maintenance practices are little understood or documented in Canada.

1.3 Research Objectives

Several recently published studies suggest that urban yard care and maintenance practices reflect societal norms and expectations, while most municipal by-laws also shape the management of private outdoor space. Yard-care practices are also believed to be influenced by demographics, location, economics, and environmental attitudes. It is assumed that these environmental and socio-economic variables can be determined by social survey responses from two postal questionnaires administered in different decades. This type of data has implications for identifying respondents: environmental attitudes and awareness; yard behaviours and uses; financial and weekly time constraints for yard maintenance;

response change over time individually and collectively; and motivations for managing and landscaping residential yards.

Many authors have recognized the link between environmental degradation and urban residential yards. However, an in-depth study that quantifies this relationship through an analysis of homeowner responses to questions of maintenance practices has not been published in Canada. The objectives of this thesis are to combine the results of two parallel surveys to:

- Learn how urban Canadian homeowners maintain their yards with respect to chemical inputs, landscape practices, and yard aesthetics;
- Understand the attitudes of urban households and investigate any linkages with yard maintenance and landscaping practices; and
- Identify any substantial changes between sampling years and categories of respondents.

Most related literature has originated from data collected within the United States. Although it is likely that urban residential behaviour and lot maintenance practices are at least somewhat mirrored in Canadian urban areas, none of the published literature from the United States suggests that its results and conclusions can be transferred beyond its borders. It is assumed that a longitudinal study of two neighbouring Canadian cities will pave the way for a greater understanding of yard behaviour and attitudes of urban households in Canada. This descriptive research should reveal whether Canadian urban residents follow after their neighbours to the south in this capacity or whether Canadians tendency for yardscaping and maintenance are different.

1.4 Study Site

I selected for study the twin cities of Kitchener and Waterloo, Ontario, Canada (43°27'N 80°30'W and 43°28'N 80°32'W, respectively). Located in the Grand River watershed of southern Ontario, approximately 100 kilometers from Toronto by road (Government of Ontario 2005), Kitchener and Waterloo comprise two of three cities in the Regional Municipality of Waterloo. These cities were initially selected in 1994 because home ownership was known to be higher than other cities of similar size and the timing of the study coincided with a government funded initiative to explore many environmental, social and planning themes in the region. In 2004, a parallel survey was distributed in these cities for consistency and comparability of datasets between survey years. Kitchener and Waterloo were specially chosen as they are typical of southern Ontario mid-sized urban centers and have many similarities with other northeastern North American cities in general.

The political 'state of play' regarding pesticides and pesticide use within the Region of Waterloo have been changing rapidly throughout the preparation of this thesis. This thesis reflects the situation in Kitchener and Waterloo up until September 22, 2005.

1.4.1 Climate

The local climate is characterized by warm summers and mild winters with a mean annual temperature of approximately 6°C (Environment Canada 2004c). The average growing season is May through September with an average annual high and low temperature of 11.8°C and 1.6°C, respectively (City of Kitchener 2004). Precipitation is evenly distributed throughout the year with a mean annual rainfall of 765 mm and a mean snowfall accumulation of 160 cm (Environment Canada 2004c; City of Kitchener 2004).

1.5 Thesis Organisation

This thesis is organized into eight chapters. Chapter 2 discusses relevant literature to the urban yard maintenance and landscaping problem, setting the context for the hypothesis and discussion of survey results. After a brief look at the study environment in Chapter 3, the hypothesis is presented using alternatives to frame the comparison between surveys. The methods used to carry out the surveys are described in Chapter 4. The results of both the 1994 and 2004 surveys are presented and illustrated in Chapter 5. Chapter 6 discusses the results and clarifies the interpretation of the results. Chapter 7 concludes by synthesizing the ideas and results into two major themes. Chapter 8 presents recommendations and ideas for taking the next step towards understanding urban residential yard landscaping and managing this issue in the future.

Chapter 2.0 - Literature Review

2.1 Overview

My research should have a unique and important niche in urban ecology planning. According to Pickett *et al*. (2001), urban ecology encompasses any exchange of materials and influence between cities and surrounding landscapes. Urban growth has led to increasing energy demands (Anderson *et al*. 1996), problems of access and transportation (Murray *et al*. 1998) and issues of urban vegetation cover, vegetation diversity, and greening potential (Tjallingii 2000; Attwell 2000). Together these components, in conjunction with urban land use planning, ecological connectivity, patch dynamics, biodiversity, invasive species establishment, and the social dimensions of urban ecology are being explored under the rubric of urban ecology (Rudd, Vala, and Schaefer 2002; Pickett *et al.* 2001; Niemela 1999; Botkin and Beveridge 1997; Rookwood 1995). Foundational considerations of urban ecology issues have also been examined to determine whether cities and urban areas should be treated as one integrated ecosystem, or as a mosaic of sub-ecosystems (Rebele 1994). In summary, the concepts identified from the literature explore the evolving perspectives and issues in urban ecology and ecosystems.

Few studies clearly recognize or distinguish the complex relationship between built and natural environments. However, more authors (Pickett *et al*. 2001; Zipperer *et al*. 2000; Niemela 1999; Rebele 1994) understand that human influences on the urban ecosystem cannot be explained by ecology alone but, rather, that interdisciplinary research is necessary to graft ecology into urban planning theories and contexts. Rookwood (1995) argues that if the present landscape is a snapshot of the ever-changing interaction between man and nature, then human action is a component of all ecosystems. Only recently have traditional ecological theories been undergoing modification to include human behavioural strategies (Collins *et al.* 2000). In the scientific community, many sources provide information on specific aspects of this relationship between built and natural environments, but few recognize how to view all the specialized research as information on the urban ecosystem as a whole. Thus, current research is on the cusp of integrating both human behavioural approaches and ecological theories in urban areas, referred to by Bookchin (1993) as 'social ecology'.

2.1.1 Impervious Surfaces

As urban development sprawls over adjacent lands, increasing portions of impervious surfaces result. Roads, parking lots, driveways, roof tops, sidewalks, and other impervious structures decrease the surface area for groundwater recharge in urban areas (Hamilton and Waddington 1999). The effect of urbanization and its concomitant imperviousness has been well studied and understood since the 1960s (Antoine 1964; Leopold 1968; Brater 1968; and Lull and Sopper 1969). These surfaces have also been

long identified as a legitimate variable for measuring the intensity of the urban environment (Espy *et al.* 1966; Stankowski 1972). Recognized for their impact on habitat and watershed health, impervious surfaces are an important indicator of environmental quality (Arnold and Gibbons 1996).

Urbanization significantly changes the ratio of pervious to impervious areas. This change from pervious surfaces – forested land, wetlands, fields, agricultural lands and other forms of open space – to impervious ones creates significant changes for the landscape, particularly watershed systems (Brabec *et al.* 2002). Changes in quality and quantity of stormwater runoff are a major focus for watershed planning. Arnold and Gibbons (1996) note that although an impervious surface does not directly generate pollution, a clear link has been made between impervious surfaces and the hydrologic changes that degrade water quality. Bannerman *et al.* (1993) understand that changes in stormwater runoff ultimately lead to degraded stream and watershed systems through increased quantity of stormwater for stream systems to absorb, increased sedimentation, and an increased pollutant load carried by the stormwater.

For years, evaluating imperviousness using percentage cover ratios has been a method to estimate urban environmental quality and hydrologic function. Much of the effort of early research (Sullivan *et al.* 1978; Stankowski 1972) was devoted to compiling the percentage of impervious cover within specific land use classes (Table 2.1). In early research, compiled by Brabec *et al.* (2002), impervious surface ratios in urban environments are shown to vary considerably with land-use types. For example, Table 2.1 shows that residential lots could have at least 50 percent less impervious cover than the average commercial lots. However, Brabec *et al.* (2002) understand that although increasing parcel size results in more pervious area per site, imperviousness per capita still increases, mostly due to the additional roadway lengths necessary to access the larger lots. Therefore, impervious surface ratios differ between and within urban land cover classes, although it is understood that imperviousness as a whole is much greater than the original land use, whether it was rural, agricultural, forested, swamp or uncultivated land.

2.1.2 Pervious Surfaces

The pervious sections in urbanized areas are all that remain to conduct water to the groundwater aquifer systems. However, various types of pervious land cover in urban areas can negatively impact stream quality and environmental function. While impervious surface cover is the dominant determinant of stream quality (Brabec *et al.* 2002), several studies (Ross and Dillaha 1993; Booth and Jackson 1997) show how pervious cover affects peak flows, water quality, and contributes to urban runoff.

Table 2.1 - The percentage impervious area ascribed to various land use categories, showing the Total Impervious Area (TIA) used in various studies (adapted from Brabec *et al.* 2002)

	Percentage TIA							
Land Use Category	Cooper (1996)[a]	Taylor (1993)[b]	Alley and Veenhuis (1983)[c]	City of Olympia (1995)[d]	Stankowski (1972)[e]	Griffin *et al.* (1980)[f]	USDA (1986)[g]	Rouge Program Office (1994)[h]
Study Location	--	Seattle	Denver	Seattle	n/a	n/a	New Jersey	Detroit
Agricultural land/ open space	5	2-5	--	–	0	--	--	1.9-2.0
Public and quasi-public	--	--	--	–	50-75	--	--	–
Parks	5	5	--	–	0	--	--	10.9
Golf courses	5	20	--	–	--	--	--	–
Low-density single-family residential	10	< 15 (< 1 u/ac.)	--	–	12	14-19 (0-2 u/ac.)	12 (1 u/ 2 ac.)	18.8
Medium-density single-family residential	35	20 (1-3 u/ac.)	13-16 (1-2 u/ac.)	–	25	34-42 (2-8 u/ac.)	20 (1 u/ac.)	37.8
"Suburban" density 4 u/ac	--	–	22-31 (2-4 u/ac.)	–	--	--	25	–
High-density single-family residential	60	40 (3-7 u/ac.)	30-49 (> 4 u/ac.)	40 (3-7 u/ac.)	40	25-48 (8-22 u/ac.)	30 (3 u/ac.) 38 (4 u/ac.)	51.4
Mobile Homes	--	70	--	–	--	--	--	–
Multifamily	--	80 (> 7 u/ac.)	53-64	48 (7-30 u/ac.)	60-80	47-65 (> 22 u/ac.)	65 (8 u/ac.)	–
Commercial	90	60-90	66-98	86	80-100	89-96	85	56.2
Industrial	--	–	60	–	40-90	--	72	75.9
Highways	100	100	--	–	--	--	--	52.9
Construction site	--	50	--	–	--			–

NOTE: The number of land use classes varies considerably between studies. USDA = U.S. Dept. of Agriculture

a. Abstracted from Alley and Veenhuis (1983), Pyrch and Ebbert (1996), Taylor (1993), Beyerlein (1996).

b. From King County Surface Water Management Division (1990), Department of Public Works, and PEI/Barrett Consulting Group (1990), Snoqualmie Ridge Draft Master Drainage Plan.

c. Based on direct measurement from aerial photos and field inspection from nineteen basins in the Denver area.

d. Total impervious area percentages compiled from County Surface Water Management (1990); PEI/ Barrett Consulting Group (1990), Snoqualmie Ridge Draft Master Drainage Plan; Alley and Veenhuis (1983); and for the open land/ agricultural land category, estimated based on similar land uses.

e. No discussion of methodology for determining impervious figures.

f. The source for the percentage imperviousness figures is not indicated in the report

g. Based on general field observations and studies by Carter (1961), Felton and Lull (1963), Antoine (1964), and Stall et al. (1970). These reference studies are not New Jersey specific.

h. Measured from aerial photographs and a field survey of three sample areas per land use category in each watershed.

The management of pervious areas must maximize the soil infiltration rate by causing less water to run off, potentially increasing the amount entering groundwater reservoirs (Hamilton and Waddington 1999). However, construction procedures and various pervious surface types have been found to negatively affect infiltration rates. Booth and Jackson (1997) and Hamilton and Waddington (1999) cite original lot construction activity as a principal factor for changing soil profiles through the compaction of

soil in many urban settings. The construction history on pervious surfaces determines the ability to absorb or shed rainfall. In a different type of study, Ross and Dillaha (1993) simulated a rainfall event on six different pervious surfaces – gravel driveway, bare soil, cold-season grass, warm-season turf, mulched landscape, and meadow – and found that runoff characteristics were significantly different between them (Table 2.2). The gravel driveway and bare soil acted more like an impervious surface, although these would not normally be included in impervious calculations, while the mulched landscape produced no runoff. Even areas typically considered completely pervious such as a grassed lawn do not absorb all the rainfall. Despite many authors (Morton *et al.* 1988; Gross *et al.* 1990; Petrovic 1990) demonstrating that only the most intense rain fall events generate significant amounts of runoff on turfgrass, complete hydrologic characteristics are largely unknown for urban lawns. Moreover, since most pervious fractions in urban areas are in the form of lawns planted with turfgrass (Hamilton and Waddington 1999) and the percentage of lawn appears to differ widely between lots, a better understanding of lawn or yard maintenance practices is necessary to determine infiltration rates, runoff potential, and water quality. McKenzie (1996) set the hydrological context for investigating urban residential yards.

Table 2.2. Comparison of runoff characteristics for a variety of pervious surfaces (after Schueler 1995; and Brabec *et al.* 2002)

Surface	RV (Runoff)	Nitrate	Soluble P	TSS
Gravel driveway	0.51	0.03	0.06	692
Bare soil	0.33	0.32	0.79	1935
Cold-season grass, sodded	0.05	0.31	1.12	29
Warm-season turf	0.03	0.44	0.33	43
Mulched landscape	0.00	None	None	None
Meadow	0.00	None	None	None

NOTE: RV = runoff volume; P = phosphorus; TSS = total suspended solids

Hamilton and Waddington (1999) observed that the lowest infiltration rates were found on lawns that had recent excavation, while the lawns that had no previous excavation were among the highest rates of infiltration measured. Although higher levels of lawn maintenance, including mowing, applying fertilizer and pesticides, and dethatching may sometimes increase infiltration rates in the long term, the disturbance of soil during construction appears to be the largest factor affecting infiltration. Despite the type of surface cover, Booth and Jackson (1997) found that excavated land is at best only partially pervious, even long after development has taken place. Hamilton and Waddington (1999) conclude that

excavation procedures and lawn establishment methods appear to affect infiltration of home lawns more than any other factors such as grass tiller density, soil bulk density, and percentages of sand, silt, and clay.

2.1.3 Residential Landscapes

The vegetation in residential landscapes provides numerous environmental and aesthetic benefits in urban environments (Rowntree and Nowak 1991; Hull 1992). A study on residential landscape preferences in Wisconsin by Mudrak (1983) found that the majority of respondents highly valued the presence of natural landscape elements in urban residential areas. Aside from providing aesthetic surroundings for human living, urban residential landscapes can afford increased wildlife habitat; improved groundwater recharge; protection against soil erosion; and microclimate control through shade and windbreaks (McBride 1977; McPherson *et al.* 1988; Beard 1994). In Wisconsin, Mudrak (1983) discovered that homeowners may have multiple sets of landscaping preferences. In short, individual homeowners may favour a type of landscape for their yard, but may prefer different types of landscaping for the neighbourhood, city or regional landscape. Moreover, landscape attributes can differ between locations, environments, and homeowner preferences. Martin *et al.* (2003) reported that ease of maintenance and landscape aesthetics were the two traits considered most important by respondents for their landscapes.

Property values are commonly perceived by homeowners to reflect styles of residential landscaping. In addition to the ecological benefits, landscape plantings and aesthetics tend to increase property values (Ravlin and Robinson 1985), sometimes by up to 20% (Hardy *et al.* 2000) and are often a key factor when purchasing a home (Correll and Knetson 1978; Anderson and Cordell 1988). Although residential landscapes are often designed for human purposes (Martin *et al.* 2003), they provide the means by which people can contact nature on a daily basis (Niemiera *et al.* 1993; Garber and Bondari 1995).

Residential landscape design is not always a reflection of the homeowner. Neighbourhood community associations may govern homeowner landscape practices under covenants agreed to by the owner upon purchase of a home. These communities may dictate plant materials and control homeowner landscape activities under the premise of preserving community property values (Martin *et al.* 2003). In the Phoenix metropolitan area, a study by Martin *et al.* (2003) compared landscaping practices between neighbourhoods with and without landscaping covenants. Respondents reported similar landscape attitudes and preferences, regardless of the presence or absence of a regulating body.

2.2 The Historical Context of Gardens and Lawns

Despite grass plants (*Poaceae*) first appearing over 70 million years ago (Appendix 1), only within the past 200 years have turfgrass lawns become the most popular form of urban landscape (Schultz 1999). The residential lawn can be defined as 'land covered with grass kept closely mown, especially in front of or around a house' (Guralnik and Friend 1960). For many centuries, grasses have enhanced people's quality of life and recreational pursuits as well as aided in the protection of the global environment (Beard 1994). Throughout history, grasses have been used as design elements as in ancient Persia, the emperor's gardens in China, and for the wealthy and powerful in Europe. Large swathes of manicured grass, called a lawn, were a luxury in Europe and were the playgrounds of the privileged in early Western life.

The expansion of the middle class at the beginning of the 20th century found many yards in Canada and the United States of America (USA) decorated with ornamental trees and swathed in green lawns (Wilson 1992). Von Baeyer (1984) writes that early 19th century Canadian society expected yards to include an open lawn, unscarred by flower beds, trees, or paths. It was understood in that time that gardening and yard maintenance was a reflection of the homeowner, sending cultural messages that benefited the neighbours, city and nation. Meanwhile, the USA was experiencing a parallel history of yard maintenance and lawn superiority. Vernon L. Parrington wrote in 1904 with regards to the lawn that "in the conventional suburban layout, Americans were more interested in courting the approval of neighbours and strangers than in securing their own comfort and privacy" (Handlin 1979, 167). Notions such as these in both countries served multiple purposes including: contributing to civic beautification; providing an aesthetic remedy from the hardships of life; and showing the morality and wealth of the homeowner to neighbours and strangers (von Baeyer 1984).

After the Second World War, urban areas spread prolifically. Wilson (1992) describes the suburban yard as an open, green landscape with the lawn as its hub. Maintenance of the lawn became convenient and allowed people to have larger lawns with the development of affordable lawnmowers, as their production and sale boomed post-WWII. Soon after the war, the quality of the lawn began to receive attention as native grasses and broadleaf plants were considered inferior to exotic varieties. Ancient lawn species such as Dutch clover (*Trifolium repens*) and dandelions (*Taraxacum officinale* L.) were considered weeds that needed to be removed. Chemicals like herbicides and insecticides were the easy solution to help nonnative grass species survive in many regions of North America and assist in ridding lawns and gardens of weed plants (Robbins and Sharp 2003b), while fertilizers could help lawns to look greener and healthier. To combat unwanted pests, new pesticides and insecticides were developed for the

residential homeowner. It was in this post-WWII era that both lawns and yard maintenance intensified on a large scale (Jenkins 1994).

In the late twentieth century, with the establishment of more accessible suburbs by automobiles and the invention of the lawn mower, the lawn rapidly became an integral part of the Western way-of-life for most people (Wilson 1992; Schultz 1999). Today the lawn remains a ubiquitous and principal landscape feature in urban and rural settings in North America.

2.3 Benefits of Turfgrasses

The benefits of turfgrass lawns have been thoroughly documented in Beard (1994). He discussed three beneficial categories for turfgrass: functional/environmental, recreational, and aesthetic (Fig. 2.1). Urban environments have been specially identified as an area where turfgrass lawns can provide many functional benefits. Gladon *et al.* (1993) reported that certain turfgrasses, such as tall fescue (*Festuca arundinacea* Schreber) are useful in absorbing CO_2, common in urban environments. In addition, turfgrasses can dissipate high levels of radiant heat by the cooling process of transpiration, offsetting some of the urban heat island effect (Beard 1994). Diverse wildlife populations may be better supported in urban areas through an integrated landscape composed of turfgrass, tree, shrub, and water features, such as that found on golf courses (Green and Marshall 1987). Other functional benefits often cited include noise abatement, minimization of soil erosion, suppression of noxious weeds, dust prevention, and nuisance animal prevention (Beard 1994; Adamczyk 1993). These functions provide evidence of the merits of managing turfgrasses in urban areas.

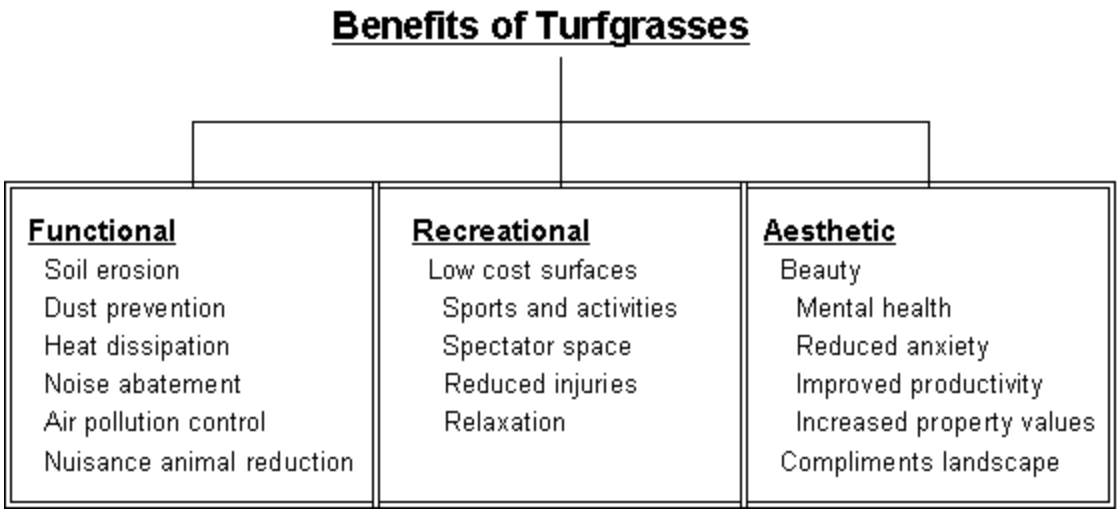


Fig. 2.1 – Summary of benefits derived from turfs (adapted from Beard 1994)

Recreational and aesthetic benefits of well groomed turfgrass have long been understood. Outdoor sports and recreational activities continue to be played on turfgrass lawns all over the world. In contact sports like football, rugby, soccer, and lacrosse, turfgrasses can reduce injuries because of its cushioning effect (Beard 1994). In addition to being aesthetically pleasing, turfgrass lawns can also provide important mental therapeutic benefits. A study by Ulrich (1984) found that hospital patients recovered quicker if given an outdoor view of the landscape including grass and trees. In fact, most city dwellers attach considerable importance to urban areas with views of grass, trees, and open space (Ulrich 1986). Kaplan and Kaplan (1989) found that employees with increased access to turfed landscapes near workplaces had lower levels of perceived job stress. Hence, turfgrass areas not only provide the venue for many recreational activities but these areas can also alleviate mental stresses, improve work and home environments, and complement landscape aesthetics in urban settings.

2.4 Prevalence of Lawns

Urban areas are continuing to expand in land cover in North America. According to the Organisation for Economic Cooperation and Development (OECD), Canada is one of the most urbanized nations. In 2001, 79.4% of Canadians lived in an urban center of 10,000 people or more, compared with 78.5% in 1996 (Statistics Canada 2003). The rate of population growth in urban areas increased 5.2% between 1996 and 2001. As approximately 80% of people in Canada and the United States (U.S. Census Bureau 2002) live in urban areas or are housed on the outskirts of large metropolitan areas (Statistics Canada 2003), studies on the urban environment are of particular importance. Robbins and Birkenholtz (2003) claim that the expansion of turfgrass lawns is parallel to the growth of suburbs, noting that suburbs are growing quickly across the state of Ohio, in particular. They also suggest that lawns are growing in proportion to lot size and that they comprise a significant proportion of total land cover. Roberts and Roberts (1988) estimated that there was about 10 million hectares of turfgrass lawns in the United States. Five years later, Bormann *et al.* (1993) estimated turfgrass covered between 10 and 16 million hectares in the United States. Natural Resources Conservation Service (2000) estimates that urban land in the U.S. has expanded by 675 thousand hectares per year between 1982 and 1997. Assuming the calculations from Robbins and Birkenholtz (2003), lawn coverage could increase by more than 155,000 hectares annually. With this aggregate estimate of total lawn coverage, it appears as though urban lawns surpass the land area of some U.S. crops including barley (5 million ha), cotton (4.5 million ha), and rice (1.1 million ha) (Bormann *et al*. 1993).

Many American homeowners maintain and enjoy a yard with a lawn and/or garden. Butterfield (1999) reports that 47% of American households have a lawn and more than 80% of American

households participate in gardening activities (Behe and Beckett 1993). The average gardening expenditures per household reached $452 USD in 1998, according to the U.S. National Gardening Survey, and spending increased 11% in the previous 5 years (Butterfield 1999). As lawn care ranks highest of all gardening activities in the U.S. (Butterfield 1999), it is safe to assume that most of these expenditures are for lawn care and related activities. These studies underscore the importance and prevalence of turfgrass lawns in residential landscapes throughout the United States.

2.5 Residential Lot Size and Lawn Size

Residential lot size can vary between urban, suburban, and rural locations as well as between cities, planning districts, and provinces (states). The size of properties in U.S. urban areas are typically less than 0.20 hectares (Meyer *et al.* 2001), while 'suburban' lots were found to be larger than 'urban' lots on average (US Census Bureau 1999).

Lawn sizes are highly variable, ranging from several hectares in rural areas to tens of square meters in inner urban areas. Few studies quantify the size of residential lawns. Vinlove and Torla (1995) used formulas to estimate lawn size by state (U.S.), but did not conduct surveys. Numerous surveys have been conducted to assess the value of lawns and turf (Duvall 1987; and Evans *et al.* 1989) but these did not measure or estimate residential lawn size or area. However, a study in Minnesota by Meyer *et al.* (2001) estimated that the average size lawn was 0.25 hectares, larger than the 0.13 hectares previously reported in Minnesota by Vinlove and Torla (1995). Meyer *et al.* (2001) realize that residential turfgrass comprise a significant portion of land in Minnesota and estimate that this figure will continue to increase as urban and suburban developments grow. The Missouri Valley Turfgrass Association (1998) reported an average home lawn size of 0.2 hectares in Missouri, and residential lawns accounted for half of the total turfgrass in the state. Thus, many of the field studies measuring lawn sizes have originated from Minnesota and Missouri. Estimates have been difficult to quantify given the wide spectrum of lawn sizes across the U.S. and Canada.

2.6 Economic Impacts

Some people may see the maintenance of turfgrass lawns as an exercise in aesthetics only. However with this viewpoint, Adamczyk (1993) argues that the lawn would serve no essential purpose beyond the economic aspects of supporting a huge industry that sells products and services for this sector of the market. Robbins and Sharp (2003b) outlined the economic impetus behind the sale of lawn and yard chemicals to urban residents. Cockerham and Gibeault (1985) conservatively estimated that the annual expenditure in the USA for maintaining turfgrass was 25 billion US$. While this estimate assumes

expenditures from all areas of the economy (i.e. industrial, commercial, institutional, governmental, residential, international trade, etc.), it is assumed that this estimate has substantially increased in 20 years. Other surveys have been conducted to assess the value of commercial turf (Duvall 1987; and Evans *et al.* 1989) with results that are difficult to quantify.

In 1999, Meyer *et al.* (2001) reported participants spending an average of 200 US$ annually on their lawns, including new equipment and maintenance. This figure is similar to the reported 190 US$ per household, 8.9 billion US$ nationally, from a National Gardening Association (2000) survey regarding lawn-care-input purchases. However, the Missouri Valley Turfgrass Association (1998) reported a higher expenditure figure, 333 US$ per year on lawn care products, services, maintenance and equipment.

There are some conflicting estimates of lawn-care sales. Butterfield (1999) reports that American households spend 8.5 billion US$ per year on maintaining lawns. The Missouri Valley Turfgrass Association (1998) conducted a state-wide survey and reported that the turfgrass industry was involved in sales of about 1.3 billion US$. In Minnesota, using some lawn care participation rate calculations from Butterfield (1999), Meyer *et al.* (2001) estimated that over 150 million US$ are spent annually on lawn care. In terms of pesticide sales, Templeton *et al.* (1998) estimate that U.S. households spent 1-1.3 billion US$ on pesticides applied outdoors in 1995.

2.7 Lawn Chemicals

The application of pesticides and fertilizers has gradually received increasing attention from the academic and scientific literature since *Silent Spring* was first published by Rachel Carson in 1962. Robbins and Birkenholtz (2003) note that the expansion of lawns and greater use of chemicals on home lawns are offsetting reductions of chemicals deposited on agricultural land, due to land-use conversions involved in the growth of suburban areas. In terms of chemical inputs in suburban areas, Smith (1996) understands the development of suburban areas as a process where one 'produced or artificial nature', that of high-input agriculture, is replaced by another, that of high-input lawns. More than twenty years ago, Watschke (1983) indicated that pesticide and fertilizer use on home lawns was steadily rising. Surface and ground water contamination, attributed to increased nutrients and chemicals, has become a concern for many countries including the USA (USEPA 1995) and Canada (Environment Canada 2004a). Adamczyk (1993) asserts that no pesticide and few other common household chemicals are totally free of hazard. Urban pollution sources are diverse, although most contaminants are delivered from non-point sources, such as lawn and yard chemicals. According to USEPA (1995) estimates, urban runoff only accounts for 12% of the total non-point source load. A study by Hipp *et al.* (1993) found that turfgrass contributes relatively small amounts of nitrogen to surface runoff. However, Osmond and Hardy (2004) explain that

these results reflect the fact that most water moves through the turf, rather than over the turf. Hence, since lawns are purportedly growing with urban population growth, many authors (notably Robbins and Sharp 2003 a & b) are wary of increased application rates of lawn chemicals.

2.7.1 Fertilizers

As lawns became the preferred choice of landscape in urban and suburban residential areas, fertilizers increasingly were relied upon to keep the grass green. The purpose of fertilizers is to increase soil fertility for specified turf grasses as this tips the competitive balance away from a variety of other species. Fertilizers can be synthetic or consist of natural materials, including nitrogen, phosphorous, and potassium compounds. While beneficial and essential nutrients for plant life, high concentrations of nitrogen and phosphorous in water cause eutrophication of rivers and lakes (Varlamoff *et al.* 2001). In addition, high concentrations of nitrates are toxic to humans and other wildlife, while ammonia is toxic to aquatic life (Frick *et al.* 1998). Fertilizer runoff from well maintained urban lawns has been identified as a major source of excess phosphorous in watersheds and a significant contributor to groundwater and surface water contamination (Osmond and Hardy 2004; Brezonik and Stadelmann 2002; Martin, Kaushik, Trevors, and Whiteley 1999; Morton *et al.* 1988). A study by Line *et al.* (2002) recorded higher nitrogen losses from established residential areas, golf courses, and new construction sites than from a fescue pasture or newly established residential areas.

A study by Carpenter and Meyer (1999) showed that many homeowners 'don't know' how much fertilizer to use on turfgrass. Lack of information may account for over-applications of fertilizers and other chemicals by homeowners, ultimately increasing lawn runoff. Thus, fertilizers can assist the growth of plants, but in high concentrations may become detrimental to watersheds and toxic to humans, terrestrial and aquatic life.

2.7.2 Pesticides

The use of pesticides – defined in general as chemicals used to kill pests, such as rodents, insects, or other plants – has become a major issue in Canadian and U.S. urban environments. Weed-free lawns and landscaping are appreciated by much of the population for their aesthetics and for recreation, as well as attracting premium house prices (Luttik 2000), but these environments are increasingly controlled by heavy chemical inputs (Bormann *et al.* 1993; Jenkins 1994). Homeowners reported that comfort, safety from pests, and enhanced appearance of yards were the benefits of using outdoor pesticides (Templeton *et al.* 1998). On U.S. lawns, the most commonly used home pesticides (including both herbicides and insecticides), according to a survey by the EPA, are shown in Table 2.3 (Robbins *et al.* 2001). In southern Ontario, Struger *et al.* (1995) conducted a study that involved two streams and stormwater detention

ponds where water samples were taken and a pesticide use questionnaire was circulated to neighbouring residents. The results highlight the diversity of pesticides used by residents and note the higher application rates in urban areas versus those in agricultural settings for a number of chemical compounds. The United States Geological Survey (USGS 1999) published similar results - 99% of urban stream samples contain one or more pesticides with insecticides being detected more often and at higher concentrations in urban watersheds than in non-urban systems. The four major insecticides detected in this study included Chlorpyrifos, Diazinon, Carbaryl, and Malathion, all exceeding the U.S. Environmental Protection Agency guidelines for protection of aquatic life (Frick *et al.* 1998). Lawns are assumed to be a significant contributor, despite a range of urban sources (Robbins and Sharp 2003b). Thus, in North America, urban environments are exposed to more chemically diverse compounds, if not more chemicals than in rural or agricultural areas. As scientific study advances, more detailed knowledge on pesticide types, toxicity, levels, and effects in urban scenarios will become known.

Table 2.3. Pesticides Used on U.S. Lawns[a]

Pesticide	Mkg Active[b]	Half-life (days)	Type	Use	Toxicity (EPA)[c]	Environmental Toxicity
2,4-D	3-4	10	Systemic phenoxy herbicide	General	Slight to High	Birds, Fish, Insects
Glyphosate	2-3	47	Non-selective systemic herbicide	General	Moderate	Birds, Fish, Insects
Dicamba	1-3	14	Systemic acid herbicide	General	Slight	Aquatic
MCPP	1-3	60	Selective phenoxy herbicide	General	Slight	NA
Diazanon	1-3	21	Non-systemic organo-phosphate insecticide	Restricted	Moderate	Birds, Fish, Insects
Chlorpyrifos	1-3	60+	Broad-spectrum organo-phosphate insecticide	Restricted	Moderate	Birds, Fish
Carbaryl	1-2	28	Wide-spectrum carba-mate insecticide	General	Moderate to High	Fish, Insects
Dacthal (DCPA)	1-2	90+	Phthalate compound herbicide	General	Low	Birds, Fish

[a] Following (Robbins and Birkenholtz 2003; Robbins and Sharp 2003)
[b] Millions of kilograms of active ingredients used in the United States 1996 (U.S. Environmental Protection Agency (EPA) 1996)
[c] Toxicity risks based on the standards of the U.S. EPA (Extension Toxicology Network 2000)

2.7.3 Herbicides

Herbicides are chemicals designed to eliminate unwanted plants. In residential yards, herbicides are applied to kill 'weed' plants and improve the appearance of turfgrass lawns. Selective herbicides control certain plant species without seriously affecting the growth of others, while nonselective herbicides kill plants regardless of species (Frick *et al.* 1998). Of all landscape chemicals found in urban watersheds, herbicides are often detected in the highest concentrations (Varlamoff *et al.* 2001). A popular selective herbicide treatment for lawns, 2,4-D and other phenoxy herbicides have been found to increase the probability of pet cancer (Hayes *et al.* 1995). While herbicides increase grass growth rates and eliminate weeds, they are often over-applied in residential yards and lawns (Frick *et al.* 1998).

2.7.4 Insecticides

Insecticides are chemicals developed to kill problem or nuisance insects. Despite recent concerns from U.S. consumers, insecticides markedly improve the surface appearance of edible produce and flowers (Varlamoff *et al.* 2001). Although suspected as human carcinogens (Day *et al.* 1995), insecticides still play a prominent role in the yield of many vegetables and flowers and yard aesthetics regardless of potential health and safety concerns. Insecticides are used to treat lawn pests such as the larvae from the root-eating beetle and are often applied on landscape trees as well as lawns and gardens. Typical broad range insecticides (Carbaryl, Chlorpyrifos, Diazinon, and Malathion) have appeared in high concentrations in urban watersheds (Varlamoff *et al.* 2001). Insecticides are still widely used on residential yards and lawns despite rising health concerns from repeated exposures (OMA 2004).

2.7.5 Fungicides

Thousands of species of parasitic fungi cause plant diseases. Fungicides are used to treat harmful fungi, but are the least popular of pesticides, accounting for only 5% of pesticides (by volume) used by homeowners (Varlamoff *et al.* 2001). Fungicide use among homeowners is low for a number of reasons including the difficulty in identifying fungal diseases, results that are not immediately apparent, cost, and the frequency with which they must be reapplied (Varlamoff *et al.* 2001). Spraying is the common application method on lawns. Compared with other outdoor yard chemicals, fungicides do not represent as significant a threat to watersheds (Frick *et al.* 1998).

2.8 Health Issues

2.8.1 Public Concerns

Recently, there has been rising public concern over pesticide residues in drinking water and in urban terrestrial environments. In the late 1980s and early 1990s, Canada and the United States set standards on the allowable limits of pesticide residues in drinking water (Health Canada 2004; Barrett *et al.* 1993). Aside from health concerns, pesticide residues can also contaminate other hydrologic systems including stormwater runoff and treated sewage effluent (Bailey *et al.* 1997).

Drinking and ground water sources in urban areas may be vulnerable to contamination from pollutants that originate in residential areas. Aelion, Shaw, and Wahl (1997) note that suburbanization increases the potential for surface- and ground water contamination from the use of nitrogen-based fertilizers and other urban non-point pollution sources. Urban non-point or diffuse pollutants can result from house heating, exhaust emission of vehicles, fine particles, worn off tires, street litter, lawns, yards, drive-ways, parking lots, septic tanks, pets and other residential activities (Boroumand-Nasab 1996; Judy 1985). In close proximity to impervious zones, chemicals applied to lawns have a high potential for surface runoff (Morton *et al.* 1988). Non-point pollution sources, specifically containing nitrogen and phosphorous are known contaminants to watersheds (Brezonik and Stadelmann 2002; Martin, Kaushik, Trevors, and Whiteley 1999; Morton *et al.* 1988). In addition, stormwater contamination is a major issue threatening the quality of urban water systems (Lau, Khan, and Stenstrom 2001). However, riparian vegetation buffers can mitigate urban water pollution and accomplish a number of other ecological functions such as: habitat, conduit, filter, source and sink (Butler 2001; Corley *et al.* 1999; Fennessy and Cronk 1997; Hill 1996).

Nitrogen contamination in drinking water supplies has received much attention recently as epidemiologic evidence has provided links between nitrogen in drinking water and cancer rates in human populations. The evidence is well documented, whereby nitrates convert to nitrites then to nitrosamines, substances that are known to be carcinogenic in experimental models (Cantor, 1997; Vermeer and van Maanen, 2001). This evidence has led to a number of studies attempting to understand the relationship between high nitrate levels in public drinking water and mortality rates as a result of different cancers, especially gastric cancers (Sandor, Kiss, Farkas, and Ember, 2001; Vermeer and van Maanen, 2001). Murphy (1992) linked lawn fertilizer with nitrate pollution in ground and well water supplies. Since fertilizers, which are commonly nitrogen-based, are often used on urban gardens and lawns, residential areas contribute to contaminated drinking water that may aid the development of gastric cancers in the general population. To help reduce human health risks from nitrates in ground water supplies, several nitrate risk-management methodologies have been developed by Lee, Dahab, and Bogardi (1992, 1994).

Thus, the perceived and real threat to human health from nitrate contamination in drinking water supplies is becoming a serious issue.

The risk of exposure to lawn chemicals and air pollution in and around residential neighbourhoods has been documented. For example, Nishioka *et al.* (1996) and Leonas and Yu (1992), found that chemicals applied to lawns are more persistent and transportable than previously believed. Significant amounts of lawn pesticides can linger in house dust, accumulating in carpets, placing small children at risk of contact (Lewis *et al.* 1994; Nishioka *et al.* 1996; Nishioka *et al.* 1999). While acute health impacts are not known or understood, consistent exposure to common lawn chemicals poses serious health risks in the long-term (Zartarian *et al.* 2000).

The risk of exposure to chemicals applied to urban residential lawns and yards may be higher than in rural or agricultural settings. Since householders take fewer precautions than farmers, have higher herbicide and insecticide application rates than most farms, directly or through a lawn-care provider, Templeton *et al.* (1998) explain that the concentration of pesticides is likely higher in urban waterways near treated yards than those near treated farms. In southern Ontario, Canada, Struger *et al.* (1995) corroborate these assumptions through a study involving two streams and stormwater detention ponds. Moreover, given the population densities of urban opposed to rural areas, it is assumed that more people would potentially be at risk of chemical exposure in urban areas.

2.8.2 Air Pollution

Linked with the management practices of private residential yards is the notion of air pollutants being emitted from small engines characteristic of garden equipment (i.e. lawnmowers). Unregulated until recently, lawn-mowers were found to be even dirtier than previously believed (Lamarre, 1996). Christensen, Westerholm, and Almen (2001) suggest that emissions from lawn-mower engines are still relatively large despite the potential for improvement. They contend that lawn mowers remain significant contributors to local air pollution through carcinogenic exhaust emissions, despite improvements in design and fuels. Lamarre (1996) found that emissions associated with cordless electric mowers are dramatically lower than those from gasoline mowers. Priest *et al.* (2000) compared standard lawn-mower engine emissions with other transport sources for several chemical compounds, and found that in the study area lawn-mowers contributed 5.2 and 11.6% of total transportation emissions of CO and NMHC emissions, respectively. These examples highlight the contribution that lawn-mower emissions can make to local air pollutants and global climate change, in general. Hence, residential areas are replete with contaminant exposure because of persistent lawn chemicals and lawn related air pollution.

2.8.3 Ecosystem Health

The impact of lawn chemicals on the urban natural environment is also significant though understudied. The associated chemical inputs of lawns can have severe ecological effects on local insect, fish and bird populations. Problems with lawn chemicals include loss of beneficial insects and earthworms, bird kills and reproductive impairment, and the development of pest resistance (Racke and Leslie 1993).

Urban residential area lots are too small and scattered to provide a hospitable environment for a larger functioning ecosystem. While lawns represent permeable surfaces in impervious high-density urban development, lawns are liabilities in ecosystem functioning and form a fragmented landscape that is tolerable to few insects and wildlife (Robbins and Sharp 2003b). In addition to increased air pollution from old mowers, these fragmented 'lawnscapes' adversely affect reproduction, survivorship, and dispersal of bird species (Marzluff and Ewing 2001; Racke and Leslie 1993). In urban residential areas the cumulative impact of homeowners' fertilization, irrigation, pest management and other landscape practices can degrade water, land, and biotic resources (Beverly *et al*. 1997).

2.8.4 Alternatives to Chemicals

In general, outdoor residential pesticide use requires less money, time, and knowledge than other less-toxic pest control measures. Lawn and yard chemicals provide fast, efficacious results compared with other methods that are more time and information-intensive such as integrated pest management strategies (Frankie and Koehler 1983). Such strategies can work but Robbins *et al.* (2001) argue that there are deeply structured roots in society to lawn chemical use which prevent such strategies from gaining a wide acceptance.

