TRAVEL DISTANCE AND MODE CHOICE

OF DOG PARK USERS IN HALIFAX, NS

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Submitted in fulfillment of the

requirements of GEOG 4526

For the degree of Bachelor of Environmental Studies

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April 7, 2017

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ABSTRACT

Travel Distance and Mode Choice of Dog Park Users in Halifax, N.S.

by Eric J. Norris

Dogs are increasingly common in the urban landscape, yet little is known about their spatial and functional patterns. A short survey was conducted to determine: the average travel distance of off-leash dog park users in the Halifax, Canada region; their mode of transit; their reasons for choosing the off-leash park; and whether they accomplish any other tasks on their journey. Results show that off-leash park users travel an average of 5559 m one-way, producing between 431 and 579 kg CO_2 per year; however, there is a difference between urban and suburban park users travel habits, with urban users typically walking more and traveling shorter distances than their suburban counterparts. Off-leash capability and proximity are the most common reasons for park choice in Halifax and people are more likely to make the trip to the off-leash park a single destination trip than completing multiple errands.

May 28th, 2017

RÉSUMÉ

Le Distance de Voyage et Le Méthode de Transport de

Les Utilisateurs du Parc Sans Laisse, Halifax, N.S.

by Eric J. Norris

Des chiens sont communs dans le paysage urbain, mais on sait peu de choses sur leurs habitudes spatiale et fonctionnelle. Une courte enquête a été effectuée pour déterminer la distance moyenne des utilisateurs du parc du chien sans laisse dans la région d'Halifax, Canada, leur mode de transport en commun, leurs raisons de choisir le parc sans laisse, et s'ils accomplir tout autres tâches sur leur voyage. Les résultats montrent que les utilisateurs du parc sans laisse s`en vont en moyenne 5559 m et produisant entre 431 et 579 kg CO_2 par année ; cependant, il y a une différence entre les zones urbaines et suburbaines, les habitudes de déplacement des usagers du parc avec les utilisateurs urbains et plus généralement à des courtes distances de déplacement que leurs homologues banlieusards. Capacité sans laisse et proximité est les raisons les plus courantes pour le choix d'Halifax et que les gens sont plus susceptibles de faire le voyage au parc sans laisse une seule destination voyage que remplissent plusieurs courses.

Le vingt-huit mai, 2017

ACKNOWLEDGEMENTS

The following people made this paper possible: Dr. Novak, Dr. Grek-Martin, Lindsay Carmichael, Greg Baker, Saint Mary's University Research Ethics board and the survey participants. I am very grateful to the off-leash park users who stopped to talk to me during their summer walks and provided me with many insights and great conversation. I also want to thank the Research Ethics board for giving me permission to go forward with this project and being very helpful in the application process. I also want to thank Greg Barker of the Saint Mary's University Geography department for providing me with GIS help along the way as well as providing the necessary data to make the maps and analysis possible. Much appreciation also goes to Lindsay Carmichael at the Saint Mary's University Writing Centre for being patient while I turned my words into English. I would also like to thank Dr. Grek-Martin for being my second reader and providing great advice to improve my thesis. Last but certainly not least, I want to thank my supervisor Dr. Novak for guiding me in the creation of this project and for making this project, not only a success, but a lot of fun.

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CHAPTER 1

Introduction

1.1. Introduction

Man's best friend or environmental burden?

There are roughly 6.4 million dogs in Canada with 34% of Canadian households owning at least one dog (Canadian Animal Health Institute, 2015). The Canadian dog population is nearly double the human population of Atlantic Canada, thus, dogs and dog ownership is important to many Canadians (Statistics Canada, 2016). Dog ownership is associated with increased activity level (Garcia et al., 2015; Owen et al., 2010; Brown & Rhodes, 2006) and psychological benefits (Cline & Marie, 2010). However, like the adage, "there is no such thing as a free lunch", dog ownership has a cost.

The environmental impact of dog ownership has come into question in recent years. A controversial book by Brenda and Robert Vale *Time to eat the dog: A real guide to sustainable living* equates the carbon footprint of owning a dog to that of an SUV (Sharps, 2013; Hammerly & DuMont, 2012; Williams-Derry, 2009; Vale & Vale, 2009). The book has started an emotionally fuelled debate on the Internet, with both sides producing attempting to prove the other is wrong (Williams, 201; Schwartz, 2014). A thick line in the sand emerges between people who agree with the Vales and those who think their argument is absurd; however, regardless of your viewpoint, such provocations prompt us

to examine the environmental costs of one of our most cherished companions. Thus, the question emerges: What is the carbon footprint of dog ownership?

Calculating a comprehensive carbon footprint of dog ownership would require a wealth of data and information; however, if broken down into many parts, this argument can be addressed in a more approachable fashion. Many different variables would be involved in the carbon footprint calculation, such as food production, toy production, and transportation. One notable aspect that is seldom reported is the environmental impact of driving dogs to veterinarian appointments, groomers, doggie daycares, and other services. This research aims to calculate the carbon footprint of one of the transportation decisions - driving to and from off-leash parks. Thus, adding to our understanding of the environmental impact of dogs.

The environmental consequences of our actions, including dog ownership, are becoming increasingly important and recognised on the global scale. After the enactment of the Paris Agreement on December 12th, 2015 and its corresponding ratification by the United Nations on November 4th, 2016, it is clear that many countries aim to keep global temperature rise to a maximum of 2 degrees Celsius above pre-industrial levels (United Nations Framework Convention on Climate Change, 2016). Aggressive carbon reduction strategies are at the forefront of the agenda for many countries. Thus, any information that might produce environmentally conscious actors is valuable.

Many of the necessary mitigation strategies are large-scale operations involving governments and utilities. On an individual level, environmental stewardship can leave

many with the feeling of hopelessness. What to do, what to buy, and how to get around are common questions. One sector that provides the ability for individual behaviour change to have a large impact is transportation (Skippon et al., 2012). The transportation sector is said to account for 23% of the global greenhouse gas emissions in 2010 (Climate Change 2014: Mitigation of Climate Change, 2014), thus providing a major challenge in a world where car registration surpassed one billion vehicles in the same year (Awadallah & Fini, 2013).

An individual's carbon footprint from transportation can be lowered by combining errands to make multi-destination trips (Gardner & Stern, 2008). This study determines whether off-leash park users are making the trip to the dog park a single- or multi-destination in order to answer the question, are off-leash park users behaving in an environmentally conscious manner. In addition, this study uncovers why off-leash park users choose specific parks, revealing park users' motives and desires. This research also looks for answers to the questions of, how far are off-leash park users travelling to reach their desired park and how often are they frequenting the park. These findings, along with the parks users' transportation mode, can help determine optimal placement for off-leash dog park facilities, providing better services to the community while reducing the environmental impact of this activity.

1.2. Overview of Thesis

The next chapter provides a literature review summarising the scholarly work on the benefits and costs of dog ownership, issues surrounding the place of dogs in the city in general and off-leash dog parks, and the environmental concerns in the era of global climate change. The following chapter presents the methods used, namely a survey of off-leash dog park users, designed to estimate their carbon footprint. The survey queried for home address, transportation mode choice and the frequency of visitation of off-leash park users. Additional questions asked if other tasks were accomplished on the trip and reasons for choosing the specific park. ArcGIS was used to calculate park users' travel distance to the park of choice and the closest park to their homes.

The results reveal that 82% of off-leash park users drive to the parks and 61% of the drivers do not choose the closest off-leash park to their house, which questions the likelihood of off-leash park users considering the environmental impact of park usage. Furthermore, this study finds that there is the potential to reduce over half of the carbon footprint produced from off-leash park usage by choosing the closest off-leash park to the users' home. This study also finds that off-leash capability and proximity are the most common reasons for park choice, indicating that these two qualities are important to off-leash park users. This thesis concludes that more off-leash parks in neighbourhoods have the potential to lower the carbon footprint of off-leash parks. There is also the possibility that attraction, such as park amenities and landscape, is the main reason for park choice and that the creation of new parks would not result in a lower carbon footprint.

CHAPTER 2

Literature Review

2.1. Literature review Introduction

This chapter summarises the literature surrounding the place of dogs in society and the urban environment. The benefits of dog ownership and of green space are discussed to better understand how the combination of the two can potentially increase place attachment in the urban landscape. It traces the limited work on off-leash dog parks, including the contestation of dogs and dog parks in the city of Halifax. Green space functions are reviewed as well as how geographers track park users to increase the understanding of green space usage. Finally, it addresses some of the environmental impacts of dog ownership.

This review also includes information concerning carbon emissions from transport, a major contributor to Climate Change. Research will be presented on the global transportation carbon footprint and discuss ways that everyday citizens can reduce their impact and improve their health. A review of the literature on the carbon emissions from Canada's transportation system reveals some of the methods that can help Canadians reduce their carbon footprint from transportation. Additionally, the growing issues of city planning and Climate Change are discussed due to the increase in the urban population and the coinciding environmental impacts (WHO, 2014).

2.2. Benefits of Dog Ownership

The benefits of dog ownership are commonly known among both dog owners themselves as well as academic researchers. A substantial body of research suggests that dog ownership increases physical activity in humans (Garcia et al., 2015; Feng et al., 2014; Sirard et al., 2011). In general, dog owners are found to walk more minutes per week than non-dog owners; the primary cause of this is the obligation to care for the dog (Brown & Rhodes, 2006). Furthermore, Garcia et al. (2015) found that postmenopausal women who own a dog are more likely to walk and are less likely to be sedentary. With this, Garcia et al. (2015) concluded that older women who own a dog, especially woman living alone, are more likely to be physically active than those without a dog. Owen et al. (2010) also contribute to our understanding, with findings that children with dogs are more likely to take part in light to moderate and vigorous activity. Therefore, the research points to a clear association between dog ownership and increased physical activity among various groups.

Dog ownership is also associated with some positive psychological effects. One study found that psychological stress was higher in participants without pets than the participants who owned a pet (Cevizci et al., 2012). Additionally, Cline & Marie (2010) found that dog ownership can increase overall well-being by providing the owner with a form of social support. However, Cline & Marie (2010) also found that the benefits of owning a dog differ in relation to sex and marital status; single women were more likely to reap positive psychological benefits from dog ownership. The increased psychological

benefits for woman is due to the commonalities of relationship building, woman generally searching out emotion-based relationships whereas men search for activity-based relationships. The study also suggests married couples often balance more roles (Parent, employment, housework, etc.) than single persons and use the role stain theory as an explanation as to why single persons experience greater benefits from dog ownership. A limitation of their study, and others, is that the samples used for surveys are from potentially biased sources, such as veterinarians (Cline & Marie, 2010). Overall, the research suggests that there are positive psychological associations with dog ownership but their extent is still questionable.

2.3. Green Space and Place Attachment

Research suggests that green space is positively correlated with human health and well-being (Bell et al., 2014; Shanahan et al., 2015). The increase of urbanization can result in an increase in mental health issues such as adult criminality (Ludermir & Harpham, 1998). However, green space can be a cost effective method to combat negative health effects of urban living (Shanahan et al., 2015).

Also, green space can have an effect on place and community attachment (Arnberger & Eder, 2012; Shanahan et al., 2015). Castree et al. (2013, pg. 71), the authors of the *Oxford Dictionary of Human Geography*, refer to place attachment as "the sense of belonging, loyalty, or affection that a person feels for one or more places." The amount of green space and one's exposure intensity to the area can contribute to community attachment and more

broadly place attachment (Arnberger & Eder, 2012; Shanahan et al., 2015). However, place attachment is found to differ between urban and suburban citizens (Arnberger & Eder, 2012). Rural citizens are those dwelling within the city center and suburban dwellers are people who live in the cities outskirts, usually in residential areas. However, not only are urban dwellers more attached to green space than suburban dwellers but they also scored higher on their community's quality of life indicators (Arnberger & Eder, 2012). Overall, green space impacts an individual's perspective of an environment, but the scope of this impact varies throughout urban and suburban environments.

2.3.1. Tracking Park Users

Travel distance and user demographics provide essential background to the park and green space literature in urban studies (Rossi et al., 2015; Mccormack et al., 2007). Also, it is important to study travel distance to understand its effect on park usage. This information can improve our understanding of urban and suburban spatial environments by providing commonalities between park users. Distance Decay is one available theory that reports the interaction between two locales declines as the distance increases. As the distance between the park users and the park increases, the number of times the park users visit the park decreases (Eldridge & Jones, 1991). This, however, is not the only variable affecting park usage. Perceived attractiveness, the user's desired activity and age all affect park usage, in some cases more than distance (Rossi et al., 2015, Arnberger & Eder, 2012; Mccormack et al., 2007). For instance, Rossi et al. (2015) found that older

people frequent nearby parks more so than younger people in the area. Another study relating to distance and usage found that respondents who lived within 1.6 km of a dog park were more likely to walk their dog but not necessarily at the dog park (Mccormack et al., 2016). These park users walk their dogs more often and for longer periods of time, however, the reasons why this might be were not discovered. Nonetheless, there are different factors contributing to peoples' travel distance to parks.