2.9 Review of Lawn Studies

2.9.1 Lawn and Yard Maintenance

Diverse levels of maintenance for lawns and yards exist in urban and rural locations. Different types of maintenance practices can depend on: homeowners' preference; affluence or discretionary income; demand for leisure; level of education; location (urban, suburban, or rural); and a variety of external influences (neighbourhood agreements, contract yard maintenance, etc.). In Minnesota, Meyer *et al*. (2001) found that their respondents reported low lawn maintenance practices, in general. This included soil testing, automatic irrigation systems, time spent on lawn care, contracting a lawn-care service, fertilizer applications, and pesticide and herbicide use. However, lawn maintenance is often linked with

lawn aesthetics as Hamilton and Waddington (1999) found that all of the lawns that were rated as having the highest quality also had the highest maintenance inputs. In Hamilton and Waddington's (1999) study, the lawns that were ranked with the poorest quality, also were reported to receive only mowing. Hence, lawn aesthetics are linked with the maintenance practices.

2.9.2 Chemical Usage

During the previous 20 years, Templeton *et al.* (1998) cite that about 50% of all U.S. yards have had pesticide or fertilizer applications or both. A U.S. national home and garden pesticide use survey indicated that 41% and 50% of all households applied at least one type of pesticide at least once in 1990 and 1995, respectively (Templeton *et al.* 1998). In 1999, 74% of households in a national survey applied fertilizers while 55% applied insect controls (National Gardening Association 2000). Similarly, 75% of respondents reported fertilizing their yards in a study by Morris and Traxler (1996). A study by Varlamoff *et al.* (2001) reported that 76%, 41%, 64%, and 23% of responding Georgia homeowners who reported doing their own landscaping applied fertilizers, herbicides, insecticides, and fungicides to their landscape, respectively. With the exception of fungicides, homeowners were more likely to apply fertilizers, herbicides, and insecticides to their lawn than other landscape features. Osmond and Hardy (2004) found that over half of urban homeowners applied fertilizers to turf while 60% of households use pesticides with varying degrees of frequency. Thus, many studies concur that approximately 75 and 50 percent of U.S. homeowners apply fertilizers and pesticides, respectively, to their yards and lawns.

Households also tend to give a higher priority to controlling nuisance pests such as ants, mosquitoes, and other arthropods through the use of insecticides because they care most about their wellbeing and safety (Lajeunesse *et al.* 1997). While aggregate pesticide consumption decreased in the U.S., notably in commercial and industrial sectors, USGS (1999) reported a steady climb of pesticide use, especially on private lawns. Herbicide has been found to be the most prominent pesticide used on urban residential yards and lawns (Osmond and Hardy 2004).

U.S. residents most likely to use lawn chemicals are affluent women and men who exhibit lower tolerances to pests and risks of exposure. According to survey results from Varlamoff *et al.* (2001), 76% of homeowners rated a weed-free lawn as either 'very important', 'important', or 'somewhat important'. In Minnesota, Carpenter and Meyer (1999) cite that typical homeowners tolerate up to 10% weeds in their lawns. In the urban areas sampled by Robbins and Sharp (2003b), users of chemicals come from higher-value homes and neighbourhoods. Personal application of chemicals was more prominently used in older, middle-income urban areas, while the use of lawn-care contractors was associated with higher housing values, though found to be more common with women in charge of lawn care. Schueler (1995) describes

that households using outdoor pesticides are more likely to have higher incomes, bigger or better quality yards, lower pest tolerances, and show less concern about the risks of exposure.

Generally, urban residents are not well-informed about pesticide applications, risks, alternatives or disposal. Many households treat symptoms of pest problems without full information about the causes (Ravlin and Robinson 1985) and are unaware of non-chemical techniques (Lajeunesse *et al.* 1997). A minority of urban residents do not read pesticide labels, follow directions, or take proper precautions (Grieshop and Stiles 1989; Bennett *et al.* 1983). Residents of most households do not wear protective clothing (Lajeunesse *et al.* 1997) and apply more than the recommended dose (Grieshop and Stiles 1989). In addition, more than a million households in the U.S. are estimated to dispose of excess diluted-from-concentrate pesticides in sinks, toilets, streets, gutters or sewers (Templeton *et al.* 1998). Thus, a significant amount of households lack proper information on the use of pesticides, exacerbating personal and ecosystem health risks.

2.9.3 Application Rates

It has been estimated that each year in the United States, 70-75 million pounds of over 300 different active pesticide ingredients are applied to home lawns and gardens (Schueler 1995). In 1984 alone, approximately one million tons of fertilizer was applied across the U.S. (Jenkins 1994). Compared with rural landscapes in the early 1990s, it's estimated that treated urban landscapes received eight times the amount of active ingredients of 2,4-D and other phenoxy herbicides (Templeton *et al.* 1998). Struger *et al.* (1995) found that chemical loading is proportionally greater from urban rather than agricultural areas. Lawn care operators and households in the early 1990s had higher application rates than most farmers (Templeton *et al.* 1998; Frick *et al.* 1998; Jenkins 1994). Larger doses of lawn chemicals by homeowners and professional lawn-care providers can be attributed to the popular belief that 'more is better' (Varlamoff *et al.* 2001). Higher application rates increase the likelihood that herbicides run off into nearby streams (Frick *et al.* 1998).

2.9.4 Professional Lawn-Care Providers

Yard maintenance is often provided by local yard care companies. Martin *et al.* (2003) revealed that the median home value of residents in Phoenix who employed local landscape firms to maintain their yard was 201,750 US$ (246,135 CDN$) while the median home value of residents who maintained their own yard was 149,000 US$ (181,780 CDN$). These results are consistent with those reported by Robbins and Sharp (2003a) and (2003b). According to Templeton *et al.* (1998), the number of households who pay for professional chemical treatment of lawns and yards has been growing in the U.S. for a number of

years. It is speculated that contracted pest control has steadily increased because of a number of variables such as time availability, professional service, equipment and maintenance costs, restricted chemical use, and chemical exposure risks (Lajeunesse *et al*. 1997).

Lawn-care providers may apply more lawn chemicals than do-it-yourself homeowners. Templeton et al (1998) explain how application rates for a variety of pesticides differ between lawn-care providers and do-it-yourself households. In their U.S. study, lawn care operators tended to treat lawns with chemicals more frequently per year than householders. While insecticidal and fungicidal application rates were higher with do-it-yourself householders, lawn care operators were found to apply almost double the amounts of herbicide per acre per year. Likewise, Morton *et al*. (1988) found that commercial home lawn care companies often applied greater annual amounts of nitrogen (in fertilizers) than individual home owners.

2.10 Urban Residential Attitudes

2.10.1 General Environmental Attitudes

Attitudes regarding the natural environment held by the public originate from numerous sources. Grossman and Potter (1977) argue that socio-economic factors (demographics), the level of community participation, and the relative trust in social, governmental, and institutional organizations are the primary factors determining individual attitudes toward the environment. Similarly, Tuan (1990) suggests that an individual's environmental preference may stem from biological heritage, upbringing, educational background, occupation, and his or her physical surroundings. The amount of media coverage and the magnitude of an environmental issue, whether it is a local, national or global matter, may also influence perceptions and attitudes towards the environment (Ladd and Bowman 1995).

In a study by Feagan and Ripmeester (1999) approximately half of the homeowners interviewed were able to identify broad environmental concerns and ongoing issues. It was found that those respondents who identified broader environmental concerns were more likely to use less gas-powered lawn and garden implements, more electric tools, more manual tools, and apply chemicals more sparingly than those who did not understand general environmental concerns. Feagan and Ripmeester (1999) established a slight link between the identification of larger environmental concerns and a shift in local behaviour.

2.10.2 Lawn Chemical Attitudes

Households have differing attitudes about pesticides and the risks of using chemicals to treat lawns and yards. In two studies, only a minority of urban residents, about 12% (Lajeunesse *et al.* 1997), believe pesticides are unsafe and are less likely to use them (Grieshop and Stiles 1989). Yet in a recent study, around 70% of all respondents were concerned about safety issues when applying pesticides (Osmond and Hardy 2004). Although the greatest concern about using pesticides was for family health, the health of homeowners' pets was ranked more important than water quality or larger environmental health issues. In another study, Meyer *et al.* (2001) reported that most respondents in a Minnesota survey thought fertilizers and pesticides were harmful to the environment and public health. It seems that attitudes towards lawn and yard chemicals vary among regions in the U.S. or public attitudes are shifting. Negative public perceptions of pesticides, and to a lesser degree fertilizers, are consistent with more recent public attitudes in general.

2.10.3 Environment and Lawn Care Attitudes

Since there are many different ways of caring for a lawn, homeowners' attitudes are study-specific and vary between sample areas. Less than half of the homeowners interviewed in a study by Feagan and Ripmeester (1999) reported that their lawn-care practices reflected deeper concerns for the environment. These respondents made connections between their lawn-care actions and local or broader environmental functioning. In a study by Meyer *et al.* (2001), homeowners were asked to respond to statements linking lawn care to the environment. Homeowners in this survey reported using minimal chemical inputs and generally reported low maintenance practices; hence, they perceived their lawns were not negatively impacting the environment.

2.11 Lawn Ideology

2.11.1 Ironies

In urban areas, lawns are abundant on private property as well as on common land such as parks and along sidewalks, trails and roadways. Although private yards generally represent a higher proportion of monoculture lawns than public lands, the transport of lawn care chemicals and the consumption of water affect resources shared by all residents. Lawn pesticides and fertilizers are known to contribute to non-point source pollution in storm runoff and riparian corridors, having deleterious effects for environmental and human health (Judy 1985; Boroumand-Nasab 1996; Martin *et al.* 1999; Lau *et al.* 2001). Nitrogen-based lawn and garden chemicals can also contaminate groundwater, which can render water toxic to humans and biota (Aelion *et al.* 1997). Moreover, lawn irrigation practices can deplete

common water resources, especially in semi-arid or drought-prone areas (Nelson 1992). In a survey study by Mechenich and Shaw (1994), residents in Wisconsin noted that their greatest concerns about groundwater quality were nitrate and pesticide contamination. Ironically, the majority of respondents annually applied fertilizers and/or pesticides to their yards and gardens. Although the Wisconsin residents' recognized that education is the key to solve groundwater contamination problems, their actions did not reflect their attitudes or intentions.

Despite efforts to curb the use of pesticides, many urban residents are willing to accept the risk of exposure for an immaculate lawn and yard. Waldichuk (1998) notes that Americans are unusually predisposed to romantic perceptions of green pastures in urban/rural fringe landscapes. A survey study by Robbins *et al.* (2001) showed that respondents with high levels of income and education were more likely to apply large amounts of lawn care chemicals than other respondents. Reported as protecting property values (Robbins and Sharp 2003a), ironically, these heavy users also claim to understand environmental concerns and acknowledge the negative effects of their actions. The results from these studies reinforce the symbolic and material value of lawns to homeowners, attesting to its ideological dominance in urban and suburban landscapes (Feagan and Ripmeester 1999).

2.11.2 The Enshrined Lawn

This lawn ideology has been confirmed by many recent studies. More than half of the respondents in a study by Varlamoff *et al.* (2001) expressed the desire to have their lawn of comparable quality to their neighbours. The majority of residents surveyed in Dakota County, Minnesota considered it 'very important' or 'somewhat important' to have their lawn look as good as their neighbours (Morris and Traxler 1996). Similarly, Martin *et al.* (2003) discovered in a study that three-fourths of all homeowner respondents believed that their landscape was similar to those of their neighbours. Respondents in a study by Robbins and Sharp (2003b) were more likely to look upon their neighbours' lawn-care practices as environmentally harmful and 'take an interest' in yard management throughout their neighbourhood if they were lawn-chemical users themselves. Many users indicated conscious knowledge of the possible harmful implications of using chemicals but their perceived obligation to maintain perfect lawns for the sake of neighbourhood cohesion outweighed this knowledge (Robbins and Sharp 2003b). Moreover, lawn-chemical users typically associated the condition of the lawn with moral character and social reliability, something the turfgrass and pesticide industry has subtly encouraged through marketing for decades (Robbins *et al.* 2001; Jenkins 1994). Thus, lawns may represent more than U.S. homeowners landscaping preferences. They may be a reflection or public statement of neighbourhood pressure, private property behaviour, moral character, and social reliability.

2.11.3 Lawn Supremacy

The lawn has been considered by many authors (Wilson 1992; Bormann *et al*. 1993; Jenkins 1994; Schultz 1999; Pollan 1991) to be a symbol of control or superiority over our environment. Schultz (1999, p52) describes lawn care as "an exercise in control, bordering on domination". Comments such as these represent notions that are often cited as the underlying cause for a host of global environmental problems (Weddell 2002). White (1967) describes this way of thinking as an anthropocentric philosophical tradition, rooted in the ethic of western Christianity, which encourages the exploitation of nature and environmental domination. Although this understanding has been disputed (Passmore 1974; Kellert 1995), this philosophical discussion may describe part of the foundation of a deeply held belief among homeowners in the United States and Canada, concerning the lawn and its superiority as a yard element.

Turfgrass lawns have been essential elements in maintaining a multi-billion dollar industry. Turfgrass continues to dominate landscapes around the world and its dominance has in part been supported and encouraged by media sources. While many recent studies and articles have been written targeting the drawbacks of lawns or its related inputs in a global ecological context (Feagan and Ripmeester 1999; Robbins *et al*. 2001; Christensen *et al*. 2001; Breen 2003; Robbins and Sharp 2003a and 2003b; and Mitchell 2004) there are still many forms of media (largely from the lawn industry) that romanticize the lawn's supremacy in landscaping. One such book, Schultz's (1999) "*A Man's Turf: The Perfect Lawn*", is discussed here briefly as an example of the ideology that is still portrayed throughout all types of media.

Although attempting a semblance of objectivity, Schultz (1999) epitomizes the 19th and early 20th century love affair with the lawn as it became a widespread phenomenon in Europe and North America. It appears that the book was intended to stir the hearts of 'men' [sic] to strive for perfect lawn quality, upholding the yard maintenance convictions of their fathers, and their fathers' fathers. Some quotes highlight the old usage of language and reinforce social values present during its rise to supremacy, most postdating World War II. Here are some:

- "…the lawn allows us to fulfill the primal need to be in touch with the natural world." (133)
- "…when it comes right down to it – when the mower blade meets grass blade – our love affair with lawns is a personal thing. For each of us, today's lawn represents all the lawns of our lives. As we step onto the turf, memories rise from it." (11)
- "The object of lawn care is not to encourage rampant growth and flowering but to control it…. Hauling out the mower allows us to obey the male directive to subdue and master nature." (52)

- "The lawn sends a signal to other men. A well-kept lawn is a sign that the man of this house is powerful, in control of nature, and is taking care of business at home…..The lawn allows us to establish our boundaries." (72)
- "A large, rolling swath of grass represents success. So does one that stays green all year, that's weed-free and as smooth as a pool table. The more pristine the lawn appears, the more refined it seems. Now that every man can have a lawn, the goal is to have the perfect lawn, and so we fertilize and water and spread chemicals, all to say to our neighbour, "I'm a success." On some level we all strive to have the biggest house, the newest car the perfect family, and the best lawn. So this lawn allows us to flaunt our success- to fuss and preen and show off." (148)

Other more academic articles (Beard 1994) also maintain these deep-rooted ideological notions of turfgrass superiority. For example, Beard (1994) contends that many people find the care and grooming of lawns to be an excellent opportunity to enjoy reasonable exercise and a healthy diversion from our lives. Without questioning the validity of these perspectives, exercise and other mental diversions could be argued for most other activities as well.

2.11.4 The Uncontested Landscape

Many forces may be responsible for the acceptance of the lawn as the dominant uncontested landscape form in North America. Initially, as U.S. culture was transforming into a consumer society around 1900, the ideology of individualism, sanctity of property ownership, the utilitarian work ethic, and the need to exert control over the wilderness most likely informed the emerging lawn sentiments of the developing North American psyche (Jackson 1985; Clark 1986; Jenkins 1994; and Feagan and Ripmeester 1999). Popular media also influenced the early stages of this landscape revolution and continues to have a major influence on the now established lawn ideology (Jenkins 1994). Advertisements and slogans intensify already instilled linkages between lawn care and social norms, for example 'the perfect lawn announces that the homeowner is a good neighbour and citizen' (Jenkins 1994). In addition, popular magazines offer advice on how to achieve the perfect front lawn, as well as permanently implanting lawn ideals into receptive minds (Table 2.4). A quick glance through various popular gardening and related magazines such as *Today's Homeowner, House and Garden, Home Mechanix, Horticulture,* and *Easy Lawn and Garden* demonstrates this assertion (Feagan and Ripmeester 1999). Mitchell (1994) writes that although the lawn landscape is heavily entrenched with 'ideological sentiment', it can come to be accepted as being somehow 'natural'. Feagan and Ripmeester (1999) cite numerous authors who clearly describe how the status of early lawns and its representation of an orderly and industrious family linked the lawn aesthetic with virtuous and 'good' morality. Robbins and Sharp (2003b) believe that the lawn is a deeply cultural and psychologically complex landscape system rooted in tacit pastoral aesthetics, traditions, and the demand for private outdoor space in urban or suburban

spaces. By the middle of the 20th century, the lawn literature shifted focus away from valuing and adopting the lawn, since many more people had them, to maintaining them and improving their quality (Jenkins 1994). Pollan (1991) writes that the lawn fully integrated into North American codes of conformity through the powerful sway of public perceptions. Hence, its ideology began to mesh with more regulatory measures.

Table 2.4 – Slogans Reinforcing the Lawn as the Supreme Landscape Ideal

Lawns for happier living
- Bormann *et al.* (1993)

A good lawn builds morale.
- Jenkins (1994)

Quit your job. That's how much time you'd need to maintain a healthy lawn without chemicals.
- Kirk (1996)

It's Mother Nature versus you.
- Advertisement for Home Depot (1997), taken from Feagan and Ripmeester (1999).

"Don't Eat 'Em, Defeat 'Em"
…. 'Some people include dandelions in their diet. Our "recipe" keeps them out of your lawn!'
– The Scotts Company (2001).

In, Robbins and Sharp (2003a).

2.12 Regulations

2.12.1 Lawn Chemical Restrictions

As urban environments are exposed to a greater diversity of chemical compounds, if not more chemicals than in rural or agricultural areas (Bormann *et al.*, 1993; Jenkins 1994; Struger *et al.* 1995), local, regional, provincial, and national governments are beginning to take precautions against potential adverse health effects on humans and biota. The majority of Minnesota homeowners agreed that the government has a right to regulate fertilizers and pesticides on public parks or lawn areas (Meyer *et al.* 2001). However, respondents were divided on regulations for private areas, such as home lawns. In addition, there still remains a lack of regulations for homeowners wishing to buy over-the-counter chemicals, many of which are monitored in agricultural settings (Robbins and Sharp 2003b).

Canada's experience with restricting lawn chemicals started in 1991 with Hudson, a Montreal suburb. Hudson became the first of many Canadian municipalities to outlaw use of cosmetic lawn pesticides (Robbins and Sharp 2003b). Despite efforts by lawn-care industry coalitions to stall and appeal the enactment of further bans across the country, the Canadian supreme court upheld Hudson's lawn chemical restrictions, providing the precedent for other municipalities to follow suit (*Lawn & Landscape Magazine* 2001; Stokes 2001; Carmichael 2002). Elsewhere in Canada, municipalities like Halifax, NS have fought to ban pesticides, exempting golf courses and large farms (Stokes 2001). In Canada, federal and provincial governments have begun to take steps against lawn chemical use, and legal cases have been taken to the Supreme Court in favour of a pesticide-ban. Thus, repeated exposure to pesticides is cautioned against (OMA 2004) and there is mounting public support for practicing the precautionary principle in light of unforeseen negative health effects of pesticides.

2.12.2 Yard and Land Restrictions

As the lawn ideology further penetrated into North American subconscious and moral beliefs, private green space began to be subject to regulations, most visibly through by-laws constructed under 'property standards' (Feagan and Ripmeester 1999). In Canada, the level of regulations stem from the top down. Federally designed to protect local ecologies from harmful plants, such as invasive species (Rappaport 1992), these directives pave the way for provincial legislation in the Ontario Noxious Weed Act, 1990, which are required by law to be reflected in Municipal By-Laws. Municipal restrictions on lawn height and plant growth are intended to maintain development value and preserve public health. Many Canadian cities can force homeowners to cut their lawns or they will be cut for them, with increasingly stiff fines for 'neglecting' property upkeep (Feagan and Ripmeester 1999). In addition to complying with municipal by-laws, many residential communities have imposed covenants that reinforce the dominance of the lawn landscape into formal agreements (Martin *et al.* 2003). Most other communities that do not have formal agreements do not need them since many residents feel that they have the right to be "watch-dogs" concerning their neighbours' yard activities (Feagan and Ripmeester 1999). Feagan and Ripmeester (1999) thoroughly describe how residents contesting or deviating from the yard-care norms, in a lawn monoculture society, face social as well as legal opposition. These restrictions are often cited as a barrier to lawn alternatives by those opposed to chemical inputs (Robbins and Sharp 2003b). Hence, the lawn has become articulated and codified into both formal and informal rules and agreements. When yard activities in private outdoor space are enforced by both legal and social means, it is difficult for alternative landscaping styles to exist.

Restrictions on land-use controls are far more difficult to implement in residential areas than in agricultural, institutional, industrial, or commercial. The deeply rooted notions of private property rights in residential lands nullify many of the policy and regulation options (Feldman and Jonas 2000). There is considerable public resistance to municipal control over some residential neighbourhood matters (Keuper 1994). Keil and Graham (1998) contend that the primacy of property rights, individual land management, and the traditional spatial pattern of residential property are notions difficult to challenge. Thus, developing lawn and yard care awareness and educational programs seems to be the direction that can empower change, as policy directives and municipal management of residential matters are so hotly contested.

2.12.3 Policy Considerations

While many local educational programs have highlighted alternatives to chemicals and distributed information on the risks of chemical use, these efforts often do not reach the target audience (Frankie and Koehler 1983). Many authors (Frankie and Koehler 1983; Templeton *et al.* 1998; Robbins *et al.* 2001) suggest the adoption of integrated pest management strategies to minimize further watershed contamination, public health risks, and hazards to ecosystem functioning and health. As well as providing public education programs, Templeton *et al.* (1998) suggest that governments provide financial incentives to curb rising pesticide applications in urban residential areas. These may include: subsidizing less toxic pesticides or increasing government-sponsored research into effective but non-toxic alternatives, higher consumer prices for more toxic chemicals through sales tax or higher registration fees, cheaper professional yard pest consultation, and lower prices for beneficial organisms to counteract pest problems. These financial strategies, though conceivable, would have to be substantial to overcome the many advantages of using current practices and toxic chemicals to treat urban lawns and yards.

Chapter 3.0 – Study Environment and Hypothesis

3.1 The Study Environment: A Kitchener and Waterloo Primer

3.1.1 Historical Environment

Kitchener and Waterloo are both firmly rooted in German and Mennonite heritage. Kitchener, originally named Berlin (est. 1833), and Waterloo (est. 1857) were both settled by Mennonite farming families (City of Waterloo 2004a; City of Kitchener 2005a). Within 200 years, the land changed from deciduous and mixed forest to agriculture and from agriculture to city and suburbs. A rich history exists in these cities, where Mennonite traditions still play a prominent role today.

Most urban residential landscape vegetation is intentionally planted, although the vegetation within and surrounding Kitchener and Waterloo is representative of a mix of temperate species. These cities are considered within the 'Manitoulin – Lake Simcoe' Ecoregion of Canada (Fig. 3.1), although this ecoregional boundary changes at the southern limits of Kitchener (Environment Canada 2004b). These forest regions consist of widely distributed broad-leaved trees primarily beech (*Fagus americana* Sweet) and sugar maple (*Acer saccharum* Marsh.), along with basswood (*Tilia americana* L.), red maple (*Acer rubrum* L.), and (northern) red, white and bur oak (*Quercus rubra* L, *Q. alba* L., and *Q. macrocarpa* Michx., respectively), while coniferous species such as eastern white pine (*Pinus strobus* L.) and eastern hemlock (*Tsuga Canadensis* (L.) Carr.) are poorly represented. The relatively mild climate can accommodate other diverse and exotic species of vegetation, though these species are not native to the area and were not present before European settlement.

3.1.2 Present-Day Environment

Kitchener and Waterloo have seen significant growth in population, employment, income, and ethnic diversity since their establishment as cities within the Region of Waterloo. Presently, the combined population of both cities is approximately 300,000 – nearly 200,000 people in Kitchener (City of Kitchener 2005a) and 102,300 people in Waterloo (City of Waterloo 2004a). Located in the centre of southern Ontario, these cities boast their close geographic proximity to other major Canadian and U.S. urban areas for many diverse enterprises, businesses, and employment. Over 5.2 million people live within a 100 kilometer radius of the cities and more than 60 percent of Canada's population, and 40 percent of the U.S. population live within an 800 kilometer radius of Kitchener and Waterloo (City of Kitchener 2004; City of Waterloo 2004a). Both cities have large employment and population growth rates, with labour force participation rates around 72% as of the 2001 Census. Both cities have a generally well-educated labour force of over 150,000 people combined, supporting two distinguished universities, a

renowned college, and other post-secondary education schools. Although the average household and individual incomes are higher in the city of Waterloo compared with Kitchener, both cities are above the national average (City of Waterloo 2004a; City of Kitchener 2004).

Fig. 3.1 – Mixedwood Plains Ecoregions (Environment Canada 2004b): http://www.ec.gc.ca/soer-ree/English/Framework/Nardesc/mixpln_e.cfm

The ethnic composition of both cities population has changed dramatically in the past 10 years. Major flows of international migrants originally came from Western Europe, but 2001 Census data revealed that thousands of people have immigrated from other areas of the world, such as Eastern European and Asian countries (City of Kitchener 2004; City of Waterloo 2004a). The city of Kitchener (2004) reports that approximately one quarter of the city's population is foreign-born. Based on immigration rates and city profiles (City of Kitchener 2004; Statistics Canada 2003), a greater amount of ethnic diversity was present in the 2004 survey sample compared with the 1994 sample. These ethnocultural differences may have a bearing on the landscaping attitudes and yard preferences results between survey years. Hence, the cities of Kitchener and Waterloo are growing amidst a multicultural atmosphere rooted in Mennonite heritage.

3.1.3 Green Cities

The cities of Kitchener and Waterloo boast a 'green' alternative to the inherent problems of larger cities (City of Waterloo 2006). Among other dynamic social, recreational, cultural and artistic programs offered in these cities, both cities are actively involved in 'green' programs ranging from waste management (i.e. litter, compost, recycling, garbage, and yard waste programs), water protection and conservation initiatives (i.e. toilet replacement program, out-door water use by-law, rain barrel program, drinking water protection areas, and salt reduction measures), chemical reductions (i.e. proposed pesticide reduction by-law), protection of significant natural areas (i.e. many Environmentally Sensitive Policy Areas, active Ecological and Environmental Advisory Committee, list of native vascular plants and species, and Regional Agreement Forests), and environmental planning initiatives (i.e. Kitchener's Strategic Plan for the Environment Survey and the Region of Waterloo's Water Resource Protection Survey) (Region of Waterloo 2006; City of Waterloo 2006; City of Kitchener 2005b). In addition to these 'green' initiatives, the populace is generally proactive regarding matters of the regional environment, striving for greater environmental awareness, stewardship and responsibility. Combined with other demographic facts including a well-educated, wealthy, and growing labour force and population, these cities continue to set high environmental standards making them 'greener' than many other similar sized cities in southern Ontario and Canada.

3.2 Hypothesis

3.2.1 Predictions

Before the analysis of the results between the 1994 and 2004 surveys were undertaken, two general arbitrary predictions were made.

Prediction #1 – The results will show that landscaping and yard maintenance practices in 2004 have changed significantly towards more sustainable and 'green' practices since 1994. Given that these 'green' cities are perhaps more proactive in matters concerning their local environment in 2004 than in 1994, it is likely that respondents' answers will not only reflect 'greener' attitudes and preferences, but that their outdoor yard maintenance practices will have changed in that direction as well since 1994. In addition, a more educated and wealthy population should be more knowledgeable towards environmental issues and 'greener' yard maintenance practices, given their level of schooling, access to information and resources, and general knowledge-base. Moreover, it is likely that many

respondents to the survey are interested in yard-care, hence, will be more knowledgeable about many landscaping and yard maintenance issues anyway.

Prediction #2 – The results will show that landscaping and yard maintenance practices in 2004 have not changed significantly since 1994. The 2004 results will parallel those from 1994 because of the deeply rooted yard-care ideals that have dominated both regulatory and non-regulatory frameworks within Canadian and American society for over 50 years. These entrenched values continue to be re-enforced through by-laws, media, cultural up-bringing, and other societal forces for example. While environmental awareness and education is perhaps greater in 2004 than it was in 1994, many barriers still exist in changing long established yard-care practices and ideologies.

These predictions are included here because it is deemed valuable to share such anecdotal positions given the theme of the surveys and the audience for which it is written. In an urban planning context, predictions are often logical arguments used to evaluate plans or projections for the future. Hence, these predictions help give clarity and insight into a meaningful hypothesis.

3.2.2 Hypothesis

It is assumed that the relationship between urban land use and ecological functioning can be understood from assessing the behaviour, attitude, preferences, and socio-economic status of representative residents. It is hypothesized that the relationship between urban residential yard-care practices and ecological health is capricious, but that it is generally linked to societal norms and awareness trends. The influence of social norms and ideals is suspected to underscore the many linkages between residential yard behaviour and environmental actions despite respondents' education, income, or environmental knowledge. Similarly, it is hypothesized that urban residential yard landscaping and maintenance practices are influenced by cultural upbringing, media, and tacit societal forces.

Chapter 4.0 – Research Methods

4.1 General Survey Typology

In general, quantitative research can be divided into two categories: a single point in time (cross-sectional) and multiple time points (longitudinal). Cross-sectional studies give one a 'snapshot' of a single, fixed time point that allows detailed analysis to begin (Robson, 1993). Compared with cross-sectional research, longitudinal research provides multiple 'snapshots' that are generally better able to impart understanding of causal relationships between variables (Babbie 2001). There are two main types of longitudinal research: a panel study, where the same group of participants are observed across time periods; and a trend or cohort study, in which observations are repeated on the same target population. Neuman (2000) depicts longitudinal research as providing "a moving picture that lets one follow events, people, or social relations over periods of time" (pg. 30). Babbie (2001) notes that the time sequence in social research is critical to determining causal linkages between variables, the generalizability of research findings, and the accuracy of descriptions and explanations. Thus, my research is quantitative, employing a longitudinal approach to understand residential behaviour and environmental attitudes in a typical North American mid-sized city.

4.2 Survey Information

4.2.1 Survey Design

A mailed questionnaire was initially developed in 1994 for residential homeowners with questions asking for information about their yard landscaping and maintenance practices. The design of the questionnaire was refined from a lengthy public survey of the early 1990s called the 'Omnibus' survey, which resulted from a University of Waterloo, Tri-council secretariat initiative called 'Green Plan Strategic Research' (Suffling 2002). The regional Omnibus survey, created under the vision of the Green Plan, warranted information on many themes, including regional housing, environmental attitudes, and watershed protection issues. It was designed to aid understanding of many social, environmental, and planning themes of the day and assist in future decision-making. The 1994 mail questionnaire on 'Yard landscaping and maintenance practices' was a spin-off. It retained similar questions and themes but was refined and fashioned by Dr. Roger Suffling, School of Planning, University of Waterloo. As the 1994 survey was an offshoot of the Omnibus survey, an informal pre-testing process was used mainly to clarify or simplify questions and statements. The 2004 'Survey of Yard Landscaping and Maintenance Practices' followed the same design framework as its 1994 predecessor, with only minor layout modifications. The 1994 and 2004 surveys were deliberately alike in their design and questions, so as to create reliable and

comparable datasets. Before public distribution in 1994 and 2004, the questionnaires and survey packages received ethics clearance from the University of Waterloo's Office of Research Ethics.

Participants in the 1994 survey were asked 45 questions over 10 sections while the 2004 survey contained 40 questions over 11 sections. There were no open-ended questions in either questionnaire, although some questions had space for participant descriptions, if the fixed responses were inadequate. Approximately one-half of both questionnaires contained agree/disagree, rankings, or rating question formats. In terms of the questionnaire content in 1994, two questions inquired into attitudes on general environmental issues; nine questions prompted participants to describe their residence and private outdoor space; four questions asked about future accommodation in the next 5 years; three questions centered on the costs and usage of water; six questions concerned garden landscaping preferences; and eight questions concerned yard maintenance attitudes and behaviour. Further, three questions asked about attitudes towards plants and animals; seven questions centered on urban greenspaces and water elements; and the remaining five questions concerned demographics.

The majority of questions in the 2004 questionnaire remained the same as in 1994. However, some minor revisions, deletions, rephrasing, and additional questions produced differences in the 2004 questionnaire. These changes reflected contemporary interests and a slightly different research emphasis. Noteworthy changes in the 2004 questionnaire include the deletion of questions 13-15 (future accommodation), 31 and 35-40 (attitudes towards plants, animals, and urban greenspaces) from the 1994 questionnaire and the addition of questions 22-25, 32 (yard usage, yard enjoyment, and opinions towards yard regulations and policies). Material and text specific to the 1994 questionnaire can be seen in Appendix 3, while all questions from the 2004 questionnaire are in Appendix 4.

4.2.2 Sample Design

The sampling unit in both the 1994 and 2004 surveys was household addresses or residential occupancies. In 1994, a random sample of residential addresses was purchased from a consulting company using a list generated from current city tax roll and property assessment information. Commercial properties and large apartment complexes were not included in the 1994 sample. Small apartments were intentionally included in the random sample, as it was deemed that occupants could still complete the majority of survey questions, and may indicate preferences for landscaping practices in future homes with a yard. All respondents should have, at one point, had private land associated with their dwelling unit that was maintained and managed in some fashion.

After a re-evaluation of the 1994 sample set, it was determined that some changes would have to take place in the 2004 survey sample. A review of 1994 survey addresses revealed that some addresses

within the 1994 survey sample were rezoned, renumbered, contained addresses from medium sized apartment complexes, or did not exist for other reasons in the 2002 tax rolls and property assessments of Kitchener and Waterloo. Apartment units were not included in the 2003 sample , unless city records proved that the owner or occupant was the same as indicated in the 1994 sample. This was done in the event that the same household responded to both surveys, despite the units being apartments. Moreover, since apartments are unlikely to have private yard space, these addresses were deleted from the 2004 sample and replaced with a random selection of residential dwelling unit(s) nearby, usually located on the same street. This alteration to the sample set seemed appropriate since apartments generally have a higher turn-over rate than single dwelling units and few apartment dwellers responded to the survey in 1994.

Individual owner and occupant information of the entire 1994 sample was also reviewed through the 2002 city tax rolls and property assessments. Along with addresses, occupant name(s) were checked for consistency between sample sets. To ensure personalized mailings, sample accuracy, and to increase response rates, 1994 occupant names were adjusted to reflect the 2004 context. Thus, the residential occupancy information in the 2004 sample was as up-to-date as possible.

Issues relating to study validity were also reviewed since the previous 1994 study. To maintain the same level of sample representativeness, it was determined that the 2004 sample set would have to reflect the current housing stock in Kitchener and Waterloo, as ten years had passed since the 1994 sample was generated. Thus, any houses or dwellings that were built and occupied since the previous 1994 study needed to be represented in the 2004 sample for a proper representation of Kitchener and Waterloo in 2004. To ensure this, random street addresses were selected from roads built since 1993. This was accomplished by overlapping a 2004 urban road map (MapArt 2004) over a 1993 urban road map of Kitchener and Waterloo (Dun-Map 1993). Occupant information for these new addresses was also obtained from 2002 city tax roll and property assessments. This methodological deviation from the 1994 study reduces the potential problem of internal validity between sampling years and adds credibility to the representation of Kitchener and Waterloo housing stock in the 2004 survey sample.

To reflect the urban landscape in 2004, new residential addresses were added to the 1994 sample. Within the residential development areas that had been added to Kitchener and Waterloo since the 1994 survey, 192 new randomly selected addresses were added to the 2004 survey sample base (88 from Kitchener and 104 from Waterloo). Within the residential areas present in the 1994 sample, 191 new randomly selected addresses were chosen for the 2004 sample from the city of Kitchener. These new addresses were exclusively added from Kitchener because 1) fewer addresses were added for the expansion areas in Kitchener compared with Waterloo; 2) more of Kitchener's 1994 addresses were invalid when tax-roll checked than Waterloo's; and 3) Kitchener has double the population of Waterloo.

After many alterations were made to the 1994 sample set, the 2004 randomly selected sample included 634 Kitchener addresses and 513 Waterloo addresses. Thus, although the 2004 sample set was based on addresses used in the 1994 sample, the 2004 survey sample was revised to represent the 2004 environment.

4.2.3 Sample Size , Survey Package, and Delivery

In 1994 and 2004, the survey package was delivered by mail to more than 1,000 urban residential occupancies in the cities of Kitchener and Waterloo, Ontario. The survey package was delivered to exactly 1,014 and 1,147 randomly selected residential addresses in 1994 and 2004, respectively. In 1994, the survey sample contained approximately the same percentage of addresses from both cities, while the 2004 sample had more addresses from Kitchener, exactly 634 Kitchener addresses compared with 513 Waterloo addresses.

As in 1994, each 2004 survey package contained a questionnaire, detailed cover letter, self-addressed stamped envelope, and poster of yard and garden pictures, to assist in the completion of the questionnaire. Kitchener and Waterloo residents 18 years and older were asked to indicate information on the private land that is managed or has been managed at their residence.

Within a month after the initial mailing of the 1994 survey, two reminder postcards were separately mailed to all survey recipients who had not yet responded. After five weeks, a second complete survey package was mailed to any non-respondents. The 1994 survey was considered complete after 7 weeks from the initial mailing, as with other reports (Dillman 1978; Martin *et al*. 2003), although the few completed surveys that were returned after this time were still accepted and coded.

Similar to the 1994 survey delivery, four weeks after the initial mailing of the 2004 survey package, the first reminder postcard was sent out to 894 addresses that had not responded to the mailing. Approximately five weeks after the first reminder, 9 weeks after the initial mailing, a second reminder postcard was sent to 783 addresses. Due to time and financial constraints, a second mailing of the complete survey package was not assembled. The survey was considered complete after 12 weeks from the date of the initial mailing, although a few completed surveys that were returned after this time were still coded and analysed (Fig. 4.1).

All data were hand-entered into a Microsoft Excel (Microsoft Corp., Redmond, WA, 2000) spreadsheet. Data was analyzed using both Excel and SPSS (Statistical Package for the Social Sciences 2004). Missing answers were coded as missing values. Descriptive statistics were calculated for all variables of interest. Statistical significance tests, especially those comparing proportions of respondents

between survey years, were conventionally calculated (95% confidence level) for important variables and differences found in tables and figures within the results section. Examples of these calculations and a summary of statistical significance tests not included within tables are found in Appendix 2.

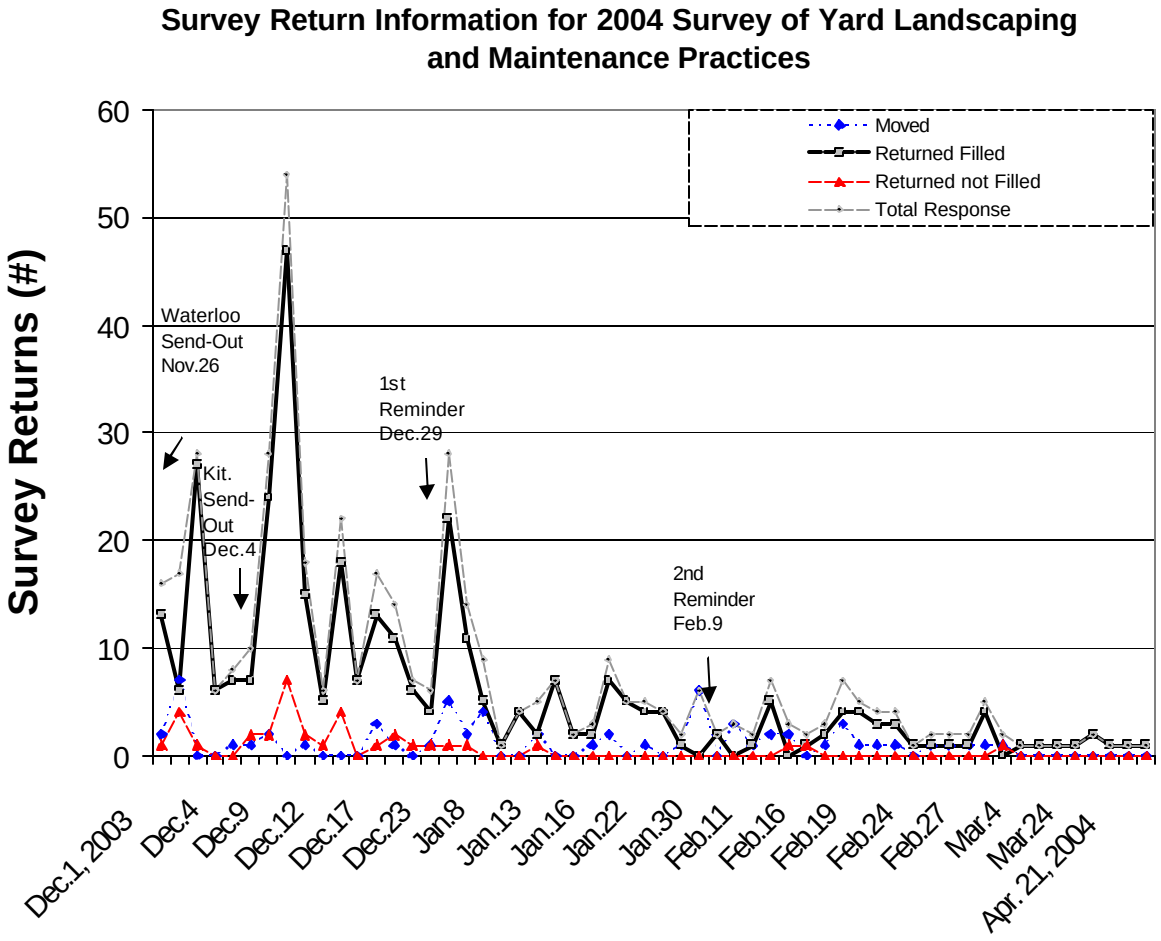


Fig. 4.1 – Survey Return Information for 2004 Survey of Yard Landscaping and Maintenance Practices

Chapter 5.0 – Results

5.1 Survey Demographics

5.1.1 1994 Survey

The 1994 survey was distributed to 1,014 addresses, with a response rate of 41.2% or 332 respondents. Kitchener respondents totaled 174 (52.4% of respondents), while there were 150 Waterloo respondents (45.2%). There were 8 unknown or anonymous respondents (2.4%). The known non-respondents in the sample comprise 80 (7.9%) unanswered questionnaires and 208 (20.5%) non-reachable addresses that were reported as 'moved'. Three hundred and ninety-four (38.9%) questionnaires are unaccounted for in the 1994 survey (Table 5.1). Thus, a slightly higher percentage of Kitchener residents responded to the 1994 survey than Waterloo residents.

The majority of survey respondents, 68.8%, were born in Ontario, while over 78% of the respondents were born in Canada (Table 5.2). The other sampled respondents were born elsewhere and have subsequently migrated to the Kitchener-Waterloo area. These foreign-born demographic results mirror those from the 1991 Canadian Census for the Kitchener metropolitan area (Statistics Canada 2005). According to the sample of respondents, Germany was the second commonest birth country at 5.6%, followed by Britain/U.K. at 4.3%. European countries together account for 17% of 1994 respondents' place of birth and represent the dominant foreign-born area in the 1994 survey. The average year in which the migrant respondents reported to arrive in Canada was 1961, while the median was 1958.

Sixty-two percent of respondents answering the 1994 survey were males while 38% were females (Table 5.3). In terms of gender proportions, more males responded from Kitchener (58%) than Waterloo (40%) though slightly more females responded from Waterloo (54%) than Kitchener (45%). The average age of all respondents was 49 years and the median age was 47 years. Age differences between Kitchener and Waterloo respondents were small, although Waterloo respondents were slightly younger than Kitchener respondents. Seventy-two percent of all respondents were between 31 and 60 years of age with the 41-45 age cohort the largest of all. In terms of employment, more than half of the respondents (58%) indicated that they worked full time, 23% were retired, 10% worked part-time, 5% attended school, and the remaining 5% did not answer.

Forty-nine percent of the respondents described their household as a couple living with children followed by: a couple (29%), individual living alone (12%), single with children (3%), and other household combinations (7%) (Table 5.4). In terms of level of education, more than 65% of the survey respondents indicated that they had at least one year of post-secondary education (full time equivalent), while 33% indicated at least three years of post-secondary education, including university, college,

vocational, or technical schooling (Table 5.5). In contrast, 19% of respondents indicated that they had less than a grade 12 equivalent level of schooling. In general, respondents from Waterloo were better educated than their Kitchener counterparts. For example, compared with Kitchener, 17% more respondents from Waterloo had at least three years of post-secondary education and substantially fewer respondents had less than a grade 12 education equivalent. The average annual gross household income was reported to be $45 – 75,000 (Table 5.6). Waterloo's average income range was reported to be significantly higher than Kitchener's (z = 5.592 – Appendix 2).

Table 5.1 - Summary of Mailed Survey Return Information

	1994 Survey		2004 Survey	
	#	%	#	%
Distributed				
Waterloo	500*	49.3*	513	44.7
Kitchener	514*	50.7*	634	55.3
Total	**1014**	**100.0**	**1147**	**100.0**
Respondents/ Response Rate				
Waterloo	150	45.2	146	43.6
Kitchener	174	52.4	186	55.5
Anonymous	8	2.4	3	0.9
Total	**332**	**41.2[1]**	**335**	**30.9[1]**
Non-Respondents				
Moved	208	20.5	63	5.5
Unanswered	80	7.9	35	3.1
Unaccounted	394	38.9	714	62.2
Total	**682**	**67.3**	**812**	**70.8**

***** - approximately

[1] - response rate was calculated by dividing the number of respondents by the total number of distributed surveys (subtracting non-reachable addresses i.e. 'moved')

5.1.2 2004 Survey

The 2004 survey was distributed to 1,147 addresses, with a response rate of 30.9% or 335 respondents. Kitchener respondents totaled 186 (55.5% of respondents), while there were 146 Waterloo respondents (43.6% of respondents). There were 3 unknown or anonymous respondents, 0.9% of the total respondents. The known non-respondents in the 2004 survey sample comprised 35 (3.1%) unanswered questionnaires and 63 (5.5%) addresses that were reported as 'moved'. 714 (62.2%) addresses are unaccounted for in the 2004 survey (Table 5.1). This compares with fewer addresses (1,014), a

significantly higher response rate (41.2% or 332 respondents) (z = 4.618 – Appendix 2), similar numbers of respondents in both Kitchener and Waterloo, and more anonymous respondents in the 1994 survey. In addition, the 1994 survey reported 80 (7.9%) unanswered questionnaires, 208 (20.5%) 'moved' addresses, and 394 (38.9%) unaccounted questionnaires (Table 5.1).

Table 5.2 - Survey Respondents Province/Country of Birth

Within Canada

	1994 Survey		2004 Survey	
	#	%	#	%
Canada	255	78.7	266	80.6
NFLD	5	1.5	1	0.3
NS	2	0.6	6	1.8
PEI	-	-	1	0.3
NB	3	0.9	-	-
QUE	9	2.8	12	3.6
ON	**223**	**68.8**	**234**	**70.9**
MAN	6	1.9	4	1.2
SK	1	0.3	4	1.2
AB	2	0.6	2	0.6
BC	4	1.2	2	0.6

Note: 1994 n = 324, 2004 n = 330

Respondent's Place of Birth Totals

	1994 Survey		2004 Survey	
Place	#	%	#	%
Canada	255	78.7	266	80.6
Britian/U.K.	14	4.3	16	4.8
Germany	18	5.6	12	3.6
Other European	23	7.1	23	7.0
USA	3	0.9	3	0.9
Asia	3	0.9	6	1.8
Central/S.America	3	0.9	4	1.2
Middle East	2	0.6	-	-
unanswered	8		5	

Foreign Born Arrival Year in Canada

Year	Mean	Median	Most Recent	Least Recent
1994	1961	1958	1990	1922
2004	1967	1966	1997	1928

More than 70% of all 2004 survey respondents were born in Ontario, while over 80% of the respondents were born in Canada (Table 5.2). These results closely correspond to those in the 1994 survey. According to the 2004 sample of respondents, Britain/U.K. was the second largest place of birth country (4.8%), followed by Germany (3.6%). In total, European countries account for 15.4% and 17% of the respondent's place of birth in the 2004 and 1994 sample, respectively. The average year the migrant respondents reported to arrive in Canada was 1967, while the median was 1966. In both survey years, immigrant householders arrived many years before responding to the survey. As in the 1994 survey, most results and responses for the 2004 survey generally reflect an Ontario residential environment and Canadian cultural upbringing (Table 5.2). In both surveys, foreign-born respondents were primarily of European heritage and well established in Canada for many years before they responded to the survey(s). The 2004 survey respondents' place of birth composition may be slightly different than the present ethnic diversity in Kitchener and Waterloo, although the percentage of foreign-born respondents (19.3%) is only slightly lower than (22.1%), as reported in the 2001 Census for the metropolitan of Kitchener (Statistics

Canada 2005). Future studies on yard landscaping and preferences would benefit from purposefully sampling foreign-born residents in Kitchener and Waterloo and cross-comparing the results with Canadian-born respondents.

Table 5.3 - Survey Respondent Information

		1994 Survey		2004 Survey	
		#	%	#	%
Sex	Male				
	Waterloo	78	24.7	84	26.7
	Kitchener	114	36.1	76	24.1
	Total	197	62.3	160	50.8
	Female				
	Waterloo	64	20.3	56	17.8
	Kitchener	53	16.8	99	31.4
	Total	119	37.7	155	49.2
	Unanswered	16		20	
Age	30 & under	25	8.4	29	9.8
	31 - 40	68	22.7	57	19.3
	41 - 50	87	29.1	84	28.5
	51 - 60	59	19.7	61	20.7
	61 - 70	33	11.0	30	10.2
	over 70	27	9.0	34	11.5
	Unanswered	33		40	
Age Statistics	Mean	Age		Age	
	Waterloo	47		50	
	Kitchener	50		48	
	Total	49		49	
	Median				
	Waterloo	45		50	
	Kitchener	47		46	
	Total	47		48	
Employed	Full-Time	193	60.9	187	59.2
	Part-Time	33	10.4	40	12.7
Other Activity	School	15	4.7	14	4.4
	Retired	76	24.0	75	23.7

Note: 1994 n = 332 (subtract unanswered)
2004 n = 335 (subtract unanswered)

The average age of respondents was identical in both surveys at 49 years of age with similar ages between respondents from both cities. Opposite in the 1994 survey, Waterloo respondents were slightly older than Kitchener respondents in the 2004 survey (Table 5.3). As in 1994, approximately seventy percent of respondents in 2004 were between 31 and 60 years of age with the 41-45 age cohort the largest. Employment and other activities of the 2004 survey respondents mirrored those of the 1994 survey.

Table 5.4 - Household Description

	1994 Survey		2004 Survey	
	#	%	#	%
Individual Living alone	40	12.2	31	9.3
Couple	94	28.7	135	40.4
Couple w/ children	160	48.9	137	41.0
Single w/ children	11	3.4	13	3.9
Other combinations	22	6.7	18	5.4
unanswered	5		1	

Note: 1994 n = 327, 2004 n = 334

In terms of household description, the 2004 survey differs from the 1994 survey in that 41% percent of respondents indicated that their household was a couple with children and 40% indicated themselves as a couple (Table 5.4). These results could reflect smaller families or delayed births given that these 2004 household descriptions are significantly different ($z = 2.048, 3.188$ – Appendix 2) than 1994 results. However, the combined totals of 'couple' and 'couple with children' are not statistically different between survey years ($z = 1.211$ – Appendix 2). These findings are followed by respondents reporting as an individual living alone (9%), other combinations (5%), and single with children (4%). More than 75% of 2004 survey respondents indicated that they had at least one year of post-secondary education, while 37.5% reported more than three years of post-secondary education, including university, college, vocational, or technical schooling (Table 5.5). Compared with the education levels of the 1994 survey respondents, 10% more 2004 survey respondents reported years spent in post-secondary schools with slightly more respondents having spent more than 3 years in post-secondary education, although this difference is not significant ($z = 1.140$ – Appendix 2). In addition, significantly fewer 2004 survey respondents (12%) reported less than a grade 12 equivalent level of schooling than respondents from the 1994 survey (19%) ($z = 2.245$ – Appendix 2). Parallel to the results from the 1994 survey, more Waterloo respondents indicated more than three years of post-secondary education while the majority of respondents that had less than a grade 12 equivalent education were from Kitchener in the 2004 survey.

The average annual gross household income was reported to be approximately $75,000 in the 2004 survey as the average was between both $45 – 75,000 and $75 – 105,000 income brackets. This is significantly higher than the average from the 1994 survey (z = 5.385 – Appendix 2), although adjustments for inflation (Bank of Canada 2006) may offset the differences (Table 5.6). As with the 1994 survey, Waterloo respondents in the 2004 survey reported a higher household income average than Kitchener respondents. On average, Waterloo respondents were above the total income average while Kitchener respondents were below.

Table 5.5 - Reported Years of Schooling

		1994 Survey		2004 Survey	
		#	% answered	#	% answered
High School Years	Gr. 8 or less	14	4.4	10	3.1
	Gr. 9	8	2.5	2	0.6
	Gr. 10	26	8.2	13	4.0
	Gr. 11	11	3.5	15	4.6
	Gr. 12/13	257	81.3	285	87.7
	Total Answered	316		325	
Years Post Secondary	1	24	7.6	28	8.6
	2	43	13.6	41	12.6
	3	36	11.4	54	16.6
	4	45	14.2	56	17.2
	5	30	9.5	41	12.6
	6	13	4.1	9	2.8
	6 or more	17	5.4	16	4.9
	Total Answered	208	65.8	245	75.4
	Note:	1994 n = 316		2004 n = 325	

Schooling Statistics		1994 Survey		2004 Survey	
		#	%	#	%
More than 3 years of Post Secondary	Waterloo	60	57.1*	65	53.3*
	Kitchener	41	39.0*	55	45.1*
	Total	105	33.2	122	37.5
Less than Grade 12 Equivalent	Waterloo	17	28.8*	11	27.5*
	Kitchener	42	71.2*	29	72.5*
	Total	59	18.7	40	12.3

* Percent based on total for given category

5.1.3 Survey Demographic Discussion

More survey packages were unaccounted for in the 2004 survey than in the 1994 survey, which explains the significant difference between survey response rates (z = 4.618 – Appendix 2). The number of non-respondents is difficult to assess in mail surveys since there are many external and internal factors involved. External variables may include a problem with postal service and delivery, incorrect addresses, the possible perception of junk mail, and whether or not the intended household recipient received the material. Similarly, there are at least two reasons why questionnaires are returned unanswered. First, if the box on the first page of the questionnaire (Appendix 4) was checked, then it is likely that the questionnaire was returned because the recipient did not have private yard space and would not have a private yard in the next five years. Second, some questionnaires may have been returned uncompleted because the recipients did not wish to participate but wanted to give the package back. Mail-surveys are known for the large proportion of non-respondents, but response rates of both years are considered average to moderately high for this type of survey (Palys 2003).

Table 5.6 - Household Income before Taxes

	Tax Years 1993 & 2002			
	1994 Survey		2004 Survey	
Income Brackets	#	%	#	%
$25K or less (1)	38	12.7	20	6.0
$25K - 45K (2)	74	24.7	42	12.5
$45K - 75K (3)	104	34.8	96	28.7
$75K - 105K (4)	47	15.7	70	20.9
$105K - 120K (5)	14	4.7	31	9.3
more than 120K (6)	22	7.4	40	11.9
unanswered	33		36	
Income Average*	3.0		3.6	
Waterloo	3.3		3.8	
Kitchener	2.7		3.4	

Note: * scale between 1-6 (see Income brackets)
1994 n = 299, 2004 n = 299

A number of known non-respondents can also be explained within the category ‘moved’. The ‘non-respondents’ category encapsulates diverse responses including complete opened or unopened survey packages with ‘MOVED’, ‘NOT ACCEPTED’, ‘REJECTED’, or ‘RETURN TO SENDER’ scratched over the surface of the package. Many postcard reminders were also annotated in this manner likely because of the insistence to complete the questionnaire or because addressees wished to avoid

further correspondence. Furthermore, phone calls, emails, or other miscellaneous information directed to the contact person, were recorded under this heading. Therefore, while the 'moved' category does assist in identifying the attributes of non-respondents, it is also a catch-all for reasons why recipients did not want to complete the questionnaire.

The survey respondents are typical of urban residents living in mid-sized North American cities. Survey respondents reported similar heritage and place of birth proportions between survey years, with the majority of respondents having an Ontario or Canadian background. The majority of respondents that migrated into Canada are of European origin, either British or German, although this does not necessarily reflect the cosmopolitan diversity that exists in both cities today, as more recent immigrants generally do not own houses. There were significantly more male respondents in the 1994 survey than the 2004 survey ($z = 2.934$ – Appendix 2), which may indicate many socio-behavioural changes between survey years. In the context of yard landscaping, is there less insistence that 'men' rule the household? Or are more women caring for their outdoor space? The age of the survey respondents is higher than the urban population average, but this is a reflection of the age cohort that can afford a typical residential unit. In both sampling years, a large proportion of respondents were over 60 years of age and more than 20% of respondents indicated that they were retired. 2004 survey respondents indicated a general increase in the number of years of post secondary education over 1994 respondents. Both surveys showed that Waterloo respondents, in general, had more years of post-secondary education and higher household incomes than their Kitchener counterparts. This information is useful for understanding and qualifying the responses to the following themes regarding yard maintenance and landscaping practices.

5.2 Matched Residential Occupancies

Aside from minor necessary deviations, all aspects of the 2004 survey execution were comparable to the 1994 survey. In this context, at least one unique benefit to studying the responses from both years is that the same sample sets were used between surveys. Hence, the opportunity to report findings from the same residential occupancies between a ten year span makes the results from this study exceptional for identifying yard landscaping preferences within Kitchener and Waterloo, Ontario, Canada, and within north-eastern North America, generally speaking.

In the 1994 survey, 60% of ($n=332$) respondents reported that they had lived in their current residence at the time of sampling for less than 10 years. The 2004 survey found similar results with over half of the ($n=335$) respondents reported as moving into their residence before the previous 1994 survey. The average year in which 2004 survey respondents reported moving into their residence was 1990. This does not mean however, that all 2004 respondents were 1994 survey respondents as well.

Using the identification numbers on the top-right of the returned questionnaires, I linked addresses and names of households contacted in both sampling years. If residential occupants completed questionnaires in both survey years, other information found in the questionnaire could be used to determine what type of match exists. Three types of 'matched' categories emerged linking the 2004 sample addresses with those of 1994. These are: 1) matched respondents; 2) matched households; and 3) matched addresses. Questionnaires identified as 'matched respondents' were those returned from both sample years in which respondent attributes closely match those of both years, taking into consideration the passage of time and other household information. Similarly, questionnaires identified as 'matched households' linked respondents by information provided in the completed surveys. Questionnaires identified as 'matched addresses' resulted from different respondents completing the questionnaire from the same address but in different survey years. For example, if it is known that the same address but different name of occupant was contacted in both survey years, and both questionnaires were returned completed, then these types of surveys are matched by address, since it is unlikely that the same household or respondent could have returned both surveys[1]. If the same address and occupant was contacted in both surveys, and both times the questionnaire was returned completed, then further examination of the respondents' background information would be necessary to determine the association between respondents. Upon investigation, if the respondent was not the same, then likely the partner or spouse completed the survey and these types of surveys are matched by household. Between the 1994 and 2004 surveys, over one-third of occupants (37% exactly) were matched together (Table 5.7).

Table 5.7 - Matched and Unmatched Occupants between 1994 and 2004 Surveys

Total Matched Occupants

	#	%
Matched Respondents	73	21.8
Matched Households	16	4.8
Matched Addresses	36	10.7
Total	125	37.3

Total Unmatched Occupants

	1994 Survey		2004 Survey	
	#	%	#	%
Isolated Occupants	164	49.4	97	29.0
Unique Addresses	35	10.5	110	32.8
Anonymous Occupants	8	2.4	3	0.9
Total	207	62.3	210	62.7

1994 n = 332, 2004 n = 335

Completed questionnaires from 'unmatched occupants' were also assigned into three categories: 1) isolated occupants; 2) unique addresses; and 3) anonymous occupants. 'Isolated occupants' were those returned surveys from residences in either sampling year, but not returned in both sampling years. 'Unique addresses' never had a chance to be matched between sampling years, as these addresses were unique to either the 1994 or 2004 surveys. 'Anonymous occupants' categorize those questionnaires that had their identification number removed or scratched out beyond recognition, so that matching and other descriptive information would be impossible to verify. More 'unique address' questionnaires were returned in the 2004 survey (n=110) than in 1994 (n=35), while the 1994 survey had slightly more anonymous occupants (n=8) (Table 5.7).

5.3 Residential Information

In both Kitchener and Waterloo, the majority of urban residents live in single dwelling units including single-detached, semi-detached, and town house/ row housing structure types. This type of residential development is common in both cities with over 45,000 units in Kitchener and over 25,000 units in Waterloo, totaling more units than any other by structure type, including apartment buildings (City of Kitchener 2004; City of Waterloo 2004b). Compared with other cities in Canada, both Kitchener and Waterloo have higher percentages of home ownership and a high percentage of single dwelling units. In this respect, these cities are a little unusual. Approximately 95% of respondents in both the 1994 and 2004 surveys indicated their residences as single-detached, semi-detached, or town/row housing (Table 5.8). In both surveys, more than 80% of respondents indicated they lived in a single-detached house. Although apartment units were included in the initial 1994 survey sample, less than 5% of respondents indicated their residence as either an 'apartment in a building of 4 storeys or lower' or 'apartment in a building of 5 storeys or higher'. For the 2004 survey, apartment dwellers were not intentionally sampled unless they had remained in the same unit since the 1994 survey. Thus, only 1.5% of respondents were from apartment buildings in the 2004 survey.

The majority of respondents' residences in 1994 were between 11 and 40 years old while in 2004 they were between 21 and 40. The most common age of residences were reported to be between 21 and 40 years of age in both survey years. A significant difference of residence ages between surveys was the 6 to 10 year bracket ($z = 6.111$ – Appendix 2), with substantially more respondents in 1994 than in 2004. This difference reflects a recent house-building boom in Kitchener and Waterloo between 1985 and 1990 approximately. Likewise, significantly more 2004 respondents indicated their residence fit the 41-60 years bracket than in 1994 ($z = 4.175$ – Appendix 2). This finding may reflect the aging housing stock that was built during the housing boom after World War II (Fig. 5.1).

Table 5.8 - Residence Types

	1994 Survey		2004 Survey	
	#	%	#	%
Single detached house	271	82.1	288	86.7
Semi-detached house	17	5.2	18	5.4
Town house /Row house	27	8.2	23	6.9
Apartment in a building of 4 storeys or lower	12	3.6	5	1.5
Apartment in a building of 5 storeys or higher	3	0.9	0	0.0
Rooms in a house or apartment	0	0.0	1	0.3
	n = 330		n = 335	

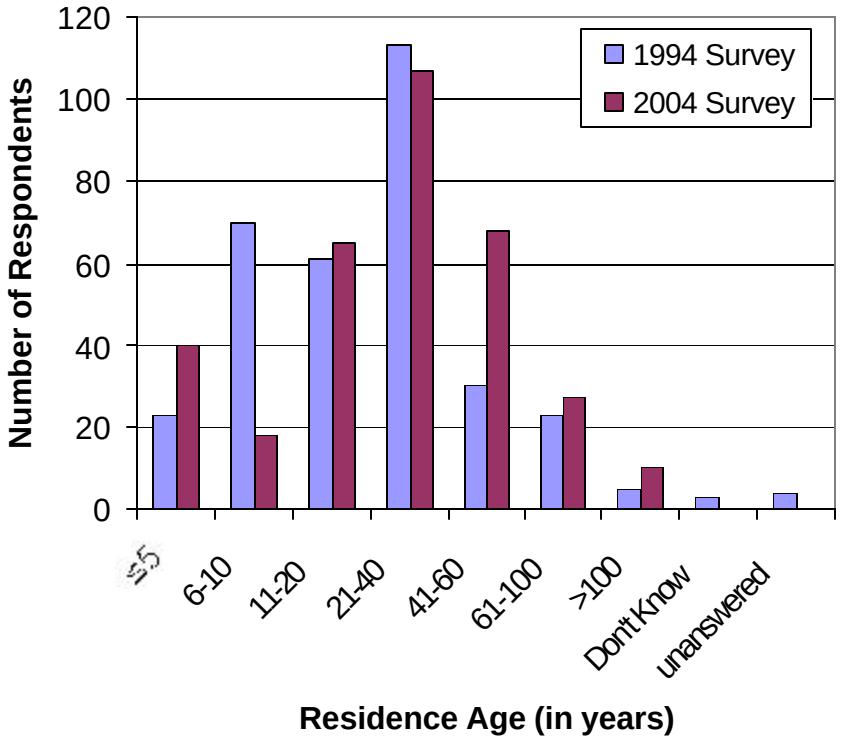


Fig. 5.1 - Age of Residences

The majority of respondents from both survey years owned their residence. Eighty-seven percent and 94% of respondents in 1994 and 2004 surveys, respectively, owned their residences. Less than 5% of respondents owned their residence as a condominium in both surveys, while approximately 10% of

respondents in the 1994 survey were renters, compared with 2% in 2004. These percentages do not match housing statistics of the City of Kitchener (2004) where approximately 40% of the occupied private dwellings are rented and approximately one-third of dwellings are rented in the Region of Waterloo. It is speculated that this discrepancy is an artefact of reporting rates, since the content of this survey is perhaps more geared towards homeowners and less toward renters. In addition to poor response rates in mail-in surveys, renters are less likely to respond to this survey because their investment in the residence is short-term and yard landscaping concerns are probably not a priority on property that is not their own. Therefore, the majority of residences sampled were reported to be between 21-40 years of age with most of the respondents owning their residences.

The cost of housing is increasing in Kitchener and Waterloo as in all of Southern Ontario. In Kitchener alone, the cost of a standard 2-storey home has increased more than $30,000 since the year 2000 (City of Kitchener 2004). This trend is also seen in the market values of housing in the 1994 and 2004 surveys (Table 5.9). Statistically, the housing values were reported to be between $25 to 50,000 more in the 2004 survey compared with the 1994 survey. More than 65% of respondents in the 1994 survey indicated their residence market value was between a $100 to 200,000 range compared with a $150 to 300,000 range in the 2004 survey. In 2004, the City of Kitchener (2004) cites an average of $185,000 for a standard 2-storey house compared with an average $197,000 in the City of Waterloo (2004b). Therefore, the market value of housing reflects differing trends in housing costs between survey years.

Table 5.9 - Residence Market Values

	1994 Survey		2004 Survey	
	#	%	#	%
less than $100,000	14	4.2	3	0.9
$100 K, 100-150,000	125	37.9	57	17.2
$150 K, 100-200,000	103	31.2	125	37.8
$200 K, 100-300,000	49	14.8	98	29.6
more than $300,000	19	5.8	39	11.8
Don't Know	20	6.1	9	2.7
unanswered	2		4	

mean	$150K	$150K - 200K
mode	$100K	$150K
	n = 330	n = 331

The majority of survey respondents had residences with private outdoor space. Eighty-five percent (n = 326) and ninety percent (n = 334) of 1994 and 2004 survey respondents, respectively, had private yards that were only used by the respondent's household (Table 5.10). The remaining percentage of respondents had either common or a combination of common and private outdoor space. The majority of longitudinal matches (respondent, household, and address matches) also had private yard space, although several indicated a switch to private outdoor space in the 2004 survey from a combination of common/private space in the 1994 survey.

Table 5.10 - Types of Yards

	1994 Survey		2004 Survey	
	#	%	#	%
Common	15	4.6	4	1.2
Both common/private	33	10.1	29	8.7
Private	278	85.3	301	90.1
unanswered	6		1	
	n = 326		n = 334	

Survey respondents estimated the size of their private outdoor space excluding the ground area of buildings but including paved areas and other hard surfaces. More than seventy percent of respondents from both survey years indicated that their outdoor space was less than 900 square meters, while approximately ten percent of respondents indicated their space was greater than this amount (Table 5.11). Size estimates were roughly the same between survey years and cities. In both surveys, there was a large portion of respondents (>15%) that either could not estimate the size of their outdoor space or were not familiar with the measurement units, as they indicated "I don't know". Likewise, many respondents (approximately 17% in both surveys) left this question unanswered. Despite providing the option for respondents to estimate their yard in imperial measurements, both the "I don't know" and "unanswered" categories together account for a large percentage of the survey respondents, approximately 30% of both surveys. In the 1994 questionnaire there was a half-page blank space for respondents to draw or determine their outdoor area using a different method, however, to cut down the questionnaire's length in 2004, this mechanism was not included. Responses were also highly variable between longitudinally matched surveys – matched respondents, households, and addresses – revealing a similar trend (Fig. 5.2). With this question in particular, matched respondents could not determine the size of their outdoor space consistently between survey years. Therefore, while the majority of respondents indicated they had an

outdoor space below 900 square meters, many respondents could not estimate the size or did not answer the question.

Table 5.11 – Estimated Size of Private Outdoor Space

	1994 Survey (n = 275)		2004 Survey (n = 309)	
Square Meters (m^2)	#	%	#	%
< 25	7	2.5	15	4.9
26 - 100	56	20.4	57	18.4
101 - 400	65	23.6	80	25.9
401 - 900	75	27.3	75	24.3
901 - 1600	19	6.9	18	5.8
> 1600	11	4.0	12	3.9
Don't Know	42	15.3	52	16.8
not answered	57		26	
Summary: < 900 m^2	203	73.8	227	73.5

In residential areas, outdoor space is usually an assortment of many different types of uses. In the questionnaire, respondents divulged information about the kinds of uses that form their outdoor space and estimated its percent area of the total space. If respondents could not figure out the percentages of the use (to the nearest 5%), then they could simply mark each use that was present in their private outdoor space. The three types of uses that were most common in both the 1994 and 2004 surveys were lawns, flower gardens, and shrubs and trees (Table 5.12). In the 1994 survey, 86% of respondents indicated that they had a lawn, 79% had a flower garden, and 77% had shrubs and trees. In the 2004 survey, 93% of respondents indicated that they had a lawn, 87% had a flower garden, and 82% had shrubs and trees. Asphalt and various hard surfaces also were common uses indicated by more than half of the survey respondents in both years, followed by less common items (in order by percent use): concrete, vegetable garden(s), ground covers, a swimming pool, and other items specific to each dwelling. The lawn, flower garden, and hard surfaces were the only uses significantly more abundant in 2004 than in 1994 ($z = 3.050$, 2.663, 2.874 – respectively, Table 5.12).

The order or rank of typical uses was not much different between survey years. With the exception of vegetable gardens, the 2004 survey had higher percentage responses for every use compared with the 1994 survey (Table 5.12). Hence, more respondents in 2004 reported having additional uses in their private outdoor space than survey participants in 1994. This trend is confirmed in longitudinally matched surveys, where the same residence was in question for both survey years (Table 5.13). The ‘vegetable

garden' use is of particular interest as it received the most substantial difference of responses between survey years for both matched respondents and households, yet it did not comprise a significant difference (z = 1.640, 1.155 – respectively, Table 5.13). Nine matched respondents (n=73) indicated that they did not have a vegetable garden in 2004 when they had one in 1994, while four matched households (n=16) had a vegetable garden in 2004 while they indicated they did not have any in 1994. Also of note is the trend for more 'flower gardens', as there were significantly more flower gardens reported in 2004 by matched respondents than in 1994 (z = 2.369, Table 5.13). While every use, except 'vegetable garden', received more responses in all 2004 surveys, more 'flower gardens' were consistently reported to be present in the yards of matched respondents, households, and addresses in 2004 (Table 5.13). Flower gardens are the only type of use that increased between all three longitudinally matched categories in 2004. Therefore, lawns, flower gardens and shrubs and trees were the most dominant elements in residential outdoor spaces, having remained in this order for at least 10 years.

Table 5.12 - Percent Area of Private Outdoor Space – All Occupancies

Type of Use Present

	1994 Survey (n = 332)		2004 Survey (n = 335)			
	#[1]	%	#[1]	%	Z Score	S.S.D.[4]
Concrete	141	42.5	149	44.5	0.521	NO
Asphalt	215	64.8	235	70.1	1.463	NO
Hard Surfaces*	201	60.5	238	71.0	2.874	YES
Lawn	284	85.5	311	92.8	3.050	YES
Flower Garden	263	79.2	291	86.9	2.663	YES
Shrubs/trees	254	76.5	276	82.4	1.890	NO
Vegetable Garden	107	32.2	100	29.9	0.642	NO
Swimming Pool	30	9.0	29	8.7	0.136	NO
Ground Covers	86	25.9	105	31.3	1.547	NO
Others	21	6.3	25	7.5	0.612	NO

Type of Use Present with Estimation

	1994 Survey			2004 Survey				
	#[2]	%	[3]Mean %	#[2]	%	[3]Mean %	Z Score	S.S.D.[4]
Concrete	89	26.8	11.8	100	29.9	8.7	0.185	NO
Asphalt	150	45.2	12.4	178	53.1	12.1	0.031	NO
Hard Surfaces*	139	41.9	13.5	180	53.7	12.7	0.060	NO
Lawn	224	67.5	54.2	240	71.6	52.7	0.057	NO
Flower Garden	178	53.6	10.9	212	63.3	11.6	0.084	NO
Shrubs/trees	161	48.5	11.9	199	59.4	10.1	0.212	NO
Vegetable Garden	60	18.1	10.6	68	20.3	7.9	0.220	NO
Swimming Pool	19	5.7	16.3	23	6.9	14.7	0.045	NO
Ground Covers	52	15.7	8.9	73	21.8	10.5	0.095	NO
Others	13	3.9	9.5	21	6.3	14.4	0.122	NO

Note: * - surfaces that let water through

[1] - the number of respondents that ticked or estimated (%) each type of use they had

[2] - the number of respondents that estimated % of total area, according to type of use

[3] - the average % of total area estimated

[4] - S.S.D. = Statistically Significant Difference - significant at the .05 level

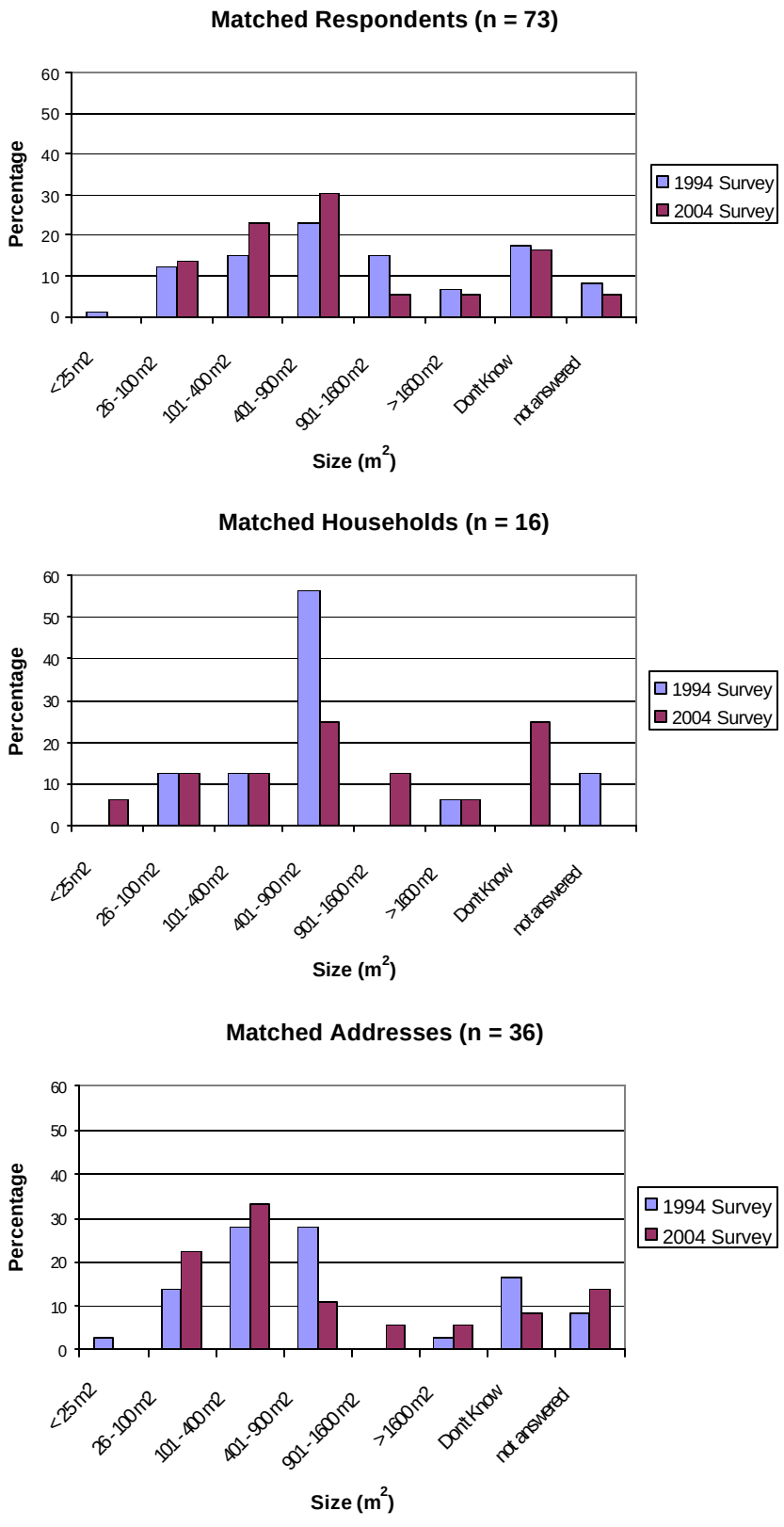


Fig. 5.2 - Matched Occupants Estimating Size of Yard Space

Private outdoor spaces can be constructed to the residents' taste, at least to some degree. The results in Table 5.12 indicate that lawns are favoured by the majority of respondents in both survey years, estimated to cover over 50% of the total private outdoor space, on average. Other common uses such as flower gardens and shrubs and trees typically cover approximately 10% of the total outdoor area. Asphalt and other hard surfaces may cover slightly more than 10% of the total outdoor area for any given residential property. Overall, pervious surfaces were estimated to cover approximately 18% of occupants'

Table 5.13 - Types of Uses Present in Private Outdoor Space – Matched Occupancies

	1994 Survey		2004 Survey			
	#[1]	%	#[1]	%	Z Score	S.S.D.[2]
Matched Respondents (n=73)						
Concrete	28	38.4	32	43.8	1.264	NO
Asphalt	48	65.8	50	68.5	1.154	NO
Hard Surfaces*	52	71.2	53	72.6	0.859	NO
Lawn	68	93.2	68	93.2	0.000	NO
Flower Garden	62	84.9	68	93.2	2.369	YES
Shrubs/trees	61	83.6	62	84.9	0.896	NO
Vegetable Garden	28	38.4	19	26.0	1.640	NO
Swimming Pool	9	12.3	8	11.0	0.325	NO
Ground Covers	24	32.9	25	34.2	0.562	NO
Others	4	5.5	2	2.7	0.240	NO
Matched Households (n=16)						
Concrete	5	31.3	5	31.3	0.000	NO
Asphalt	13	81.3	13	81.3	0.000	NO
Hard Surfaces*	10	62.5	11	68.8	0.820	NO
Lawn	15	93.8	16	100.0	0.996	NO
Flower Garden	14	87.5	15	93.8	0.970	NO
Shrubs/trees	14	87.5	13	81.3	0.927	NO
Vegetable Garden	4	25.0	8	50.0	1.155	NO
Swimming Pool	3	18.8	2	12.5	0.366	NO
Ground Covers	2	12.5	9	56.3	1.248	NO
Others	3	18.8	4	25.0	0.445	NO
Matched Addresses (n=36)						
Concrete	17	47.2	15	41.7	0.934	NO
Asphalt	23	63.9	22	61.1	0.798	NO
Hard Surfaces*	27	75.0	29	80.6	1.266	NO
Lawn	34	94.4	32	88.9	1.365	NO
Flower Garden	29	80.6	32	88.9	1.620	NO
Shrubs/trees	31	86.1	30	83.3	0.930	NO
Vegetable Garden	12	33.3	11	30.6	0.552	NO
Swimming Pool	0	0.0	2	5.6	n/a	NO
Ground Covers	10	27.8	11	30.6	0.537	NO
Others	2	5.6	2	5.6	0.000	NO

* - surfaces that let water through

[1] - the number of respondents that ticked each type of use they had

[2] - S.S.D. = Statistically Significant Difference - significant at the .05 level

private outdoor space compared with 10% coverage of impervious surfaces, on average. The average percentage cover of all pervious uses fell by almost 1% in 2004 from 1994 estimations (Table 5.14). This slight difference was also reflected in the matched occupancies. Matched occupancies estimated that impervious uses covered at least 2% more space, on average, in 2004 than in 1994, while the results from all occupancies showed declining pervious use coverage in 2004. Therefore, while there was no significant difference between percentage cover of individual types of uses and survey years, average percentage coverage of combined pervious/impervious uses showed minor differences between all and matched occupancies.

Table 5.14 – Average Pervious/Impervious Cover between 1994 and 2004

Pervious*	**1994 (%)**	**2004 (%)**
All Occupancies	18.34	17.58
Matched Occupancies	18.33	17.87
Impervious*		
All Occupancies	13.48	11.84
Matched Occupancies	9.48	11.83

*Note: pervious cover included: hard surfaces, lawn, flower garden, shrubs and trees, vegetable garden, and ground covers
impervious cover included: concrete, asphalt, and swimming pool

The average percentage cover of 'ground covers', 'vegetable gardens', and 'swimming pools' varied slightly between survey years for matched longitudinal surveys (Fig. 5.3). For example, matched respondents in 2004 reported an average 6% area increase in ground covers since 1994, although the difference was not found to be significant ($z = 0.111$ – Appendix 2). Matched addresses in 2004 show a slight increase in average area percent cover of lawn, swimming pool, and ground cover and a slight decrease in average area percent cover of asphalt, vegetable garden, and other uses compared with 1994 survey results. Thus, comparing the same addresses between survey years, it seems that ground covers and swimming pools, in particular, slightly increased in percentage cover of outdoor space since 1994. In contrast, vegetable gardens decreased in average percentage cover of outdoor space since 1994, although these changes are not significantly different between survey years (Appendix 2). Hence, for the major outdoor uses such as the lawn and shrubs and trees, little change in percent area cover occurred in ten years. However, for less common features such as vegetable gardens, swimming pools, and ground covers, the fashion for these uses seems to have changed somewhat.