2.3.2. Dog Parks

Some parks are specifically designed and designated for dogs, and their popularity is rising in North America (Schlereth, 2016). Not only do dog parks offer facilities for the pets to exercise, they can serve many benefits for the owners as well. From increasing social networking to serving as a place of relaxation (Graham & Glover, 2014; Lee et al., 2009), dog parks are socially beneficial. One study found that dog parks can create the opportunity to meet new people and facilitate community building (Lee et al., 2009). Some evidence of this can be found on social media, where various dog park groups such as Shubie Doggie Park, can act as a medium for new interactions and organizing group meetings (https://www.facebook.com/pages/Hantsport-Dog-Park/537964442977629, https://www.facebook.com/shubiedoggiepark/). Additionally, Graham & Glover (2014) found that the title of "dog owner" can remove barriers of race, social class and more, giving the dog park a unique sense of community. Ultimately, the literature suggests that dog parks can act as a vector for social interaction.

Perhaps unsurprisingly, the literature also suggests that there is a dichotomy in views of off-leash parks between dog owners and non-dog owners. A case study in Kansas City found that, for non-dog owners, a focus on human-centered space was more important than the creation of animal-friendly environments. Dogs' inherent spontaneity and energy (potentially uncontrollable) are some of the reasons why park users push for dog-free public space (Urbanik & Morgan, 2013). In contrast, Wolch (2002) suggests that animals are an important part of place and place identity. Dog parks are an example of this, some dog walkers may attribute part of their identity to being a dog owner and using a specific park. However, the realization of this identity seems to be dependent on the individual's perception of animals among other factors.

Berlin, Germany developed a novel response to confrontations between pet and non-pet owners by creating a form of dog licence. In order to walk a dog off-leash in Berlin, dog owners must show that their dogs are manageable and obedient and then apply for a permit (O'Sullivan, 2016). This licence is said to allow dogs to roam off-leash in public areas with there owners. Although information on the effectiveness of this initiative is lacking, it is a solution that has been put forward to appease non-dog owners and has potential to work in other countries. However, as it stands, there are still issues surrounding dog parks globally.

2.4. Issues/Contestation of dogs in the city

Recently, dog ownership has been a hot topic in Halifax. In 2007, due to an influx of complaints from non-dog owners in the HRM, By-Law A-300 was passed in an attempt to control unwanted dog behaviour and noise in the HRM, such as barking and howling (HRM, 2007). However, the regulation did not solve the issues and, in 2015, By-Law A-700 was adopted (HRM, 2015). The new legislation redesigned the old By-Law to broaden the regulations in hopes to address the continued complaints from Halifax's citizens. However, the new regulation was met with backlash from the dog community, with many dog owners feeling they were not properly consulted (Lee, 2015)

Seaview or Africville Dog Park was revoked as an off-leash park as of January 1st, 2015 (CBCnews, 2015). This park has historical value to the African-Canadian community and after public debate, the majority of attendees ruled out the continuation of the off-leash dog park. This decision was made due to the cultural importance of the Africville site and the important archeological artifacts which may be there. (Borden-Colley, 2014). Another park, Long Lake Provincial Park, tried to enforce stricter leashing requirements due to complaints from park users, but was met with resistance when dog owners pulled down the sign in front of news cameras (CTVAtlantic, 2014). At Shubie Park, municipal staff documented the problem of dog barking on 17 different occasions and took action. The city posted a sign at the park that was met with controversy: the sign was in relation to uncontrolled dog barking and ended with #respect. Some dog owners called the signage ridiculous; however, the residents in the area are happy that the city has finally taken some

action (VanKampen, 2016). As of yet, there is no information out on the effectiveness of the signage in the HRM.

Another concern with off-leash dogs is dog attacks. Statistics on dog attacks in Halifax are not collected, however, reports on severe to fatal dog attacks are found in the literature (Matthias et al., 2015; Raghavan, 2008; De Munnynck & Van de Voorde, 2002). While there were no fatal dog attacks in Nova Scotia or PEI between 1990 and 2007 (Raghavan, 2008), an estimated 500,000 dog attacks occur every year in Canada, revealing a safety issue (Picard, 2016). A study in Bay County, Florida found that boys between the ages of six and 14 were most likely to report being bitten by a dog when compared to their young female counterparts and all other age groups (Matthias et al., 2015). Also, the study found that the largest percent of dog bites reported were related to irresponsible dog owners and the second most common reason for dog bites was due to the dog's protective behavior.

Until there is more research into the effectiveness of Halifax's new by-laws and the local occurrence of dog attacks, the only conclusion afforded is the need for more research in the area. Citizens of Halifax value dog parks but a sound management system that satisfies both dog owners and non-dog owners has yet to emerge.

2.5. Environmental Issues of Dog Ownership

Unwanted barking and dog attacks are not the only issue with dog ownership; the environmental impact of the common household pet is quite significant (Assadourian,

2014). While information on the environmental impact of dog ownership is sparse in the academic literature, it is, however, found throughout the grey literature (i.e. that which is not peer reviewed). Rather than a lack of interest in the topic, the gap in the literature is likely indicating the contentious nature of the question. There is the potential, that because dogs are prized household companions, researchers do not want to face likely backlash. Furthermore, most of the results appear to stem from biased opinions, some finding either an extremely large carbon "paw print" while others showing a miniscule carbon footprint. Thus, this section will attempt to show both sides of the argument with the caveat that most of the research is not peer-reviewed.

The debate started with Brenda and Robert Vale's publication *Time to Eat the Dog: The Real Guide to Sustainable Living* in 2009. The Vales concluded that a medium size dog eats roughly 360 pounds of meat and 210 pounds of cereal a year, which requires roughly 0.84 global hectares (gha) of land to produce (Schwarts, 2014). This figure is then compared to the amount of gha required to construct and drive a Toyota Land Cruiser 10,000 km per year, which they estimated to be 0.41 gha a year. Thus, according to these calculations, owning a large dog has a larger environmental impact than driving a large SUV. Using the Vales' calculations, a journalistic source continues the debate by determining that the annual resources needed to provide food for two German Shepards is greater than the average Bangladeshi's total resource needs (Assadourian, 2014).

Clark Williams-Derry (2009), a chief researcher of a sustainability think-tank, produced his own calculations claiming the Vales' estimate was highly incorrect. Williams-

Derry (2009) claims that the meat and cereal used in dog food are by-products of human food production and would not be eaten otherwise, thus, the two cannot be directly compared. Also, Williams-Derry (2009) finds that the estimates for the Toyota Land Cruiser are off by at least a factor of three, and this is not including the indirect impacts of SUVs such as parking spaces, roads, etc. Such results lead some to also argue that if people are serious about reducing our environmental impact, dogs are not the place to start (Rahner, 2009).

It should be mentioned that *New Scientist* and others agree with the Vales' dog food consumption estimates, suggesting that the estimates are not entirely flawed (Parks, 2015). Also, all of these studies are from non-academic sources, implying that peer-reviewed studies need to be done on this topic in order to provide objective results. Although the debate continues on the environmental impact of dogs, this paper attempts to provide key information necessary for calculating the carbon footprint of dogs, namely, emissions produced by driving your dog to off-leash parks.

2.6. Carbon & Transport

According to the most recent Intergovernmental Panel on Climate Change Report, the transportation sector accounted for 23% of global CO_2-equivalent emissions in 2010, which was a total of 7.0 $GtCO^2$-equivalent emissions (Climate Change 2014: Mitigation of Climate Change, 2014). Additionally, the report finds that emissions from road transport accounted for 72% of the emissions from the transportation sector as a whole, 40% of

which comes from urban areas. Thus, when tackling global carbon emissions, the transport sector and specifically road transportation is a prime area for investment (Awadallah & Fini, 2013).

Many companies, such as BMW and Tesla, are producing electric vehicles in attempts to combat the issue of carbon emissions from road transportation. However, these new technologies come at a cost and how the electricity is generated matters when assessing their carbon footprint. The price range of electric vehicles is from $24,000 to $140,000 (Edelstein, 2017). The maximum travel distance on one charge varies considerably, with low-end models being able to travel 60 miles on one charge, making their practicality questionable. A less expensive alternative and more practical solution with today's technology is the hybrid car, part gasoline/diesel, and part electric, which offers emissions saving to less affluent people and without the risk of electric vehicles.

Increased vehicle efficiency and the switch to electric vehicles (when technology becomes practical and affordable) are recommended throughout the literature to help lower emissions from road transportation (Skippon et al., 2012; Climate Change 2014: Mitigation of Climate Change, 2014). Shipping companies such as UPS are beginning to offer carbon neutral options, where some of the revenue from shipping costs goes towards carbon offsets such as tree planting (UPS, 2017). Overall, it is clear that road transportation is moving towards a carbon-reduced future, but it will take time for the technology to become practical.

Another option presented for carbon reductions is behaviour change (Climate Change 2014: Mitigation of Climate Change, 2014; Skippon et al., 2012; Nazelle et al., 2010). This type of mitigation strategy not only offers environmental benefits but health benefits as well. Some types of behaviour change reported in the literature are actions such as avoiding unnecessary trips and investing in walking and cycling infrastructure (Climate Change 2014: Mitigation of Climate Change, 2014). Furthermore, Nazell et al. (2010) conclude that switching motorized trips of less than three miles to non-motorized trips would see a decrease in emissions and increase in the health of the population. This is relevant to the global community because obesity is on the rise globally and is found among both adults and children (Vandevijvere et al. 2015; Morency & Demers, 2010). Therefore, research shows that, in terms of road transport, behaviour change offers both environmental and health benefits.

2.6.1. Carbon, Transport & Canada

Scaling down from the global carbon scene, in 2014, Canada's emissions from transportation accounted for 28% of the nation's total carbon emissions (Environment and Climate Change Canada, 2016). Furthermore, the report from Environmental and Climate Change Canada (2016) found that 69% of these emissions came from the road transportation sector. The daily commute, to and from work, is a major source of emissions. A survey conducted by Statistics Canada found that 74% of respondents' report driving private vehicles to work and only 5.6% commute as a passenger (Statistics Canada,

2016). Some of these emissions are addressed under the Passenger Vehicle and Light Truck Greenhouse Gas Emission Regulations, where all vehicles coming into Canada to be sold must comply to strict carbon emission regulations that increase every year after 2011 (Environment Canada, 2016). However, these regulations address vehicle efficiency and do not encourage other, potentially better, mitigation strategies such as active transport, which as mentioned can lower environmental impacts and increase overall health (Green & Klein, 2011). Nevertheless, the transportation sector is a major polluter in Canada. The government is attempting to address the problems presented by the carbon-based transportation sector; however, with the growing urban environment it is clear intelligent planning in necessary.

CHAPTER 3

Methods

3.1. Introduction

In order to begin addressing the environmental impact of dog ownership, this study completed four tasks. They were, finding the average travel distance of off-leash park users, finding their rationale for park choice, the commonality of accomplishing other tasks on the trip to the park, and the carbon footprint associated with the commute. A survey was used to gather all the relevant data from off-leash park participants, and then was analyzed using ArcGIS. This section will layout the study areas where the survey took place and then give an overview of how the survey and data were collected. Details are given regarding the methods used to analyze the survey data and then how ArcGIS was employed to achieve results. The final section will break down the methods used to calculate the estimated carbon footprint of this activity in the HRM.

3.2. Study Area

Six officially sanctioned off-leash parks in the HRM were chosen from the HRM's website because of their off-leash capability and locations. At the time, these were the only off-leash parks listed on the HRM's website, however a seventh, Halifax Mainland Commons, has recently been added but is not included in this report. The parks surveyed

were: The Dartmouth Common, Fort Needham Memorial Park, Hemlock Ravine Park, Point Pleasant Park, Sandy Lake and Shubie Park (Figure 3.1).