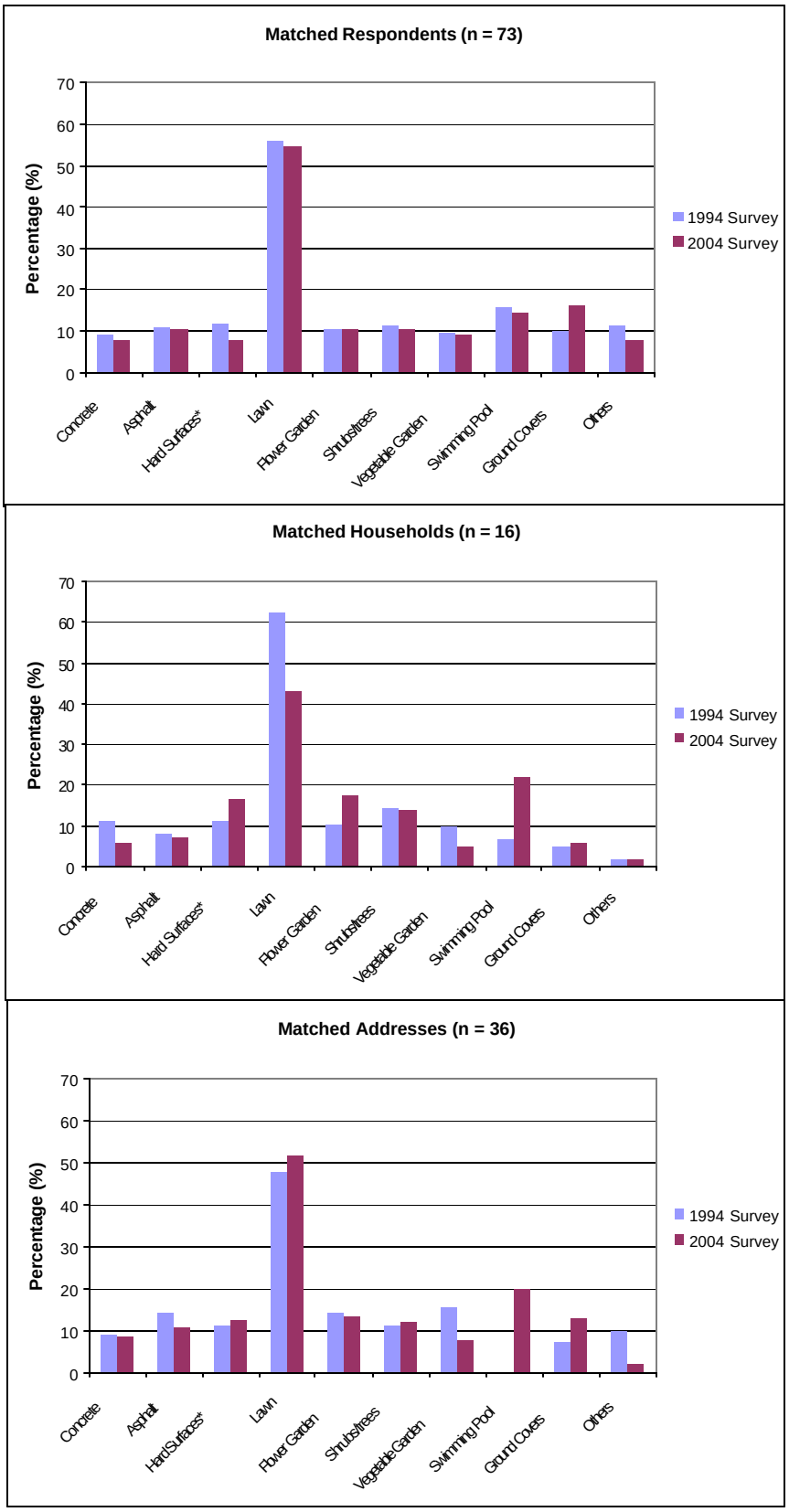


Fig. 5.3 – Average Percent Area of Private Outdoor Space – Matched Occupancies

5.4 Water Information

5.4.1 Water Costs

Survey respondents were asked to give information on water charges at their place of residence. The 2004 survey asked residents to provide the total utility fee for November 2002 to October 2003, including the water and sewer charge. On average (n=234), the total utility fee was $491 for respondents, including those values based on actual bills and best guesses. Total utility fees from actual bills were reported to be $417, on average, while respondents' best guesses were slightly higher at $518. Since the total utility fee is divided into a water and sewer charge, the approximate cost of water charges for a residence in Kitchener and Waterloo were reported to be between $210-260 per year. The 2004 average utility fees were lower than fees reported in the 1994 survey, although 1994 participants were asked to only record the water charge. As more than 30% of respondents in both survey years either did 'not know/could not say' what the total utility fee was for their residence or left this question unanswered it may have been confusing or difficult. Thus, it is likely that a large percentage of respondents did not understand what values were asked of them in question 16 of the 1994 survey.

Results from the longitudinal matched surveys reveal a similar pattern to those of all occupants. On average, the total utility fee for matched respondents (n=62) in 2004 was $524.00 – matched households (n=11) $480.81 and matched addresses (n=25) $392.28 – including those values based on actual bills and best guesses. Average 2003 utility fees based on actual bills were $444.90 for matched respondents (n=43), $458.33 for matched households (n=7), and $422.79 for matched addresses (n=10). Average 2003 utility fees based on best guesses were $486.79 for matched respondents (n=18), $331.19 for matched households (n=4), and $381.77 for matched addresses (n=15). Reported 1994 water charges were higher than approximate 2004 water fees (divide total utility fee in half for approximate water charges) for matched occupancies. These matched results between 1994 and 2004 surveys parallel those found for all occupancies.

In both survey years, respondents were also asked how much they would be prepared to pay to water their garden and/or lawn per year. There was a mix of responses to this question as many respondents said that they don't water their yard and others said that they would be willing to spend up to $5000 a year. However, on average, survey respondents reported that they would be willing to pay $152 (n=216) in 1994 and $187 (n=241) in 2004 (Table 5.15) to water their lawn and/or garden, a difference of $35 between survey years. Using an inflation calculator (Bank of Canada 2005) based on monthly Canadian consumer price index (CPI) data, respondents spending $152 in 1994 is equivalent to $186 in 2004. Thus, survey respondents in 1994 and 2004 were prepared to spend an equivalent amount of money to water their lawn and/or garden.

Table 5.15 - How much are Respondents Willing to Pay to Water the Garden and/or Lawn?

	1994	2004
Mean	$151.63	$186.91
Max	$1,000.00	$5,000.00
Median	$100.00	$100.00
Mode	$100.00	$100.00

1994 n = 216, 2004 n = 241

Longitudinal matched surveys revealed similar results regarding water costs for gardens and/or lawns. Longitudinally matched respondents, households, and addresses in 2004 were willing to spend more money on water for gardens and/or lawns than they reported in 1994 (Table 5.16). Matched respondents in 2004 indicated they would spend an average of $60 more to water their garden and/or lawn then reported in 1994, although this is only slightly more than respondents were willing to spend in 1994 after adjusting for inflation (Bank of Canada 2006). After inflation adjustments, matched households and addresses in 2004 reported they would spend slightly less than they indicated in 1994. Yet typical urban residents are still willing to pay money to water their garden and/or lawn. While some respondents were willing to pay much to water their lawn and/or garden and others were willing to pay nothing at all, the overall results signify that average urban residents in 2004 were willing to pay the same as what they were willing to pay in 1994, which is about $150 to 200 per year.

Table 5.16 - How much are Matched Respondents Prepared to Pay to Water the Garden and/or Lawn?

		n = $0	n = > $0	$ >= $0	
				Average ($)	Median ($)
MR	1994	10	40	148.40	77.50
	2004	11	41	212.02	67.50
MH	1994	1	12	136.54	60.00
	2004	1	9	159.50	150.00
MA	1994	4	20	106.04	62.50
	2004	9	19	127.14	75.00

Note: MR - Matched Respondents (n=73)
MH - Matched Households (n=16)
MA - Matched Addresses (n=36)

5.4.2 Water Devices

Survey respondents indicated which types of outdoor water devices were present at their place of residence. More than half of the respondents from both survey years had an outside tap, a garden hose, and a non-hand held sprinkler (Fig. 5.4). Most residences had a garden hose and an average of 1.58 outside taps. Less than ten percent of respondents had a swimming pool, a hot tub, an in-ground sprinkler system, a private well, or a cistern. Water barrels or similar devices collecting water were found at thirty percent of 2004 respondents' place of residence, ten percent more than reported in 1994. The proportional difference in water barrels between survey years is statistically significant ($z = 2.955$ – Appendix 2). In addition, the average number of barrels rose from 1.75 to 2.3 per residence. Generally, the statistics for longitudinal matched occupancies mirrored those of all occupancies between sample years. In-ground sprinklers were also found to be significantly more abundant in 2004 than in 1994, although they only account for 6% of 2004 respondents ($z = 2.410$ – Appendix 2). These results confirm that with the exception of water barrels and in-ground sprinklers, outdoor water devices did not greatly change between survey years or between matched respondents, households, or addresses in Kitchener and Waterloo. The increase in water barrels may reflect the free water barrel program in the Region of Waterloo. Therefore, the majority of respondents had an outside tap, a garden hose, and a non-hand held sprinkler at their residence in 1994 and 2004. In general, residences in 2004 resembled those in 1994 except that water barrels were significantly more common.

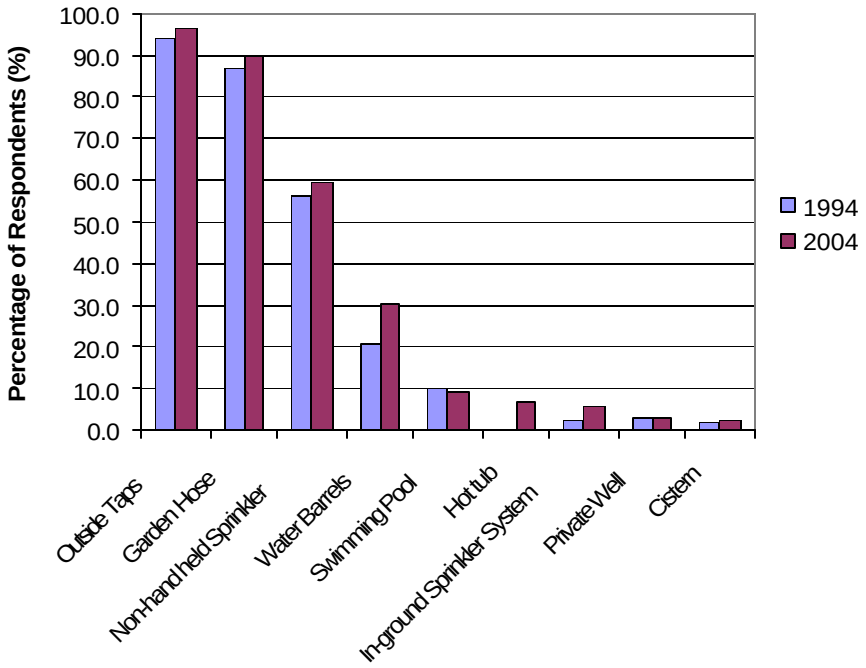


Fig. 5.4 - Percentage of Respondents with Water Devices

5.5 Landscape Preferences – Survey Poster Results

5.5.1 Actual Yard Style

Respondents to the 1994 and 2004 surveys on yard landscaping and maintenance practices were asked to identify which pictures from the poster, which was included in the survey package, were most like their own. (Yard Photographs are in Appendix 5). Photograph A – Lawn represented more than 60% of respondents' yards in both survey years (Table 5.17). Photograph B – Flower Garden matched approximately 25% of respondents' yards while photograph E – Stone & Ground Cover and F – Edged Ornamental matched roughly 10% each. In both surveys, 13% of respondents indicated that 'none of the pictures on the poster were like their own garden'. Less than 5% of respondents indicated that photograph D - Xeriscape was like their own yard style in some way. Significantly more respondents identified Photograph C – Edged Garden as resembling their yards in 2004 than in 1994 ($z = 2.126$, Table 5.17). In general, the Lawn photo reflected the majority of respondents' yards and gardens while the Xeriscape photo represented an uncommon style of landscaping found on few residential properties.

Similar results were found among longitudinally matched surveys. The Lawn photo continued to be the dominant style of respondents' yards between survey years for longitudinally matched respondents, households, and addresses (Fig. 5.5). The Edged Garden photo resembled more yards in 2004 than in 1994, especially for matched addresses where the percentage difference was statistically significant ($z = 1.785$ – Appendix 2). Few yards resembled the Xeriscape photo, with little change between survey years. Although the major trends are consistent between survey years, there are interesting percentage changes between longitudinal matches. For example, yards resembling the Flower Garden photo were identified fewer times by matched respondents in 2004 than in 1994. However, the Flower Garden photo represented more yards in 2004 than in 1994 for matched households and addresses, even though these differences are insignificant ($z = 0.575, 0.644$ – Appendix 2). In addition, results from matched addresses show a significant reduction of yards represented by the Lawn photo ($z = 2.029$ – Appendix 2) and a significant increase ($z = 1.785$ – Appendix 2) in yards similar to the Edged Garden photo in 2004 compared with 1994 results. Hence, while major trends remain the same for longitudinal matches and total respondent information between survey years, interesting longitudinal data exists that could be further explored.

Yard Photograph Descriptions - Kitchener/ Waterloo Gardens Poster (Appendix 5)

Photo A – Lawn – a monoculture lawn with a sidewalk. Small flowers and shrubbery lie adjacent to the walls of the home.

Photo B – Flower Garden – a sidewalk with ground covers, flowers, landscaping, and some shrubs on either side. No lawn present.

Photo C – Edged Garden – a sidewalk lined with mulch, flowers, and some shrubs and trees, followed by edged lawn. Similar to Edged Ornamental Photo.

Photo D – Xeriscape – a xeriscaped yard consisting of rocks, stones, and drought-resistant shrubs and trees. No lawn present.

Photo E – Stone & Ground Cover – an armour-stone landscaped yard, covered with ground cover, low bushes, and a single deciduous tree.

Photo F – Edged Ornamental – a sidewalk lined with compact bushes, hardy plants, and some flowers. Limited edged lawn is pictured. Similar to Edged Garden Photo.

Table 5.17 – Yard Styles Reflected in Survey Respondents' Yards

	1994 Survey		2004 Survey			
Photograph	#	%	#	%	Z Score	S.S.D.*
A - Lawn	200	60.2	211	63.0	0.744	NO
B - Flower Garden	83	25.0	76	22.7	0.697	NO
C - Edged Garden	59	17.8	82	24.5	2.126	YES
D - Xeriscape	8	2.4	11	3.3	0.699	NO
E - Stone & Ground Cover	36	10.8	37	11.0	0.083	NO
F - Edged Ornamental	38	11.4	37	11.0	0.164	NO
G. None	44	13.3	45	13.4	0.038	NO

Note: 1994 n = 332, 2004 n = 335

* S.S.D. = Statistically Significant Difference - significant at the .05 level

5.5.2 Landscape Discussion

A ten year gap between surveys is enough time for residents to change the style of their yard if given the opportunity and will to do so. Respondents' yard style at the time of the survey can help to identify yard aesthetics and fashions between two different decades. The results indicate that yard fashions have not changed much between 1994 and 2004, with the exception of the Edged Garden photo style, which was reported as a landscape style significantly more times in 2004 than in 1994. Perhaps an emerging landscape style is a blend between the Edged and Flower Garden styles. Yet, despite this change, the aesthetic fashion for residential yards and gardens has changed little between decades, with the majority of yards reflecting a large lawn presence similar to the Lawn photo. Shrubbery, ground covers, mulch, and some perennial and annual flowers are also reflected in approximately a quarter of residents' yards as seen in the Flower and Edged Garden photographs. Overall, these yard styles have not changed dramatically between decades.

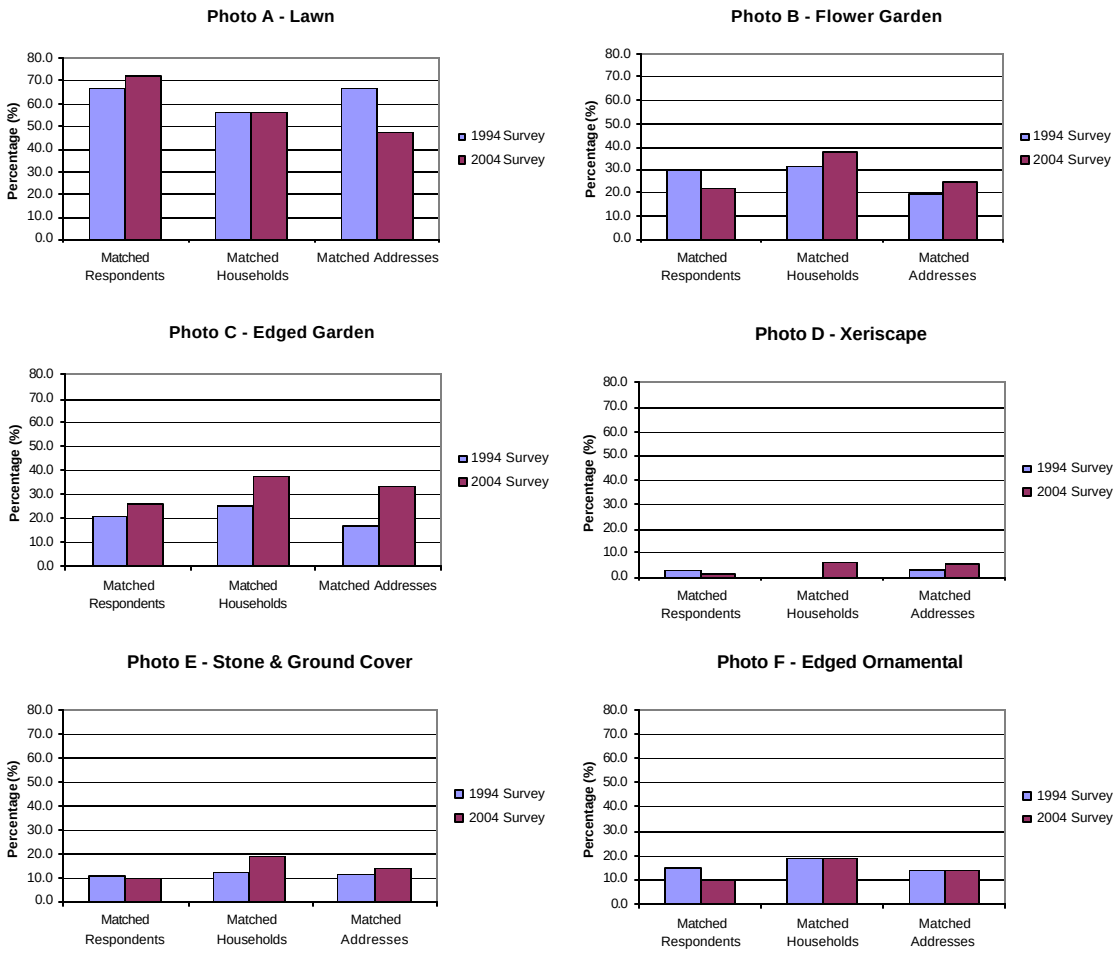


Fig. 5.5 – Yard Styles Most Reflected in Survey Respondents' Yards - Matched Occupancies

5.5.3 Attitudes Towards Yard Photographs

Survey respondents were asked to identify how they felt about each style of landscaping from the photographs in the poster. The allowed response range varied from '5' – strongly likes to '1' – strongly dislikes. Percentage responses were calculated for each photograph for all occupants (Table 5.18) and matched respondents (Table 5.19). The Lawn and Flower Garden photographs were most strongly liked while the Xeriscape photo was the most strongly disliked between survey years, all surveys, and matched respondents. The Edged Ornamental photo was also liked by approximately half of the respondents in both surveys. The Edged Garden and Stone & Ground Cover photographs were generally neither strongly liked nor strongly disliked. While respondents showed varied attitudes towards the photographs on the

poster, notable strong feelings were shown towards the Lawn, Flower Garden, and Xeriscape photographs.

Table 5.18 – Percent Responses for each Style of Landscaping – All Occupants 1994 & 2004

		Strongly Like				Neutral				Strongly Dislike			
		5		4		3		2		1		Z	
	Survey Year (%)	1994	2004	1994	2004	1994	2004	1994	2004	1994	2004	Scores[1]	S.S.D.*
Photographs	A - Lawn	26.0	25.5	33.0	26.4	22.1	28.0	13.5	9.6	5.4	10.6	**1.452**	NO
	B - Flower Garden	28.1	32.9	38.2	37.9	20.6	19.4	9.2	7.2	3.9	2.5	**1.789**	YES
	C - Edged Garden	6.9	12.1	26.4	31.2	26.7	35.8	24.1	15.9	15.8	5.0	**5.160**	YES
	D - Xeriscape	3.0	5.7	8.5	8.5	19.0	18.9	31.8	30.3	37.7	36.6	**0.993**	NO
	E - Stone & Ground Cover	6.9	10.7	21.6	25.5	27.5	28.6	28.2	25.2	15.7	10.1	**2.798**	YES
	F - Edged Ornamental	14.4	19.4	35.3	40.4	31.4	27.0	14.1	8.5	4.9	4.7	**2.509**	YES

Note: * S.S.D. = Statistically Significant Difference - significant at the .05 level

[1] - based on means for 1994 and 2004 survey respondents

1994 n=332 (subtract unanswered)

2004 n=335 (subtract unanswered)

Table 5.19 – Percent Responses for each Style of Landscaping – Matched Respondents

		Strongly Like				Neutral				Strongly Dislike			
		5		4		3		2		1		Z	
	Survey Year (%)	1994	2004	1994	2004	1994	2004	1994	2004	1994	2004	Scores[1]	S.S.D.*
Photographs	A - Lawn	32.4	27.8	32.4	34.7	19.7	23.6	12.7	6.9	2.8	6.9	**0.525**	NO
	B - Flower Garden	23.9	25.7	42.3	45.7	21.1	14.3	5.6	10.0	7.0	4.3	**0.488**	NO
	C - Edged Garden	5.8	8.5	30.4	32.4	26.1	29.6	24.6	21.1	13.0	8.5	**1.051**	NO
	D - Xeriscape	1.4	0.0	4.3	4.3	25.7	17.1	30.0	28.6	38.6	50.0	**1.513**	NO
	E - Stone & Ground Cover	4.2	7.1	21.1	22.9	33.8	27.1	23.9	30.0	16.9	12.9	**0.473**	NO
	F - Edged Ornamental	14.3	20.3	37.1	37.7	30.0	20.3	10.0	15.9	8.6	5.8	**0.621**	NO

Note: * S.S.D. = Statistically Significant Difference - significant at the .05 level

[1] - based on means for 1994 and 2004 matched respondents

Matched Respondents n = 73 (subtract unanswered for each survey year)

Percentages of photographs liked (response of '5' or '4'), disliked (response of '2' or '1'), or found neutral (response of '3') are compiled in Fig. 5.6. The Lawn, Flower Garden, and Edged Ornamental photographs are liked by at least half of the respondents while the Xeriscape photo is disliked by more than sixty percent of the respondents. An interesting occurrence between survey years is that, with the exception of the Lawn photo, all other photographs were liked more and disliked less in 2004 than in 1994. Specifically, the Edged Garden, Stone & Ground Cover, and Edged Ornamental photographs were liked significantly more in 2004 than in 1994 (z = 2.584, 2.062, 2.574, respectively – Appendix 2). Results from matched respondents in Fig. 5.6 generally reflect more consistency in preferences of landscaping styles than all survey results. However, a particular difference is noticeable - approximately ten percent more matched respondents indicated they disliked the Xeriscape photo in 2004 than in 1994, although this difference is not statistically significant (z = 1.351 – Appendix 2). These

trends are also highlighted in the average responses to yard photographs in 1994 and 2004 (Fig. 5.7). Fig. 5.7 confirms that the Lawn, Flower Garden, and Edged Ornamental photographs were typically liked by respondents, the Flower Garden and Edged Ornamental photographs more so in 2004 than 1994. The Edged Garden and Stone & Ground Cover photographs were neither liked nor disliked, in general, although they were slightly disliked in 1994. The Xeriscape photo was disliked in both survey years, perhaps with a greater consistency than any of the other pictures. Percentage differences between survey years may be a small clue to the attitude trends of residents towards yard aesthetics or what is considered attractive or unattractive in private yards and gardens.

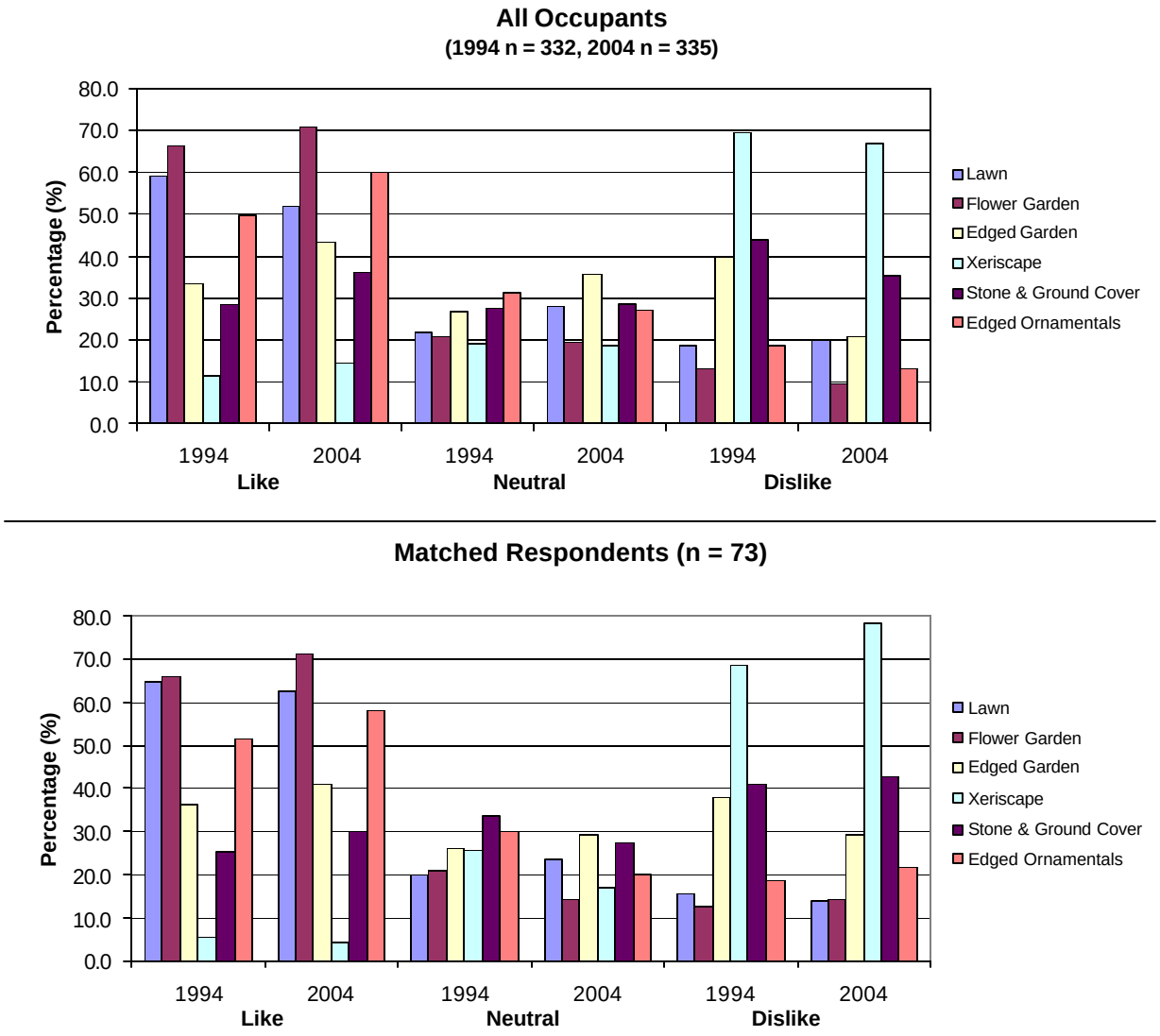


Fig. 5.6 - Summary of Percentage Responses towards Yard Photographs – All and Matched Respondents

Respondents were asked to imagine a scenario where they are interested in buying or renting a residence. Respondents were asked to identify which style or styles would attract or deter them from choosing that dwelling. The Lawn and Flower Garden photographs were found to attract approximately 50% and deter approximately 10% of respondents in both survey years (Figs. 5.8 and 5.9). The Edged Garden and Stone & Ground Cover photographs had similar levels of attractiveness with one another, attracting approximately 15-20% and deterring approximately 20% of respondents. The Xeriscape photo was the least attractive style of landscaping, attracting fewer than 10% and deterring over 60% of respondents. The Edged Ornamental photo attracted approximately 35% of respondents while deterring roughly 10%. In general, responses from matched respondents paralleled these landscaping style preferences from all the surveys.

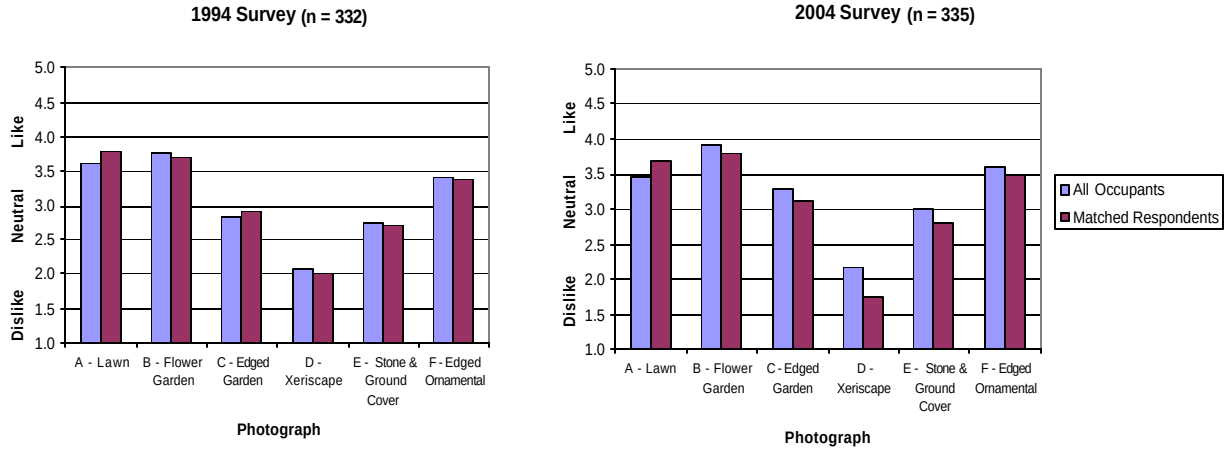


Fig. 5.7 - Average Response to Yard Photographs – 1994 & 2004 Surveys

Interesting discrepancies between survey years draw attention to styles of landscaping that are gaining acceptance or losing favour in residential areas. For example, in all surveys, all photographs were considered more attractive in 2004 than in 1994, except for the Lawn photo, which was almost 10% less attractive (Fig. 5.8). Similarly, the Lawn photo was found to deter more respondents in 2004 than in 1994 (Fig. 5.9). Both of these preference changes are statistically significant (Appendix 2). However, the Lawn photo was still the second most attractive picture in 2004, attracting nearly 50% of respondents to buy or rent that dwelling (Fig. 5.8). Likewise, more than 60% of matched respondents found the Lawn photo as attractive in 2004 as in 1994. Hence, the style of landscaping seen in the Lawn photo may deter more residents from buying or renting a dwelling since 1994, but it is still attractive to the majority of residents, especially those matched respondents surveyed in 2004 and 1994. In addition, more diverse styles of landscaping, as in the Edged Garden, Stone & Ground Cover, and Edged Ornamental photographs, became significantly more attractive and less deterring in 2004 than in 1994 (Appendix 2). On the

contrary, the Xeriscape photo remained unattractive to most respondents and significantly increased putting off more residents in 2004 than in 1994 (z = 2.147 – Appendix 2).

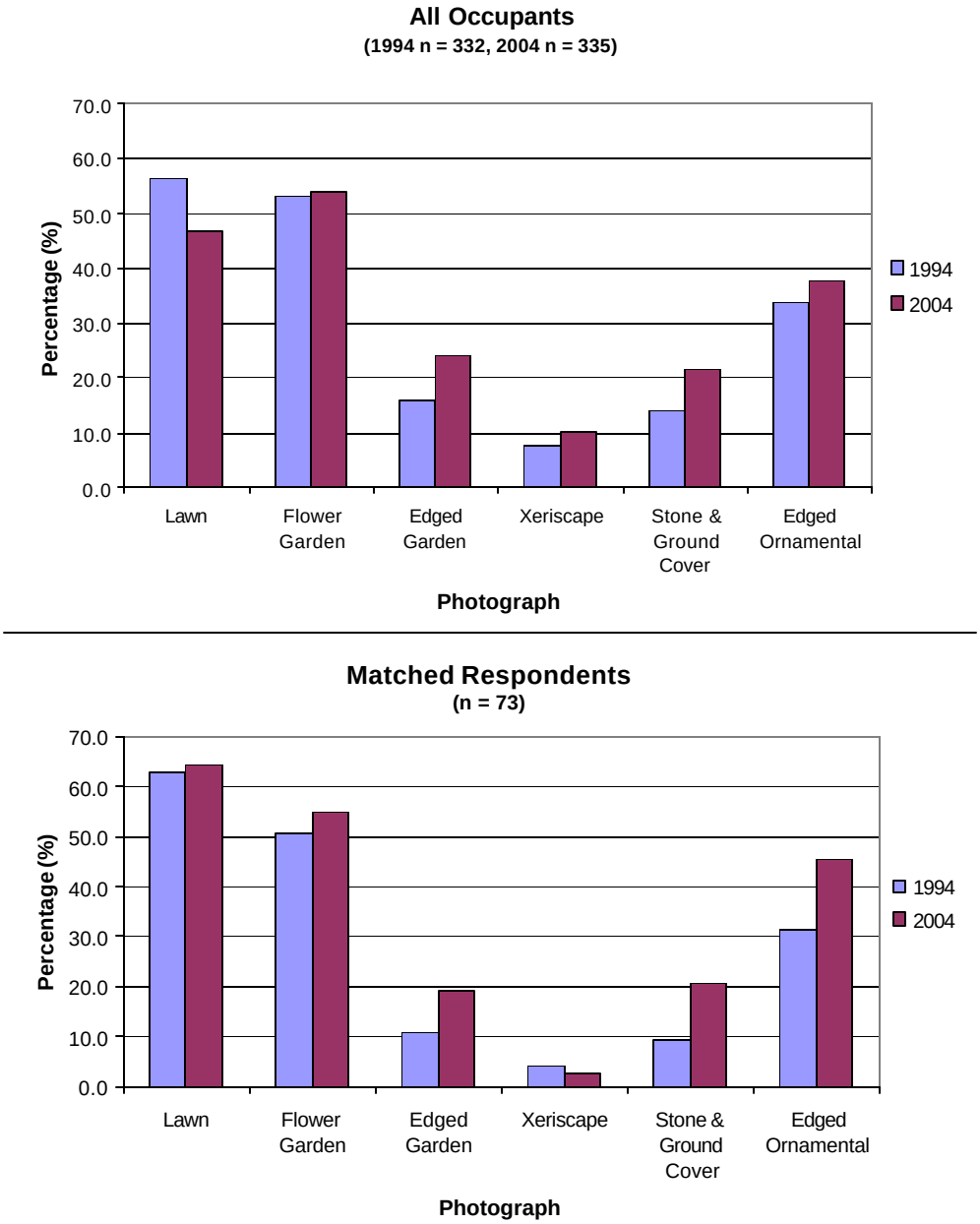


Fig. 5.8 - Attractive Yards – All Occupants and Matched Respondents

It is not surprising that the pictures that most attracted and deterred respondents from choosing to buy or rent a dwelling were also the most and least liked. In 1994, the Lawn and Flower Garden photographs were tied for most liked garden, together accounting for approximately 80% of the

respondents (Fig. 5.10). In 2004, the Flower Garden photo was also the most liked picture with responses from 40% of respondents, while approximately 30% of respondents indicated the Lawn photo, a significant drop of about 10% from 1994 (z = 3.075 – Appendix 2). Other pictures such as the Edged Garden, Stone & Ground Cover, and Edged Ornamental photographs received more responses in 2004 than in 1994, the Stone & Ground Cover photo received significantly more responses in 2004 (z = 3.571 – Appendix 2). The least liked picture was the Xeriscape photo (Fig. 5.11). More than 55% of respondents in 1994 and more than 60% in 2004 indicated the Xeriscaped photo as the least liked garden. Other

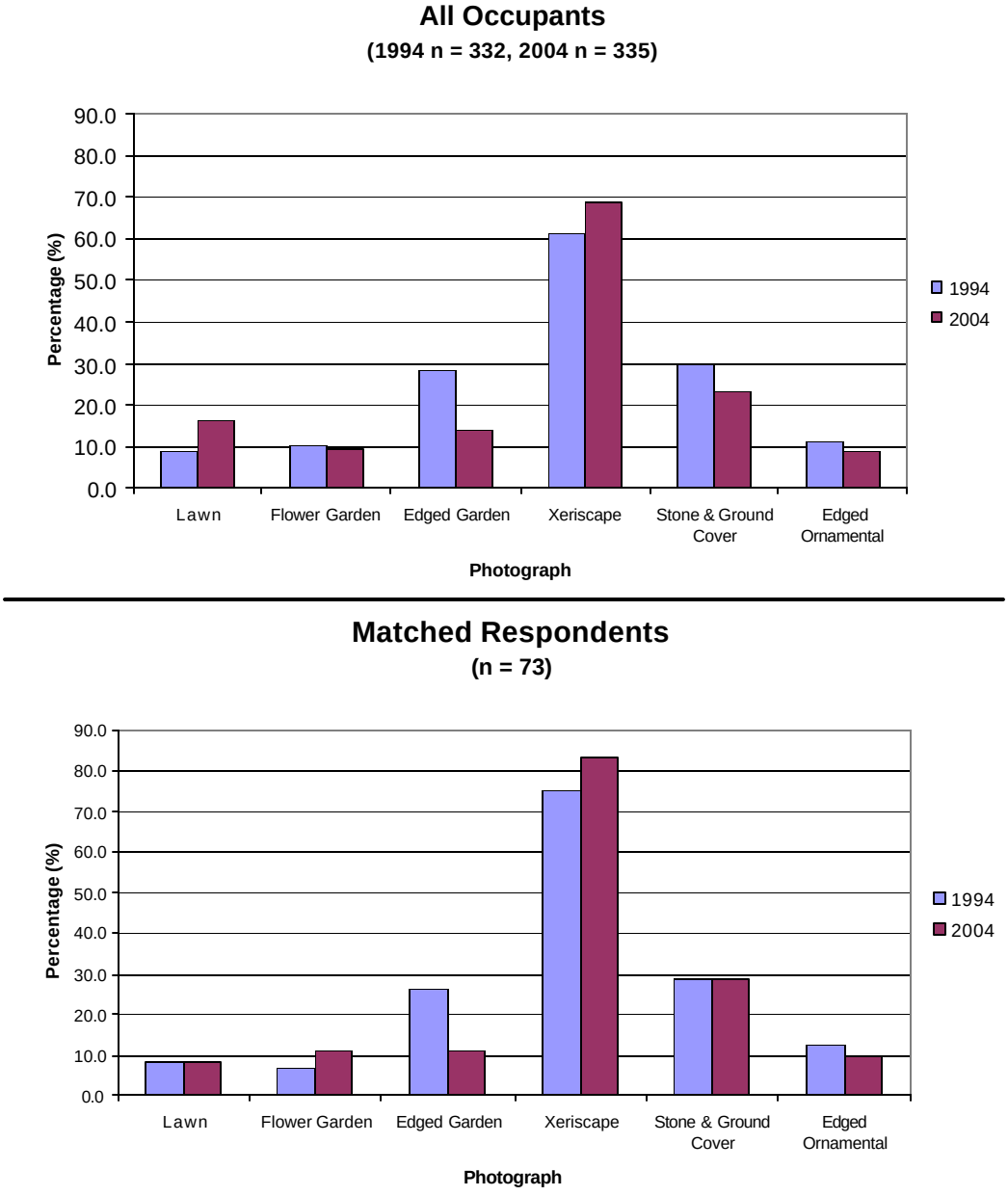


Fig. 5.9 - Yards Deterring Buying or Renting – All Occupants and Matched Respondents

notable differences between years for least liked garden was a significant increase in responses for the Lawn photo (z = 2.717 – Appendix 2) and decreased responses for the Edged Garden (z = 2.574 – Appendix 2), Stone & Ground Cover, and Edged Ornamental photographs in 2004, compared with 1994 results. Hence, the Lawn photo seemed to lose the most favour with respondents in 2004, while at the same time remaining the second most-liked style of landscaping. The Edged Garden, Stone & Ground Cover, and Edged Ornamental photographs all gained favour from respondents in 2004.

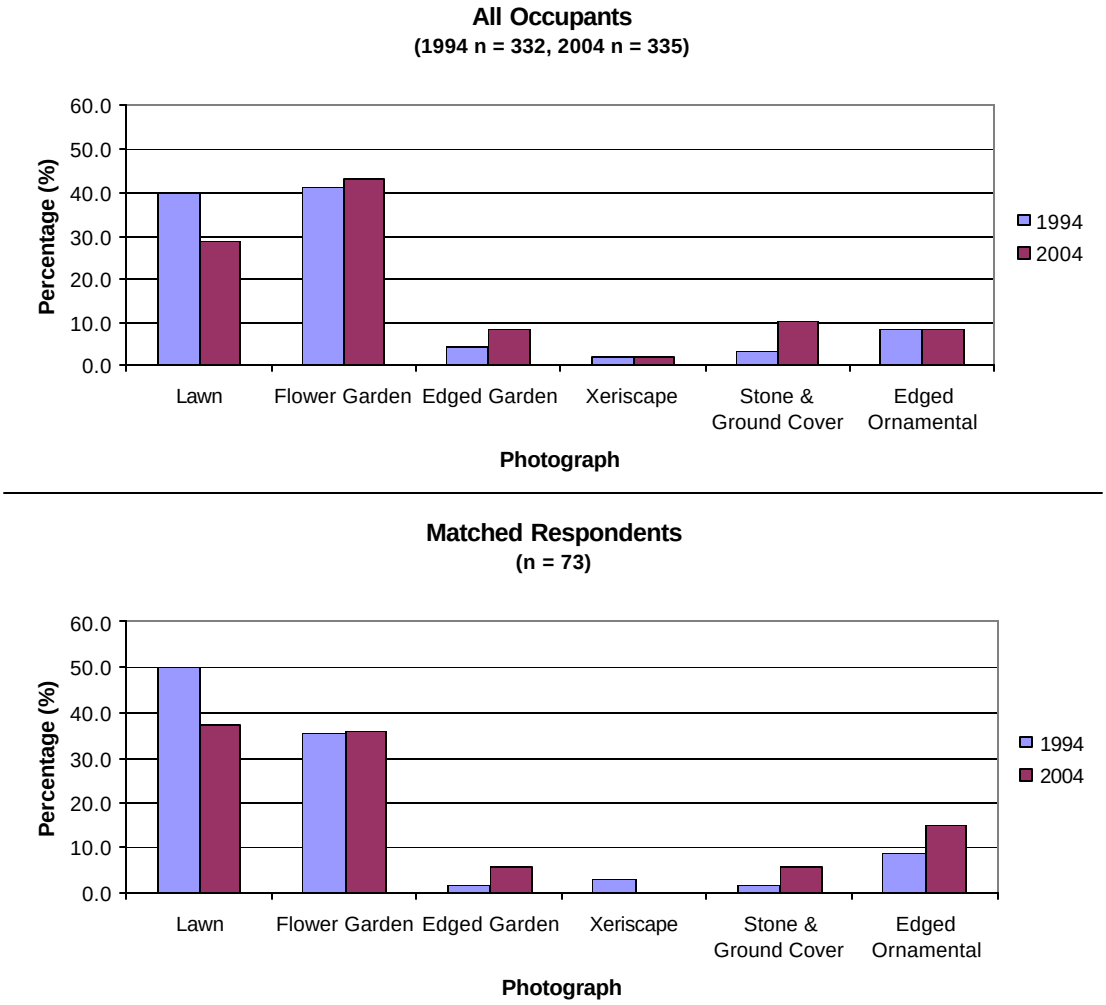


Fig. 5.10 - Most Liked Yard Picture – All Occupants and Matched Respondents

The results from the most and least liked yard picture slightly differed between matched respondents and all occupants. The Lawn photo was the most liked picture in 1994 with 50% of responses from matched respondents, while the Flower Garden photo captured over 35% of responses (Fig. 5.10). In 2004, the Lawn and Flower Garden photographs tied for most liked picture with over 35% of responses

each. Of note, almost 15% of matched respondents most liked the Edged Ornamental photo in 2004, compared with fewer than 10% of responses in 1994 (z = 1.100 – Appendix 2). In contrast, the trend for least liked pictures among matched respondents was analogous to all survey results (Fig. 5.11). The only difference was that more matched respondents (z = 1.377 – Appendix 2) indicated the Xeriscape photo as the least liked picture in 2004 than in 1994.