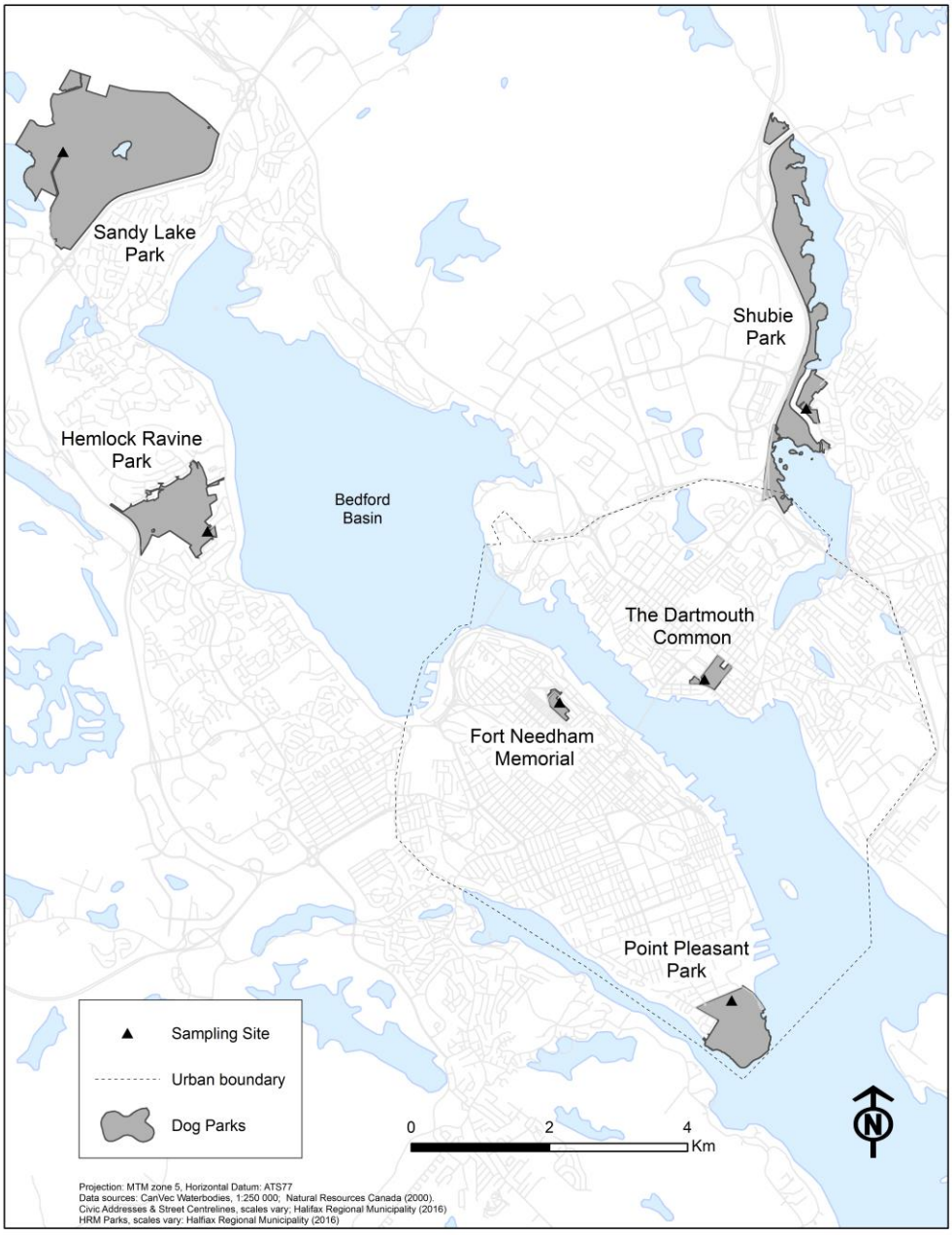

Figure 3.1. Off-leash Parks in the HRM and Halifax Center Plan Boundaries

The study area entails three urban parks and three suburban parks. Dartmouth Common, Fort Needham Memorial and Point Pleasant Park were considered urban parks because they fell within the boundaries of Halifax's Centre Plan (HRM, 2016). The Dartmouth Common has large fields with paved trails and a gazebo looking towards the Bedford Basin. The Dartmouth waterfront and downtown core are nearby, as is the Dartmouth Sportsplex and a few schools. Off-leash dogs are allowed everywhere at the Dartmouth Common except for on the sports field and the school area. Also, Dartmouth common has large fencing enclosing the park and contains many garbage cans and dog bag dispensers throughout.

Fort Needham Memorial has a large multi-purpose field with off-leash areas along the side; however, during the data collection it was observed that most off-leash park users at Fort Needham Memorial use the multi-purpose field. This park has a memorial for the 1917 Halifax explosion; however, it is considered to have the least amount of dog park amenities. There is very minimal parking at Fort Needham Memorial and the dog bag dispensers are located far away from where the off-leash park users frequent.

Point Pleasant Park is one of the largest parks in the survey. It is located at the southern tip of the Halifax peninsula and has arguably the widest range of amenities, including many benches in the woods and by the water, and trails that wind through its forests. Point Pleasant Park is surrounded by water with excellent vistas and has historically significant landmarks, such as the Prince of Wales Tower. When and where dogs can be off-leash is a contentious issue at Point Pleasant Park. The park has multiple

off-leash areas with signage, however, a map showing these trails is not on the HRM's website and there is usually some confusion or disregard as to where dogs can be off-leash.

The three suburban parks (i.e. located outside of the Halifax Centre Plan boundary) of this study are Hemlock Ravine, Sandy Lake Park, and Shubie Park. Hemlock Ravine is a large forested area with many trails and benches throughout, as well as a heart-shaped pond. All of the trails at Hemlock Ravine are off-leash, however, some of the routes are quite short in comparison to the other parks. Hemlock Ravine is part of "Prince's Lodge", the old estate of Prince Edward, the Duke of Kent, which was given to him in 1794 (Nova Scotia Archives, n.d.).

Of all the parks in the study Sandy Lake is the furthest from the downtown core. This park has a large forested area with trails that lead to a beach and the trails continue past into woodland. All of Sandy Lake is considered off-leash during the "off season" where park users do not need to bring a leash. This is different from the other parks where users are supposed to keep their dogs' on-leash until they enter the off-leash areas. Sandy Lake is known to have a well-kept beach, however, dogs are not permitted at the beach or on one of the two trails during the summer season.

Shubie Park is a suburban park that consists of forested areas with walking trails throughout. It is a well-known off-leash park in the HRM with many of the normal park amenities such as garbage cans and benches. This park borders a lake with many look-offs and areas for swimming. There are many different routes for off-leash park users and also a large open section that allows dogs to freely roam.

The parks were each surveyed for an average of 7.5 hours. Park usage varies greatly from park to park, thus, total time spent in the park was adjusted accordingly to obtain a sufficient sample size. Sandy Lake was thus surveyed for 10.5 hours due to low usage and Point Pleasant Park was surveyed for 6.25 hours due to high traffic volume. Fort Needham Memorial was studied for 6 hours due to rain.

3.3. Survey and Data Collection

The six-question survey was developed to determine how far off-leash park users travel to use the park, why they chose that specific park, and their carbon footprint associated with driving to the park. Specifically, the survey asked the following questions: What is the mode of transport you took to the dog park today? If you drove, what is the make/model of your car? How often do you come to the park? What is your home address? Do you accomplish other tasks while taking your dog to the park? What is your rationale for choosing this park today?

Before distributing, the survey was sent to the Research Ethics Board for approval. The survey included an introductory statement that outlined why the survey was being done and that the participant could refuse and request to not have their information used at any point. Participants were not compensated and were free to decline answering any of the questions.

Upon receiving ethic's approval, surveys were given to 252 off-leash park users during the months of June and July: on Tuesdays and Sundays from 8:30 – 10:00 am, and 1:30 –

3:00 pm; and on Wednesdays from 6:00 – 7:30 pm. All six of the parks were surveyed for one week each, for example, on Sunday, Tuesday and Wednesday. Each survey took roughly 2 – 4 minutes and the responses were recorded on paper. The survey answers were then transcribed into an MS Excel table for future analysis. At least five surveys from each park were verified by rechecking the dataset and the original paper form to ensure accuracy in the transcriptions.

3.4. Data Analysis – Survey Results

The average number of surveys conducted per hour was calculated for each park. Park users were separated into categories based on their home location and travel mode. The percent of users who walked to the park and users who drove were calculated for each park as well as the aggregate. Park users were separated into those who travel from urban areas (within the Centre Plan) and those from suburban areas for analysis, in order to see if there are any differences between the two. Also, common vehicles, such as Honda Civics, were examined for commonalities between park users as well as the amount of users driving large vehicles, large vehicles consisted of trucks, vans and SUVs, and both findings were expressed by a percentage.

Using an Excel pivot table, park users' reported frequency was combined with their transportation mode for analysis. The frequency of visits was placed on the top row while the mode of transit and corresponding park in the first column. Also, a table was made to show which users completed other tasks and which did not. Survey results were separated

by theme and perceived importance. For example, if a participant reported accomplishing the task of “groceries” or “gas”, both responses were grouped separately. However, less mentioned responses of “Wal-Mart” and “shopping” were recorded as “Errands”. A similar process was done for participants’ park choice rationale. Each similar response counted for one, and if more than one response was given, it was used in all relevant categories. Responses such as “near home”, “live close by” and “in my backyard” were listed under “proximity”.

3.5. Data Analysis – GIS

A Geographic Information System was constructed primarily for the analysis of travel distance between dog park users’ homes and the park where they were interviewed. HRM parks, water and street centre line layers were used to structure this project and were downloaded from HRM's open GIS data catalogue and were imported into the GIS workbook from http://catalogue.hrm.opendata.arcgis.com/. A new shapefile was also created and populated to store the interview locations within the parks.

A composite address locator was obtained from the SMU geography department. The address locator would attempt to match the addresses through four different address locators: 1) HRM-provided Street Number & Name /w Community exact building location points; 2) HRM-provided Street Number & Name /w community, estimated from line-based address ranges; 3) HRM-provided Street Names, location returned is half-way the length of the entire road with matching name; and 4) DMTI Spatial-provided Postal Code polygons,

location returned is centroid of postal code LDU. The geocoding tool would attempt to match with the first and most accurate address locator, but if no match was found, it would proceed through the less preferred locating files. All of the addresses were current up to 2016.

The first geocoding attempt matched 71% of the addresses. The list of unmatched addresses was checked and adjusted for spelling and ensuring the proper districts (e.g. Bedford and Cole Harbour) were recorded. This resulted in a 93% match, with 18 responses being unmatched. The remaining unmatched addresses were excluded based on being outside of the study area or that they could not be found. In the end, there were 234 usable addresses. A verification process was done using Google maps, where up to ten of the geocoded address locations from each park were compared with the address locations found using Google Maps.

Using the ArcGIS Network Analyst extension, the Closest Facility application was used to calculate travel distance between home and park. This network extension calculated the shortest travel distance to the off-leash park via roadways. In the new Closest Facility, the Point of Survey of each park was placed in facilities, and the geocoded addresses were placed in incidences. Next, the distance travelled, if all users had chosen the closest off-leash park to their home, was found. Calculations were done to find park and aggregate averages, expressing the average distance travelled to each park if all park users chose the closest park to their homes.

Survey results were then separated into parks and corresponding park users. A new Closest Facility application was created and a parks Point of Survey was put into the facilities section. Related park users were placed in incidences. The closest facility application was then solved to find the actual distance park users travelled to the park. These results were labeled as Actual Travel Distance. The Actual Travel Distance for each park was found and the results were combined to find an average for each park and for all surveyed parks.

The table containing Actual Travel Distance for all parks was combined with the full list of geocoded addresses using the Join application in ArcGIS employing their FIDs as a common field. Park users, their corresponding parks and their Actual Travel Distance were separated into categories of walkers and drivers and a layer was made for each group. For each of these categories an average travel distance and distance range was found.

Park users were then separated into groups based on whether they fell within the boundaries of the Centre Plan or not. The Halifax Centre Plan is a three-phase project that looks to increase economic and environmental sustainability in Halifax and provide social benefits to HRM's citizens. Participants falling inside the boundaries were considered urban dwellers, and the participants who fell outside the boundaries were considered suburban dwellers. An average travel distance was found to represent the distance travelled by each group. This distinction was made to find information on the spatial relationships of off-leash park users in the HRM.

3.6. Carbon Footprint Analysis

For the carbon footprint estimate, the sample size was 193 because it excluded walkers and one other participant whose vehicles carbon emissions could not be located. All of the carbon estimates were converted to kilograms of Carbon Dioxide ($KgCO^2$) and were rounded to the nearest whole number. Vehicle emissions data was found using the Fuel Consumption Rating Tool, a Canadian government resource (http://oee.nrcan.gc.ca/fcr-rcf/public/index-e.cfm). Unless the participant specifically mentioned their engine size, an average was taken of all the listed engine sizes' carbon emissions. Finally, the Actual Travel Distances calculated in ArcGIS were converted into kilometers and then were doubled to account for the round trip, and were labeled Doubled Actual Travel Distance (DATD).