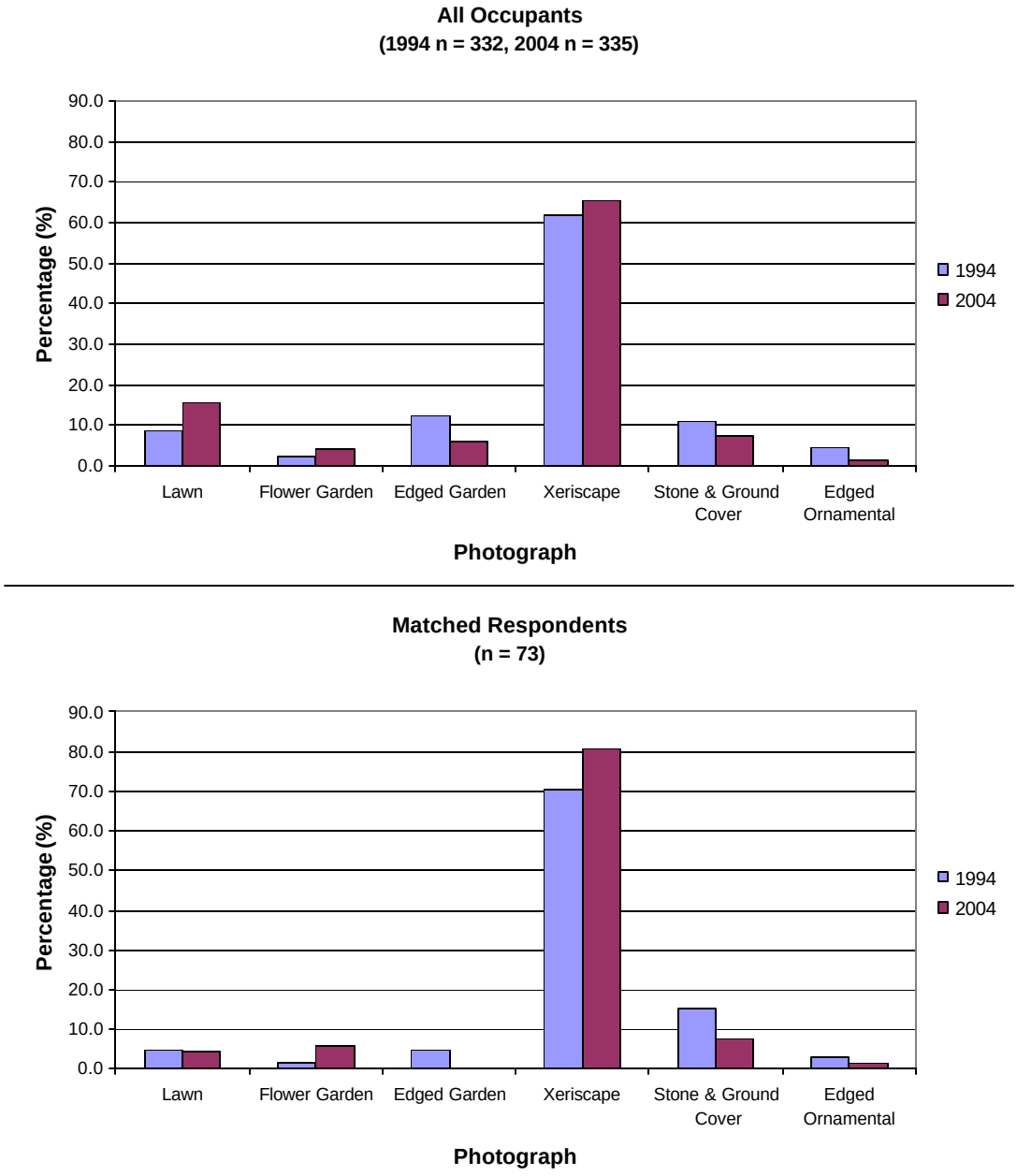


Fig. 5.11 - Least Liked Yard Picture – All Occupants and Matched Respondents

Why did respondents most like the Lawn and Flower Garden photographs and most dislike the Xeriscaped photo in the surveys? The answer to these types of questions not only validates respondents' choices but perhaps gives insight into external and environmental conditions, providing a better context for the results. For instance, the Lawn photo was most liked by respondents because: 1) it was practical to maintain (perhaps interpreted as requiring less time to maintain); 2) it was deemed acceptable to neighbours; and 3) they liked the shapes of the plantings (Table 5.20). The Flower Garden photo was most liked by respondents because: 1) they liked the colours; 2) they liked the shapes of the plantings; and 3) its environmentally acceptable. Since the other photographs were not as well liked, results from the most liked pictures were combined in Table 5.20. The top three reasons why gardens were most liked overall were because: 1) they liked the shapes of the plantings; 2) it looked practical to maintain; and 3) they liked the colours. These results are consistent with the responses from matched respondents. Therefore, the governing elements of the most liked yard pictures include the shapes of the plantings, the colours, and the practicality of it to maintain.

Table 5.20 – Reasons Garden Photographs were Most Liked – Top Photographs

	Lawn Photo		**Flower Garden Photo**		**Overall**	
	(n=125)	(n=89)	(n=128)	(n=134)	(n=308)	(n=312)
	1994%	**2004%**	**1994%**	**2004%**	**1994%**	**2004%**
like the colours	46.4	47.2	91.4	95.5	65.3	71.2
like the shapes	56.0	58.4	80.5	86.6	71.4	74.4
practical to maintain	86.4	91.0	39.1	50.7	64.6	72.4
enjoy using space	42.4	44.9	28.1	37.3	35.1	37.8
attractive to wildlife	3.2	10.1	45.3	48.5	27.9	38.8
acceptable to neighbours	62.4	62.9	55.5	56.0	56.8	53.8
env. acceptable	40.8	49.4	60.9	64.9	52.3	59.6
cheap to run	45.6	50.6	18.0	22.4	31.2	39.7
other	16.8	15.7	14.1	8.2	14.3	16.7

Yard pictures were least liked for both similar and different reasons to those pictures most liked. The Xeriscape photo was least liked by respondents because: 1) their household could not enjoy using the space; 2) they disliked the colours; and 3) it looked unattractive to wildlife (Table 5.21). For interest sake, those respondents who least liked the Lawn photo, especially in 2004, reported it was because: 1) it looked unattractive to wildlife; 2) it's environmentally unacceptable; and 3) it looked expensive to run. Overall, the four most cited reasons for not liking the yard photographs were because: 1) their household could not enjoy using the space; 2) they disliked the colours; 3) it looked unattractive to wildlife; and 4) they disliked the shapes of the plantings. These results are consistent with the responses from the matched

respondents. This information is valuable for understanding why respondents least liked the yard pictures, particularly the Xeriscape photo.

Table 5.21 – Reasons Garden Photographs were Least Liked

	Lawn Photo		Xeriscape Photo		Overall	
	(n=25)	(n=48)	(n=184)	(n=202)	(n=297)	(n=309)
	1994%	**2004%**	**1994%**	**2004%**	**1994%**	**2004%**
dislike the colours	8.0	20.8	62.5	64.4	54.9	56.0
dislike the shapes	20.0	33.3	49.5	54.0	54.9	52.8
impractical to maintain	40.0	43.8	21.7	20.8	31.0	31.7
cannot enjoy space	24.0	22.9	71.7	73.8	61.6	63.4
unattractive to wildlife	52.0	72.9	57.6	61.9	47.5	56.0
unacceptable to neighbours	0.0	2.1	30.4	27.7	26.3	24.9
env. unacceptable	40.0	54.2	8.7	14.4	10.1	20.1
expensive to run	36.0	54.2	3.3	3.0	10.1	13.6
other	40.0	50.0	26.6	23.8	24.2	27.5

5.6 General Environmental Attitudes

Respondents in both the 1994 and 2004 surveys were asked to indicate how serious they thought environmental problems were by region on a scale from 'not at all serious' to 'extremely serious'. Survey respondents revealed that environmental problems were perceived to be more serious on a global rather than local scale (Fig. 5.12). At the neighbourhood and city region, respondents were more likely to indicate that environmental problems were 'not at all' serious or 'neutral', especially in the 1994 survey. In both survey years, as regions increased in size and moved away from local areas, environmental problems were felt by respondents to become more and more serious. Environmental problems on a larger or global scale, indicated by 'the world' region, were seen as extremely serious by the majority of respondents. The mean responses of survey respondents in Fig. 5.13 display a similar trend to those identified in Fig. 5.12. Figure 5.13 also highlights that 2004 survey respondents felt environmental problems were more serious for all regions or scales identified, excluding the world, than 1994 survey respondents. In other words, local regions were seen as having more serious environmental problems in the 2004 survey than reported in the 1994 survey. This tendency was parallel among matched respondents and occupancies. This heightened environmental awareness of the 2004 survey, particularly at the more local regions, may be indicative of numerous social factors that have shaped society between survey years and decades. Yet, regardless of the factors involved, the perception that environmental issues have become more serious, especially closer to home, is a slight shift from the responses in the 1994 survey.

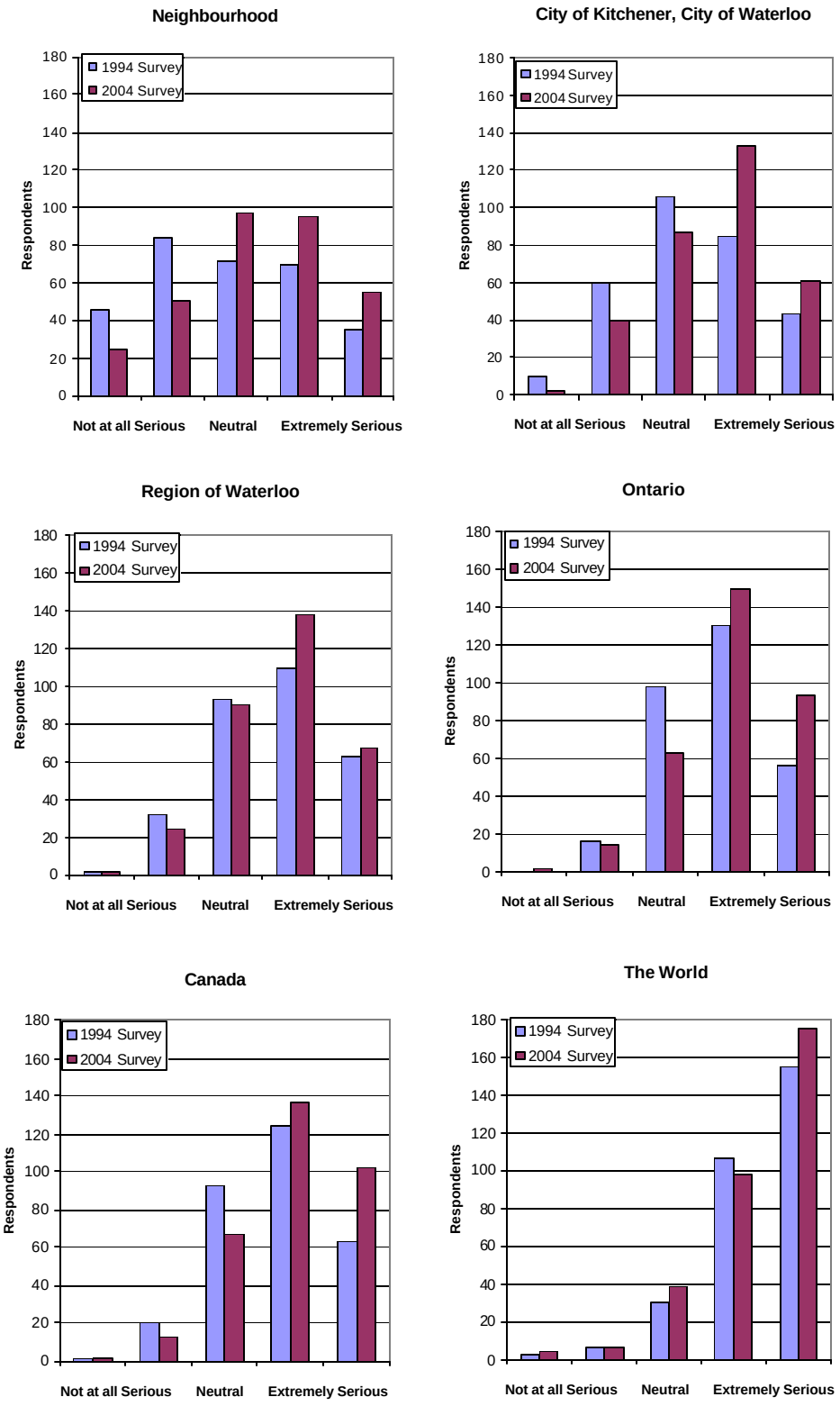


Fig. 5.12 – Seriousness of Environmental Problems by Area
(1994 n = 332, 2004 n = 335)

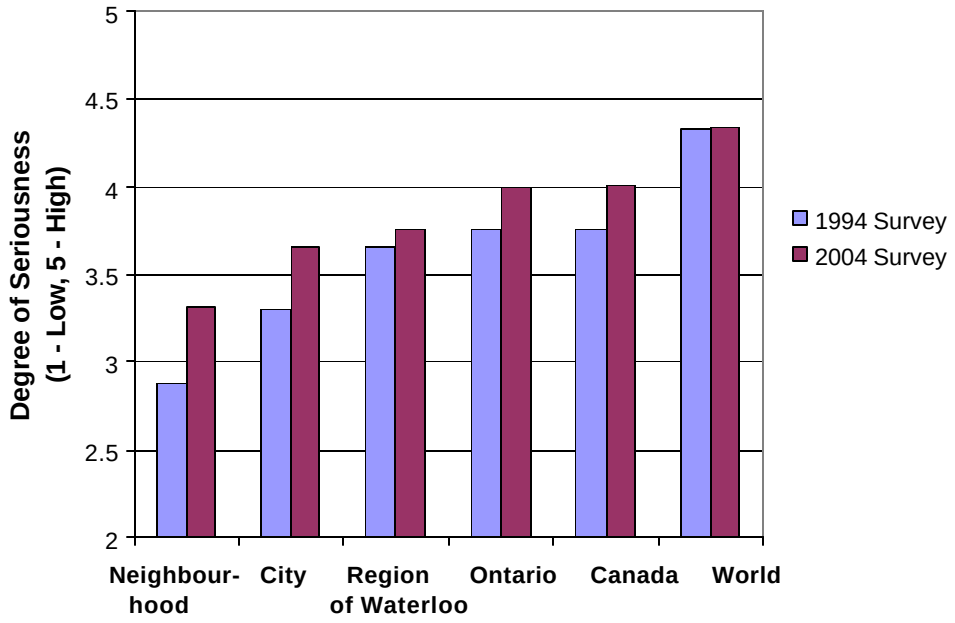


Fig. 5.13 – Environmental Problems by Area, on Average
(1994 survey n = 332, 2004 survey n = 335)

5.6.1 'Level of Greenness'

Another way that general environmental attitudes of respondents can be assessed is through the use of a 'Greenness Index'. A Greenness Index is a way to rank survey respondents according to their degree of "greenness" or the degree to which their environmental attitudes are reflected in their responses to general environmental statements. Specifically developed for these surveys, the greenness index is based on the 'agree or disagree' responses to general statements about current conditions in Question 2 of both surveys (Appendix 4). The responses are given scores: 'Strongly Agree' – is assigned a value of 5; 'Neutral' – a value of 3; and 'Strongly Disagree' – a value of 1, for example. However, the questionnaire contained ten statements covering several different environmental paradigm scales. An analysis using a reliability index and inter-item correlation matrix was used in SPSS (2004) to discern a unidimensional scale. As a result of the exploratory analysis, four statements constituted a reasonable unidimensional scale (Alpha 0.661_{1994}, Alpha 0.638_{2004}) with strong inter-item correlations. These statements are:

- 2.b) Rapid economic growth often creates more problems than benefits;
- 2.c) The balance of nature is very delicate and easily upset;
- 2.f) Humans should live in harmony with nature in order to survive; and
- 2.g) The earth is like a spaceship with only limited room and resources.

Thus, when the responses to these four general statements are summed up for each respondent, their total score fits a 'level of greenness' category, out of a maximum score of 20. Respondent's attitudes and feelings on these four general environmental statements should reflect their degree of "greenness" or environmental bias. Each 'level of greenness' category corresponds to a specific range of totals, for example, a respondent who scored 18 would be considered "Green", while a score of 11 would be considered "Gray", and so on (Table 5.22). Hence, a 'Greenness Index' was developed for this study as another way of evaluating the general feelings and attitudes of the respondents on environmental issues.

Table 5.22 – Greenness Index – All Occupants and Matched Respondents

All Occupants

	1994 Survey (n = 315)		2004 Survey (n = 328)	
	#	%	#	%
Brown	7	2.2	9	2.7
Gray	73	23.2	77	23.5
Green	235	74.6	242	73.8
Missing Data	17		7	

Matched Respondents

	(n = 70)		(n = 72)	
Brown	1	1.4	1	1.4
Gray	10	14.3	11	15.3
Green	59	84.3	60	83.3
Missing Data	3		1	

Note:

Category	***Scoring***
Brown	6 - 10
Gray	11 - 15
Green	16 - 20

'Level of Greenness' Definitions

The 'level of greenness' categories are only an abstract measure of one's general environmental outlook. They do not reflect lifestyle, religion, philosophy, or other viewpoints that could be misconstrued out of the context of these surveys. Definitions for 'Level of Greenness' categories are anecdotal, deriving from content within the environmental statements themselves. The definitions are as follows:

> **Brown (Score: 6-10)** – an exploitative, individualistic, human-centered approach to viewing the natural world. 'Brown' people agree that fast-paced industrial and economic growth is the key to many benefits allowing the better management of Earth's infinite

resources. 'Brown' people have little regard towards the natural environment and view nature as something to be controlled and used for their profit.

Gray (Score: 11-15) – 'Gray' people may believe that although the natural world was intended to be used for human purposes, the balance of nature must be governed in a way that prolongs its usefulness while maximizing its benefits to humanity. 'Gray' people may agree that the natural world has inherent value that is easily disturbed by humans, yet appreciate that economic growth is based upon some of these limited and fragile resources. These people are fence-sitters that may favour the 'Brown' or 'Green' perspectives depending on the issue.

Green (Score: 16-20) – a sustainable and harmonious perspective of Earth, where all living entities synchronize together towards a peaceful co-existence. People with 'green' attitudes are aware of the connectivity and frailty of life processes, realizing that humans must cooperate with nature, using finite resources sparingly, in order to survive. A major threat is that unregulated economic growth may further exploit Earth's limited resources.

The results of the 'Greenness Index' show that the majority of respondents are 'Green'. The 2004 survey echoed the greenness index results of the 1994 survey for all occupants (Table 5.22). In both survey years, the highest percentage of respondents was 'Green' comprising approximately 75% respondents. Second highest category in both years was the 'Gray' category, containing more than 20% of respondents. The 'Brown' category was the smallest, consisting of fewer than 3% of the total respondents in both years.

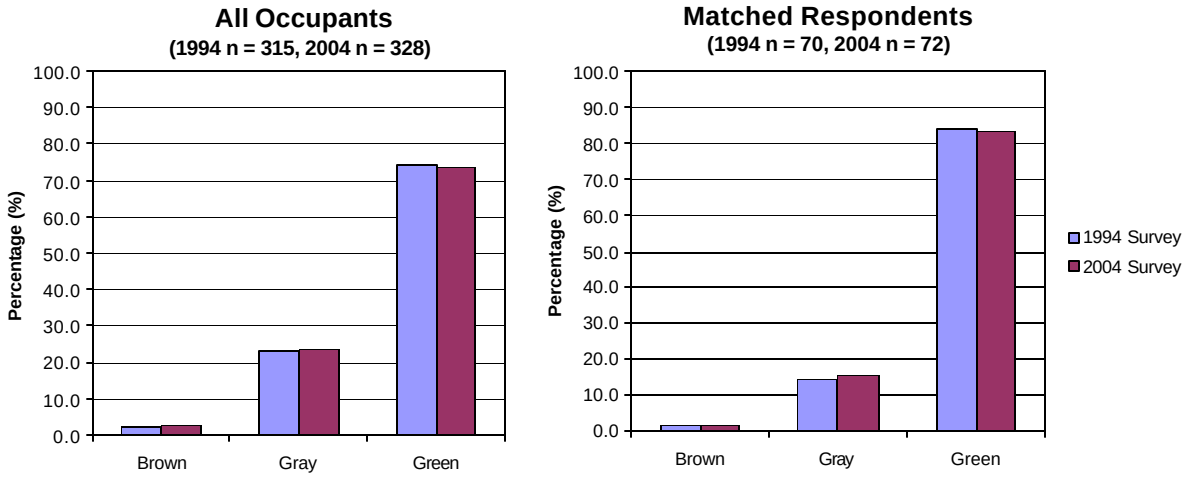


Fig. 5.14 – Distribution of Greenness Index Results

The matched respondents showed an identical pattern to that of all occupants. The matched respondents have a slightly greater percentage of 'Green' respondents and slightly lower percentage of

'Gray' respondents than all occupants for both survey years (Fig. 5.14). Hence, according to the 'Greenness Index', it seems that the majority of respondents in both 1994 and 2004 are very 'Green'. 'Gray' respondents total less than 25% and only a handful of 'Brown' respondents completed the questionnaire in both survey years, according to these results. Thus, the respondents fit a 'Green' environmental profile, based on their responses to four general statements about current environmental conditions.

The general environmental attitudes of survey respondents were assessed by two measurements: the seriousness of environmental problems by region, and the 'Greenness Index'. The 2004 survey respondents reported that environmental issues were becoming more serious in nearby regions compared to responses ten years earlier, although larger areas were consistently seen as having more serious environmental problems between survey years. The perception that environmental problems are always more serious away from the places that are most familiar may be rooted in both ignorance and media portrayal. The media often has ceaseless information of environmental problems from other parts of the province, country and world. It could be that many citizens are not terribly concerned with local environmental issues because they are continually up-to-date on issues far from home. Thus, knowledge of more wide spread environmental problems often takes precedence over local concerns. This is demonstrated by the responses in both the 1994 and 2004 surveys, although results from the 2004 survey suggest that local environmental problems are starting to receive more recognition, as seen in Fig. 5.13.

The 'Greenness Index' revealed that more than 70% of all respondents had 'Green' tendencies. This may not be surprising given the theme and underlying environmental tones throughout the survey, but it would be interesting to know how representative this percentage is of all the Kitchener and Waterloo residents? How would the distribution look if a similar 'Greenness Index' was applied to a higher percentage of K-W residents? Despite pondering these questions, much fewer respondents were considered 'Brown' and 'Gray' than 'Green', thus questioning the audience that chose to respond to the questionnaire. The results of the 'Greenness Index' also indicated that this distribution pattern was the same between survey years, all respondents, and matched respondents. The only differing trend was that more matched respondents were ranked 'Green' in both 1994 and 2004.

5.7 Yard Maintenance Attitudes

Survey respondents were asked to indicate whether they agree or disagree to a number of statements regarding various aspects of yard maintenance. The scale ranged from 5 – strongly agree to 1 – strongly disagree. Complete results are shown in Table 5.23. Respondents had strong attitudes towards many of the statements. The largest percentage of respondents, 67% in 1994 and 59% in 2004, strongly

agreed that 'they liked trees in a yard (E)'. The second strongest attitude from 50% and 57% of respondents in 1994 and 2004, respectively, strongly agreed that 'it is troubling to water the yard when there is a regional water shortage (L)'. Approximately 45% of respondents strongly agreed that 'having a tidy yard is important (k)' while the same amount strongly disagreed that 'a lawn is mainly to look at, not to use (J)'. More than one-third of respondents strongly agreed that: 'they like to look after a yard (A)'; 'they like to grow flowers (B)'; 'a yard has to have a lawn (D)'; and 'people should be able to 'do their own thing' in landscaping backyards (O)'. Hence, many respondents expressed strong feelings towards numerous statements on yard maintenance.

Respondents also expressed attitudes towards yard maintenance statements that were not strong but neutral. As seen in Table 5.23 and Fig. 5.15, attitudes were divided on many statements including: 'I like to grow vegetables (C)'; 'I dislike raking autumn leaves (F)', 'I dislike mowing (G)'; 'People should not be allowed to use herbicides/pesticides on their yards (H/I)'; 'I dislike the sound of other people mowing (M)'; 'I dislike the sound of my own mower (N)'; and 'I know a lot about gardening (Q)'. With these statements, in general, the majority of respondents could neither agree nor disagree. Matched respondents reported similar results between survey years.

Several attitudes towards yard statements have significantly changed between survey years. For example, 65% of 2004 respondents agreed that 'a yard has to have a lawn (D)' while 17% disagreed (Table 5.24). This compares with 75% of 1994 respondents agreeing and 11% disagreeing with this statement. While the majority of respondents in both years agree that 'a yard has to have a lawn', a 10% change between years is significant ($z = 3.289$ – Table 5.24). Two other interesting attitude changes between years involve the statements 'people should not be allowed to use "herbicides/pesticides" on their yards (H/I)'. For both statements, approximately 10% more respondents agreed in 2004 than in 1994. These attitude changes are also clearly seen in Fig. 5.15. These particular changes may reflect a host of external conditions different between sampling years, including a variety of factors such as societal norms, individual behaviour and preferences, and education. In reference to these three statements, the differences may indicate a slight attitude change in 2004, in favour of greater environmental consciousness since the 1994 survey. Results from matched respondents parallel the findings from all the surveys between sample years. The results of these statements and others will be explored further in later chapters.

Table 5.23 – Percentage of Respondents' Attitudes towards Yard Maintenance Statements – All Occupants

		Strongly Agree				Neutral				Strongly Disagree			
		5		4		3		2		1		Z	
Statements	#	1994%	2004%	1994%	2004%	1994%	2004%	1994%	2004%	1994%	2004%	Score[1]	S.S.D.[2]
I like to look after a yard	A	33.6	38.6	37.7	33.1	20.1	21.0	4.0	4.3	4.6	3.0	0.985	NO
I like to grow flowers	B	45.1	42.0	31.8	32.0	13.0	17.2	7.1	6.0	3.1	2.7	0.486	NO
I like to grow vegetables	C	22.3	21.6	19.4	17.6	25.2	30.4	19.7	17.6	13.4	12.9	0.000	NO
A yard has to have a lawn	D	47.4	35.4	28.0	29.9	13.2	17.4	5.8	9.5	5.5	7.9	3.289	YES
I like trees in a yard	E	67.3	58.6	24.1	30.2	6.5	7.6	1.9	2.4	0.3	1.2	2.137	YES
I dislike raking autumn leaves	F	13.8	12.8	13.4	16.4	37.8	35.6	21.3	20.4	13.8	14.9	0.000	NO
I dislike mowing	G	9.4	8.5	13.5	13.4	37.7	40.2	22.6	24.7	16.7	13.1	0.449	NO
People should not be allowed to use herbicides on their yards	H	17.4	24.4	13.6	15.9	36.4	28.4	19.0	17.4	13.6	14.0	1.653	YES
People should not be allowed to use pesticides on their yards	I	16.6	25.2	15.7	15.5	36.4	29.7	16.9	15.8	14.4	13.9	1.856	YES
A lawn is mainly to look at, not to use	J	5.2	3.3	4.9	7.3	14.2	16.0	29.8	28.7	45.8	44.7	0.231	NO
Having a tidy yard is important	K	46.9	43.1	34.0	34.6	12.0	14.5	4.6	6.6	2.5	1.2	0.787	NO
It troubles me to water the yard when there is a regional water shortage	L	49.5	56.8	28.2	24.0	14.7	13.1	4.4	3.0	3.1	3.0	1.493	NO
I dislike the sound of other people mowing or using power yard tools	M	9.6	10.0	11.7	13.3	38.9	40.0	24.4	19.4	15.4	17.3	0.331	NO
I dislike the sound of my own mower	N	8.7	9.5	12.5	13.2	36.1	36.9	24.0	20.3	18.7	20.0	0.322	NO
People should be able to 'do their own thing' in landscaping backyards	O	35.9	34.4	39.0	38.7	16.4	17.8	6.5	6.6	2.2	2.4	0.513	NO
People should be able to 'do their own thing' in landscaping frontyards	P	23.8	22.5	37.0	36.8	22.5	22.8	12.0	13.4	4.6	4.6	0.459	NO
I know a lot about gardening	Q	8.3	12.6	20.4	26.7	40.7	32.4	19.4	18.0	11.1	10.2	2.169	YES
When I don't know how to tackle a garden problem, I can find out about it easily	R	30.4	37.4	43.5	43.2	18.3	14.3	5.3	3.6	2.5	1.5	2.344	YES

Note: 1994 Survey n=332 (subtract unanswered)
2004 Survey n=335 (subtract unanswered)
[1] - based on average responses to yard maintenance statements
[2] - S.S.D. = Statistically Significant Difference - significant at the .05 level

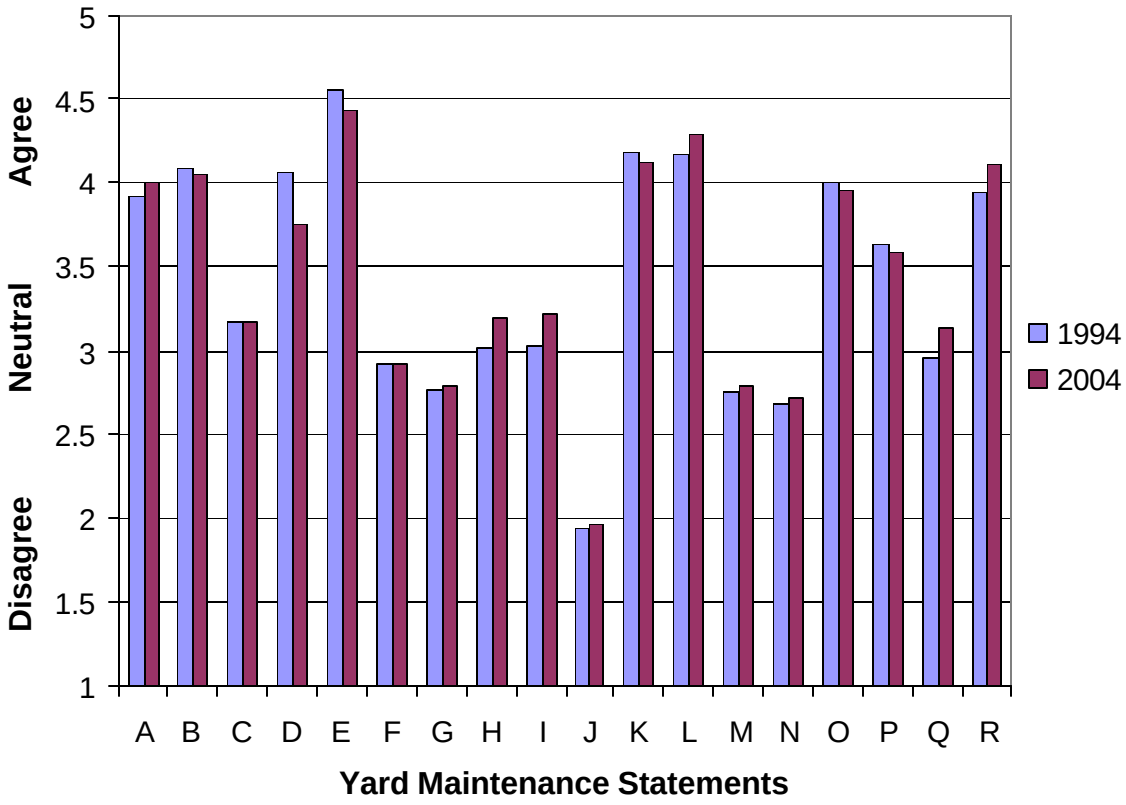


Fig. 5.15 – Average Responses to Yard Maintenance Statements

Table 5.24 – Summarized Percentages of Respondents' Attitudes towards Yard Maintenance Statements – All occupants

		Agree		Neutral		Disagree		Z	
Statements	#	1994%	2004%	1994%	2004%	1994%	2004%	Score[1]	S.S.D.[2]
I like to look after a yard	A	71.3	71.7	20.1	21.0	8.6	7.3	0.985	NO
I like to grow flowers	B	76.9	74.0	13.0	17.2	10.2	8.8	0.486	NO
I like to grow vegetables	C	41.7	39.2	25.2	30.4	33.1	30.4	0.000	NO
A yard has to have a lawn	D	75.4	65.2	13.2	17.4	11.4	17.4	3.289	YES
I like trees in a yard	E	91.4	88.8	6.5	7.6	2.2	3.6	2.137	YES
I dislike raking autumn leaves	F	27.2	29.2	37.8	35.6	35.0	35.3	0.000	NO
I dislike mowing	G	23.0	22.0	37.7	40.2	39.3	37.8	0.449	NO
People should not be allowed to use herbicides on their yards	H	31.0	40.2	36.4	28.4	32.6	31.4	1.653	YES
People should not be allowed to use pesticides on their yards	I	32.3	40.6	36.4	29.7	31.3	29.7	1.856	YES
A lawn is mainly to look at, not to use	J	10.2	10.6	14.2	16.0	75.7	73.4	0.231	NO
Having a tidy yard is important	K	80.9	77.7	12.0	14.5	7.1	7.8	0.787	NO
It troubles me to water the yard when there is a regional water shortage	L	77.7	80.9	14.7	13.1	7.5	6.1	1.493	NO
I dislike the sound of other people mowing or using power yard tools	M	21.3	23.3	38.9	40.0	39.8	36.7	0.331	NO
I dislike the sound of my own mower	N	21.2	22.8	36.1	36.9	42.7	40.3	0.322	NO
People should be able to 'do their own thing' in landscaping backyards	O	74.9	73.1	16.4	17.8	8.7	9.1	0.513	NO
People should be able to 'do their own thing' in landscaping frontyards	P	60.8	59.3	22.5	22.8	16.7	17.9	0.459	NO
I know a lot about gardening	Q	28.7	39.3	40.7	32.4	30.6	28.2	2.169	YES
When I don't know how to tackle a garden problem, I can find out about it easily	R	73.9	80.5	18.3	14.3	7.8	5.2	2.344	YES

Note: 1994 Survey n=332 (subtract unanswered)
2004 Survey n=335 (subtract unanswered)
[1] - based on average responses to yard maintenance statements
[2] - S.S.D. = Statistically Significant Difference - significant at the .05 level

5.8 Yard Attributes

5.8.1 Yard Use

Yard use is a key element that affects how residential yards are landscaped and maintained. In other words, the way in which private yards are enjoyed by its owners or tenants will usually have an impression on yard design, management, and landscaping style. Understanding the benefits, primary uses, and functions of yards, from the residents' points of view, puts the overall styles of landscaping and

maintenance practices into context. The 2004 survey sought to determine how residents used their yard space most often.

Almost every 2004 respondent (approximately 98%) indicated that they enjoy having and using their yard space. As single dwelling units often have some private yard space and are the most common house structure in Kitchener and Waterloo, it is not surprising that occupants like to have their own outdoor space. Moreover, yard space is an important factor when buying or renting a home. As lawns comprise a significant percent of yard area, more than 70 percent of all survey respondents indicated that lawns were to be 'used' and not 'looked at' (Table 5.24 - J). Hence, most respondents indicated that using and having yard space is enjoyable. The next question is 'how' are yards used most often?

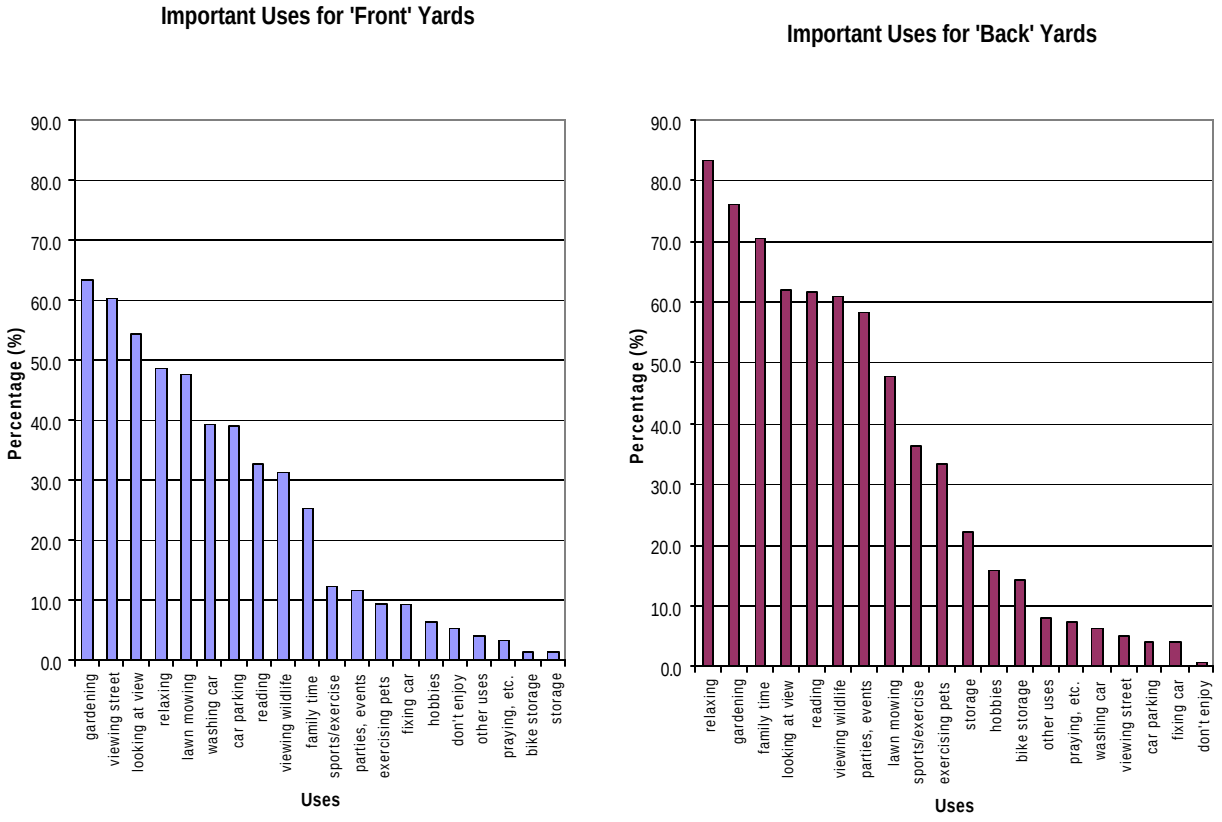
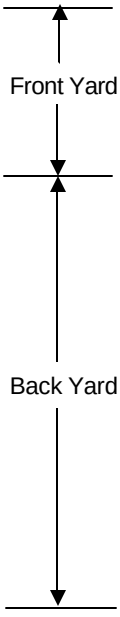


Fig. 5.16 – Ranked Uses for Enjoying 'Front' and 'Back' Yards – 2004 Survey (n = 335)

Most houses with private yards in Kitchener and Waterloo have both a 'front' and 'back' yard. Survey respondents were asked to identify all the uses that are important for enjoying their 'front' and 'back' yards on a regular basis. The highest percentage of respondents indicated that 'gardening', 'viewing street', and 'looking at view' were the most important uses in the 'front' yard (Fig. 5.16). The most important uses in the 'back' yard were 'relaxing', 'gardening', and 'family time'. Between both 'front' and 'back' yards, 'gardening' was the most important use, followed by 'relaxing' and 'looking at view'. Compared with the 'backyard', only four uses were reported to be more important in the 'frontyard' – 'viewing street', 'car parking', 'washing car', and 'fixing car' (Table 5.25). Approximately 5% of respondents indicated that they 'don't enjoy' using the 'frontyard'. 'Lawn mowing' was equally important for both 'front' and 'back' yards. 'Parties and events' was the most important use solely for 'back' yards, followed by 'family time', 'relaxing', 'viewing wildlife', and 'reading'. In general, a higher variety of yard uses were more important in 'back' yards than 'front' yards. For example, the three most important uses identified for the entire yard – 'gardening', 'relaxing', and 'looking at view' – were more important uses in the 'back' yard. Thus, using the 'back' yard seemed to be more enjoyable than using the 'front' yard. Overall, a mix of uses was really important for respondents to enjoy their yards, but yards are used most often for gardening, relaxing, and looking at the view.

Table 5.25 – Uses Important for Enjoying 'Front' and 'Back' Yards – 2004 Survey (n = 335)

	Front Yard		Back Yard		Difference *	
	#	%	#	%	#	%
viewing street	202	60.3	17	5.1	-185	-55.2
car parking	131	39.1	14	4.2	-117	-34.9
washing car	132	39.4	21	6.3	-111	-33.1
fixing car	31	9.3	14	4.2	-17	-5.1
don't enjoy	18	5.4	2	0.6	-16	-4.8
lawn mowing	160	47.8	160	47.8	0	0.0
other uses	14	4.2	27	8.1	13	3.9
meditation, etc.	11	3.3	25	7.5	14	4.2
looking at view	182	54.3	208	62.1	26	7.8
hobbies	22	6.6	53	15.8	31	9.3
gardening	213	63.6	255	76.1	42	12.5
bike storage	5	1.5	48	14.3	43	12.8
storage	5	1.5	75	22.4	70	20.9
exercising pets	32	9.6	112	33.4	80	23.9
sports/exercise	41	12.2	122	36.4	81	24.2
reading	110	32.8	207	61.8	97	29.0
viewing wildlife	105	31.3	204	60.9	99	29.6
relaxing	163	48.7	279	83.3	116	34.6
family time	85	25.4	236	70.4	151	45.1
parties, events	39	11.6	195	58.2	156	46.6



NOTE: * Indicates which outdoor use is more important for front vs. back yards on a regular basis. A positve value indicates that the use was more important for the backyard, while the opposite is true if it is a negative value.