The participants' DATD was multiplied by the CO_2 emissions per km. The result was the estimated amount of carbon emissions per one trip to the dog park and was labeled Single-Trip Emissions (STE). After the carbon emissions per trip were found for each participant, the reported weekly frequencies were converted into low, medium and high annual estimates. Examples of the low, medium and high estimates are found in Table 3.1. Using the participant's range of frequencies, an annual estimate was made by multiplying the low, medium and high weekly frequency by 52. For example, if a participant reported "<1" the low estimate was 13 (.25 x 52) and for participants' who reported "Daily" the medium estimate was 333 (6.5 x 52) (Table 3.1).

The participants' STEs were then multiplied by the corresponding low, medium and high annual frequencies reported by the participants. This calculation represented each individual park users' carbon footprint. The individual carbon footprint of off-leash park users was then separated into the participants chosen parks and an average carbon footprint for each park and the aggregate was found. Furthermore, the individual carbon footprints were then combined to find the estimated Annual Carbon Footprint (ACF) of off-leash parks in the HRM.

Using the Possible Travel Distance, the estimated high and low annual frequencies and vehicle CO_2 emissions, the lowest amount of carbon emissions, if all park users chose the closest park and all else was equal, was calculated. This calculation represents the Potential Carbon Emissions produced if the 118 users would have went to the closest park to their homes. To find the emissions produced from one trip to the closest dog park, the Possible Travel Distance and the participant's vehicles CO_2 emissions were multiplied together. This figure was multiplied by the participant's low and high annual frequency estimates. The potential carbon emissions value was then subtracted from the ACF to show the avoidable carbon emissions in the HRM.

Table 3.1. Reported Weekly Frequency of Off-leash Park users, Calculated Annual Estimates

	Estimated Visitation Frequency					
Stated	**Low**		**Medium**		**High**	
Frequency	**Weekly**	**Annual**	**Weekly**	**Annual**	**Weekly**	**Annual**
<1	.25	13	.5	26	.75	39
1 or 2	1	52	1.5	78	2	104
3 or 4	3	156	3.5	182	4	208
5 or 6	5	260	5.5	286	6	312
Daily	6	300*	6.5	333*	7	365

CHAPTER 4

Results

4.1. Survey Results

Of the 252 surveys taken, 234 were geocoded successfully (Figure 4.1). 176 of the 234 surveys were taken on sunny or mostly sunny days, accounting for 75% of the surveys. In addition, 34 surveys were taken on overcast days and 23 surveys were taken on days with light rain. Fort Needham Memorial had one day in the afternoon where the rain was too heavy and the survey time frame was considered 'rained out'. Furthermore, all of the surveys from Sandy Lake were taken on days that some type of rain was recorded (Table 4.1)

The busiest time at the parks is between 9:00 am and 10:00 am. 31% of surveys were taken on Tuesdays and Sundays at this time. The second most common time is between 6:00 pm and 7:00 pm on Wednesdays, when 21% surveys were taken. Park usage varies greatly from park to park; while the average overall number of surveys per hour is 5.2, results range from 0.8 to 12.3 surveys per hour across the parks (Table 4.1). Point Pleasant Park had the highest ratio of surveys per hour and Shubie Park has the second highest ratio, indicating general park usage. At only 0.8 surveys per hour, The Dartmouth Common was the least used park, falling well below the average survey per hour of 5.2. Hemlock Ravine and Sandy Lake have the second and third lowest ratios, respectively.

Overall, the survey results are largely based on Point Pleasant Park and Shubie Park, where 69% of the surveys were taken.

Table 4.1. Surveys per hour

Park	**Surveys**	**Hours spent at park**	**Surveys per hour**
Dartmouth Common	6	7.5	0.8
Fort Needham Memorial	31	6	5.2
Hemlock Ravine	13	7.5	1.7
Point Pleasant	77	6.25	12.3
Sandy Lake	23	10.5	2.2
Shubie	84	7.5	11.2
Total	**234**	**45.25**	**5.2**

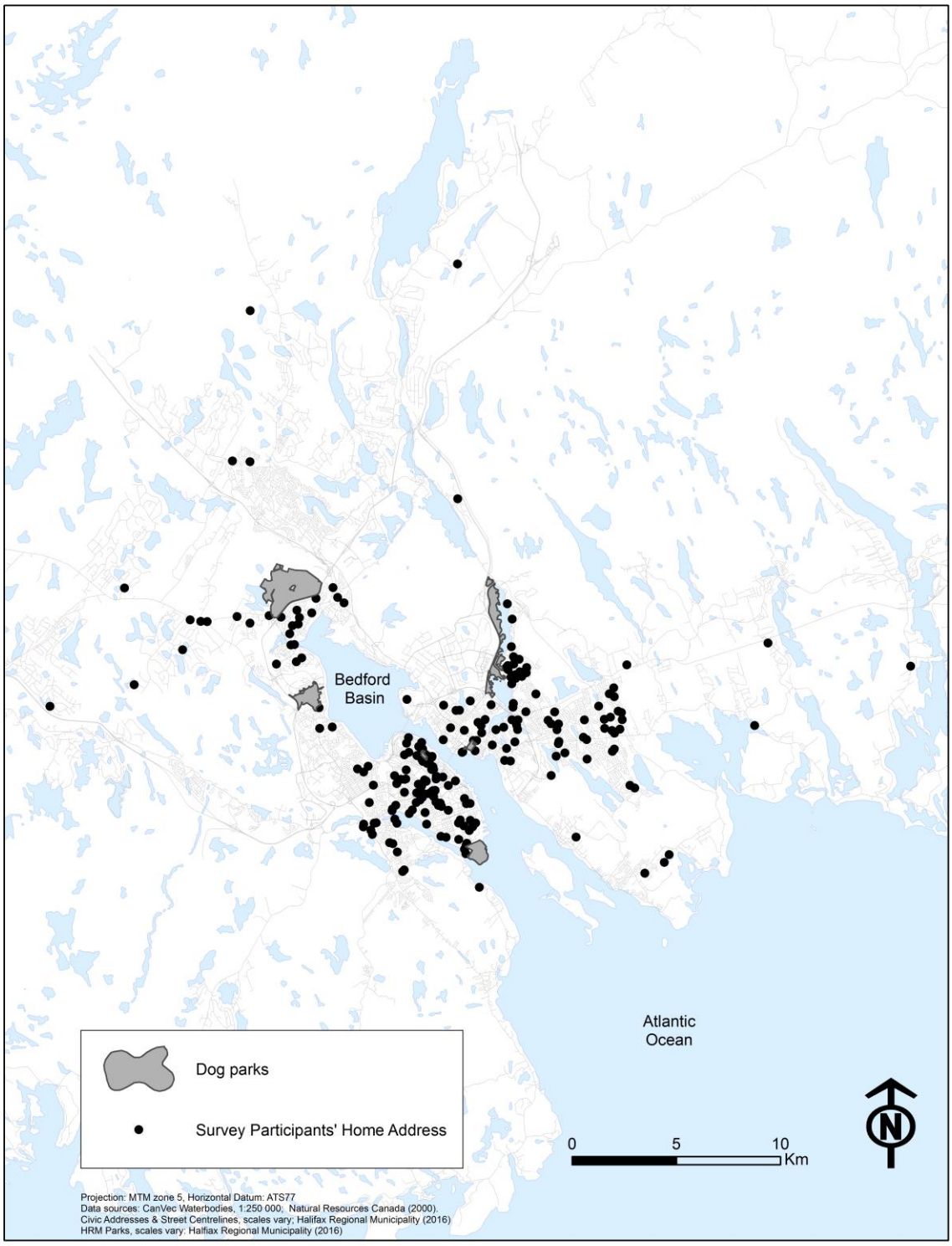

Figure 4.1. Location of Parks and the Home Addresses of Participants

4.2. Park Users' Mode Choice and Average Travel Distance

Driving to the dog park is the most common mode of transit (Table 4.2); 193 park users chose to drive whereas only 41 park users walk to the facilities. Sandy Lake and Shubie Park have the highest percentage of drivers with 96%. However, Hemlock Ravine, Point Pleasant Park, Sandy Lake and Shubie Park all have 90% or more of the survey respondents choosing to drive. Walking is much less common, representing only 18% of the usable surveys; however, this trend is reversed in the urban parks of Fort Needham Memorial and the Dartmouth Common, where 74% or more of users walk to the park. That being said, the two urban parks represent only 16% of the surveys.

The average one-way distance travelled from participants' homes to an off-leash dog park is 5559 m (Table 4.2). Hemlock Ravine, a suburban park, had the highest average distance travelled at 9097 m. The Dartmouth Common had the lowest average distance travelled at 832 m (Table 4.2). The range of all park users' travel distance is 32 m to 32,460 m. Fort Needham Memorial and the Dartmouth Common both have the smallest distance ranges. Point Pleasant Park has the greatest range in distance travelled followed by Shubie Park and Hemlock Ravine, respectively.

There is a notable difference between urban and suburban park users' travel distance. On average, urban dwellers travel 3400 m to off-leash parks while suburban dwellers travel an average of 7681 m. Furthermore, the three surveyed suburban parks, Hemlock Ravine, Sandy Lake and Shubie Park have the highest average travel distance.

Participants who drive to the dog parks travel, on average, 6553 m one-way. The highest average travel distances come from the three surveyed suburban parks. Walkers' travel distance is much less than that of drivers. The average walking distance is 878 m and is therefore 5,675 m less than drivers. Again, Hemlock Ravine represents the highest average distance travelled for walkers at 1238m, but is followed closely by Shubie Park at 1232m.

Table 4.2. Park Users Average One-Way Travel Distance with Range

Park	**Average Distance Travelled (m)**	**Minimum Distance Travelled (m)**	**Maximum Distance Travelled (m)**
Dartmouth Common	832	535	1475
Fort Needham Memorial	1538	32	9123
Hemlock Ravine	9097	1238	22074
Point Pleasant	4604	467	32460
Sandy Lake	6560	713	17975
Shubie	5354	447	26716
All Parks	**5559**	**32**	**32460**

Table 4.3. Comparing Average Distance Travelled with Mode Choice

Park	**Walked (%)**	**Drove (%)**	**Average distance Walked (m)**	**Average distance Driven (m)**
Dartmouth common	83	17	703	1475
Fort Needham Memorial	74	26	776	3727
Hemlock Ravine	8	92	1238	9752
Point Pleasant	10	90	1124	6472
Sandy Lake	4	96	713	5565
Shubie	4	96	1232	6757
All Parks	**18**	**82**	**878**	**6553**

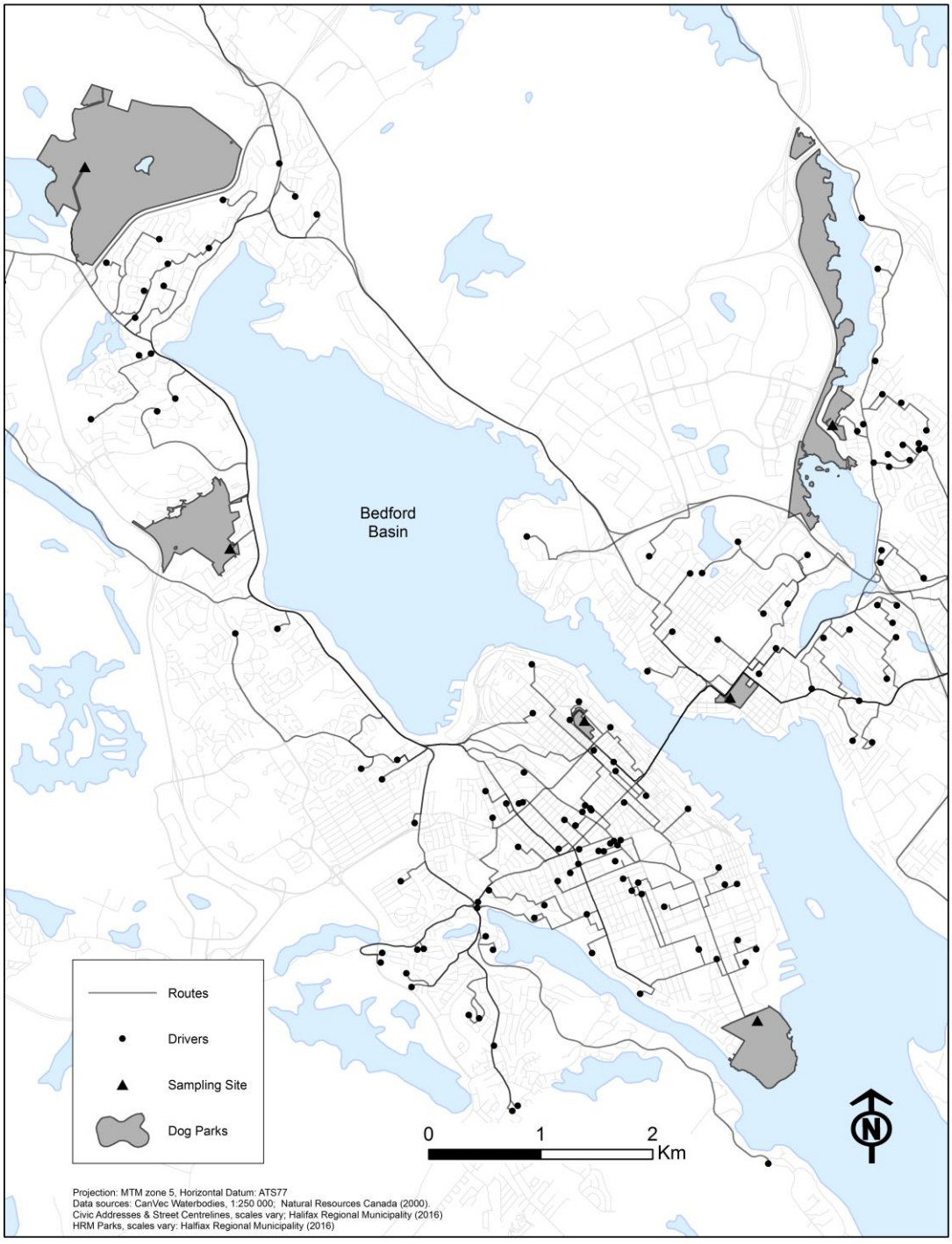

Figure 4.2. Drivers Estimated Route from Home to the Park

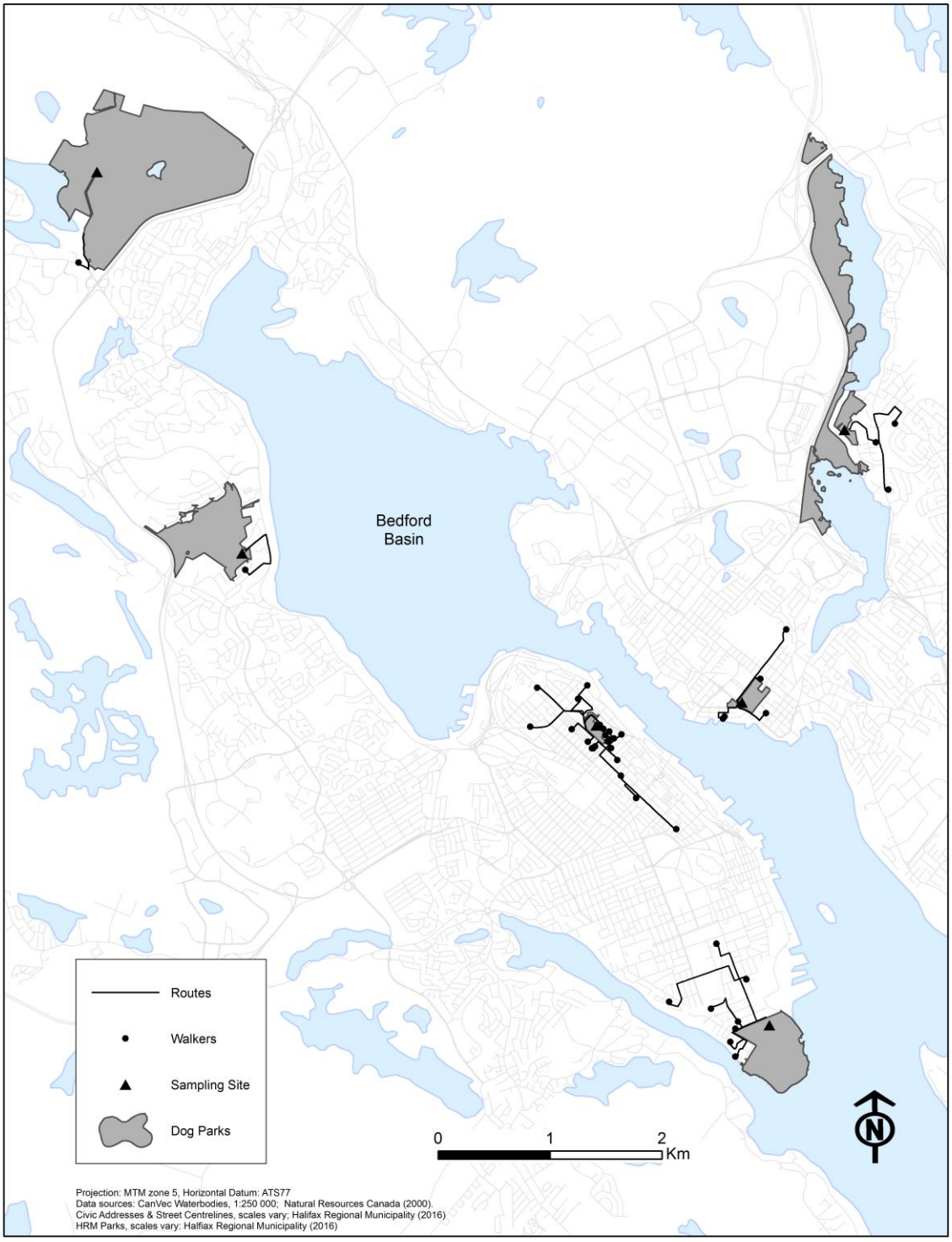

Figure 4.3. Walkers Estimated Route from Home to the Park

4.3. Comparing Park Users' Mode Choice and Frequency

It is most common for off-leash park users to report going to the park daily, with 32% of all users reporting that they travel to the park every day. 59% of walkers say they use the park daily and only 27% of drivers report the same. Furthermore, both urban and suburban users report going to the park daily more than any other frequency (Table 4.4). However, there is a higher percentage of urban users (41%) who use the park daily than suburban users (25%). The second most common frequency was "3 or 4" times per week, which was reported by 23% of participants. This is true for both urban and suburban dwellers, however, drivers represent a much larger portion of this chosen frequency with 26% going "3 or 4" times a week and only 7% of walkers doing the same (Table 4.5).

Overall, less than once per week was the least reported weekly frequency with the exception of Fort Needham Memorial and Hemlock Ravine. A higher percentage of survey participants reported going to Hemlock Ravine "<1" per week (38%), which was more than any other park. This is seen throughout the categories of both walkers and drivers and urban and suburban dwellers.

Table 4.4. Urban and Suburban Dwellers Visitation Frequency

	Frequency of Weekly Visits					
Dwelling	**<1**	**1 or 2**	**3 or 4**	**5 or 6**	**Daily**	**Total**
Suburban	16	23	26	24	29	118
Urban	8	19	28	14	47	116
Total	**24**	**42**	**54**	**38**	**76**	**234**

Table 4.5. Mode Choice and Weekly Park Usage.

	Frequency of Weekly Visits					
Park	**<1**	**1 or 2**	**3 or 4**	**5 or 6**	**Daily**	**Total**
Dartmouth Common	**1**	**1**	**1**	**1**	**2**	**6**
Drove			1			1
Walked	1	1		1	2	5
Fort Needham	**5**	**3**	**3**	**4**	**16**	**31**
Drove	4	1	1		2	8
Walked	1	2	2	4	14	23
Hemlock Ravine	**5**	**2**	**1**	**2**	**3**	**13**
Drove	5	2	1	1	3	12
Walked				1		1
Point Pleasant	**5**	**14**	**24**	**8**	**26**	**77**
Drove	5	14	23	8	19	69
Walked			1		7	8
Sandy Lake	**2**	**2**	**7**	**4**	**8**	**23**
Drove	2	2	7	3	8	22
Walked				1		1
Shubie	**6**	**20**	**18**	**19**	**21**	**84**
Drove	6	19	18	18	20	81
Walked		1		1	1	3
All Parks	**24**	**42**	**54**	**38**	**76**	**234**
Drove	22	38	51	30	52	193
Walked	2	4	3	8	24	41

4.4. Park Users' Rationale for Park Choice

The most common rationale for park choice reported by survey participants was in relation to the park being off-leash (Table 4.6). Hemlock Ravine, Point Pleasant Park, Sandy Lake and Shubie Park all had more than half of park users choose parks because of off-leash capability. Proximity is the second most common rationale for park choice: Responses like

"close", "proximity", and "near home" account for 40% of park users. This contradicts some of my results, where only 50% of participants choose the closest dog park to their homes.

Attractiveness is another common rationale for park use (38%). Responses like "Love it", "Most beautiful park around", "Dog loves it" and other responses relating to the park itself were grouped into this category. Sandy Lake saw the largest percent of users indicating park attractiveness. This park had 52% of users going because of park amenities such as the ability to swim. Three of the parks have the option to swim, Point Pleasant Park, Sandy Lake and Shubie Park, but this was mentioned most at Sandy Lake. Point Pleasant Park had the second highest percentage (47%) of users reporting rationales relating to the park itself and had the greatest number of survey participants going because of attraction.

"Sense of community" is not a common rationale, representing only 5% of all responses. However, this category is worth mentioning because Fort Needham Memorial has 16% of responses relating to a sense of community. Most of the responses like "Friendly atmosphere" or "Have friends that come here" were taken from this park. Moreover, throughout the survey period, the surveyor noticed the park gave off a strong sense of community. Many of the park users were known to each other and interacted together, also, park users at Fort Needham Memorial Park tended to stand next to one another and converse while their dogs roamed the area. Another Fascinating event to come from this park was a "dog reunion"; a group of four dog owners, with dogs from the same litter, agreed to meet up and let the dogs play together.

Interestingly, very few parks users choose parks in search for un-crowded areas. Only three respondents throughout the survey period reported searching out un-crowded parks. However, four times as many participants report a rationale which was interpreted to mean that off-leash park users are searching out parks with multiple users. Furthermore, drawing on other evidence, 11 participants go anticipating accomplishing the task of socialization.

Table 4.6. Park user's rationale for park choice

Park	**Off-leash**	**Proximity**	**Attractiveness**
Dartmouth Common	1	4	1
Fort Needham Memorial	2	23	4
Hemlock Ravine	7	2	4
Point Pleasant	40	22	36
Sandy Lake	12	7	12
Shubie	46	35	32
Total	**108**	**93**	**89**

Note: Only participants that reported one of these three rationales are represented in this table. Also, if participant reported off-leash and proximity, they were counted for in each column.

4.5. Multi-Purpose Trips

Participants were asked whether they accomplished other tasks while taking their dog to the park. Two participants did not answer this question, 98 reported accomplishing no other tasks, and 136 reported accomplishing one or more tasks as part of their visit. Table 4.7 provides a tally of the responses for the types of tasks accomplished; note, that some park users are counted twice, since they indicated accomplishing multiple tasks on their visit. For the purpose of this study, tasks such as "Socialization", "Exercise" and "Stress Relief" were grouped together since they are tasks that were completed at the park (Table 4.7). It was most common for participants to not specify what the task they were accomplishing was (41%) and the nature of the survey questions did not allow for follow-up to probe deeper. 36% of participants who stated they accomplish other tasks, reporting either going shopping or getting groceries on their way to or from the dog park.

This study found that 43% of drivers and 20% of walkers accomplish other tasks on their way to or from the dog park. However, 92% of all park users accomplishing other tasks drive to the dog parks. Hemlock Ravine, Point Pleasant Park, Sandy Lake and Shubie Park all have only drivers accomplishing other tasks. In comparison, the Dartmouth Common and Fort Needham Memorial, two urban parks, both have more walkers accomplishing other tasks than drivers. Point Pleasant Park had the highest amount of off-leash park users that reported accomplishing other tasks on their way to or from the parks (51%). The Dartmouth Common, Hemlock Ravine, Sandy Lake and Shubie Park, have

between 30-40% of their park users accomplishing tasks on their journeys. Fort Needham Memorial has the lowest percentage of participants accomplishing other tasks with 26%.