5.9 Yard Maintenance

Private property and yard maintenance standards have been monitored by cities for decades. More recently, property standard by-laws in the Cities of Kitchener (2003) and Waterloo (2002) involve the proper maintenance and upkeep of residents' 'driveways, parking areas, paths and walkways' as well as keeping 'grass, trees, bushes, hedges and other landscaped areas' in a reasonable condition. Lot maintenance by-laws have also been established to better manage the visual condition of yards including the removal of excessive growth of grass, weeds, bushes, or trees (City of Waterloo 2003; City of Kitchener 2002). Many other cities across the Province of Ontario and within Canada and the United States have established similar policies. Hence, from these by-laws it is clear that North American society has many expectations of residential yards. Since it is implied that urban residents spend some time and/or money on various aspects of yard maintenance, survey respondents were asked to answer several related questions.

Table 5.26 – Average Number of Hours per week to Look after a Yard

All Surveys*

	1994 (hrs)	2004 (hrs)	Z - Score	S.S.D.[2]
Prepared to Spend	5.33	5.93	1.356	NO
Actually Spend	4.40	5.17	1.516	NO

Matched Respondents[1]

	1994 (hrs)	2004 (hrs)	Z - Score	S.S.D.[2]
Prepared to Spend	5.33	5.46	0.158	NO
Actually Spend	4.91	5.72	0.569	NO

Note: *1994 Survey n=332 (subtract unanswered)
*2004 Survey n=335 (subtract unanswered)
[1] Matched Respondents n = 73 (subtract unanswered)
[2] S.S.D. = Statistically Significant Difference - significant at the .05 level

In general, the surveys indicate that residents like to mainta in their yard. Reviewing survey respondents' attitudes towards statements about yard maintenance reveals that approximately 70% of respondents from both years agreed that they 'like to look after a yard' (Table 5.24 – A). Although only approximately one-third of respondents 'like to grow vegetables', 'know a lot about gardening', or like to 'rake autumn leaves', almost 90% of respondents 'like trees in a yard' and approximately 75% 'like to grow flowers'. More than 70% of respondents indicated that they could easily find out how to tackle a garden problem, if necessary. Thus, not only are there governance controls on maintaining yards and gardens, but the majority of urban residents with private yards enjoy looking after them.

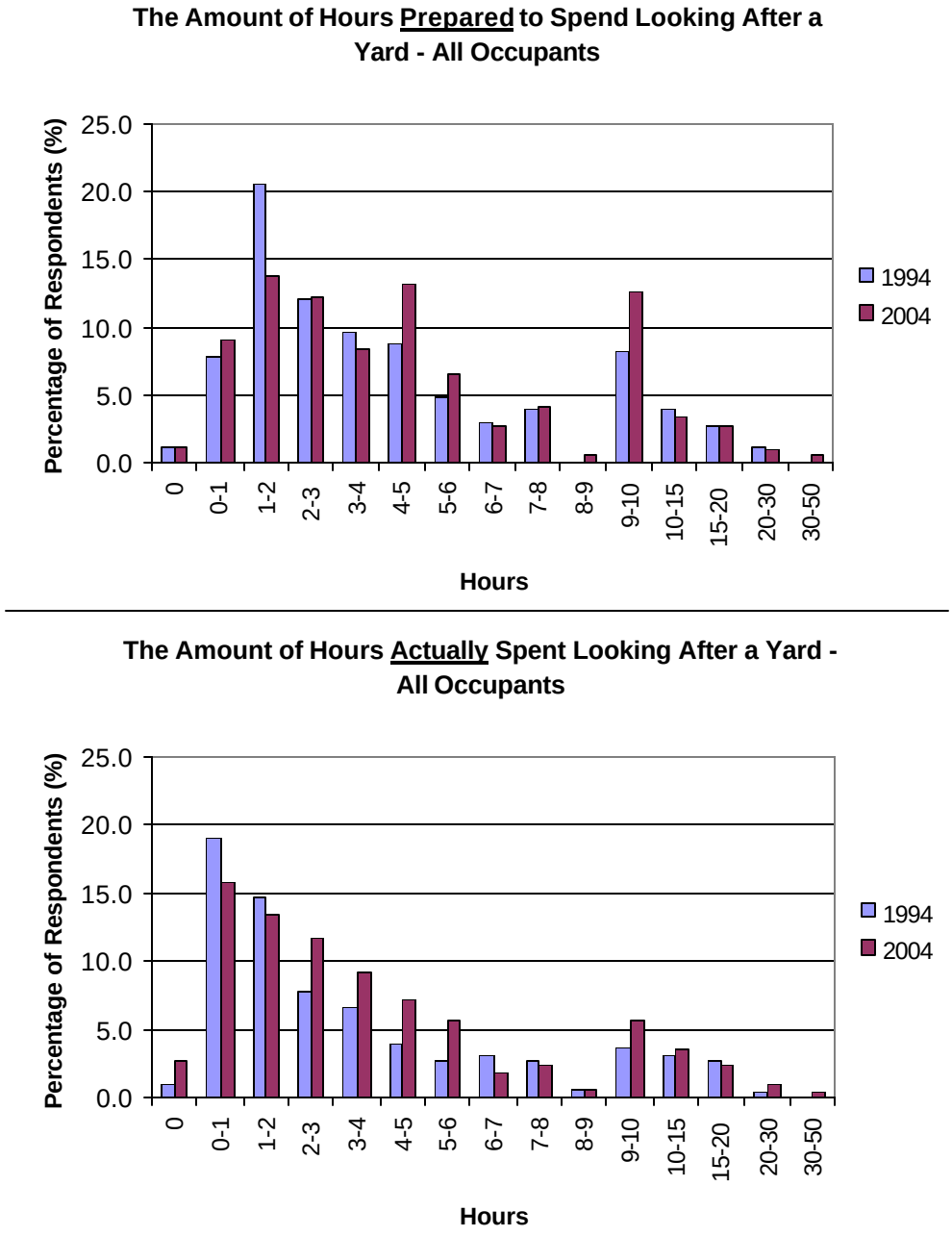


Fig. 5.17 - Hours Prepared to Spend and Actually Spent Looking After a Yard

Survey respondents were asked to specify the number of hours a week their household spends looking after a yard during the growing season, excluding mowing. In both survey years, respondents were prepared to spend more time looking after their yard than they actually spent. On average, respondents estimated that their household is prepared to spend between 5 and 6 hours per week to maintain the yard (Table 5.26). Households actually spend between 4 and 5 hours per week. 2004

respondents were prepared to spend and actually spent more time looking after a yard than 1994 respondents (Fig. 5.17 and Table 5.26). Although more than 50% of respondents indicated they were prepared to spend less than 5 hours looking after their yard, a substantial proportion of respondents were willing to spend more than 5 hours, particularly between 9 and 10 hours (Fig. 5.17). A less pronounced but similar trend is reflected in the actual number of hours respondents spend performing yard maintenance tasks. In addition, matched respondents display similar results, except that respondents in 2004 actually spent more time than they were prepared to spend maintaining their yard (Table 5.26). Overall, respondents in 2004 reported spending more time looking after their yard than they did in 1994. This indicates that yard maintenance is requiring more time of residents than it did 10 years previous, although it was not determined if this additional time is discretionary or not.

Survey respondents were also asked to specify the amount of lawn mowing their household completes in a week during the growing season. In general, respondents are prepared to spend about the same amount of time as they actually spend mowing the lawn (Fig. 5.18). Typically, respondents spend between 1 and 2 hours per week mowing the lawn. More than 70% of respondents reported spending 2 hours or less mowing their lawn. Respondents in 2004 reported they were prepared to spend a little less time and actually spent a little more time mowing the lawn than in 1994 on average (Table 5.27). This trend is greater emphasized with the results from the matched respondents in both survey years. Thus, respondents in 2004 are taking slightly more time to mow their lawn than in 1994 while they are prepared to spend less time.

Table 5.27 – Average Number of Hours to Mow the Lawn

All Surveys*

	1994 (hrs)	2004 (hrs)	Z - Score	S.S.D.[2]
Prepared to Spend	1.75	1.73	0.176	NO
Actually Spend	1.65	1.76	0.702	NO

Matched Respondents[1]

	1994 (hrs)	2004 (hrs)	Z - Score	S.S.D.[2]
Prepared to Spend	2.04	1.75	1.458	NO
Actually Spend	1.78	2.09	0.756	NO

Note: *1994 Survey (n=332)
*2004 Survey (n=335)
[1] Matched Respondents n = 73 (subtract unanswered)
[2] S.S.D. = Statistically Significant Difference - significant at the .05 level

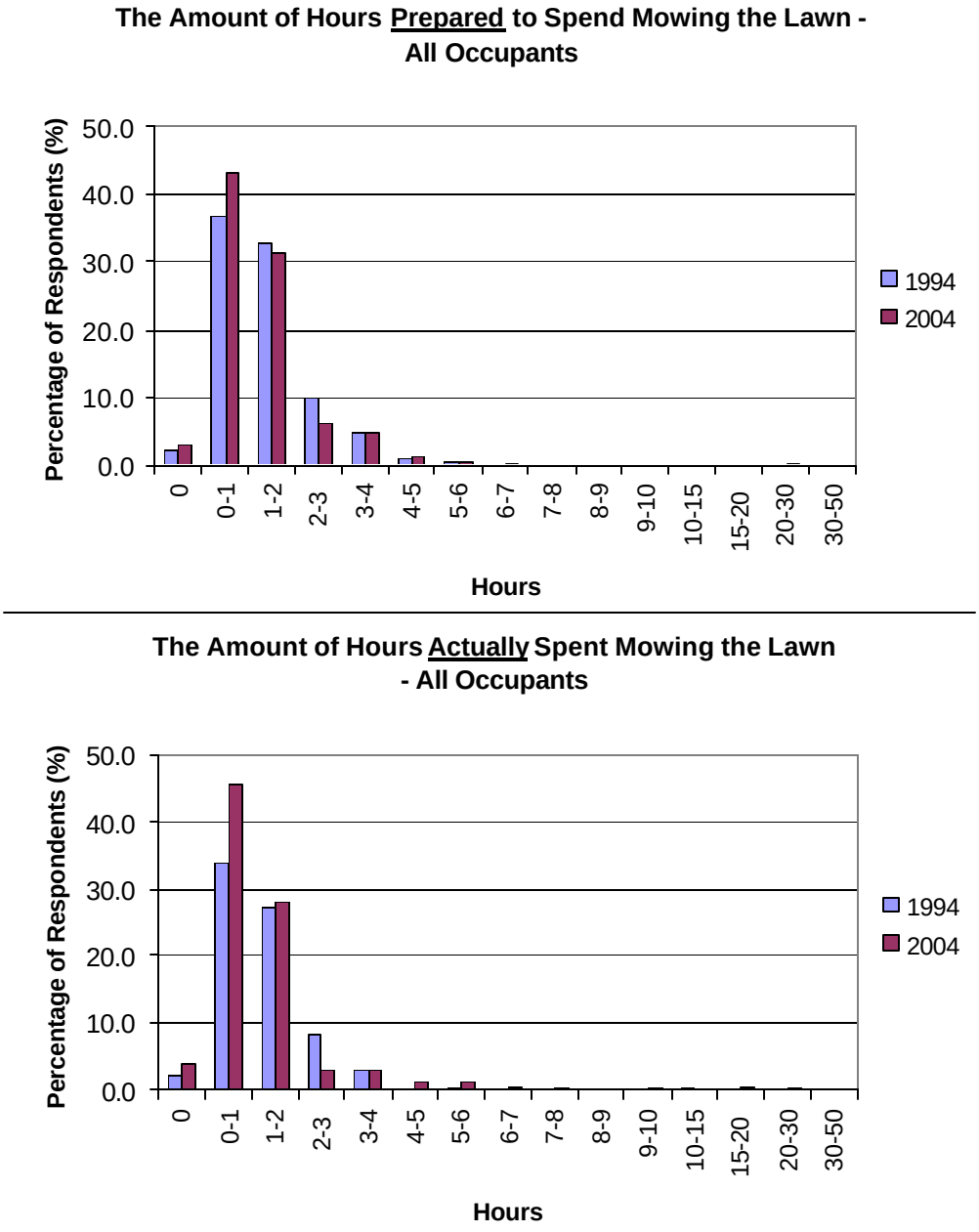


Fig. 5.18 - Hours Prepared to Spend and Actually Spent Lawn Mowing

Combining the amount of time it takes to look after a yard and mow the lawn, residents typically spend around 7 hours per week performing yard maintenance tasks during the growing season. The actual time spent on these tasks varies between households although it seems to have increased somewhat since 1994. It is unknown to what degree yard maintenance tasks are considered discretionary or compulsory by the respondents. Therefore, whether residents are maintaining their yards because of enforced by-laws or because they enjoy it, yard maintenance is continuing to be a prominent use of residents' private outdoor

space. A considerable amount of time is spent every week, by most every resident with a yard, either mowing their lawn or looking after their yard, usually a combination of both.

5.9.1 Yard Equipment

Respondents were asked to identify types of yard equipment in the survey that applied to their household. Comparable percentages of households with the same types of yard equipment were found between survey years. For example, approximately 70% of households had a gas mower in both years (Fig. 5.19). In addition, approximately: 15% of households had a push mower; 17% of households had an electric mower; and less than 5% of households had a ride-on mower. From the 2004 survey, almost 20% of households had a leaf-blower and less than 5% of households had a wood/twig shredder. Results from matched respondents revealed similar findings (Fig. 5.20). Listed types of yard equipment changed little between survey years. Therefore, gas mowers were the most popular type of yard equipment found in respondents' households in both 2004 and 1994.

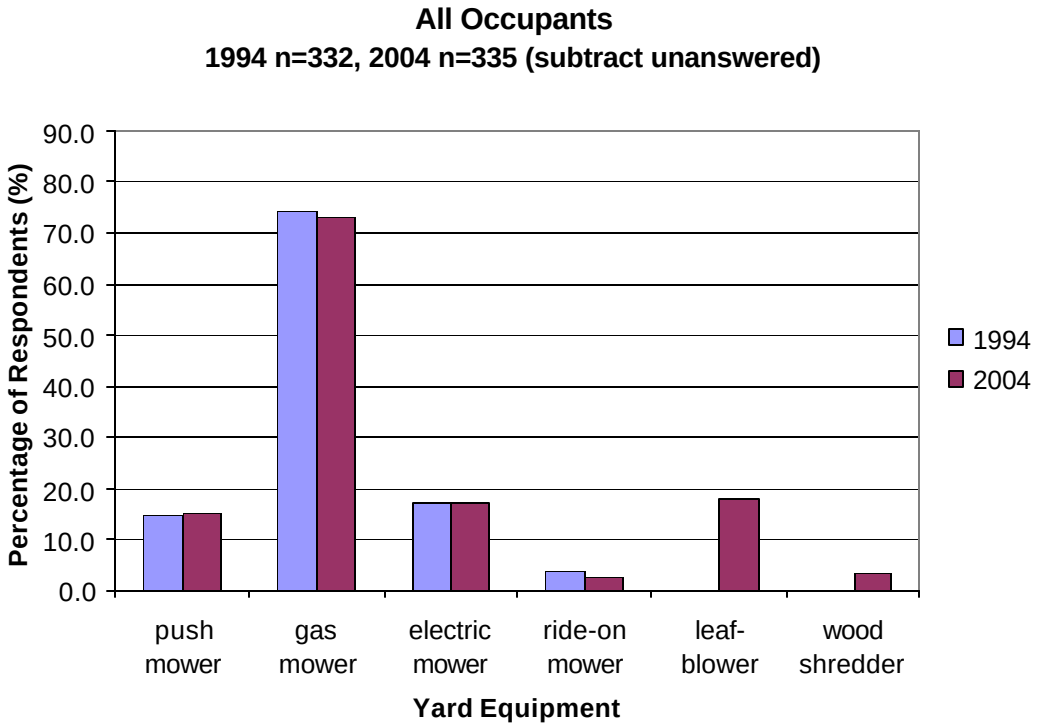


Fig. 5.19 – Percentage of All Occupants that have Specified Yard Equipment

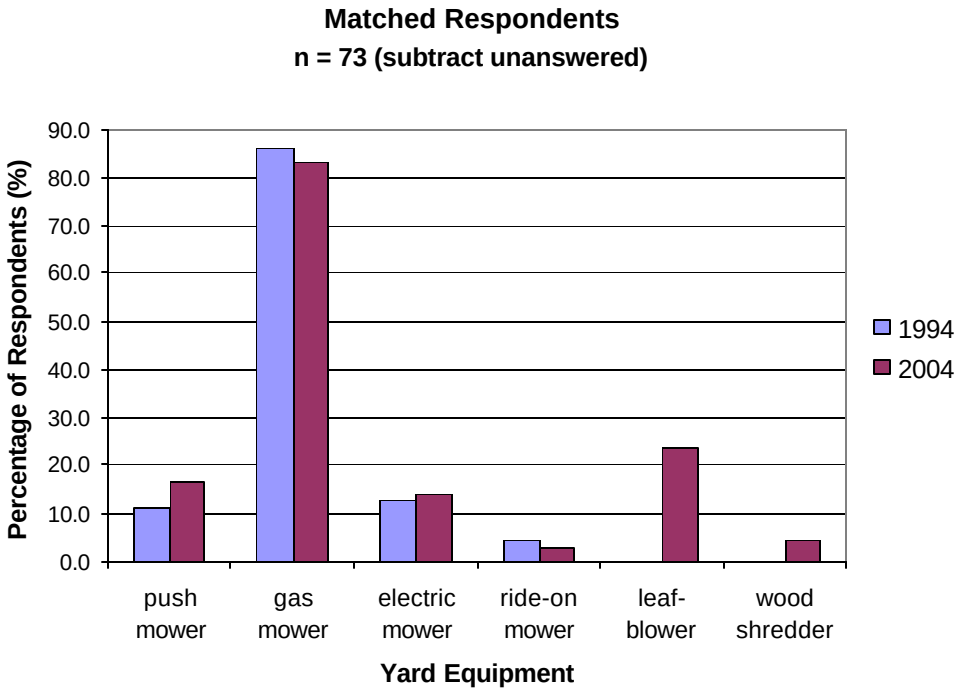


Fig. 5.20 – Percentage of Matched Respondents that have Specified Yard Equipment

5.10 Chemical Inputs

Numerous authors (Osmond and Hardy 2004; Varlamoff *et al.* 2001; Templeton *et al.* 1998) report that a large percentage of North American urban residents use chemicals to enhance their landscapes to improve residential yard aesthetics and garden productivity. Survey respondents were asked to answer chemical use questions for three main reasons: 1) because chemicals are known to play a significant role in yard maintenance; 2) information on their use helps contribute to a fuller understanding of general residential yard maintenance practices; and 3) these responses may provide useful local information for public discussions and decisions on chemical inputs in residential yards. As the Region of Waterloo has been gathering information on the use of pesticides in the region (Region of Waterloo 2005a, 2005b, 2005c); taking public opinion polls regarding support for a reduction in the use of non-essential pesticides; drafting a proposed pesticide reduction by-law that may control where and when pesticides can be used (Region of Waterloo 2005c); implementing a pesticide education campaign (Region of Waterloo 2005b); and getting consultants to present findings from telephone and online surveys, as well as from focus groups and public information sessions (PMG Consulting 2005a, 2005b, 2005c) – the results from these questionnaires may be invaluable in aiding decision-makers and local government. When reviewing the results from the chemical input questions, this rapidly changing political context should be kept in mind.

In general, respondents had mixed feelings towards the use of chemicals on residential yards. From Table 5.24, respondent attitudes in 1994 and 2004 were divided on the statements 'People should not be allowed to use herbicides (H)/ pesticides (I) on their yards'. Slightly more 2004 survey respondents agreed with this statement than 1994 respondents. This minor attitude shift is also noticeable in Fig. 5.15 of the environmental attitudes chapter, where the average response to these statements is approximately 3.25 (slight agreement) in 2004 compared to a response of 3 (neutral) in 1994. Although the differences between these average responses between survey years for both statements are significant ((H) z = 1.653, (I) z = 1.856 – Table 5.23), the average is still generally neutral. It seems that about 5% (net) of respondents with a neutral attitude in 1994 changed their attitude in 2004 towards agreement, since the percentage of respondents that disagreed with the statements did not change between survey years. The 2004 survey also had a slightly higher response rate for these statements than in 1994, accounting for about 5% more responses in total. Therefore, despite a slightly higher percentage of respondents agreeing with these statements in 2004 and a statistically significant change towards agreement of these chemical statements in 2004 than in 1994, the overall attitude towards these statements remains neutral. Respondents are generally divided on whether people should be allowed to use pesticides or herbicides on their yards.

The type of chemical used on yards and lawns did not seem to affect the attitudes of respondents. In fact, between survey years, respondent' attitudes did not distinguish a difference between herbicides (weedkillers, fungicides) or pesticides (insecticides) as the results are almost identical (Table 5.24 – H/I). Despite the inherent difference in chemical properties between herbicides and pesticides, 1994 and 2004 respondents indicated that their feelings towards their use on yards were the same. Hence, it appears that respondents do not differentiate between types of chemicals, at least between herbicides or pesticides, when expressing their feelings about their application on yards and lawns.

A large percentage of respondents reported using yard chemicals in 2004. In the 2004 survey, respondents had the option of reporting whether they used yard chemicals 'often', 'now and then', or 'never', compared to the standard 'yes' or 'no' in 1994. Approximately 5% of 2004 respondents indicated they used herbicides and pesticides 'often', while 45% and 37% of respondents indicated they used herbicides and pesticides 'now and then' and 'never', respectively (Fig. 5.21)[2]. Lawn fertilizer was 'often' used by 17% of the respondents and 'now and then' by approximately 50% of respondents in 2004. Weed & feed products were 'often' used by 11% of 2004 respondents and 'now and then' by approximately 40% of respondents. In summary, combining the percentages from the 'often' and 'now and then' categories, more than 50% of 2004 respondents used herbicides and 'weed and feed' products, while more than 40% used pesticides, and almost 70% used lawn fertilizer.

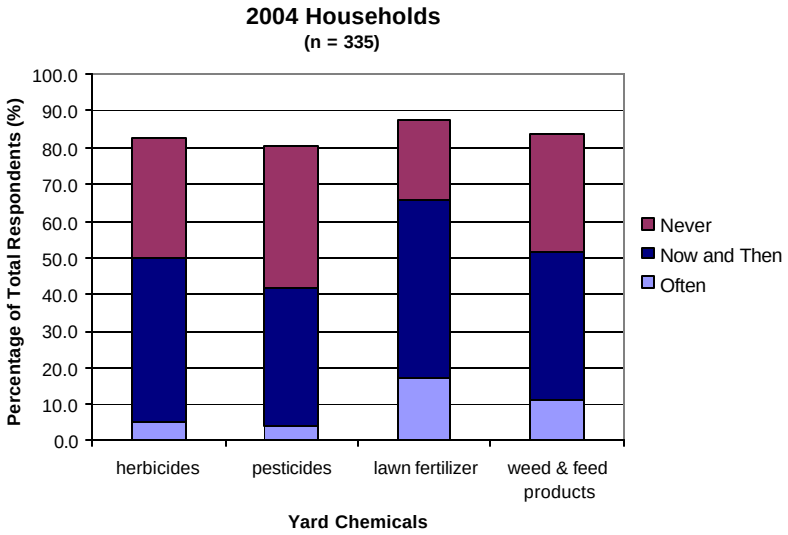


Fig. 5.21 – Percentage of 2004 Households that use the following Chemicals Themselves

Percentages of respondents using yard chemicals in 1994 were lower than in 2004. In the 1994 survey, respondents indicated a simple 'yes' or 'no' to which chemicals they used themselves. Exactly 33% and 28% of respondents indicated they used herbicides and pesticides, respectively (Fig. 5.22). More than 50% of respondents used lawn fertilizer while less than 50% used 'weed & feed type products'. Significantly more respondents in 2004 used all listed yard chemicals than 1994 respondents when the categories 'Often' and 'Now and Then' are combined, as in Fig. 5.23 (Appendix 2). Thus, compared with the combined results of chemicals used 'often' and 'now and then' in 2004 (Fig. 5.23), fewer 1994 respondents used chemicals themselves than 2004 respondents.

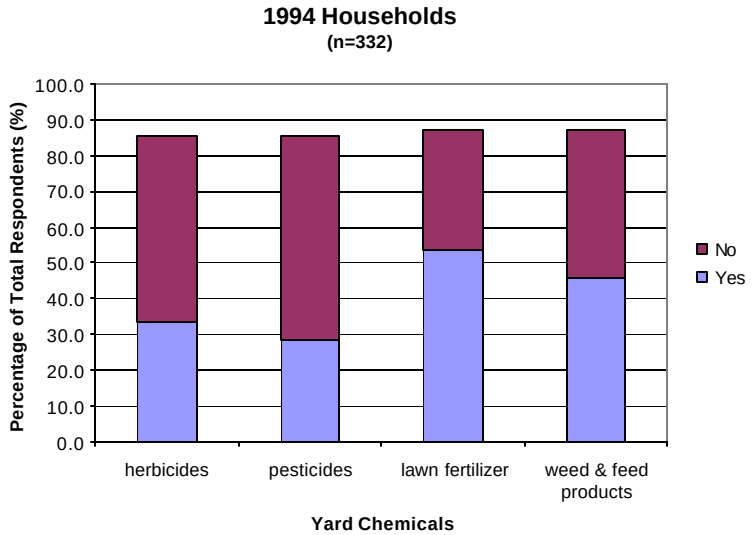


Fig. 5.22 – Percentage of 1994 Households that use the following Chemicals Themselves

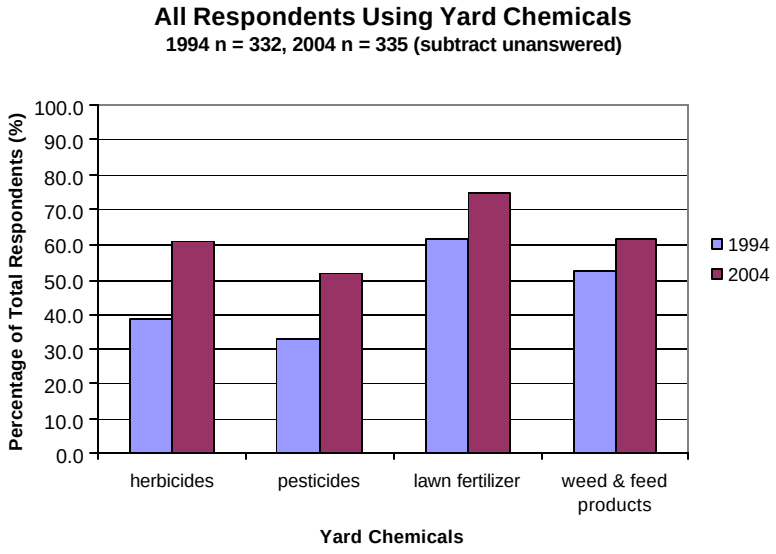


Fig. 5.23 – Comparison of Yard Chemical Usage between Survey Years – Combined 'Often' and 'Now and Then' Categories for 2004 Survey

This trend was also reflected in matched respondents. Using the same comparison, approximately 10% more matched respondents used herbicides in 2004 than in 1994 and approximately 20% more used pesticides (Table 5.28). Seven percent more matched respondents used lawn fertilizer and only 2% more used 'weed and feed' type products in 2004 than in 1994. A large percentage of respondents reported using chemicals in 2004 that they did not report using in 1994, particularly herbicides and pesticides. Therefore, yard chemicals were used by more survey respondents, including matched respondents, in 2004 than in 1994.

Table 5.28 – Percentages of Respondents using chemicals

All Respondents[1]

	1994 Survey (%)		2004 Survey (%)		
I/We use:	Yes	No	Often	Now & Then	Never
herbicides	38.9	61.1	5.8	55.1	39.1
pesticides	33.1	66.9	5.2	46.5	38.8
lawn fertilizer	61.6	38.4	19.4	55.4	22.1
'weed & feed' products	52.6	47.4	13.2	48.6	31.9

Matched Respondents[2]

	1994 Survey (%)		2004 Survey (%)		
I/We use:	Yes	No	Often	Now & Then	Never
herbicides	44.1	55.9	5.5	61.8	32.7
pesticides	27.9	72.1	5.6	55.6	38.9
lawn fertilizer	67.6	32.4	21.3	62.3	16.4
'weed & feed' products	57.4	42.6	17.5	52.6	29.8

Note: A substantial percentage of matched respondents did not answer these questions in the 2004 survey compared with the 1994 survey.

[1] 1994 Survey n = 332, 2004 Survey n = 335 (subtract unanswered)

[2] Matched Respondents n = 73 (subtract unanswered)

5.11 Contract Services

Less than half of the survey respondents were willing to annually pay someone to look after their yard. Contracting a yard-care provider to perform yard maintenance services has become more common in recent years (Templeton *et al*. 1998). Several survey questions were directed at understanding the amount of money respondent households were willing to pay for yard maintenance services. Figure 5.24 displays the estimated fees that survey respondents were prepared to pay annually for someone to maintain the yard. In 1994, 40% of respondents indicated they were prepared to spend no money for someone look after the yard, while the same number of respondents indicated they were prepared to spend more than $0 (Table 5.29). Approximately 50% of 2004 respondents indicated they were unwilling to spend money, compared to 43% of 2004 respondents that indicated they were prepared to spend some money. Hence, about 10% more respondents in 2004 indicated they would not spend any money for someone to maintain their yard than in 1994. Results from matched respondents were similar to those of all surveys in 2004 but differed in 1994. In 1994, more matched respondents indicated they were not prepared to spend money and fewer matched respondents were prepared to spend some money at all.

Generally, less than half of the respondents in both survey years indicated they would pay someone to look after their yard.

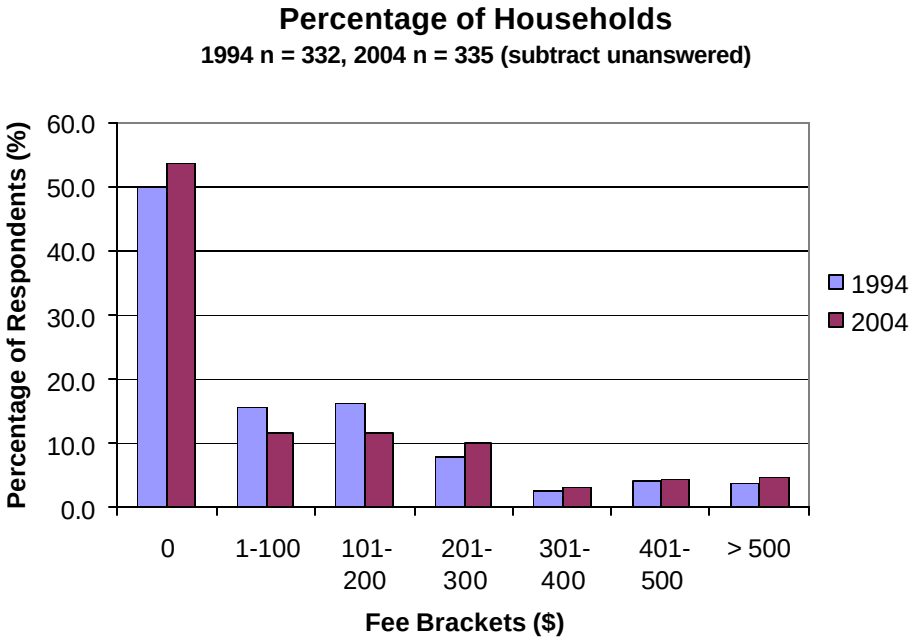


Fig. 5.24 – Percentage of households that are prepared to pay for annual yard maintenance

Most respondents estimated they would spend less than $500 annually on yard maintenance that was provided by someone else. The average amount of money all respondents were prepared to spend annually for somebody to maintain the yard was $132.53 in 1994 and $154.60 in 2004 (Table 5.29). Calculating the inflation adjustment between 1994 and 2004 (Bank of Canada 2005), 1994 respondents were prepared to spend a little more than 2004 respondents on average. Results from matched respondents differed by an average of $40 between survey years, which, with inflation, is about equivalent. In all surveys, the respondents that indicated they were willing to spend more than $0 for someone else to maintain the yard averaged $264 (1994) and $332 (2004) annually. Results from the matched respondents differed slightly with an average of $230 (1994) and $394 (2004) annually. These figures are approximately double the average cost estimated by all respondents in both survey years. Overall, more than 75% of 1994 and 85% of 2004 respondents were willing to spend $500 or less for somebody to maintain the yard. Respondents who estimated spending no money ($0) for someone else to maintain their yard comprised the largest category in both years. Thus, the average amount of money all respondents were willing to pay someone for yard maintenance was approximately $150 per year, while the majority of respondents were not prepared to spend more than $500 annually.

Respondents that were prepared to annually pay someone to maintain their yard were asked to identify which services they would be willing or not willing to pay a professional yard-care provider to perform. Although 40% of 1994 (n=134) and 43% of 2004 (n=143) survey respondents indicated they would be willing to annually pay someone for yard maintenance, approximately 50% of 1994 and 2004 respondents (on average n=165) responded to this question in both surveys. Professional yard-care services using chemicals to control potential yard problems caused by weeds, insects, fungi, or lack of nutrients were services many respondents were willing to purchase. In 1994, more than 20% of respondents were willing to purchase insect control, fungus control, and dethatching and aeration services, followed by a willingness to pay for weed control, fertilizing, mowing, and looking after flower beds (Fig. 5.25). In 2004, more than 30% of respondents were willing to purchase tree trimming services (this service was not listed in the 1994 survey), followed by more than 20% of respondents willing to purchase insect control, weed control, fungus control, fertilizing, and dethatching and aeration services. Tree trimming was the yard service most willing to be purchased by respondents in 2004. Interestingly, except for fungus control and dethatching and aeration, more respondents were willing to pay for every yard service in 2004 than reported in 1994. In particular, more 2004 respondents were willing to pay for weed control and fertilizing services than in 1994.

Table 5.29 – Estimated Fees for Yard Maintenance Services

Percentage of Respondents

	All Surveys[1]				Matched Respondents[2]			
	1994 (%)	2004 (%)	Z - Score	S.S.D.[3]	1994 (%)	2004 (%)	Z - Score	S.S.D.[3]
Pay Fees = $0	49.8	53.4	0.861	NO	58.7	50.7	0.919	NO
Pay Fees > $0	50.2	46.6	0.861	NO	41.3	49.3	0.919	NO
Pay Fees <= $500	96.3	94.8	0.875	NO	98.4	89.6	2.173	YES

Estimated Average

	1994 ($)	2004 ($)		1994 ($)	2004 ($)
Total Average	132.53	154.60	Total Average	95.10	193.84
Average of Fees > $0	264.07	331.90	Average of Fees > $0	230.42	393.55

Note: [1] 1994 n=267, 2004 n=307

[2] Matched Respondents 1994 n=63, 2004 n=67

[3] S.S.D. = Statistically Significant Difference - significant at the .05 level

Many respondents indicated they were 'not willing' to purchase many of the listed yard services or they indicated that they 'already purchased this service'. Services such as growing vegetables, looking after ground covers and flower beds, as well as mowing the lawn, were yard services more than 65% of respondents were 'not willing' to purchase in both survey years (Fig. 5.25). In terms of already purchased services, weed control, insect control, and fertilizing were the most common services already purchased

by respondents in both survey years, followed by fungus control and dethatching and aeration services. Yard services such as growing vegetables, looking after flower beds, and looking after ground covers were the least common services purchased in both years. Only a small percentage of respondents were not sure about purchasing the listed services. Interestingly, more 2004 respondents were willing to pay for most of the listed yard services than reported by 1994 respondents, while more 1994 respondents 'already purchased' many of the listed yard services than respondents in 2004.

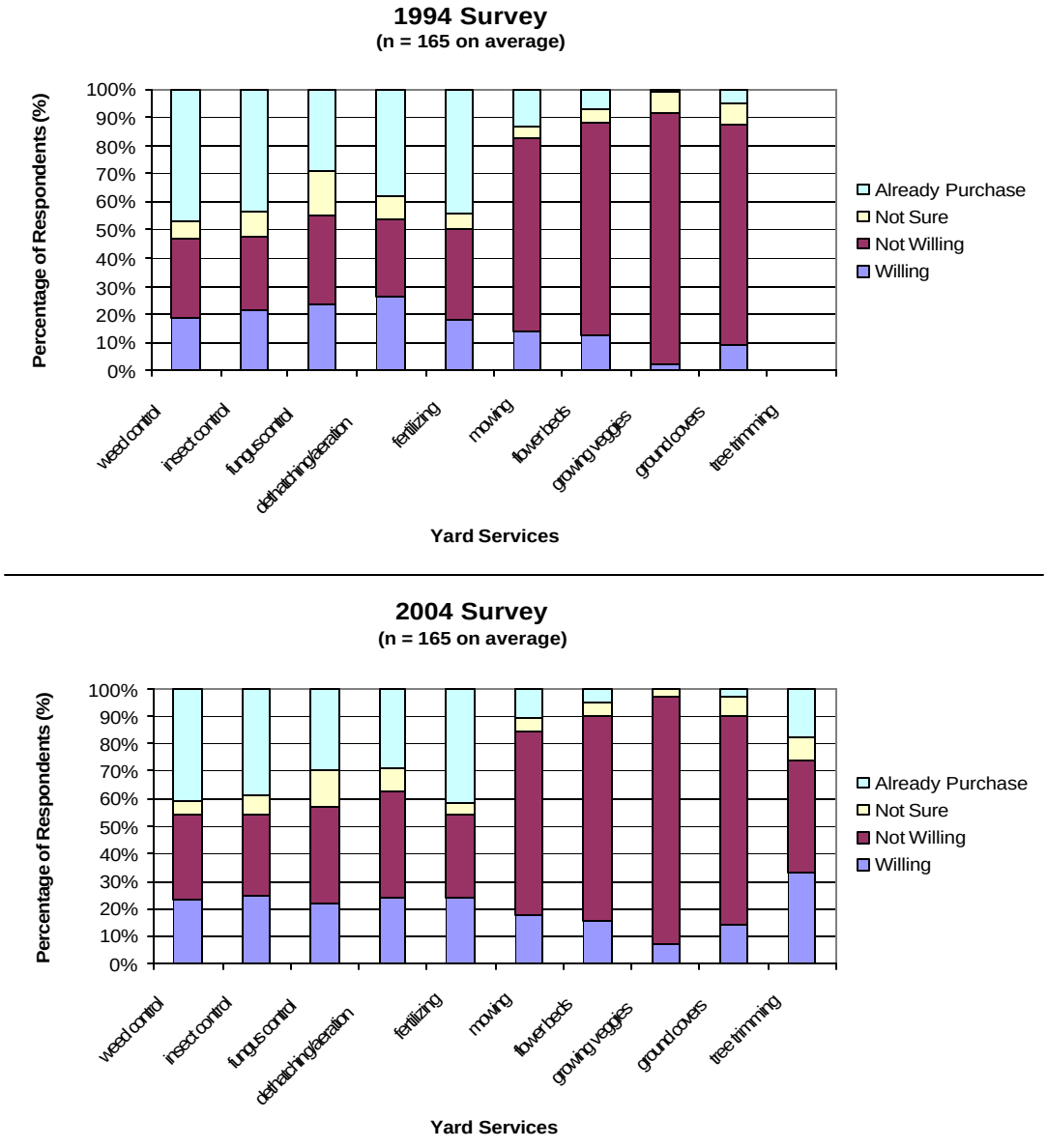


Fig. 5.25 – Percentage of Respondents Interested in Paying a Landscaper for Yard Services – the 1994 and 2004 Total Sample (n) varied between yard services and years

In a hypothetical situation in which the respondent was setting up a newly occupied house, respondents were asked to estimate separately the most they would be willing to pay a landscaper for a garden *design* and for *installation*. Approximately 35% of all respondents from both years indicated they would spend up to $500 on a garden *design*, while more than 40% of respondents from both years indicated they would not spend anything (Fig. 5.26). Likewise, excluding driveways or swimming amenities, more than 30% of all respondents from both years indicated they would spend up to $2500 on the *installation* of a garden, while more than 45% of respondents from both years would not spend anything. Therefore, in general, respondents answered consistently between years and questions.

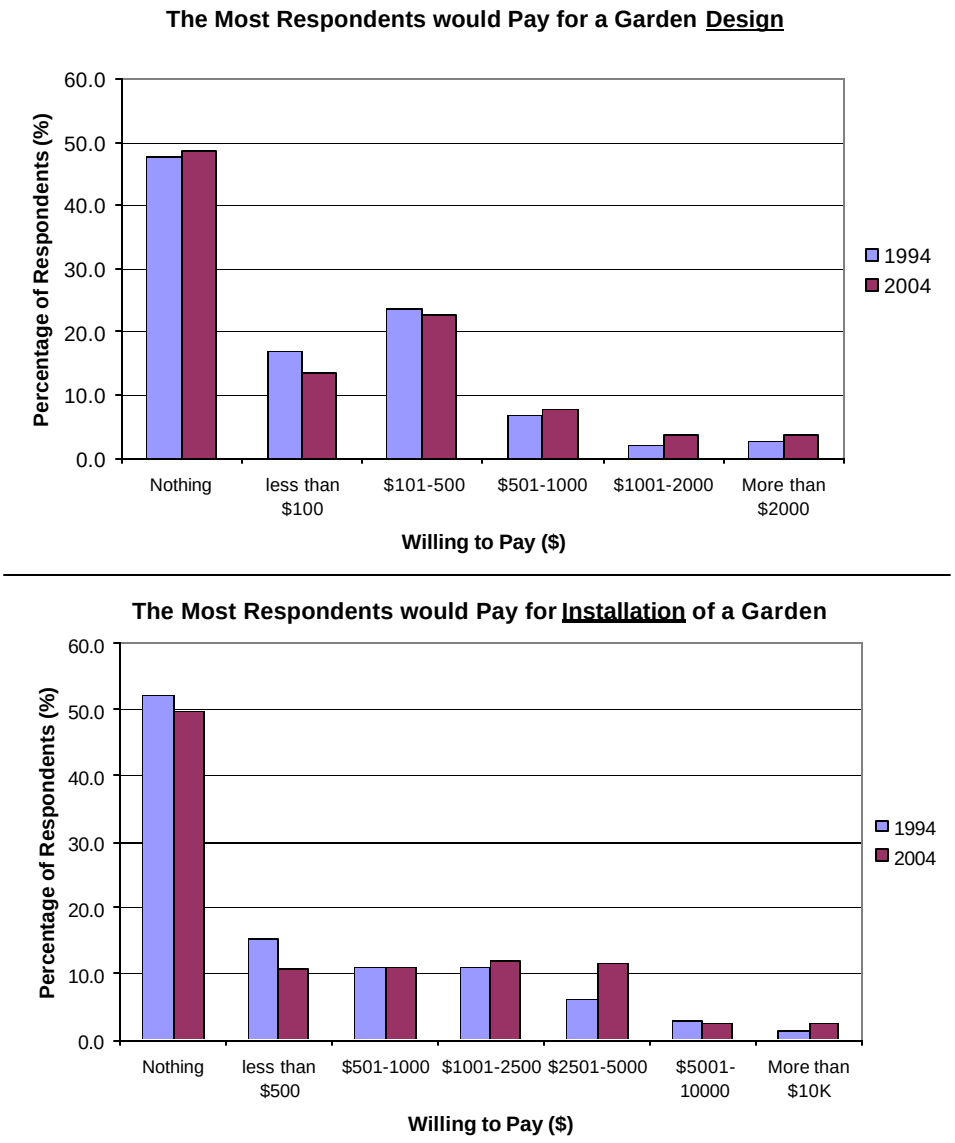


Fig. 5.26 – Percentage of Respondents Willing to Pay a Landscaper for a Garden Design and Installation

About half of the respondents from both 1994 and 2004 either pay someone to maintain their yard or consider this as an option in the future. Approximately half of the respondents from both survey years either do not pay someone else to look after their yard or are unwilling to pay someone for these types of services. These results indicate that the survey respondents are generally divided between those who already pay for yard-care services or would like to in the future and those who are not interested or are unwilling to pay someone for yard-care services.