Table 4.7. Tasks Accomplished on Trip to Dog Park

Park	Groceries	Errands	Coffee/ Food	Gas	Did not Specify	Task at Park	No task
Dartmouth Common	1	1	0	0	0		4
Fort Needham Memorial	3	3	3	0	0	12	11
Hemlock Ravine	3	1	0	0	0	4	5
Point Pleasant	17	4	4	2	19	17	21
Sandy Lake	2	0	0	1	7	4	10
Shubie	6	7	6	1	11	9	47
All Parks	**32**	**16**	**13**	**4**	**37**	**46**	**98**

Note: If participant reported Gas and Groceries they were counted for in each column. Also, "No task" is adjusted to include reported task done at the park (Fitness, Socialization, etc.)

4.6. Estimated Carbon Footprint of Surveyed Off-Leash Dog Parks

To estimate an off-leash park user's carbon footprint, the participants' vehicles' carbon emissions, found using the Fuel Consumption Rating Tool, was multiplied by the participants' estimated travel distance from their home to the park. This is the emissions from one trip to and from the dog park (STE). This calculation was then multiplied by the amount of times the participant reported going to the park each week. The annual carbon footprint was found by multiplying the reported weekly frequency by 52. In order to provide a range of potential carbon emissions, three different calculations were made to show low, medium and high estimates for an annual carbon footprint. These figures were then combined to show the average individual carbon footprint at each park. Also, the annual carbon footprint was calculated by adding all of the individual carbon footprints together to express the carbon footprint of this study.

The most common car reported was a Honda Civic, models 2003 – 2015. 14 Honda Civics were recorded, with emissions ranging from 188 – 202 gCO_2/Km. The second most common car was the Toyota Matrix models 2005 – 2014. Nine participants drove a Toyota Matrix with emissions ranging from 194 – 219 gCO_2/Km. 72 participants choose to drive large vehicles to the parks. A large vehicle is defined in this study as trucks, SUVs and vans, representing 37% of all driving participants.

For each driver, the average annual carbon footprint estimate ranges from 106 to 632 $kgCO_2$ (Table 4.8.). The range varies widely from park to park; the Dartmouth Common

and Fort Needham Memorial Park fall well below the average and Shubie Park recorded the highest carbon footprint per individual.

The annual carbon footprint reported was 82,664 to 111,171 $kgCO_2$, which is equivalent to 83 – 111 US tonnes of CO_2. In contrast, if all park users chose the closest park to their home, there would be emissions ranging from 33,767 to 46,430 $kgCO_2$ equivalent to 34 to 46 US tonnes of CO_2. Therefore, the result of all surveyed off-leash park users choosing the closest park to their homes would be an annual decrease in carbon emissions between 49 and 65 tonnes of CO_2.

Table 4.8. Average Off-Leash Park Users Carbon Footprint in $kgCO_2$ (1 User)

Park	**Low**	**Medium**	**High**
Dartmouth Common	106	124	142
Fort Needham Memorial	122	152	180
Hemlock Ravine	344	428	510
Point Pleasant	458	534	608
Sandy Lake	374	436	498
Shubie	470	552	632
Total	**431**	**505**	**579**

CHAPTER 5

Discussion

5.1. Study Overview

This research aims to add to our understanding of off-leash park users' travel distance, mode choice and frequency of visits, and ultimately calculate their carbon footprint. The following section compares urban and suburban park users' park use habits and why people are attracted to certain parks. Using participants' travel distance data and rationales for park choice, inferences are made as to whether park users act in an environmentally conscious manner. Furthermore, this section discusses the importance of dog parks to the off-leash park users, which is shown in the collected data. The final component of this section looks at some revisions that could be made to increase the efficiency of the study.

5.2. Comparing Urban and Suburban Off-leash Parks and Users

Urban and suburban off-leash park users have some habitual differences in regards to travel distance and visitation frequency. Suburban dwellers travel on average 4,281 m farther than urban dwellers to reach their chosen park. This might be attributed to necessity, meaning that suburban dwellers have fewer nearby parks. For the most part, suburban parks are large forested areas and have fewer houses in the immediate

surrounding. The lack of surrounding houses might mean the parks are harder to reach and users have to travel farther to reach the park. While the lack of parks in the neighbourhood may account for the longer travel distance of both walkers and drivers in the suburbs, it does not account for the suburban dwellers who travel long distances to reach distant parks like Point Pleasant Park instead of using the off-leash park closer to their home. This phenomenon will be discussed in the section on attraction.

Perhaps another explanation for the longer travel distances is that suburban dwellers are accustomed to using their cars more often than urban dwellers. It is more likely for an urban dweller to live within walking distance of parks, stores and restaurants whereas a suburban dweller might habitually go to their car for transportation due to the increased travel distance of every day activities. Thus, the larger travel distance of suburban dwellers might be linked to potential habitual vehicle usage.

In terms of visitation frequency, suburban dwellers are less likely to visit the park daily than their urban dwelling counterparts. One possible explanation is that the participants cannot fit the longer travel distance into their daily schedules. Suburban dwellers have a larger average travel distance than urban dwellers; thus, it is less convenient for the suburban dwellers to use the park everyday. This would mean the off-leash park's distance from the dog owners home affects how often they frequent the park and would be in accordance with the distance decay theory (Eldridge & Jones, 1991).

Another explanation for the reduced visitation frequency could be that participants travel to different parks throughout the week. During the survey period a number of

participants asked for clarification as to whether or not the question was about off-leash parks in general, or the park they were being surveyed at. The participants were asked to give answers relating to the park they were at that day. Perhaps suburban dwellers travel to other parks throughout the week, thus, reducing the frequency they visit any given park. A nearby park might encourage users to visit the park everyday, however, if the closest park is a ten-minute drive it might encourage the off-leash park users to visit different parks. If a potential park user has to drive ten-minutes, a 15-minute drive might be seen as reasonable. Whereas when one can walk to an off-leash park in the neighbourhood, they may be less inclined to drive 10 -15 minutes.

Excluding the most popular off-leash park, Point Pleasant Park, there are many similarities in the urban and suburban park statistics in relation to travel distance and transportation methods. The majority of park users travelling to urban parks walk, whereas, driving is more common in the suburban parks. This difference is most likely related to the park users' home location. If a desired off-leash park user has a facility within walking distance of their house, they might choose to walk or they might walk out of necessity since they may not own a vehicle.

Point Pleasant Park is an urban park, however, the transportation trends are similar to suburban parks. An explanation for the higher percentage of users driving to Point Pleasant Park could be due to the park's attractiveness and its popularity, thus, attracting many dog walkers from far away. Point Pleasant Park is isolated on the southern extent of the Halifax peninsula and cut off from the city by a major rail line, which means it may not

be as integrated into the city as the other urban parks, i.e. completely surrounded by urban areas. The other urban parks are basically surrounded by residential areas and might be within walking distance of more potential dog walkers.

5.3. Park Attractiveness and Rationale for Visiting

Attractiveness appears to affect park usage in the HRM. Point Pleasant Park and Shubie Park are the most popular parks (Table 4.1) and are arguably the most attractive. Both parks are located on large bodies of water, have many trails throughout their largely forested areas, and are generally aesthetically pleasing with vistas and natural surroundings. When looking at the urban parks, Point Pleasant Park had more than double the number of total users (77) and double the amount of surveys taken per hour (12.3) than the second most popular urban park, Fort Needham Memorial (31 surveys at a rate of 5.2 per hour). When looking at the suburban parks, Shubie Park had more than triple the number of total users (84) and five times as many surveys taken per hour (11.2) than the second most popular suburban park, Sandy Lake (23 surveys averaging 2.2 per hour). Interestingly, Point Pleasant Park and Shubie Park have the largest travel distance in this study (Table 2), which says something about their attractiveness and desirability.

Another explanation for the high traffic at Point Pleasant Park and Shubie Park is their social attraction. There is the potential that dog owners want to be seen walking their dogs at the more popular parks to be seen as a “good” dog owner, meaning the individual provides their dog with many different stimulations and goes above and beyond the

necessary care for their pet. The results point to this conclusion because it can be argued that Hemlock Ravine and Sandy Lake have similar amenities to the more popular parks, yet have much lower usage. Also, many people reported completing the task of socialization at the park, which would imply they acknowledge the social attractiveness offered at the busier parks.

On the other hand, the Dartmouth Common and Fort Needham Memorial are, albeit subjectively, the least physically attractive parks of the survey. Unlike Shubie Park or Point Pleasant Park, neither has access to water or trails going through forests. Fittingly, the Dartmouth Common's and Fort Needham Memorial's maximum travel distance is smaller than all other parks by 9000 m or more, thus people seem to use these parks because of the convenience (close to home) instead of physical attraction (Table 4.2). Another explanation for the low numbers reported at the Dartmouth Common could be its reputation as a dangerous area (Bousquet, 2013). Park usage will logically be impacted by muggings happening at least every month. This would largely affect people from the surrounding areas because they will know that area better and have a better understanding as to why it is seen as dangerous.

Fort Needham Memorial is the third busiest park and the park usage is average for off-leash parks in the HRM; therefore, to say it has low usage would be incorrect. However, it is much less busy than Point Pleasant Park and Shubie Park and when looking at travel distance, it does not attract many users from far away as the other more popular parks do. As mentioned, Fort Needham Memorial has very few amenities and a large portion of

walkers. This also suggests that attractiveness, or unattractiveness, is affecting park usage and travel distance in the HRM.

On the other hand, Fort Needham Memorial has a very strong sense of community and this was reported in the surveys taken at the park. This park had the largest amount of responses relating to community orientation. Responses such as "good community of dog owners," "great people" and "friendly place, friendly atmosphere" were common. This might be because many users live within walking distance of the park and not too many people are driving in from afar, which might make the park users see it as a neighbourhood or community park instead of a city park. Also, because this park is more or less just an open field, there might be a lot more interaction between park users when they are standing in the field, instead of walking through paths at different rates. A practice that is more common at the other dog parks.

Many off-leash park users reported choosing a park because of off-leash capability and proximity; however, 61% of off-leash park users who drive to the park do not use the closest park to their homes. Also, of the 93 off-leash park users that reported choosing parks because of proximity, 23 did not in fact choose the closest park as shown by the GIS analysis. This would afford the conclusion that attraction, either social or physical, draws in more people than off-leash capability and proximity do. This is highlighted by the amount of users choosing parks because they are close, but not choosing the closest park. Another explanation could be the park users do not know about the other off-leash parks and they are actually using the closest dog park to their house in their own mind. Also, reporting

proximity as a rationale does not necessarily imply the off-leash park users think it is the closest park to their house. A participant might have two parks that are close to their house and choose the park that is slightly farther away but is still convenient to them. However, this would still point to off-leash park users choosing specific parks because of attraction.

5.4. Environmental Considerations

The results show that many off-leash park users do not consider the environmental impact of driving to and from the off-leash dog parks. All of the people who walk to the dog park chose the closest park, which makes sense in terms of effort and time. However, 61% of drivers chose off-leash parks that were further away than necessary, thus creating a larger carbon footprint. Throughout the survey period many participants said they never would of thought of the carbon footprint associated with this activity, suggesting that they do not consider the environmental impact. Furthermore, many off-leash park users do not complete other errands or tasks on their journey to or from the dog park. Combining errands is known to be more environmentally friendly than single-destination trips (Gardner et al., 2008). Less than half of the off-leash park users completed multiple tasks on their trips to or from the dog park, suggesting that it is less common for dog park users to act in an environmentally friendly manner.

There is also the possibility that the participants who report choosing parks because of proximity value convenience rather than reducing their environmental impact. Trip length and subsequent environmental impacts are increased due to the probability that

many are choosing parks for their desirability rather than their proximity. This might imply that a large percentage of off-leash park users do not consider the environmental impact of the activity. This would mean that more marketing of off-leash parks is needed to make sure all users know about the resources close to their homes so that, whether for environmental reasons or practicality, off-leash park users can have the option to choose the closest park to their homes because they know of the available resources.

5.5. Importance of Dog Parks

This study shows the importance of dog parks to dog owners in the HRM. Where it is not uncommon to see people walking their dogs on the streets, many people still choose to drive to off-leash parks every day. This shows the importance of dogs to their owners; some survey participants went as far as saying their dog loves a particular park, revealing the potential ability of a dog to increase the place attachment and identity (Wolch, 2012). Some dog owners during the survey period were also worried that the study would result in the closure of the park. This type of speech was not recorded, however, several participants brought it up, which shows the importance of the parks to its users.