5.12 Private Property Regulations and Policies

The majority of cities and municipalities across Canada and the United States exert some legal control over the management of private residential property in urban areas. The Cities of Kitchener (2002, 2003) and Waterloo (2002, 2003) are no exception, as seen with their property standards and lot maintenance by-laws. Respondents were asked whether they agree or disagree with several questions related to local policies and regulations. The responses provide insight on the degree to which policies and by-laws reflect the attitudes of the local residents.

Survey respondents were asked whether they agree or disagree with the statement – 'Among the fundamental rights in this country is the use of one's property without interference'. The distribution of responses followed similar patterns in 1994 and 2004 (Fig. 5.27). In general, respondent attitudes towards this statement were divided between sample years. Approximately 40% of both 1994 and 2004 survey respondents agreed with the statement, while about 35% disagreed. Minor percentage changes between years showed that slightly more 2004 respondents disagreed or had neutral feelings with this statement than 1994 respondents. However, the average response between survey years was the same at 3.1 – which means 'neutral,' with slight agreement. Matched respondents reported a similar response distribution and average. Therefore, survey respondents were divided on whether the use of one's property without interference is a fundamental right in our country.

Three statements inquired into respondent attitudes towards private property regulations and policies. These include: 'Having a tidy yard is important'; 'People should be able to 'do their own thing' in landscaping backyards'; and 'People should be able to 'do their own thing' in landscaping frontyards'. Having a tidy yard was important for many survey respondents, as more than 75% of both 1994 and 2004 respondents agreed with the statement. I did not determine the degree to which local lot maintenance by-laws or related regulations influenced respondents' attitudes to this statement. Nonetheless, a tidy yard was felt to be important by the majority of respondents.

Frontyards and backyards are often landscaped differently. The 'do your own thing' phrase from the previous statements refer to the diversity of landscaping styles that exist, for example as seen in the

garden pictures. These statements were geared towards understanding respondent attitudes concerning the styles of landscaping on neighbours' yards. As neighbour attitudes are known to influence styles of landscaping [for example, see Handlin 1979; von Baeyer 1984; Jenkins 1994; Morris and Traxler 1996; Varlamoff *et al.* 2001; Martin *et al.* 2003; and Robbins and Sharp 2003b], prominent neighbourhood attitudes also shape the interpretation and clarification of local policies. Thus, attitudes towards neighbours' styles of landscaping can affect local property regulations and enforcement.

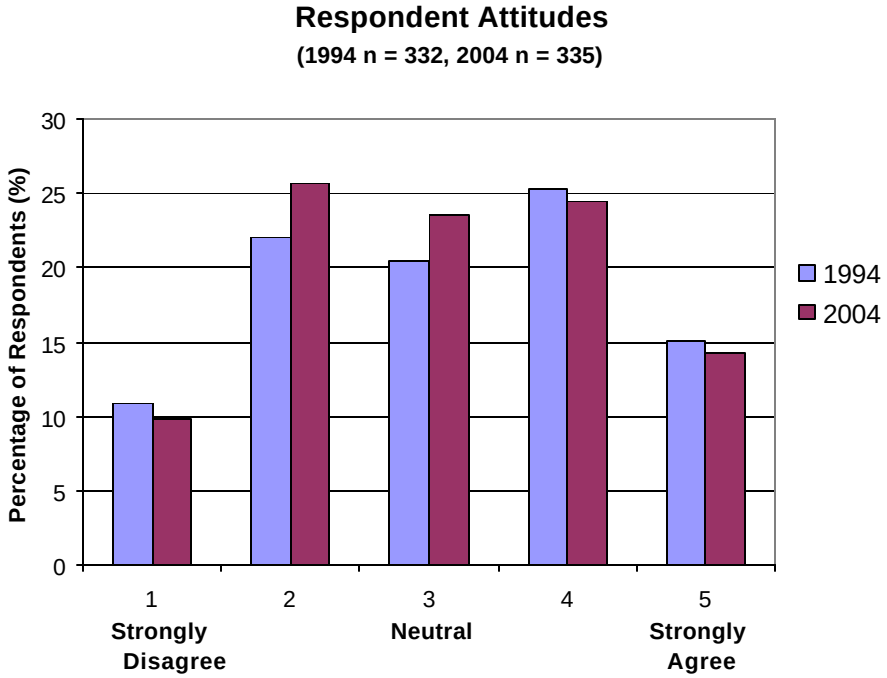


Fig. 5.27 – Respondent attitudes towards the statement – 'Among the fundamental rights in this country is the use of one's property without interference'

Respondent attitudes towards landscaping styles revealed an interesting difference between front- and backyards. While the majority of respondents agreed that people should be able to 'do their own thing' in landscaping backyards and frontyards (Fig. 5.28), a significant difference between respondent attitudes towards these statements still exist (Appendix 2). Hence, survey respondents continue to view these areas as somewhat separate from one another, having slightly different expectations for landscaping styles. It was interesting that responses varied little between survey years, which indicates that attitudes towards backyards and frontyards have remained consistent. Furthermore, matched respondents reflect a similar response distribution and average to those of all surveys respondents.

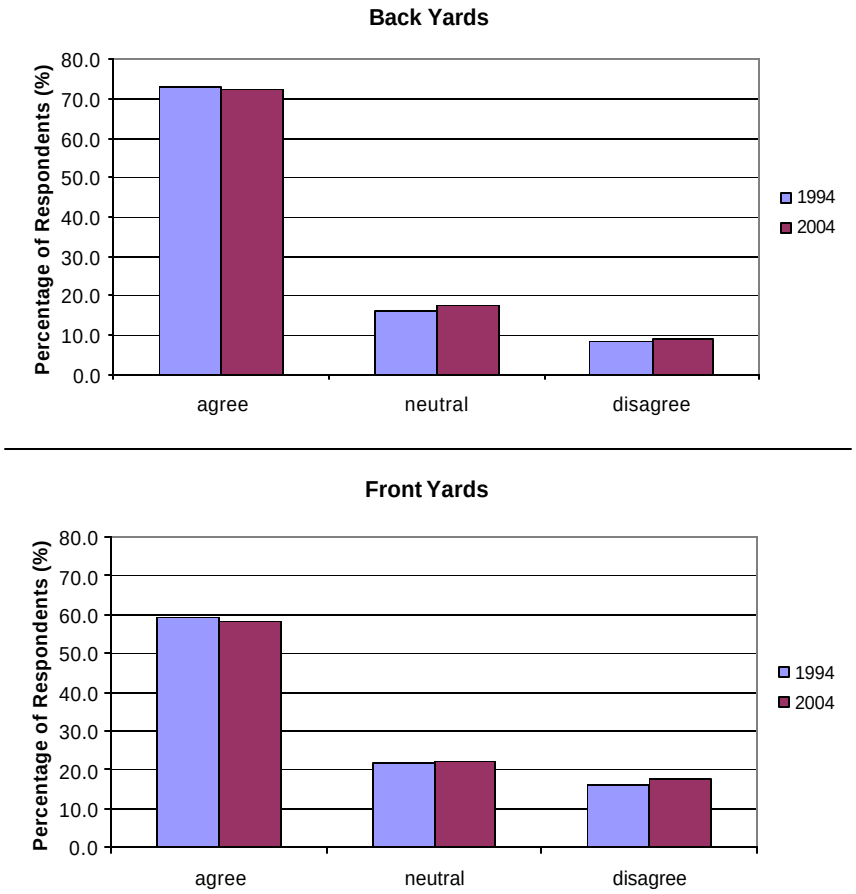


Fig. 5.28 – Respondent attitudes towards the statements 'People should be able to 'do their own thing' in landscaping backyards/frontyards' - (1994 n = 332, 2004 n = 335)

In 2004 only, survey respondents were asked 'If a yard or garden looks very different from most of the yards or gardens in their neighbourhood, do they think it should conform to the majority?' More than 75% of respondents replied 'no' – yards or gardens should not conform to the majority while 12% said 'yes' and 9% did not know their opinion. Hence, many 2004 respondents do not think that a different looking yard or garden should conform to the appearances of the majority in the neighbourhood.

Four questions on private property regulations and policies were also added to the 2004 survey. Respondents were asked to indicate whether they agree or disagree (scale: 5 - strongly agree to 1 – strongly disagree) with the following statements:

- More yard and lot maintenance regulations are necessary;
- Yard and lot maintenance regulations contribute to community harmony;
- Lot by-laws and yard policies ensure that property values do not diminish; and
- Yard regulations inhibit private yard expressiveness and diversity.

Respondent opinions were mixed between statements (Fig. 5.29). Respondents were divided over the 'necessity for more yard maintenance regulations' with an equal one-third split (approximately 33%) between attitudes. The average response to this statement was 3.0 or neutral. Likewise, respondents were divided in their attitudes regarding 'yard regulations inhibiting yard expressiveness and diversity'. The average response was 3.1 – neutral with a slight agreement, with 35% of the respondents in agreement. In the other two statements the response of the community is slightly more uniform. More than 55% of respondents agreed that yard and lot maintenance regulations contribute to community harmony and ensure that property values do not diminish. The response distributions for both of these statements were similar as well as the average responses – 3.5 and 3.6 – neutral with slight tendency to agree. In general, the results of these statements show that respondents are mostly divided on issues concerning yard and lot maintenance regulations.

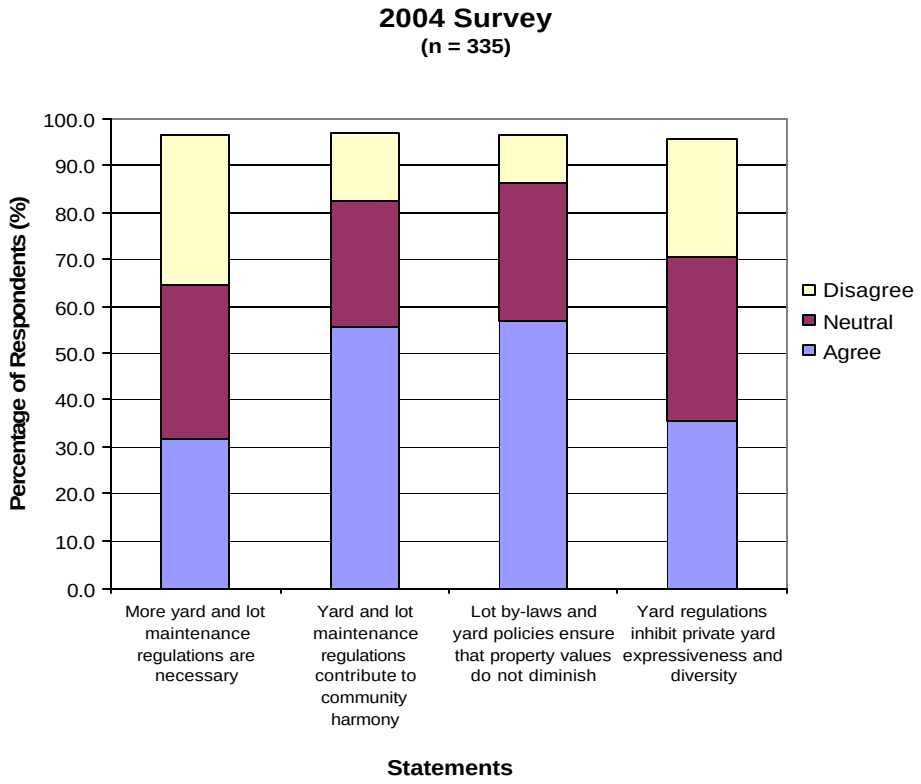


Fig. 5.29 – Respondent Opinions towards Statements on Private Property Regulations and Policies

Chapter 6.0 - General Discussion

An important consideration for urban and suburban residents of Canadian and American cities is the availability of private outdoor space. Most survey respondents reported they live in a residence with an outdoor area that has at least some private space. With the exception of apartment buildings, private outdoor space is often an essential element with many types of urban housing. Although the majority of respondents indicated that they were owners of single family dwelling units, most of the housing stock in suburban areas in Canada and the U.S.A. provide some private outdoor space. Thus, the availability of outdoor space in private residential settings is not a unique characteristic of the cities of Kitchener and Waterloo, but is more generally representative of suburban areas across North America.

Urban private outdoor spaces consist of many different types of covers or uses. Impervious covers such as asphalt or concrete were common in more than half of the respondents' private space, while pervious covers such as lawns or gardens were common in almost every space surveyed. These private outdoor spaces, which were typically estimated to be less than 900 square meters in this study, are often a mosaic of impervious and pervious covers. Many suburban areas have surfaces that prevent water from reaching the soil, such as driveways and sidewalks. Impervious surfaces were estimated to cover an average of less than 25 percent of the total area of private outdoor space, confirming the estimate of 15 to 45% by Brabec *et al.* (2002) for single-family residential dwellings percent impervious cover, depending on the size of the lot and residence itself. Generally, residential areas have much lower percentages of impervious cover than commercial or industrial spaces. However, when impervious areas in residential neighbourhoods are combined together with roads and other infrastructure necessary to access these lots, single-family dwellings may cumulatively have a significant impact on urban environmental quality and hydrologic function.

In this study, most private outdoor spaces have more pervious than impervious covers. Respondent estimates indicate that impervious surfaces account for an average 25 percent of their outdoor space. Pervious covers, which account for approximately 75% of private outdoor space on average, were most commonly lawns, flower gardens, and shrubs and trees. The percentage cover of these typical uses varied little between 1994 and 2004. Other more uncommon types of pervious uses saw greater variation between survey years. For example, ground covers were estimated to cover more space in 2004 than in 1994 while vegetable gardens saw a decline in percentage cover in 2004. These results suggest that ground covers are gaining wider acceptance in private outdoor spaces while urban vegetable gardening may be on the decline. Whatever the reason for these minor shifts between survey years, it is clear that private outdoor spaces are divided into many types of covers, the majority of them allowing water to access groundwater aquifer systems.

The types of covers on private outdoor spaces often reflect what those spaces are used for. Uses that are important for households to enjoy their outdoor space varied between the front- and back-yards. Mostly uses that occur on impervious space such as car parking, washing or fixing the car were important uses for the front-yard, while uses of pervious space such as gardening, family time, reading, and viewing wildlife were more important in the back-yard. Based on the importance of yard-uses, the back-yard seemed to be more important in enjoying the residences' private outdoor space than the front-yard.

Urban residential 'yards', those private outdoor spaces that contain a heterogeneous mix of covers, often tend to have a section of grass or turf, called a lawn. Lawns continue to be used as design and recreational elements in many residential outdoor spaces. Lawns may complement other design features such as flower gardens, rocks, water elements, trees, and shrubs, yet they can also be the principal landscape attribute. In terms of the ubiquity of residential lawns, 93 percent of respondents indicated they had a lawn in 2004; a 7 percent increase from the 1994 survey. Moreover, of six possible pictures of yard and gardens in Kitchener and Waterloo, more than 60 percent of respondents reported that their yard most resembled the picture of a monoculture lawn with a sidewalk. It was found that slightly more 2004 respondents reported their yard looked like a monoculture lawn than 1994 respondents. Hence, these reports confirm that turfgrass lawns continue to be a dominant feature in residential yards over at least a decade and the use of turfgrass as a landscape design does not appear to be going out of style any time in the near future.

In urban and suburban areas, residential lawns can vary in size from 5 to 100 percent of private outdoor spaces. This study found that in both 1994 and 2004, lawns were estimated to cover more than 50 percent of private outdoor space on average. Typically, lawns were found to be twice as large as impervious surfaces and five times larger than other types of pervious uses or covers. Although the exact size of lawns was not measured in this study, other studies have estimated that average urban lawn sizes range from 0.13 ha (Vinlove and Torla 1995) to 0.25 ha (Meyer *et al.* 2001). Thus, urban residential lawns cumulatively account for a large percentage of total land cover in both Canada and the U.S.A., often representing the largest pervious cover in outdoor yards.

The yard preferences of urban and suburban residents are also clearly in favour of turfgrass lawns. The picture of the mown lawn with a small sidewalk in a frontyard was 'strongly liked' by approximately 25 percent of all respondents in both 1994 and 2004. At least half the respondents in both years 'liked' the manicured lawn picture and would be attracted to buy or rent the dwelling. A small percentage, approximately 10 to 15 percent, of respondents indicated they would be deterred from purchasing the dwelling if the yard had a well manicured turfgrass lawn as in the picture on the poster. It is interesting to note that generally this picture was slightly more 'liked' or preferred in 1994 then in

2004. This trend is evident throughout the survey regarding the poster of yard pictures. Another example of this tendency shows almost 40 percent of 1994 respondents indicating the lawn picture was 'most liked' while this percentage dropped to approximately 25 percent in 2004. These trends may signify a slight yard aesthetic shift away from the dominant weed-free lawn design. However, respondent preferences do not seem to coincide with what residents yards look like in reality as the majority of residents' yards reflect the manicured lawn picture. In addition, the manicured lawn was still 'liked', 'strongly liked', and considered 'attractive' by the bulk of respondents in 2004. Hence, residents often prefer to have turfgrass lawns as a yard feature and find this yard design attractive.

Respondent attitudes concerning the lawn also reflect its dominance in residential yards and private outdoor spaces. Given that respondent attitudes based on the Greenness Index were found to be more 'green' than 'brown', it is perhaps surprising that the majority of respondents indicated that a yard has to have a lawn. Although 10 percent fewer respondents agreed that a yard has to have a lawn in 2004 than in 1994, lawns are still the most common feature in yards today. However, this slight change in attitude may signify a greater openness to other landscaping forms where yards that do not have a lawn are at least tolerated if not accepted by neighbours, the community, and society.

Lawns often provide an ideal site for enjoying both front- and backyards. Almost 75 percent of survey respondents indicated that a lawn should be used, not just looked at. Many types of uses such as exercising pets, sports or exercising, reading, relaxing, and enjoying parties and family time are just some of the activities that often take place on residential lawns. The 2004 survey showed that the number and diversity of uses were greater in the backyard compared to the frontyard. Front lawns are not used as frequently as backyards, but perhaps provide a complementary aesthetic to the residence itself while exhibiting a 'good neighbour' appearance. Back lawns are perhaps more versatile than front lawns, allowing a greater number of activities to be achieved with a greater sense of privacy. Hence, lawns provide the venue for enjoying many different uses on a regular basis.

All turfgrass lawns must be mowed to maintain that soft, carpet-like feel and trimmed manicured look. Respondents estimated they spend between 1 and 2 hours mowing the lawn every week during the growing season. Interestingly, almost half of the respondents in the 2004 survey indicated that lawn mowing was really important for enjoying both the front- and back-yards. Similar results between survey years indicated that more than a third of respondents reported that they liked the sound of mowing the grass, compared with roughly 20% that disliked the sound, regardless of whether it is their mower or someone else's. Hence, many people have positive attitudes about mowing the lawn and do not mind spending an hour or two a week operating the lawn mower. Moreover, suburban residents consider lawn mowing an important activity for enjoying their yard and many of them appreciate the sound of lawn

mowers. Sentiments such as these have been reinforced by North American culture for decades, especially after World War II, and are still communicated in the popular media (Robbins and Sharp 2003a; Schultz 1999; Feagan and Ripmeester 1999; Jenkins 1994; Bormann *et al.* 1993). With the invention of the lawn mower, lawn maintenance has been made convenient and easy.

Given that there are other options for mowing, it was surprising that gas-powered lawn mowers were favoured by the majority of respondents. In both survey years, approximately 70 percent of respondents had a gas-powered lawnmower while less than 20 percent of respondents had either a non-motorized push mower or an electric mower. Riding lawnmowers were not common among survey respondents. Although new models of lawnmowers have recently been regulated, emissions of gas-powered lawnmowers can significantly contribute to local air pollution through carcinogenic exhaust emissions (Christensen *et al.* 2001; Priest *et al.* 2000). Emissions from electric mowers are dramatically lower than gasoline mowers (Lamarre 1996), yet gasoline mowers continue to be favoured by the majority of urban residents. Thus, gas-powered mowers are often used to cut lawns despite the availability of non-motorized push mowers or less polluting electric mowers.

Lawnmowers help keep turfgrass well-trimmed but water is essential for green and healthy lawns. Over 70 percent of respondents in the 2004 survey were willing to spend money to water their garden and/or lawn. On average, 2004 respondents were willing to pay approximately $190 a year to water their yard. This figure is more than three quarters the average yearly water fees (based on actual bills) for residences in Kitchener and Waterloo. Hence, many respondents are willing to pay almost $200 a year to water their yard, which is more than 75 percent of their actual annual water fee on average. Although in-ground sprinkler systems were not common in residences surveyed, paying to water the lawn and yard was important to the majority of respondents.

While water is essential for keeping grass looking green and attractive, chemicals were often used to further enhance the aesthetic quality of lawns. Chemicals such as fertilizers are used to improve soil fertility for specific species while pesticides and herbicides are used to control weeds and pests. In this study, survey respondents were asked which chemicals they used themselves. More respondents reported using yard chemicals, including herbicides, pesticides, lawn fertilizers, and 'weed and feed' products, in 2004 than in 1994. In this study, lawn fertilizers were the most 'often' used chemicals by respondents, while herbicides and pesticides were used 'often' by a marginal percentage of 2004 respondents. However, more than half of all 2004 respondents used herbicides, lawn fertilizers, and 'weed and feed' products 'now and then'. Although pesticides were reported to be the least used yard chemical in both survey years, approximately 20 percent more respondents in 2004 reported they used pesticides every 'now and then' than 1994 respondents. These urban residential chemical usage statistics are consistent

with other studies (Osmond and Hardy 2004; Varlamoff *et al.* 2001). Hence, yard chemicals were reported to be used by respondents more in 2004 than in 1994 with lawn fertilizers being the most popular chemical used.

In recent years, yard chemicals have come under scientific and political scrutiny. These discussions continue to address the costs and benefits of using chemicals on lawns and residential yards, especially in light of human and ecosystem health concerns (Osmond and Hardy 2004; Robbins and Birkenholtz 2003; Varlamoff *et al.* 2001; Zartarian *et al.* 2000). When asked their opinion on the use of chemicals on residential yards, survey respondents reported mixed feelings. Approximately one third of respondents agreed that 'people should be allowed to use herbicides and/or pesticides on their yards' while approximately one third of respondents disagreed. A slightly higher percentage of respondents disagreed with these two statements in 2004, but the parity of responses generally remained the same. Interestingly, respondents did not differentiate their responses between the two types of yard chemicals. This indicates that at least pesticides and herbicides are viewed in the same chemical category, despite their inherent differences. Therefore, as in many scientific and political discussions, survey respondents were divided on whether chemicals should be allowed on residential yards, even though at least half the total respondents used these chemicals themselves on their yards.

Residents who do not wish to apply chemicals themselves can purchase these services from a yard-care provider. Approximately 40 percent of respondents from both years were willing to spend money, less than $500 a year on average, to have someone else look after their yard. Weed control, insect control, fungus control and fertilizing were the most common yard services 'already purchased' and most 'willing' to be purchased by respondents. It is clear that a substantial number of respondents either already purchased services from a yard-care provider or were willing to pay for these services, many of which involve the use of chemicals.

Despite growing numbers of urban households who use chemicals on their lawns and gardens, Frick *et al.* (1998) established that homeowners and lawn-care operators tend to use as much as ten times more chemicals per acre on their lawns than farmers use on agricultural land. Similarly, lawn-care operators were found by Templeton *et al.* (1998) to apply double the amounts of herbicide per acre per year than homeowners. Hence, larger doses of lawn chemicals by homeowners and lawn-care operators often can be attributed to the accepted principle 'more is better' (Varlamoff *et al.* 2001).

The use of lawn chemicals on residential yards is not diminishing. The proportion of respondents using lawn-care contractors for weed control, insect control, fungus control, and fertilizing differed very slightly between survey years. As chemical treatments are often a major component of many lawn-care operators' services, this study attests to the fact that there has not been a decrease in professional chemical

treatments for at least a decade. In the U.S., Templeton *et al.* (1998) reported that the number of households who pay a lawn-care contractor for chemical treatments had been growing. Moreover, more survey respondents in 2004 reported they used do-it-yourself chemicals including herbicides, pesticides, lawn fertilizers, and 'weed and feed' products at least occasionally than was reported in 1994. Consistent with the experience in the U.S., the USGS (1999) reported a steady climb of pesticide use on private lawns. Given that the growth of turfgrass lawns is linked with the expansion of suburban areas (Robbins and Birkenholtz 2003), this study suggests that the application of lawn and yard chemicals is also growing in proportion to suburban development.

I propose that the dominance of chemical inputs on private residential lawns is directly linked with the deeply rooted lawn ideology found in Canada and the United States. Compared with other countries and continents, North American culture is unusually predisposed to romantic perceptions of green pastures in urban and rural landscapes (Waldichuk 1998). The lawn, as the dominant form of yard style, has come to be accepted as being 'natural' in urban and rural settings (Mitchell 1994). Western society has long established sentiments that position the lawn far above other styles of landscaping, often to the exclusion of alternatives. This uncontested lawn ideology provides the impetus for the application of pesticides and herbicides to rid lawns and gardens of 'pest' or 'weed' species. Many respondents in this study seemed predisposed to use chemicals, despite generally 'Green' environmental attitudes from the majority of respondents. Hence, it is a mystery why environmental attitudes do not affect respondents' behaviour towards their local environment, at least in the case of lawns and yard chemicals. Clever marketing by chemical companies and popular yard and gardening magazines continue to promote 'Brown' lawn ideals in residential landscaping. Wasowski and Wasowski (2000) report that homeowners feel compelled to emulate what they see in the media, in particular when they see other homeowners using high levels of pesticides and fertilizers on pristine, immaculate lawns. Therefore, the perceived 'need' to use hazardous chemicals on lawns and yards originates from the same principles that have firmly entrenched lawns into our social and moral fabric.

Survey respondents confirmed the resilience of ideological principles concerning lawn supremacy. The picture of the uniform lawn in the survey poster was most liked because 'it looks practical to maintain' and 'would be acceptable to the neighbours'. For those respondents that maintain a lawn themselves, a lawn may look practical to maintain if homeowners already have a lawn-mower, 1 to 2 hours a week to spare for mowing, and additional time to devote towards watering, trimming, re-seeding, fertilizing, and adding other chemicals as needs arise. If homeowners do not have the equipment, time, or money initially, then maintaining a lawn can be quite inconvenient. Even if homeowners have all the necessary tools (lawnmower, trimmer, yard hose and sprinkler, etc.), resources (gas, oil, electricity,

chemicals), and enough discretionary time at the outset of having a lawn, lawn care is not as convenient as it seems, especially compared to maintaining an alternative style of yard landscaping. Many alternative forms of landscaping such as xeriscaping or naturalized yards combine the functionality of ecosystems with the aesthetic tastes of the homeowner. While alternative styles of landscaping may require additional time and money in the beginning, seasonal maintenance requirements of these yard styles is usually low. Therefore, lawns were reported as looking practical to maintain, although alternative landscaping styles are often just as 'practical' if not easier to manage.

Yet many homeowners want to have high quality lawns. Pristine looking, manicured lawns are usually a result of high maintenance costs combining time, money, and chemical inputs. In a study by Hamilton and Waddington (1999) in Pennsylvania, the highest quality lawns were found to have the highest maintenance inputs while lawns that were rated with the lowest quality were reported as receiving mowing only. Hence, the practicality of do-it-yourself lawn maintenance is not as easy as advertisements or the media may portray. However, if homeowners are not limited by financial resources, then of course the lawn is practical to maintain, as lawn-care operators can professionally maintain it every week with little hassle to the homeowner.

Reaffirming the dominant lawn ideology, the picture of the monoculture lawn on the poster in the survey was also well liked because it was thought to be acceptable to the neighbours. This is not surprising given that other recent studies (Martin *et al.* 2003; Robbins and Sharp 2003b; Varlamoff *et al.* 2001; Morris and Traxler 1996) confirmed similar findings. Neighbours are known to influence each other in terms of yard care practices and landscaping. Jenkins (1994) and Pollan (1991) have discussed how strong linkages between being a 'good' neighbour and maintaining your lawn have become engrained in North American society since World War II. Martin *et al.* (2003) reported that three-fourths of all homeowners believed that their landscape was similar to those of their neighbours. Similarly, in a study by Varlamoff *et al.* (2001), respondents expressed their desire to have their lawn of comparable quality to their neighbours. Homeowners with high maintenance lawns often assuage their concerns about chemicals with the belief that their lawn is proving to the community that they are a 'good neighbour and citizen' (Robbins and Sharp 2003b). The tacit belief that lawns represent an orderly, industrious, and law-abiding family continues to link the lawn aesthetic with virtuous and 'good' morality (Feagan and Ripmeester 1999). Thus, as the monoculture lawn is deeply rooted in associations with moral character, social reliability, neighbourhood pride, and perceived closeness with nature, lawns do not just represent the preferences of homeowners, but are a reflection of larger implicitly held societal norms.

As national and local regulatory frameworks embraced the dominant lawn ideology, private outdoor space in urban residential areas became subject to policies designed to maintain land value,

preserve public health and safety, and uphold yard-care norms. However, many survey respondents still believe that 'a fundamental right in Canada is the use of one's property without interference'. Although respondent attitudes were mixed on this issue, Keuper (1994) confirmed that municipal control over some residential matters meets considerable public resistance. These regulations and policies wield some legal control over the management of private residential property in urban areas through property standards' and 'lot maintenance' by-laws for example (City of Kitchener 2002 & 2003; City of Waterloo 2002 & 2003). Lawns, gardens, and yards are now policed with the threat of fines or legal action to ensure property and yard upkeep. Yet these legal controls may be unnecessary as many residents feel within their rights to be watchdogs of neighbours' yard-care activities (Feagan and Ripmeester 1999). In addition, more than three-fourths of survey respondents from both years reported that 'having a tidy yard was important' to them. Hence, it seems that property maintenance policies generally uphold the yard-care norms that are shared by most homeowners anyway.

For many years, alternative styles of landscaping faced social as well as legal opposition. In terms of policies, restrictions articulated in municipal by-laws did not allow much deviation from the normative yard-care practices. Residents incorporating alternative forms of yard landscaping were opposed as much by neighbours as the regulations themselves (Feagan and Ripmeester 1999). Only in recent years have these yard-care restrictions been amended, allowing special exemptions for 'ecological gardening', 'alternatives', and 'other landscaping' that are in a 'good state of repair' (City of Waterloo 2003; City of Kitchener 2003). However, these revised policies do not allow an 'anything goes' approach either. Exterior property areas must be 'maintained in a safe condition and so as not to detract from the neighbouring environment' (City of Kitchener 2003). The removal of 'noxious weeds pursuant to the *Weed Control Act* and any excessive growth of other weeds or grass' (City of Kitchener 2003) 'more than eight inches (City of Kitchener 2002) or 15 centimetres (6 inches) (City of Waterloo 2002) in height' are still legally enforceable in both cities. Hence, residential yards with alternative landscaping styles have been lawfully acceptable for several years in Kitchener and Waterloo, provided these private outdoor areas adhere to related policies and by-laws.

Since private outdoor area policies changed to allow more naturalized landscapes in urban areas, this survey investigated homeowner's attitudes to determine if yard-care norms are consistent with this change in policy. In general, respondents are accepting of a diversity of landscaping styles. The majority of respondents agreed that 'people should be able to 'do their own thing' in landscaping back- and frontyards. Although people 'doing their own thing' in landscaping backyards had greater agreement among respondents than 'people doing their own thing' in frontyards. Hence, alternative landscaping styles in the backyard is perhaps favoured more than in the front. Interestingly, respondent attitudes

towards yard-care norms showed little to no change between survey years. These findings are in contrast to a study by Feagan and Ripmeester (1999) in Niagara Region, Ontario, Canada, where the majority of respondents expressed a negative response towards alternative landscaping forms including properties with ecologically naturalized or restored sites.

Respondent attitudes towards yard conformity and the efficacy of yard policies and regulations were explored in 2004. More than three-fourths of respondents in 2004 reported that yards or gardens should not have to conform to the aesthetic majority in a neighbourhood. This percentage is consistent with respondent attitudes towards 'people doing their own thing' in landscaping residential yards. Yet, in terms of respondent attitudes towards the efficacy of residential yard policies, respondents were especially divided about 'the need for more of them' and whether 'yard regulations inhibit private yard expressiveness and diversity'. However, more than half of the respondents indicated that they thought lot maintenance regulations and policies 'contribute to community harmony' and 'ensure that property values do not diminish'. Therefore, the effectiveness of yard maintenance policies and regulations is unclear.

Chapter 7.0 – Conclusions

In Kitchener and Waterloo, turfgrass lawns represent the dominant style of yard landscaping in urban residential areas. Turfgrass lawns were found in at least ninety percent of households' private outdoor space in 2004. In both 1994 and 2004, lawns typically covered more than half of the respondents' private outdoor space, making them the largest and most consistently reported ground cover. Moreover, many respondents reported that a yard has to have a lawn. Hence, the fashion for having a lawn over other forms of landscaping did not change over a decade.

Respondent households found lawns practical to maintain. At a minimum, lawns require water and mowing to keep them green, healthy, and carpet-like, although additional maintenance is often required for a flawless looking lawn. On average, households were willing to spend almost $200 a year to water their lawn, while do-it-yourself homeowners mowed the lawn for an hour or two every week, often with a gas-powered lawnmower. To boost the health and appearance of lawns, approximately half of the households used chemicals themselves, with fertilizers the most frequently used chemical. Less than half of the households employed lawn-care professionals to look after their yard. Lawn services most often purchased by households utilized chemicals such as herbicides, fertilizers, pesticides, insecticides, and fungicides to keep lawns looking beautiful. Thus, either by themselves or with professional assistance, urban households reported lawns to be practical to maintain.

Respondent households were attracted to lawns because they are perceived to be acceptable to the neighbours. There continue to be many strong linkages between maintaining the lawn and being a 'good neighbour' in Canada's society and culture. A lawn still symbolizes order, control, industriousness, and moral virtues. Homeowners in other studies have also expressed their desire to have a yard of comparable quality to their neighbours. In addition, it was found that neighbouring attitudes towards yard landscaping could alleviate fears of using chemicals to achieve immaculate lawns and yards. Hence, gaining acceptance from neighbours can be seen as achieving a higher ethical standard than protecting or caring for the environment in which we live. I believe that this, in part, forms the foundation for the prevalence of lawns as the only suitable style of landscaping in residential areas. Lawns, then, do not just represent the yard design preferences of homeowners, but are a reflection of larger deeply rooted societal norms.

The dominance of lawns, I believe, can also be attributed to the influence the media has over our lives. Media sources have continued to encourage and support lawns because of the related multi-billion dollar industry in turfgrasses, chemicals and lawn-care equipment. Lawn or lawn chemical advertisements and slogans strengthen ideological connections with citizenship, morals, and codes of conduct. As North American society has embraced lawns as the only accepted form of landscaping for close to a century, lawns continue to be seen as 'natural' green space, perhaps more than what might naturally occur (Feagan

and Ripmeester 1999). Hence, engrained societal customs combined with media's powerful means of persuasion has built impenetrable walls around the primacy of 'lawnscaping' in urban residential areas.

In this study, respondent attitudes were shown to slightly detract from the monoculture lawn in 2004 compared with 1994 in favour of more garden-like preferences. Similarly, respondent attitudes were found to support the use of fewer chemicals in 2004 than 1994. Perhaps this indicates that attitudes towards contemporary issues, such as the presently contested pesticide debate in Kitchener and Waterloo, have forced more households to rethink some of the taken-for-granted ideological sentiments that are replete in our society. However, there was little change in general environmental attitudes between survey years and attitudes are not always a sign of behaviour or reality. While fewer respondents liked the monoculture lawn picture in 2004 than in 1994, a higher proportion of households reported they maintained lawns in 2004 than in 1994. The same condition is true concerning chemical inputs. More households used chemicals on their yards in 2004 than in 1994, despite opposite trends in attitudes. Therefore, while respondent attitudes may indicate that slight shifts concerning yard aesthetics and chemicals are in progress, household behaviour reports a different story.

Respondent attitudes towards landscaping diversity and yard-care regulations were also investigated in this study. The majority of respondents in both years seemed accepting of alternative landscaping styles. Respondents between years were more in favour of 'people 'doing their own thing' in landscaping 'backyards' than in 'frontyards'. As frontyards are more visually accessible to the public and neighbours, this type of sentiment substantiates the significance households place on appeasing neighbours and contributing to community harmony through their yard aesthetic. Hence, from this perspective, it would be more appropriate to undertake an alternative landscaping style in the backyard where it is more private and less likely to offend a neighbour or casual observer. The efficacies of yard-care policies were uncertain; however, respondents generally agreed that lot maintenance and yard regulations 'contribute to community harmony' and 'ensure that property values do not diminish'.

It is apparent that yard maintenance regulations in a dominant monoculture lawn society present a major barrier to alternative styles of landscaping and reduced chemical inputs in suburban residential areas. While yard-care awareness and educational programs are a way to empower change, other strategies must also be employed to minimize hazardous chemical inputs and increase more 'natural' environments in urban residential areas. Robbins *et al.* (2001) and Templeton *et al.* (1998) suggest the adoption of integrated pest management strategies as well as government imposed financial incentives to curb chemical inputs. All of these approaches, if implemented effectively, can help reduce chemical reliance; will underscore the advantages of naturalized landscaping forms; and assist in moving away from a dependence on lawns in urban residential areas.

Chapter 8.0 – Recommendations

Preamble

It is not the opinion of the author that turfgrass lawns be vanquished from urban residential settings. Rather, I recommend that chemical loading in these environments be limited to essential applications, if any. The over-application of chemicals to lawns and yards usually explains how residues penetrate into ground water aquifers and/or runoff into nearby water systems. There are many non-chemical ways that pests, weeds, insects, and fungi can be managed under control. These methods may not be as swift as spraying toxic chemicals but they are certainly better for human and ecosystem health. Using natural solutions to solve our gardening and landscaping problems creates a healthier environment that will often provide additional benefits in the long-term. Although idealistic, I recommend that Canadians more easily accept and tolerate landscaping differences. I suggest households incorporate aspects of alternative landscaping into their private green spaces, without necessarily compromising their preferred style. If everyone could show respect to his or her neighbours' style of landscaping, regardless of their yard preference, there would be less watch-dogs in the neighbourhood and more co-operation within the community. The societal yard-care norms in Western society must become more accepting and tolerating of landscaping diversity before a greater environmental consciousness can emerge.

Recommendations

These recommendations briefly describe options and initiatives that could be employed privately or publicly at local or national levels.

R1. After Ingram (1999), it is recommended that cities or regions take appropriate steps in their own policies towards achieving a naturalistic approach to residential yard landscaping. It is believed by Ingram (1999) and Nassauer (1997) that the management of public lands is the first step towards influencing residential landowners to consider landscaping alternatives. I have briefly outlined a five-step plan that will promote natural landscaping in public outdoor space:

1) *Problem acknowledgement* – The first step is to recognize the environmental, economic and societal problems associated with the dominant lawn ethic. In the form of an official policy statement, formally linked with other municipal planning strategies, it must be made clear that public lands are adopting an urban natural landscape management plan.

2) *Establishment of natural landscaping task force* – With the mandate of restoring landscape function and health in public landscapes, a working group assembled from citizens as well as public servants will undertake managing natural landscaping projects. Projects such as developing public awareness and education programs, landscaping discussion forums, hands-

on workshops, and initiating naturalized pilot sites or demonstration plots – each exhibiting different styles of landscaping.

3) *Development of public education programs* - Yard-care awareness and educational programs on natural landscaping may include disseminating brochures and information, creating public advisory panels, or maintaining hands-on demonstration plots. As a start, both Environment Canada (2002) and the U.S. Environmental Protection Agency (1992, 1995, 2003) have excellent literature on the web that provides preventative programs and guides for any yard or lawn.

4) *Development of a natural landscaping strategy* – This strategy includes a comprehensive landscape inventory that identifies land that could easily be naturalized based on a standard site selection and evaluation system. This strategy could also create a native plant list that is used in land conversions and site restorations.

5) *Revise the by-law structure for all outdoor spaces* – This new structure will promote natural landscaping on public, private, commercial, or residential properties. Drafted with community input, a new by-law on natural landscaping will be the foundation for the revised public policy structure concerning outdoor spaces. Existing by-laws that conflict with natural landscaping values must be amended, reworded, or removed. Regulatory enforcement of the new policies must allow time for citizens and businesses to comply. (Ingram 1999)

R2. A revised policy structure that is founded on natural or 'green' forms of landscaping and yard maintenance is the ideal recommendation for all urban outdoor areas. However, it is more realistic that natural landscaping principles be embedded within current by-laws, policies, and regulations. Yet some would argue that these 'green' values are already embodied in existing by-laws, under headings of exemptions – 'ecological gardening' or 'other landscaping' forms. I would argue that these 'green' values are not codified in present policies and regulations, but are after-thoughts that are exempted from the social norms. Conversely, I recommend that the green content in 'exemptions' form the substance of current by-laws and the present content of lot maintenance or similar by-laws be exemptions.