Park users reported socialization, fitness and stress relief in the choice of park, which shows that people search out these facilities and see them as more than just off-leash parks. They use these facilities for themselves as well as their dogs, suggesting an emotional attachment to the park. Additionally, many people reported going to parks because of the other people at the park, contradicting another study that found people

search out un-crowded parks (Arnberger & Eder, 2012). However, all of the parks in this study are not crowded, even Point Pleasant Park and Shubie Park did not seem to be over-crowded throughout the study period.

5.6. Limitations and Revisions

While the survey format worked well for this study and provided the desired results, and also, ArcGIS provided the best possible estimate of travel distance without excessive questioning about exact routes, there were some assumptions made. For example, the annual carbon footprint for individual park users was calculated using reported weekly frequencies that were then multiplied by 52 to get an annual park usage estimate. These results were adjusted and a range of estimates was given, however, there are many variables' that could affect annual park usage that were not considered such as illness and holidays. Also, there were participants that reported usually going to other parks but the survey was based on the park the participants were at that day. Issues with the CO_2 calculations arise since vehicle emission ratings may change as vehicles get older or as repairs are done on the vehicle, resulting in more emissions than reported by the Canadian government.

The GIS software calculated the shortest route to the dog parks; thus, it assumed that every participant is taking the shortest route to the park, which might not be the case. Also, the shortest route did not have access to paths that the walkers may have taken and this would change the distance travelled for some participants. Furthermore, the shortest

routes do not take into consideration traffic, habits, or any other reason as to why someone would not take the shortest route to the off-leash park.

In hindsight, revisions could be made to improve upon the survey. First, the question "Do you accomplish other tasks on your way to or from the dog park?" should be reworded for clarification. The purpose of this question was to find out whether off-leash park users make the trip to the dog park a multi-destination trip and it did not do that entirely. 46 participants answered this question in terms of tasks done at the park such as relaxation and exercise, and there were potentially more who did not specify the tasks they completed on their journeys. Providing an example after asking the question could help clarify. For example, "Do you accomplish other tasks on your way to the dog park, such as gas or groceries?"

Second, a pilot survey given to 10 – 15 off-leash park users, may have helped to fix the issues that arose with the survey questions. Pilot tests have the ability to increase the suitability of the survey instrument and highlight potential issues. Doing so would allow the surveyor to adjust the questions in order to gain all the desired results and avoid participant confusion; however, due to the length and scope of the project a pilot survey was not feasible.

There is a possible revision that can be made regarding the sample size. Instead of survey parks for an average time frame, gathering the same amount of participants could provide results that are more specific to each park. The majority of the surveys in this study come from Point Pleasant Park and Shubie Park and therefore might not accurately

describe some of the other parks. As an example, the Dartmouth Common's average number of surveys per hour is 0.8 whereas the average for the study is 5.2. Thus, a minimum number of surveys per park might alleviate this bias and create more sound results. This suggestion, however, does not incorporate time frames. The survey period was roughly 45 hours and, if a reasonable number of surveys were taken from each park, the study period would have been extended considerably. For example, to get 24 surveys from the Dartmouth Common, a surveyor would need to spend an estimated 30 hours at the park (0.8 surveys per hour x 30 hours = 24).

CHAPTER 6

Conclusion

6.1. Summary of Findings

On average, off-leash park users travel 5,559 m one-way to reach their chosen park in the HRM. Driving is the most common transportation mode for accessing off-leash parks, with 82% of users driving, on average, 6,553 m each way. Suburban dwellers travel, on average, 7,681 m to the off-leash parks whereas urban dwellers travel an average of 3,400 m to the parks. This study calculates that the average carbon footprint of a driving off-leash park user in the HRM is between 431 and 579 $KgCO_2$ per year. Also, the entire carbon footprint of all participants in this study is between 82,664 to 111,171 $kgCO_2$ per year. The total carbon output is much higher than it could be since 61% of off-leash park users fail to choose the closest park to their homes. If the closest parks are chosen, the carbon footprint of the study would have been much lower - between 33,767 and 46,430 $kgCO_2$.

Walking to the closest park is the best way to lower carbon emissions of off-leash parks, however, some residents are not within walking distance to a park. Choosing the closest park and limiting daily use of off-leash parks not within walking distance can reduce carbon emissions. Also, choosing the closest park or walking the dog in the owners' neighbourhood during the week and going to farther and potentially more desirable off-leash parks on the weekend can reduce carbon emissions.

6.2. Planning Implications/Recommendations

Cities have the ability to lower carbon emissions by creating more off-leash parks in neighbourhoods. The two most common rationales for park choice is that they offer off-leash areas and their proximity to the home of users; therefore, by creating additional off-leash parks in neighbourhoods, the city could lower carbon emissions and increase pet owner satisfaction. There were six off-leash parks listed on the HRM's website when the study was being developed in the spring of 2016, and one year later the HRM created a new park on Westridge Drive. This park has the potential to reduce the carbon footprint of other parks by drawing in people from the area that may be currently traveling to parks that are farther away. More promotion of the pre-existing parks may also lower the carbon footprint of off-leash parks in the HRM; some survey participants were unaware of parks closer to their homes.

Beyond the environmental benefits of additional parks, many off-leash park users see the time at the park as not only beneficial for the dog but also themselves. Many participants answered the question about accomplishing other tasks with responses of socialization, fitness and stress relief. This shows the importance of these facilities not only to dogs but the owners as well.

However, there are problems associated with dog parks. A prime example are the conflicts that occur with park users and the rest of the community. The HRM has tried to address this problem at Shubie Park by posting a sign attempting to limit uncontrollable barking. Another example is the sign aimed to address the complaints of other park users

at Long Lake that was pulled down in front of a news crew. Both sides, dog walkers and non-dog walkers, have strong arguments and are emotionally charged over the topic. Pet owners want a place to walk their dogs off-leash, however, the general public desires a place to enjoy the outdoors without the nuisances that dogs may bring such as noise and waste, not to mention the potential for an attack. The HRM is trying to address the other park users' complaints with By-Laws and signage to find common ground. However, several difficult questions remain: Whose rights take precedent in public spaces – the dog owners or the other park users? And how to balance offering better access to dog-parks without disturbing existing communities?

This study found the average distance off-leash park users travel to reach off-leash parks in the HRM. Using this information combined with additional demographic data, the next step could be using GIS to find other possible locations for off-leash dog parks, closer to participants' homes. Also, research could be done to find what is attracting off-leash park users to the various parks. More in-depth questioning as to park users' rationale for park choice would provide the HRM with the ability to recreate these features in new off-leash parks that might be closer to dog walkers home, thus reducing the carbon footprint and addressing the complaints from other park users.

LIST OF REFERENCES

Assadourian, E. (2014, May 01). Are pets bad for the environment? Retrieved March 28, 2017, from https://www.theguardian.com/sustainable-business/reduce-pets-sustainable-future-cats-dogs

Arnberger, A., & Eder, R. (2012). The influence of green space on community attachment of urban and suburban residents. *Urban Forestry & Urban Greening, 11*(1), 41-49. doi:10.1016/j.ufug.2011.11.003 (Arnberger & Eder, 2012)

Awadallah, F., & Fini, E. (2013). Transportation Global Environmental Impact. *Institute of Transportation Engineers. ITE Journal, 83*(9), 43-46.

Bell, S., Phoenix,C., Lovell, R., & Wheeler., B (2014). Green space, health and wellbeing: Making space for individual agency. *Health and Place, 30*, 287-292.

Borden-Colley, S. (2014, July). Majority at public meeting oppose dog area at Africville Park. Retrieved November 9, 2016, from http://thechronicleherald.ca/metro/1224948-majority-at-public-meeting-oppose-dog-area-at-africville-park

Bousquet, T. (2013, January 10). The Dartmouth Common is a dangerous, underused park. Retrieved February 28, 2017, from http://www.thecoast.ca/halifax/the-dartmouth-common-is-a-dangerous-underused-park/Content?oid=3601804

Braverman, J., Tom, M., Shaffer, H., & Reynolds, Cecil R. (2014). Accuracy of Self-Reported Versus Actual Online Gambling Wins and Losses. *Psychological Assessment, 26*(3), 865-877.

Brown, S. G., & Rhodes, R. E. (2006). Relationships Among Dog Ownership and Leisure-Time Walking in Western Canadian Adults. *American Journal of Preventive Medicine, 30*(2), 131-136. doi:10.1016/j.amepre.2005.10.007

Bryant Park to Begin Tracking Visitors' Mobile Data. (2016). Retrieved November 03, 2016, from http://www.nbcnewyork.com/news/local/Bryant-Park-Place-IQ-NYC-New-York-City-Manhattan-391324041.html.

Canadian Animal Health Institute. (2015). Latest Canadian Pet Population. Retrieved February 10, 2017, from https://www.canadianveterinarians.net/documents/canadian-pet-population-figures-cahi-2014

CBCnews. (2015, June). Africville Parks becomes on-leash for dogs as new parks opens. Retrieved November 9, 2016, from http://www.cbc.ca/news/canada/nova-scotia/africville-park-becomes-on-leash-for-dogs-as-new-park-opens-1.2888386

Cevizci, S., Babaoglu, U.T., Erginoz, E. & Issever, H. (2012). The Relation Of Pet Ownership, Psychological Stress, Regular Physical Exercise And Smoking In White-Collar Workers Of A Special Company In Besiktas Region Of Istanbu. *Nobel Medicus,* 8(3), 52-59

Climate change 2014: Mitigation of climate change. (2014). New York: Cambridge University Press.

Cline, C. & Marie, K. (2010). Psychological Effects of Dog Ownership: Role Strain, Role Enhancement, and Depression. *The Journal of Social Psychology, 150*(2), 117-131. doi:10.1080/00224540903368533

CTVAtlantic. (2014, July). Dog owners upset over new leash sign at Halifax Provincial Park. Retrieved November 9, 2016, from http://atlantic.ctvnews.ca/dog-owners-upset-over-new-leash-sign-at-halifax-provincial-park-1.1907194

De Almeida, P., & Silva, P. (2009). The peak of oil production—Timings and market recognition. *Energy Policy, 37*(4), 1267-1276.

De Munnynck, K., & Van de Voorde, W. (2002). Forensic approach of fatal dog attacks: A case report and literature review. *International Journal of Legal Medicine, 116*(5), 295-300.

Downie, R. (2016, April 26). Global Transportation: Exploring Revenue Trends and Fundamentals. Retrieved February 10, 2017, from http://www.investopedia.com/articles/markets/042516/global-transportation-exploring-revenue-trends-and-fundamentals.asp

Edelstein, S. (2017, January 17). Electric Car Price Guide: every 2017 all-electric car, with specs (updated). Retrieved February 10, 2017, from http://www.greencarreports.com/news/1080871_electric-car-price-guide-every-2015-2016-plug-in-car-with-specs-updated/page-3

Eldridge, J., & Jones, J. (1991). WARPED SPACE: A GEOGRAPHY OF DISTANCE DECAY. *The Professional Geographer, 43*(4), 500-511.

Environment Canada. (2016, November 07). Current Regulations. Retrieved February 10, 2017, from https://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=192

Environment and Climate Change Canada. (2016) National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada. *Canada's Submission to the United Nations Framework Convention on Climate Change.* Part 1

Euler Hermes. (2017). Retrieved February 10, 2017, from http://www.eulerhermes.com/economic-research/sector-risks/Global-Transportation-Report/Pages/default.aspx

Feng, Z., Dibben, C., Witham, M. D., Donnan, P. T., Vadiveloo, T., Sniehotta, F., . . . Mcmurdo, M. E. (2014). Dog ownership and physical activity in later life: A cross-sectional observational study. *Preventive Medicine, 66*, 101-106. doi:10.1016/j.ypmed.2014.06.004

Garcia, D. O., Wertheim, B. C., Manson, J. E., Chlebowski, R. T., Volpe, S. L., Howard, B. V., . . . Thomson, C. A. (2015). Relationships between dog ownership and physical activity in postmenopausal women. *Preventive Medicine, 70*, 33-38. doi:10.1016/j.ypmed.2014.10.030

Green, C., & Klein, E. (2011). Promoting Active Transportation as a Partnership Between Urban Planning and Public Health: The Columbus Healthy Places Program. *Public Health Reports (1974-), 126*, 41-49

Gardner, G., & Stern, P. (2008). The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change. *Environment: Science and Policy for Sustainable Development, 50*(5), 12-25.