R3. It is recommended that an extensive marketing strategy be geared towards urban residential occupants and those that maintain yards. A private or public task force could be given the job of making natural landscaping forms look romantic, alluring, elegant, aesthetically pleasing, and even sexy. Shifting the focus away from the economic and environmental benefits of alternative landscaping, these marketing schemes will make people look at natural landscaping forms in a new light, appealing to the interests and trends within popular culture. The economic and environmental benefits of alternative landscaping would not be the main attraction, but could be viewed or incorporated in the advertisements as a 'bonus' to having a trendy, hip, chic yard. The marketing strategy must sell the natural landscaping image to the public using all means and mediums possible, which means that it would have to have a big budget.

R4. As part of an education program, it is recommended that an information package on integrated pest management strategies (IPMs) be freely distributed at the beginning of the growing season to all households. Information reviewing product labels, responsible use, application rates, and IPM approaches to pest control will help reduce the use and risk of lawn chemicals (USEPA 2005b). IPM is a series of evaluations, decisions, and controls used to manage pest damage by the most economical means, and with the least possible hazard to people and the environment (USEPA 2005a). Giving households free information about different methods of yard treatment, as well as identifying the possible risks of chemicals, will inform households of their yard-care habits and how best to solve problems both economically and environmentally.

R5. If local, regional, provincial, or national governments are serious about limiting the amount of yard chemicals in urban areas, it is recommended that greater regulations and financial disincentives be placed on chemical products. Here are some examples of how this could work:

- Non-agricultural chemical products could be more heavily regulated from government through certificate and licensing programs of purchasers.
    - Example #1 – a pesticide certificate must be presented to buy over-the-counter yard chemicals, showing that the purchaser has participated in a yearly workshop
    - Example #2 – declare all urban areas to be under a pesticide ban. Only special permit holders who are licensed to use pesticides are exempted.
- Yard-care companies could have a chemical quota system, based on size of the company. They would also have to account for their chemical usage for each job, especially for residential clients;
- Yard-care companies or do-it-yourself homeowners must pay an additional 'environmental tax' on chemicals that are suspected to be toxic to the environment; and
- Yard-care companies or do-it-yourself homeowners could get significant rebates from purchasing organic chemicals and could claim these purchases every tax year against their income.

R6. To more accurately reflect the changing demographic composition in Kitchener and Waterloo, it is recommended that further studies on landscape preferences and yard maintenance be conducted in the future. Successive studies would follow a similar methodology as this study and continue to understand household yard landscaping and maintenance trends or use the results of this study to investigate other linkages and areas of interest.

Chapter 9.0 – NOTES

[1]Although not likely, it is possible that the same respondent or household may have responded to the questionnaire and not have been appropriately matched. It is conceivable that with name changes or tax roll errors, same respondents or households may have completed both surveys at the same 1994 residence or a different residence in K/W, if they had moved to a new location that was randomly sampled in 2004.

[2]The percentage totals of stacked figures such as those from yard equipment and chemical use sections, do not add up to 100% of the sample size because of respondents who did not answer the question. Almost all respondents indicated their amount of yard equipment, while approximately 20% of 2004 survey respondents did not answer whether they use herbicides or pesticides.

Chapter 10.0 – References

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Chapter 11.0 – Appendices

11.1 Appendix 1 – Grass – A Backgrounder

Grass (*Poaceae*)

Grass, or *Poaceae*, is the most ubiquitous of the higher plant groups on the earth, ranking fourth in families of flowering plants with 10,000 species and at least 600 genera (Armstrong 2004; Hilu 2004). Grasses are represented in all areas of the world and surpass all other genera in total percentage of global vegetation (Beard 1994). This family includes food crops, turf, ornamental grasses, and important industrial crops.

Grass is unquestionably the most important plant family, providing the majority of food for humans, domesticated animals, and other grazing herbivores (Armstrong 2004). As a food crop, *Poaceae* provides about 80 per cent of global food, containing the top four crops that feed the world and more than 10 of the 30 most economically significant crops (Hilu 2004). In addition to cereal grains (wheat, rice, barley, oats and corn), grass crops contribute to other foods through: sugar cane - the primary source of sugar (sucrose); bamboo shoots - used in many Asian foods; and barley malt (beer) and fermented rice (sake) – popular alcoholic beverages around the world (Rhodus 2004). Therefore, the grass (Poaceae) family is responsible for providing the majority of food for humans and animals alike.

Global economics are also affected by other non-food related uses of grasses. The foundation for multi-billion dollar activities in the USA and around the world stems from the prevalence of turfgrass and ornamental grass industries (Cockerham and Gibeault 1985; Beard 1994; Butterfield 1999; Schultz 1999; Robbins and Sharp 2003b). As an industrial crop, grass bye-products are found in such items as newsprint, ethyl alcohol, and insulation materials (Armstrong 2004). Construction activities also employ bamboo timbers for scaffolding and other uses. Thus, grasses are not only an important food crop, but also contribute to many sectors of the economy and form the basis for large spin-off industries and services.

11.2 Appendix 2 – Comparing Sample Proportions:

Statistically Significant Tests, Calculation Examples, and Table/ Figure Summaries

Significant Tests of Sample Proportions - A Brief Introduction

Critical Values (C.V.)

In all calculations, convential critical values determine if the difference between proportions are statistically significant. If the result is greater than these critical values, then the difference is "statistically significant" which means that the proportions' outcomes differ. These Critical Values are:

2 - tailed test C.V. = 1.96 (.05)
2.596 (.01)

1 - tailed test C.V. = 1.645 (.05)
2.33 (.01)

Tests of Direction

Before the calculations are undertaken, hypotheses direct the tests and determine which Critical Value is used. For example:

Null Hypothesis = 1995 proportion is equal to 2004 proportion, which means that there is no significant difference between proportions.

Alternative Hypothesis = 1 - tailed test - strongly believe only change will be in one direction, ie. the change between proportions will increase in 2004 from 1994. The z-value will only be found in one tail of the distribution.

2 - tailed test - no beforehand assumption but 1994 proportion is not equal to 2004 proportion. The z-value will be found in either tail of the distribution.

Outcomes

A. Reject Null Hypothesis - If z > 1.96 or 1.645 (ie. z = 1.98, P < .05), we accept the alternative hypothesis and the difference is 'statistically significant'.

B. Accept Null Hypothesis - If z < 1.96 or 1.645 (ie. z = 1.45, P > .05), we accept the null hypothesis and the difference is 'not statistically significant'. This means that the two groups are no different from one another taking into consideration sampling variability.

Calculation Examples

There were three different types of statistical significance calculations that were used to identify if significant differences exist between two proportions in the results of this thesis. These are:

Calculation #1

$$z = \frac{P_{1994} - P_{2004}}{\sqrt{\frac{PQ_{1994}}{N_{1994}} + \frac{PQ_{2004}}{N_{2004}}}}$$

P = proportion
Q = 1 - P
N = sample size

ie. For proportions like Table 4.2 - Native Born Canadian Respondents

$$z = \frac{0.787 - 0.806}{\sqrt{\frac{.787(1-.787)}{324} + \frac{.806(1-.806)}{330}}}$$

z = **0.603**

Thus, 0.603 < C.V. (1.96 = 2 - tailed C.V.)
Accept Null Hypothesis: Conclusion: No significant difference in Canadian born respondents between 1994 and 2004 surveys.

Calculation #2

$$z = \frac{Y_{1994} - Y_{2004}}{\sqrt{\frac{S^2_{1994}}{N_{1994}} + \frac{S^2_{2004}}{N_{2004}}}}$$

ie. For scales like Table 4.18 - How Respondents Feel about Lawns

$$z = \frac{3.61 - 3.47}{\sqrt{\frac{1.359}{312} + \frac{1.589}{322}}}$$

Y = mean
S^2 = variance
N = sample size

$z =$ **1.452**

Thus, 1.452 < C.V. (1.645 = 1 - tailed C.V.)
Accept Null Hypothesis: Conclusion: Pattern suggested a decrease in preference for lawns in 2004 from 1994, but the difference between proportions was not statistically significant.

Calculation #3

$$z = \frac{D}{\sqrt{\frac{PQ}{N}}}$$

ie. For Matched Occupancies like Table 4.13 - MR: Flower Garden

$$z = \frac{0.849 - 0.932}{\sqrt{\frac{0.083(0.917)}{62}}}$$

D = difference score between P_1 & P_2
P = proportion
$Q = 1 - P$
N = sample size (lowest N between proportions)

$z =$ **2.369**

Thus, 2.369 > C.V. (1.645 = 1 - tailed C.V.)
Reject Null Hypothesis: Conclusion: Since 2.369 > 1.645, there are significantly more flower gardens in matched respondents yards in 2004 than in 1994. This difference is statistically significant.

For more information about z - scores and sample proportion statistics there is lots of quick information on the internet. Specifically:

http://answers.google.com/answers/threadview?id=512749
http://math.uc.edu/~brycw/classes/148/sample_prop.htm

TABLES: Summary of Other Important Z Tests and Proportional Comparisons from Tables in Thesis

		Proportion 1				Proportion 2				Z	Significant*
Table	**Subject**	Year/Item	# or Y	P or S^2	n	Year/Item	# or ?	P or S^2	n	**Score**	Difference
4.1	Survey Response Rates	1994	332	0.412	806	2004	335	0.309	1084	**4.618**	YES
4.2	Canadian Born Respondents	1994	255	0.787	324	2004	266	0.806	330	**0.603**	NO
4.3	Males in Surveys	1994	197	0.623	316	2004	160	0.508	315	**2.934**	YES
4.3	Females in Surveys	1994	119	0.377	316	2004	155	0.492	315	**2.934**	YES
4.3	Male/Female Ratio in 2004 Survey	Male	160	0.508	315	Female	155	0.492	315	**0.402**	NO
4.3	Male/Female Ratio in 1994 Survey	Male	197	0.623	316	Female	119	0.377	316	**6.380**	YES
4.3	Respondents' age between 31-60	1994	214	0.716	299	2004	202	0.685	295	**0.825**	NO
4.3	Full-time Employment	1994	193	0.609	317	2004	187	0.592	316	**0.437**	NO
4.4	Household Description: Couple	1994	94	0.287	327	2004	135	0.404	334	**3.188**	YES
4.4	Couple w/ Children	1994	160	0.489	327	2004	137	0.410	334	**2.048**	YES
4.4	Couple + Couple w/ Children	1994	254	0.776	327	2004	272	0.814	334	**1.211**	NO
4.5	Education: > 3 yrs. of Post Secondary	1994	105	0.332	316	2004	122	0.375	325	**1.140**	NO
4.5	Education: < Gr. 12 Equivalent	1994	59	0.187	316	2004	40	0.123	325	**2.245**	YES
4.6	Household Income Average: Total	1994	3.0	1.768	299	2004	3.6	1.944	299	**5.385**	YES
4.6	Household Income Average: Waterloo	1994	3.3	2.161	299	2004	3.8	1.960	299	**4.259**	YES
4.6	Household Income Average: Kitchener	1994	2.7	1.281	299	2004	3.4	1.833	299	**6.859**	YES
4.8	Single Detached House	1994	271	0.821	330	2004	288	0.867	335	**1.637**	NO
4.10	Type of Yard: Both common/private	1994	33	0.101	326	2004	29	0.087	334	**0.616**	NO
4.10	Type of Yard: Private	1994	278	0.853	326	2004	301	0.901	334	**1.880**	NO

* Significant at the .05 level

Note: # = number
Y = mean
P = proportion (percent)
S^2 = variance
n = sample size

MR = Matched Respondents (n=73)
MH = Matched Households (n=16)
MA = Matched Addresses (n=36)
All = All survey respondents

FIGURES: Summary of Other Important Z Tests and Proportional Comparisons from Figures in Thesis

		Proportion 1				Proportion 2				Z	Significant*
Fig.	**Subject**	Year/Item	# or ?	P or S^2	n	Year/Item	# or ?	P or S^2	n	**Score**	Difference
5.1	Residence Ages: 6-10 years	1994	70	0.211	328	2004	18	0.054	335	**6.111**	YES
5.1	Residence Ages: 41-60 years	1994	30	0.090	328	2004	68	0.203	335	**4.175**	YES
5.2	Estimating Yard Size: MR - 101-400 m^2	1994	11	0.151	11	2004	17	0.233	11	**0.991**	NO
5.2	Estimating Yard Size: MR - 401-900 m^2	1994	17	0.233	17	2004	22	0.301	17	**1.114**	NO
5.2	Estimating Yard Size: MR - 901-1600 m^2	1994	11	0.151	4	2004	4	0.055	4	**0.652**	NO
5.3	Percent Area Coverage: MR - Gr. Covers	1994	0.099	1.638	18	2004	0.162	3.960	17	**0.111**	NO
5.3	Percent Area Coverage: MA - Gr. Covers	1994	0.072	0.152	5	2004	0.131	1.158	7	**0.133**	NO
5.3	Percent Area Coverage: MA - Veggies	1994	0.154	2.400	8	2004	0.078	0.069	9	**0.137**	NO
5.4	Water Devices: Water Barrels	1994	68	0.205	332	2004	102	0.304	335	**2.955**	YES
5.4	Water Devices: Garden Hose	1994	289	0.870	332	2004	300	0.896	335	**1.045**	NO
5.4	Water Devices: In-Ground Sprinkler	1994	7	0.021	332	2004	19	0.057	335	**2.410**	YES
5.4	Water Devices: Outside Taps	1994	312	0.940	332	2004	323	0.964	335	**1.450**	NO
5.5	Similar Yard Styles: MR - Edged Garden	1994	15	0.205	15	2004	19	0.260	15	**0.934**	NO
5.5	Similar Yard Styles: MH - Edged Garden	1994	4	0.250	4	2004	6	0.375	4	**0.756**	NO
5.5	Similar Yard Styles: MA - Edged Garden	1994	6	0.167	36	2004	12	0.333	36	**1.785**	YES
5.5	Similar Yard Styles: MR - Flower Garden	1994	22	0.301	16	2004	16	0.219	16	**1.195**	NO
5.5	Similar Yard Styles: MH - Flower Garden	1994	5	0.313	5	2004	6	0.375	5	**0.575**	NO
5.5	Similar Yard Styles: MA - Flower Garden	1994	7	0.194	7	2004	9	0.250	7	**0.644**	NO
5.5	Similar Yard Styles: MR - Lawn	1994	49	0.671	49	2004	53	0.726	49	**1.689**	YES
5.5	Similar Yard Styles: MH - Lawn	1994	9	0.563	9	2004	9	0.563	9	**0.000**	NO
5.5	Similar Yard Styles: MA - Lawn	1994	24	0.667	17	2004	17	0.472	17	**2.029**	YES
5.6	Lawn Photo: All - Liked	1994	184	0.590	312	2004	167	0.519	322	**1.803**	NO
5.6	Flower Garden Photo: All - Liked	1994	203	0.663	306	2004	226	0.708	319	**1.212**	NO
5.6	Edged Garden Photo: All - Liked	1994	101	0.333	303	2004	139	0.433	321	**2.584**	YES
5.6	Xeriscape Photo: All - Liked	1994	35	0.115	305	2004	45	0.142	317	**1.008**	NO
5.6	Stone & Ground Cover Photo: All - Liked	1994	87.0	0.285	305	2004	115	0.362	318	**2.062**	YES
5.6	Edged Ornamentals Photo: All - Liked	1994	152	0.497	306	2004	191	0.599	319	**2.574**	YES
5.6	Xeriscape Photo: MR - Disliked	1994	48	0.686	70	2004	55	0.786	70	**1.351**	NO
5.8	Attractive Yards: All - Lawn	1994	187	0.563	332	2004	156	0.470	335	**2.414**	YES
5.8	Attractive Yards: All - Edged Garden	1994	53	0.160	332	2004	80	0.241	335	**2.627**	YES
5.8	Attractive Yards: All - Stone & Ground C.	1994	46	0.139	332	2004	72	0.217	335	**2.648**	YES
5.8	Attractive Yards: All - Edged Ornamental	1994	112	0.337	332	2004	125	0.377	335	**1.079**	NO
5.8	Attractive Yards: MR - Edged Garden	1994	8	0.110	73	2004	14	0.192	73	**1.393**	NO
5.8	Attractive Yards: MR - Stone & Ground C.	1994	7	0.096	73	2004	15	0.205	73	**1.863**	YES
5.8	Attractive Yards: MR - Edged Ornamental	1994	23	0.315	73	2004	33	0.452	73	**1.719**	YES
5.9	Unattractive Yards: All - Lawn	1994	30	0.090	332	2004	54	0.163	335	**2.855**	YES
5.9	Unattractive Yards: All - Edged Garden	1994	94	0.283	332	2004	47	0.142	335	**4.516**	YES
5.9	Unattractive Yards: All - Xeriscape	1994	203	0.611	332	2004	229	0.690	335	**2.147**	YES
5.9	Unattractive Yards: All - Stone & Ground C.	1994	99	0.298	332	2004	77	0.232	335	**1.936**	NO
5.9	Unattractive Yards: MR - Edged Garden	1994	19	0.260	73	2004	8	0.110	73	**2.381**	YES
5.9	Unattractive Yards: MR - Xeriscape	1994	55	0.753	73	2004	61	0.836	73	**1.248**	NO
5.10	Most Liked Yard: All - Lawn	1994	125	0.401	312	2004	89	0.285	312	**3.075**	YES
5.10	Most Liked Yard: All - Edged Garden	1994	14	0.045	312	2004	25	0.080	312	**1.811**	NO
5.10	Most Liked Yard: All - Stone & Ground C.	1994	10	0.032	312	2004	32	0.103	312	**3.571**	YES
5.10	Most Liked Yard: MR - Lawn	1994	34	0.500	68	2004	25	0.373	67	**1.500**	NO
5.10	Most Liked Yard: MR - Edged Ornamental	1994	6	0.088	68	2004	10	0.149	67	**1.100**	NO
5.11	Least Liked Yard: All - Lawn	1994	25	0.084	297	2004	48	0.155	309	**2.717**	YES
5.11	Least Liked Yard: All - Edged Garden	1994	36	0.121	297	2004	19	0.061	309	**2.574**	YES
5.11	Least Liked Yard: All - Xeriscape	1994	184	0.620	297	2004	202	0.654	309	**0.870**	NO
5.11	Least Liked Yard: All - Stone & Ground C.	1994	32	0.108	297	2004	23	0.074	309	**1.455**	NO
5.11	Least Liked Yard: MR - Xeriscape	1994	45	0.703	64	2004	54	0.806	67	**1.377**	NO
5.11	Least Liked Yard: MR - Stone & Ground C.	1994	10	0.156	64	2004	5	0.075	67	**1.457**	NO

5.23	Yard Chemical Usage: All - herbicides	1994	110	0.389	283	2004	168	0.609	276	**5.332**	YES
5.23	Yard Chemical Usage: All - pesticides	1994	94	0.331	284	2004	139	0.517	269	**4.501**	YES
5.23	Yard Chemical Usage: All - lawn fertilizer	1994	178	0.616	289	2004	220	0.748	294	**3.455**	YES
5.23	Yard Chemical Usage: All - 'Weed&Feed'	1994	152	0.526	289	2004	173	0.618	280	**2.228**	YES
5.26	Pay for Garden Design: < $100	1994	49	0.168	291	2004	43	0.135	318	**1.134**	NO
5.26	Pay for Garden Installation: < $500	1994	46	0.154	299	2004	34	0.107	317	**1.731**	NO
5.26	Pay for Garden Installation: $2501-5000	1994	18	0.060	299	2004	37	0.117	317	**2.513**	YES
5.28	People should be able to do their own thing in landscaping back vs. front yards' - Agree 1994 Survey	1994	242	0.749	323	1994	197	0.608	324	**3.884**	YES
5.28	People should be able to do their own thing in landscaping back vs. front yards' - Agree 2004 Survey	2004	242	0.731	331	2004	195	0.593	329	**3.787**	YES

* Significant at the .05 level

Note: # = number
Y = mean
P = proportion (percent)
S^2 = variance
n = sample size

MR = Matched Respondents (n=73)
MH = Matched Households (n=16)
MA = Matched Addresses (n=36)
All = All survey respondents

11.3 Appendix 3 – Material specific to the 1994 Questionnaire

Text and questions only appearing in 1994 Survey (in page order) – non-booklet form

IF YOU DON'T HAVE A PRIVATE OUTDOOR SPACE BUT YOU HOPE TO MOVE TO A PLACE WITH SUCH A SPACE WITHIN THE NEXT FIVE YEARS.

This questionnaire should be filled out by the person in the household who does most yard maintenance, or (if you do not have a yard) by the person who might do most if you had a yard.

BUT:

IF you DON'T have a private yard AND you will probably not move to a residence with a private yard in the next five years,

Question 8: Does the residence have **(please tick one only)**:

☐ No outdoor space

*If you answered that your present residence has no yard, or has a common outdoor space only, **don't answer the questions that follow** but please go straight to **question 12 (part C)**.*

Question 9: You may draw a sketch map with dimensions, if this helps:

Part C

We are asking you the questions below to find out whether you are likely to move to a different kind of accommodation in the next 5 years.

12. Do you think that you will still be living in your present residence in 5 years?

Yes _____No_____

If you answered "Yes", please ***skip the rest part C.***
Go straight to part D.
Do not answer questions 13-15.

13. If you answered **"No"** above please indicate below, the accommodation that you will most probably occupy in five years time. We are interested in where you will **most likely** live, **not** where you would **most like** to live!

- ☐ A single detached house
- ☐ Semi-detached house
- ☐ Town house/ row house
- ☐ Apartment in a building of 4 storeys or lower
- ☐ Apartment in a building of 5 storeys or higher
- ☐ Rooms within a house or apartment

14. Is your residence of 5 years time likely to be newly built or existing?

New_____Existing_____.

15. The market value (based on today's prices) of this **likely** residence of 5 years time is:

- ☐ Less than $100,000
- ☐ $100,001-150,000
- ☐ $150,001-200,000
- ☐ $200,001-300,000
- ☐ More than $300,000

16. If your household pays the water bill, please estimate the total **water charges** in the last year (July 1993-June 1994).

Your **water charge** is exactly half the total utility bill. The other half is a sewage charge.

17. If you do not presently have a private outdoor space, but hope to move to a residence with one, then please answer for the future residence.

Part H

This section asks about your attitudes towards the animals and plants in your neighbourhood.

31. For each animal or plant below, how do you feel about having them in your neighbourhood?
Please tick one column.
Also, place a ***** by each one that you have *seen* in your neighbourhood in the last year.

Animal or plant seen –––>		I like them in the neigh-bourhood	Neutral	I don't like them in the neigh-bourhood	I don't know enough about this animal or plant to say if I like it or not
raccoons					
black/grey squirrels					
red squirrels					
foxes					
chipmunks					
rabbits					
deer					
groundhogs					
dogs					
frogs/toads					
cats					
woodpeckers					
bats					
rats					
bees					
wasps					
house sparrow					
butterflies					
cardinals					
ducks					
caterpillars					
hummingbirds					
hawks					
swallows					
dandelions					
trilliums					
ragweed					
golden rod					

35. Is there a pond or stream in your neighbourhood?

Yes_____No__I don't know____.

If you answered **"Yes"**, please answer the following questions,
if you answered "No" or "I don't know"
please go to question 38.

36. Is there a Pond_____, a stream_____, or a pond and a stream_____?

37. **Please tell us about your neighbourhood pond or stream:**

	Yes	No	I don't know
...if there is a pond, is it a Storm Water Detention Pond?*			
...is the pond or stream bounded by weeds or trees?			
...are there many insects around the water?			
...do ducks or geese use the pond or stream?			
...do you like the appearance of the pond or stream?			
...is the pond or stream dry part of the year?			
...is most or all of the pond or stream lined with concrete, stone filled wire baskets or bricks?			

* **A storm water detention pond** is an artificial pond that fills with water after major rainstorms and thaws, and then drains slowly, so as to lessen flooding downstream.

*****Please go directly to Question 39*****

38. If you answered **"No" or "I don't know"** to whether there is a pond or stream:

Do you wish that there was a pond or stream in your neighbourhood?

Yes_____No__I don't know____.

39. Please tell us how much you **agree** with the following statements regarding urban ponds and streams:

	Strongly Agree		**Neutral**		**Strongly Disagree**
I like the way a pond or stream looks	5	4	3	2	1
I like the animals that live round a pond or stream	5	4	3	2	1
A pond or stream increases my property value	5	4	3	2	1
A pond or stream makes a neighbourhood look healthy	5	4	3	2	1
Ponds or streams in a neighbourhood looks dirty and polluted	5	4	3	2	1
Ponds or streams bring unpleasant insects to urban neighbourhoods	5	4	3	2	1
Ponds or streams are unsafe for children to play around	5	4	3	2	1
A pond or stream near my house is a flooding hazard	5	4	3	2	1
It bothers me if the pond or stream in my neighbourhood dries up at times	5	4	3	2	1

40. Are there any other reasons that you **like** or **dislike** to have a stream or pond in your neighbourhood?

Yes_____No_

(If **yes**, please describe) _____
_____.

11.4 Appendix 4 – 2004 Survey Questionnaire (non-booklet form)

Survey of Yard Landscaping and Maintenance Practices

School of Planning

University of Waterloo

2003

PLEASE FILL IN THIS QUESTIONNAIRE IF:

YOU LIVE IN A RESIDENCE WITH A PRIVATE OUTDOOR SPACE -That includes *a yard round a house, a private patio, or a private yard in a condominium complex or apartment block*.
It doesn't include a garden plot away from the residence.

This questionnaire should be filled out by the person 18 years or older in the household who does most yard maintenance.

IF you don't have a private yard, please mark an **X** here ☐ in pencil and send the questionnaire back unanswered.

Thank you.

Part A

This first set of questions is designed to find out about people's feelings on environmental issues:

1. For each of the regions identified below, please indicate how serious you feel environmental problems are on a scale of 1 to 5.

	Not at all serious		**Neutral**		**Extremely serious**
a. Your neighbourhood	1	2	3	4	5
b. Your city	1	2	3	4	5
c. The Region of Waterloo	1	2	3	4	5
d. Ontario	1	2	3	4	5
e. Canada	1	2	3	4	5
f. North America	1	2	3	4	5
g. The World	1	2	3	4	5

2. These are general statements about current conditions. Please indicate whether **you agree or disagree** with each statement:

		Strongly Agree		**Neutral**		**Strongly Disagree**
a)	Plants and animals exist primarily to be used by humans	5	4	3	2	1
b)	Rapid economic growth often creates more problems than benefits	5	4	3	2	1
c)	The balance of nature is very delicate and easily upset	5	4	3	2	1
d)	To solve some of society's problems it will be necessary to place restrictions on individual behaviour	5	4	3	2	1
e)	We should know if something new will work before taking a chance on it	5	4	3	2	1
f)	Humans should live in harmony with nature in order to survive	5	4	3	2	1
g)	The earth is like a spaceship with only limited room and resources	5	4	3	2	1
h)	Canadians will have to drastically reduce their level of consumption in the next few years	5	4	3	2	1

		Strongly Agree		Neutral		Strongly Disagree
i)	Among the fundamental rights in this country is the use of one's property without interference	5	4	3	2	1
j)	Through science and technology we can continue to raise our standard of living	5	4	3	2	1

Part B

The questions in this section will help you describe the residence where you live now.

3. **When did you move into this residence?**

_____year _____month

4. **How old is the residence?**

- ☐ Less than 5 years
- ☐ 6-10 years
- ☐ 11-20 years
- ☐ 21-40 years
- ☐ 41-60 years
- ☐ 61-100 years
- ☐ More than 100 years
- ☐ I don't know

5. **Do you own or rent this residence?**

- ☐ Own
- ☐ Own as a condominium
- ☐ Rent
- ☐ Other arrangement

6. **Is this residence best described as:**

- ☐ A single detached house
- ☐ Semi-detached house
- ☐ Town house/ row house
- ☐ Apartment in a building of 4 storeys or lower
- ☐ Apartment in a building of 5 storeys or higher

☐ Rooms within a house or apartment

7. **The approximate market value of this residence is:**

- ☐ Less than $100,000
- ☐ $100,100-150,000
- ☐ $150,100-200,000
- ☐ $200,100-300,000
- ☐ More than $300,000
- ☐ I don't know

8. Do you think that you will still be living in your present residence in **5 years**?

Yes _____No_____Not Sure_____

9. Does the residence have **(please tick one only)**:

- ☐ A common outdoor space only (e.g. round an apartment building)
- ☐ A combination of a common outdoor space and a private outside space (e.g. a fenced area within a condominium complex)
- ☐ A yard which only your own residence uses, with no common outdoor space

If you ticked the first box (i.e. Your residence has a common outdoor space only) please skip the following questions ***until question 13 (Part C)***.

10. If you answered that there is a private outdoor space, **please tell us how big it is** (remember to exclude the ground area of the building, but to include paved areas like a driveway).

- ☐ Less than 25 square meters (30 square yards)
- ☐ 26 to 100 square meters (31-121 square yards)
- ☐ 101 to 400 square meters (122-484 square yards)
- ☐ 401 to 900 square meters (485-1089 square yards)
- ☐ 901 to 1600 square meters (1090 -1936 square yards)
- ☐ More than 1600 square meters (More than 1936 square yards)
- ☐ I don't know

11. Please estimate the % area of your total private outdoor space in each kind of use (to the nearest 5%).

If there is **none** of a particular **type** mark it **"0"**.
If you **can't figure out the percentages**, please put a tick **v** against each type that you have.

Kind of Use	Ticks	% of total area
Concrete		
Asphalt		
Hard surfaces that let water through (gravel, wooden decks, pavers, interlocking stone, etc.)		
Lawn		
Flower garden		
Shrubs and trees		
Vegetable garden		
Swimming pool		
Ground covers, like periwinkle, juniper, etc. (cover ground & prevent weed growth)		
Others (please describe)		
TOTAL		**100**

If you have misplaced the poster that was included in your survey package, you can view the electronic version at:
http://www.fes.uwaterloo.ca/u/rcsuffli/yardsurvey/

12. Looking at the pictures of gardens on the enclosed poster or on the website, which ones are most like your own private outdoor space **(circle as many styles as there are in your yard):**

a. b. c. d. e. f.

g. - (None of the pictures is like my garden)

Part C

*Please tell us about water costs at your residence. If your landlord pays the utility bill or you have no way of knowing the cost of water for your residence, please **go straight to Part D,** and do not answer the question below.*

13. If your household pays the water utility bill (water and sewage costs), please estimate the TOTAL **utility charges** in the last year (November 2002 -October 2003).

Your **water charge** is exactly half the total utility bill.
The other half is a **sewage charge**. Please tell us
the TOTAL for water AND sewage.

Our total utility fee was $_____and this is based on:

- ☐ Actual bills
- ☐ My best guess
- ☐ I don't know/ I can't say

Part D

This part asks about your outdoor water use in your present residence.

14. **Please tell us the most that you would be willing to pay for water for your present garden and/or lawn.**

The most that I would be prepared to pay to water my yard would be $_____ dollars per year.

15. Does your residence have any of the following **(Please tick as many as apply):**

- ☐ One or more outside taps (How many?_____)
- ☐ An in-ground sprinkler system
- ☐ One or more water barrels or similar devices collecting water off the roof for garden use. (How many?_____)
- ☐ A private well
- ☐ A garden hose
- ☐ A cistern
- ☐ A non-hand held sprinkler that you attach to the end of a hose
- ☐ A swimming pool
- ☐ A hot tub

Part E

In these questions, we would like to know how you feel about various styles of garden landscaping based on the pictures from the poster included in your survey package.
This poster can also be viewed electronically from:
http://www.fes.uwaterloo.ca/u/rcsuffli/yardsurvey/

16. Please examine the pictures of gardens on the enclosed poster or on the website. (Don't take any notice of the buildings in the background of the photos for the following questions). **By circling one of the numbers on each line below, please indicate how you feel about each style of landscaping.**

	Strongly Like		**Neutral**		**Strongly Dislike**
Photo a	5	4	3	2	1
Photo b	5	4	3	2	1
Photo c	5	4	3	2	1
Photo d	5	4	3	2	1
Photo e	5	4	3	2	1
Photo f	5	4	3	2	1

17. Imagine that you are looking for a new residence to buy or rent. You look at six residences with six gardens as in the pictures on the poster. **Which of the gardens in the pictures would attract you to choose that dwelling for rental or purchase?** (circle as many as you wish)

a b c d e f

18. Given the hypothetical situation above (question 17), **which of the gardens in the pictures would put you off choosing a dwelling for rental or purchase?**
(circle as many as you wish)

a b c d e f

19. Choose the garden picture that you **<u>like the most</u>**. **Please write the picture letter here: _____**
Now tell us **why you like it most** (tick as many lines as you wish):

_____I like the colours

_____I like the shapes of the plantings

_____It looks practical to maintain

_____My household could enjoy using this space

_____It looks good for attracting wildlife

_____It would be acceptable to the neighbours

_____It's environmentally acceptable

_____It looks cheap to maintain

Other (Please describe):_____

20. Choose the garden picture **you like the least. Please write the picture letter here:_____**
Now tell us **why you like it least**.(tick as many lines as you wish):

_____I dislike the colours

_____I dislike the shapes of the plantings

_____It looks impractical to maintain

_____My household could not enjoy using this space

_____It looks unattractive to wildlife

_____It would be unacceptable to the neighbours

_____It's environmentally unacceptable

_____It looks expensive to run

Other (Please describe):_____

Part F

The following questions ask about your attitudes towards various aspects of yard maintenance.

21.

Please indicate whether **you agree or disagree** with each statement.

	Strongly Agree		**Neutral**		**Strongly Disagree**
I like to look after a yard	5	4	3	2	1
I like to grow flowers	5	4	3	2	1
I like to grow vegetables	5	4	3	2	1
A yard has to have a lawn	5	4	3	2	1
I like trees in a yard	5	4	3	2	1
I dislike raking autumn leaves	5	4	3	2	1
I dislike mowing	5	4	3	2	1
People should not be allowed to use herbicides (weedkillers) on their yards	5	4	3	2	1
People should not be allowed to use pesticides (insecticides, fungicides) on their yards	5	4	3	2	1
A lawn is mainly to look at, not to use.	5	4	3	2	1
Having a tidy yard is important	5	4	3	2	1
It troubles me to water the yard when there is a regional water shortage.	5	4	3	2	1
I dislike the sound of other people mowing or using power yard tools.	5	4	3	2	1

21. (con'd)	Strongly Agree		Neutral		Strongly Disagree
I dislike the sound of my own mower	5	4	3	2	1
People should be able to 'do their own thing' in landscaping backyards	5	4	3	2	1
People should be able to 'do their own thing' in landscaping frontyards	5	4	3	2	1
I know a lot about gardening	5	4	3	2	1
When I don't know how to tackle a garden problem, I can find out about it easily	5	4	3	2	1

22. If a yard/garden looks very different from most of the yards/gardens in your neighbourhood, **do you think it should conform to the majority?**

Yes _____ No _____ I don't know _____

23. Do you **enjoy** having or using **your yard space**?

Yes _____ No _____ I don't know _____

If you answered **"Yes",** please answer the following questions. **If you answered "No" or "I don't know" please go to question 26.**

Part G

In the next questions, we would like to know how your yard space is used most often.

24. Which of the following uses is really **important** for enjoying your '**front**' **yard** on a regular basis? (*check all that apply – circle most important*)

____ Viewing wildlife
____ Sports/exercise
____ Relaxing/lounging
____ Fixing car
____ Storage
____ Meditation/prayer/yoga
____ Parties, events, etc.
____ Other use(s) (please describe) _____
_____
____ Don't enjoy front-yard

____ Bike storage
____ Family time
____ Car parking
____ Exercising pets
____ Viewing street
____ Hobby projects (For instance, carpentry or artwork)

____ Reading
____ Washing car
____ Gardening
____ Looking at view
____ Lawn mowing

25. Which of the following uses is really **important** for enjoying your '**back**' **yard** on a regular basis? (*check all that apply – circle most important*)

____ Viewing wildlife	____ Bike storage	____ Reading
____ Sports/exercise	____ Family time	____ Washing car
____ Relaxing/lounging	____ Car parking	____ Gardening
____ Fixing car	____ Exercising pets	____ Looking at view
____ Storage	____ Viewing street	____ Lawn mowing
____ Meditation/prayer/yoga	____ Hobby projects (For instance, carpentry or artwork)	
____ Parties, events, etc.		

____ Other use(s) (please describe)_____

_____

____ Don't enjoy back-yard

Part H

Below, we ask how much you are prepared to spend (in time or dollars) on your yard.

26. The number of hours per week our household is prepared to spend **looking after a yard** is up to _____ hours per week (over the growing season, **excluding mowing**). We actually spend_____hours.

27. The **amount of lawn mowing** our household is prepared to do is up to_____hours per week (over the growing season). We actually spend_____hours.

28. Which of the following apply to your household?

I/We have:	**Yes**	**No**	
a push mower			
a gas mower			
an electric mower			
a ride-on mower			
a leaf-blower			
a wood/twig shredder			
I/We use the following ourselves: (lawn spray companies will be covered later)	**Often**	**Now and Then**	**Never**
herbicides (weedkillers)			
pesticides (bug killers, fungicides, etc.)			
lawn fertilizer			
"weed & feed" type products			

29. The most that my household would be prepared to pay annually for somebody to maintain the yard is $ _____ .

If you answered **$0** above, please go to **question 31**

30. Which services would you be willing or not willing to pay a landscaper for?
(Place one tick on each line):

Service	Willing (I don't purchase this service yet)	Not Willing	Not Sure	I already purchase this service
Weed control				
Insect control				
Fungus control				
Removing dead grass and soil aeration				
Fertilizing				
Mowing				
Looking after flower beds				
Growing vegetables				
Looking after ground covers*				

*Ground covers are plants like periwinkle or junipers that cover the ground so that weeds will not grow.

31 (a). If you were setting up a yard in a newly occupied house, **what is the most that you be willing to pay a landscaper for a garden <u>DESIGN:</u>**

- ☐ Nothing
- ☐ Less than $100
- ☐ $101-500
- ☐ $501-1,000
- ☐ $1,001-2,000
- ☐ More than $2,000

(b). If you were setting up a yard in a newly occupied house, **what is the most you would be willing to pay a landscaper for <u>INSTALLATION</u> of a garden** (excluding driveways and any swimming pools/saunas).

- ☐ Nothing
- ☐ Less than $500
- ☐ $501-1,000
- ☐ $1,001-2,500
- ☐ $2,501-5,000
- ☐ $5,001-10,000
- ☐ More than $10,000

<u>Part I</u>

The next question is designed to <u>understand your opinions towards private property regulations and policies</u>.

32. Please indicate how much you **agree or disagree** with the following statements:

	Strongly Agree		**Neutral**		**Strongly Disagree**
More yard and lot maintenance regulations are necessary	5	4	3	2	1
Yard and lot maintenance regulations contribute to community harmony	5	4	3	2	1

Lot by-laws and yard policies ensure that property values do not diminish	5	4	3	2	1
Yard regulations inhibit private yard expressiveness and diversity	5	4	3	2	1

The next questions ask about your house or yard pets.

33. How many **dogs** are in your household?_____ (If none, enter 0)

How many **cats** are in your household? _____ (If none, enter 0)

If you don't own either a cat or dog, skip the
next question and ***move onto question 35 (Part J)***

34. If you keep a **dog** or **dogs,** are they allowed outdoors?

Yes_____No _____

If you keep a **cat** or **cats,** are they allowed outdoors?

Yes_____No _____

Part J

You are nearly finished! *This section asks about how much you like or dislike selected features of green spaces in your neighbourhood.*

35. Please indicate how much you **agree or disagree** with the following statements:

	Strongly Agree		**Neutral**		**Strongly Disagree**
I like to see a variety of kinds of trees in my neighbourhood	5	4	3	2	1
I like to have woodlots in my neighbourhood	5	4	3	2	1
It is important that green spaces and parks and woodlots are linked by corridors	5	4	3	2	1
Parks need groomed lawns and gardens	5	4	3	2	1
Parks need landscaped play areas	5	4	3	2	1
Parks need wild areas with long grass, shrubs and trees	5	4	3	2	1

Part K

*This **last set** of questions asks for some background information about you.*

36. What best describes your household? **(please check one)**

a._____Individual living alone

b._____Couple

c._____Couple with children

d._____Single head of household with children

e._____Other combinations of related or unrelated individuals

We want to find out if your background affects your landscaping preferences.

37. **Where were you born?** If in Canada, please **circle** the province or territory:

a. Newfoundland
b. Prince Edward Island
c. Nova Scotia
d. New Brunswick
e. Quebec
f. Ontario
g. Manitoba
h. Saskatchewan
i. Alberta
j. British Columbia
k. Yukon
l. North West Territories
m. Nunavut

Or, if in **another country**, please write it here : _____ _____. and please write **the year in which you arrived in Canada** here: _____.

38. **How many years of schooling have you completed?** (Include all elementary or grade school, high school, college or university training plus time spent in vocational, technical or apprenticeship programs)

Elementary through to high school (grade):

K 1 2 3 4 5 6 7 8 9 10 11 12 13

University/College/Vocational/Technical school (number of years of equivalent of full-time study)

1 2 3 4 5 6 or more

39. Please describe each of the household members **(up to 6)**

Person	Relationship to You (spouse, child, lodger, etc.)	Sex (please check)		Age (years)	Employed? (please check)		Other Activity (please check)	
		male	female		full-time	part-time	school	retired
first	yourself							
2nd								
3rd								
4th								
5th								
6th								

Please place a tick here **if there are more than 6 people** in your household_____.

The last question asks about your **household income**.
We need this information to make comparisons between households regarding their water use and their preferences for various landscaping.
YOUR RESPONSES ARE COMPLETELY CONFIDENTIAL.

40. What was your **household income for 2002?** Household income is the total income from all sources for everybody who contributed to the running of the household in 2002. This includes salaries and wages, investment income, pensions, scholarships, social assistance, unemployment insurance payments, mother's allowance, rental income, business income, etc.

What was your household income before taxes (gross income) for 2002?

- ☐ $25,000 or less
- ☐ $25,001-45,000
- ☐ $45,001-75,000
- ☐ $75,001-105,000
- ☐ 105,001-120,000
- ☐ More than $120,000

That completes the questionnaire.
Thank you very much for participating!

If there is anything further that you would like to add, please feel free to do so in the space below.

Remember to check the study web-site for updates, summaries, and other information:
http://www.fes.uwaterloo.ca/u/rcsuffli/yardsurvey/

11.5 Appendix 5 – Garden Poster Photographs

Photograph A - Lawn

Photograph B – Flower Garden

Photograph C – Edged Garden

Photograph D - Xeriscape

Photograph E – Stone & Ground Cover

Photograph F – Edged Ornamentals