Graham, T. M., & Glover, T. D. (2014). On the Fence: Dog Parks in the (Un)Leashing of Community and Social Capital. *Leisure Sciences, 36*(3), 217-234. doi:10.1080/01490400.2014.888020

Halifax Regional Municipality. (2007). Halifax Regional Municipality By-Law Number A-300 Respecting Animals. Retrieved November 9, 2016, from http://www.halifax.ca/legislation/bylaws/hrm/documents/ProposedA-300By-Law.pdf

Halifax Regional Municipality. (2015). Halifax Regional Municipality By-Law Number A-700. Retrieved November 9, 2016, from https://www.halifax.ca/legislation/bylaws/hrm/documents/By-LawA-700.pdf

Halifax Regional Municipality (HRM). (2016, September 08). Project Overview. Retrieved February 27, 2017, from http://www.halifax.ca/centreplan/

Hammerly, T., & DuMont, B. (2012). The environmental impact of pets. *Green Teacher,* (95), 25-28. Retrieved July 13, 2016, from https://login.library.smu.ca/login?qurl=?url=http://search.proquest.com.library.smu.ca:2048/docview/1032551769?accountid=13908

Hantsport Dog Park: Hantsport, Nova Scotia – Park | Facebook. (n.d.). Retrieved November 07, 2016, from https://www.facebook.com/pages/Hantsport-Dog-Park/537964442977629

Jabareen, Y. (2015). City planning deficiencies & climate change – The situation in developed and developing cities. *Geoforum, 63*, 40-43.

Lee, P. (2015, December 05). PET CORNER: For dog owners, bylaws raise concerns. Retrieved February 27, 2017, from http://thechronicleherald.ca/artslife/1326137-pet-corner-for-dog-owners-bylaws-raise-concerns

Lee, H., Shepley, M., & Huang, C. (2009). Evaluation of off-leash dog parks in Texas and Florida: A study of use patterns, user satisfaction, and perception. *Landscape and Urban Planning, 92*(3-4), 314-324. doi:10.1016/j.landurbplan.2009.05.015

Ludermir, A. B. & Harpham, T. (1998). Urbanization and mental health in Brazil: Social and economic dimensions. *Health and Place, 4*(3), 223-232.

Liu, G., Yang, Z., Chen, B., & Ulgiati, S. (2011). Monitoring trends of urban development and environmental impact of Beijing, 1999–2006. *Science of The Total Environment, 409*(18), 3295-3308. doi:10.1016/j.scitotenv.2011.05.045

Martín, J. R., Arana, C. D., Ramos-Miras, J., Gil, C., & Boluda, R. (2015). Impact of 70 years urban growth associated with heavy metal pollution. *Environmental Pollution, 196*, 156-163. doi:10.1016/j.envpol.2014.10.014

Matthias, J., Templin, M., Jordan, M., & Stanek, D. (2015). Cause, Setting and Ownership Analysis of Dog Bites in Bay County, Florida from 2009 to 2010. *Zoonoses and Public Health, 62*(1), 38-43.

Mccormack, G., Graham, T., Swanson, K., Massolo, A. & Rock, M.J. (2016). Changes in visitor profiles and activity patterns following dog supportive modifications to parks: A natural experiment on the health impact of an urban policy. *SSM - Population Health, 2*, 237-243.

Mccormack, G., Giles-Corti, B., & Bulsara, M. (2007). Correlates of Using Neighborhood Recreational Destinations in Physically Active Respondents. *Journal of Physical Activity and Health, 4*(1), 39-53. doi:10.1123/jpah.4.1.39

Morency, C., & Demers, M. (2010). Active transportation as a way to increase physical activity among children. *Child: Care, Health and Development, 36*(3), 421-427. doi:10.1111/j.1365-2214.2009.01024.x

Nazelle, A. D., Morton, B. J., Jerrett, M., & Crawford-Brown, D. (2010). Short trips: An opportunity for reducing mobile-source emissions? *Transportation Research Part D: Transport and Environment, 15*(8), 451-457. doi:10.1016/j.trd.2010.04.012

Nova Scotia Archives. (n.d.). MemoryNS. Retrieved March 29, 2017, from https://memoryns.ca/princes-lodge-association-collection

O'Sullivan, F. (2016). Berlin Is Creating a 'Driver's License for Dogs'. *CityLab.* Retrieved November 2, 2016, from http://www.citylab.com/cityfixer/2016/05/berlin-is-creating-a-drivers-license-for-dogs/483557/

Owen, C. G., Nightingale, C. M., Rudnicka, A. R., Ekelund, U., Mcminn, A. M., Sluijs, E. M., . . . Whincup, P. H. (2010). Family Dog Ownership and Levels of Physical Activity in Childhood: Findings From the Child Heart and Health Study in England. *Am J Public Health American Journal of Public Health, 100*(9), 1669-1671. doi:10.2105/ajph.2009.188193

Parks, R. (2015, June 15). Are Your Pets Contributing to Global Warming? Retrieved March 28, 2017, from https://www.vice.com/en_us/article/pet-hates-v22n5

Phdungsilp, A. (2011). Futures studies' backcasting method used for strategic sustainable city planning. Futures, 43(7), 707-714. doi:10.1016/j.futures.2011.05.012

Picard, A. (2016, June). Dog attacks are a public health issue, and should be treated as one. Retrieved November 9, 2016, from http://www.theglobeandmail.com/opinion/columnists/dog-attacks-are-a-public-health-issue-and-should-be-treated-as-one/article30516631/

Raghavan, M. (2008). Fatal dog attacks in Canada, 1990-2007. *The Canadian Veterinary Journal = La Revue Vétérinaire Canadienne, 49*(6), 577-81.

Rahner, M. (2009, November 04). Study says dogs have larger carbon footprint than SUV. Retrieved March 28, 2017, from https://phys.org/news/2009-11-dogs-larger-carbon-footprint-suv.html

Rossi, S. D., Byrne, J. A., & Pickering, C. M. (2015). The role of distance in peri-urban national park use: Who visits them and how far do they travel? *Applied Geography, 63*, 77-88. doi:10.1016/j.apgeog.2015.06.008

Rowlatt, J. (2009, November 15). BBC - Ethical Man blog: Time to eat the pets? Retrieved March 28, 2017, from http://www.bbc.co.uk/blogs/ethicalman/2009/11/time_to_eat_the_pets.html

Schwartz, L. (2014, November 20). The surprisingly large carbon paw print of your beloved pet. Retrieved March 08, 2017, from http://www.salon.com/2014/11/20/the_surprisingly_large_carbon_paw_print_of_your_beloved_pet_partner/

Schlereth, N. (2016). An Examination of Dog Parks and Recommendations for Development in the Community. *Journal of Facility Planning, Design, and Management, 4*(1), Journal of Facility Planning, Design, and Management, 2016, Vol.4(1).

Shanahan, D. F., Fuller, R. A., Bush, R., Lin, B. B., & Gaston, K. J. (2015). The Health Benefits of Urban Nature: How Much Do We Need?. *Bioscience*, *65*(5), 476-485. doi:10.1093/biosci/biv032

Sharps, L. (2013). Carbon Paw Prints: Are House Pets Worse for the Environment Than SUVs? Retrieved July 10, 2016, from http://www.takepart.com/article/2013/12/16/pets-are-killing-earth

Shubie Doggie Park: Dartmouth, Nova Scotia | Facebook. (n.d.). Retrieved November 07, 2016, from https://www.facebook.com/shubiedoggiepark

Sirard, J. R., Patnode, C. D., Hearst, M. O., & Laska, M. N. (2011). Dog Ownership and Adolescent Physical Activity. *American Journal of Preventive Medicine, 40*(3), 334-337. doi:10.1016/j.amepre.2010.11.007

Skippon, S., Veeraraghavan, S., Ma, H., Gadd, P., & Tait, N. (2012). Combining technology development and behaviour change to meet CO2 cumulative emission budgets for road transport: Case studies for the USA and Europe. *Transportation Research Part A: Policy and Practice, 46*(9), 1405-1423. doi:10.1016/j.tra.2012.05.021

Statistics Canada. (2016, September 15). Commuting to work. Retrieved February 10, 2017, from https://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/99-012-x2011003_1-eng.cfm

Statistics Canada. (2016). Population by year, by province and territory (Number). Retrieved February 10, 2017, from http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm

United Nations Framework Convention on Climate Change. (2016). Status of ratification. Retrieved February 10, 2017, from http://unfccc.int/paris_agreement/items/9485.php

UPS. (2017). Shipping carbon neutral with UPS. Retrieved February 10, 2017, from https://www.ups.com/content/ca/en/resources/ship/carbonneutral/shipping.html

Urbanik, J., & Morgan, M. (2013). A tale of tails: The place of dog parks in the urban imaginary. *Geoforum, 44*, 292-302. doi:10.1016/j.geoforum.2012.08.001

Vale, R., & Vale, B. (2009). *Time to eat the dog?: the real guide to sustainable living*. London: Thames & Hudson.

Vandevijvere, S., Chow, C. C., Hall, K. D., Umali, E., & Swinburn, B. A. (2015). Increased food energy supply as a major driver of the obesity epidemic: A global analysis. *Bulletin of the World Health Organization Bull. World Health Organ., 93*(7), 446-456. doi:10.2471/blt.14.150565

VanKampen, S. (2016, February 28). Dog owners told to control barking after neighbours complain. Retrieved February 9, 2017, from CBCNews, http://www.cbc.ca/news/canada/nova-scotia/shubie-park-dog-barking-sign-1.3467552

Wang, M., & Kexin, L. (2013). Transportation Model Application for the Planning of Low Carbon City – Take Xining City in China as Example. Procedia Computer Science, 19, 835-840. doi:10.1016/j.procs.2013.06.111

Wang, Q., Zhao, Z., Shen, N., & Liu, T. (2015). Have Chinese cities achieved the win–win between environmental protection and economic development? From the perspective of environmental efficiency. *Ecological Indicators, 51*, 151-158. doi:10.1016/j.ecolind.2014.07.022

WHO | Urban population growth. (n.d.). Retrieved October 30, 2016, from http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/

Williams, S. (2016, February 23). The Carbon Pawprint. Retrieved March 08, 2017, from http://www.triplepundit.com/2016/02/the-carbon-pawprint/

Williams-Derry, C. (2009). Dogs Vs. SUVs. Retrieved July 13, 2016, from http://grist.org/article/dogs-vs-suvs/

Wolch, J. (2002). *Anima urbis*. *Progress in Human Geography, 26*(6), 721-742. doi:10.1191/0309132502ph400oa

Woodford, Z. (2016, February). Municipality says controversial new signs at Dartmouth Dog Park are working. Retrieved November 9, 2016, from http://www.metronews.ca/news/halifax/2016/02/29/municipality-says-new-signs-at-dartmouth-dog-park-working.html

APENDIX

Research Ethics Approval

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ethics@smu.ca

Certificate of Ethical Acceptability for Research Involving Humans

This is to certify that the Research Ethics Board has examined the research proposal:

SMU REB File Number:	16-516
Title of Research Project:	Dog Park Users' Travel Distance and Mode Choice in Halifax, NS.
Faculty, Department:	Arts, Geography & Environmental Studies
Faculty Supervisor:	Dr. Mathew Novak
Student Investigator:	Eric Norris

and concludes that in all respects the proposed project meets appropriate standards of ethical acceptability and is in accordance with the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans (TCPS 2) and Saint Mary's University relevant policies.

Approval Period: May 30, 2016 – May 30, 2017*

Continuing Review Reporting Requirements

ADVERSE EVENT
Adverse Event Report: http://www.smu.ca/academic/reb/forms.html
Adverse events must be immediately reported (no later than 1 business day).
SMU REB Adverse Event Policy: http://www.smu.ca/academic/reb/policies.html

MODIFICATION
FORM 2: http://www.smu.ca/academic/reb/forms.html
Research ethics approval must be requested and obtained prior to implementing any changes or additions to the initial submission, consent form/script or supporting documents.

YEARLY RENEWAL*
FORM 3: http://www.smu.ca/academic/reb/forms.html
Research ethics approval is granted for **one year only**. If the research continues, researchers can request an extension one month before ethics approval expires.
FORM 4: http://www.smu.ca/academic/reb/forms.html
Research ethics approval for course projects is granted for **one year only**. If the course project is continuing, instructors can request an extension one month before ethics approval expires.

CLOSURE
FORM 5: http://www.smu.ca/academic/reb/forms.html
The completion of the research must be reported and the master file for the research project will be closed.

*Please note that if your research approval expires, no activity on the project is permitted until research ethics approval is renewed. Failure to hold a valid SMU REB Certificate of Ethical Acceptability or Continuation may result in the delay, suspension or loss of funding as required by the federal granting Councils.

On behalf of the Saint Mary's University Research Ethics Board, I wish you success in your research.

Dr. Jim Cameron, Ph.D.
Chair, Research Ethics Board, Saint Mary's University