

MAKING BIOPHILIC CONNECTIONS: CREATING A GREEN SPACE NETWORK IN TORONTO

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Master of Planning
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Abstract

The City of Toronto is facing unprecedented population growth, placing an increased demand on existing parkland green spaces. With intensification only projected to increase and limited opportunities to develop parkland, the City must explore other complimentary methods to protect and grow access to nature. This paper will explore the possibility for other urban green spaces to provide natural connectivity between parkland and ravines through biophilic design. Biophilic design underscores the importance of daily contact with nature in order for people to have happy lives. With rapid urbanization, however, this connection is under threat. A historical overview of parks will uncover how their design norms no longer serve the needs of today's urban populations. Then, a synthetic literature review focussed on the biophilic benefits associated with exposure to nature will show how even small green spaces deliver positive health outcomes. This research is significant for planners and designers working to prioritize access to nature and create a green space network.

Key Words

Urban green space; nature; biophilia; design; parks planning; urban planning; parkland.

Making Biophilic Connections: Creating a Green Space Network in Toronto

A Masters Research Paper



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Introduction

A Growing Problem – The Gap in Parkland Provision

The City of Toronto’s acquisition of new parkland has declined dramatically over the past decade. From 2009 to 2014, the City added 46 hectares of new parkland compared to 191.3 added from 1998 to 2008 (Lorinc, 2015). In addition, Toronto’s downtown core is growing rapidly, and complimentary parkland acquisition and development has not followed.

Toronto’s Downtown has a population of approximately 240,000, with more than 7,500 residents added annually over the past 5 years (City of Toronto, 2019). It is also Canada’s largest employment cluster with over 500,000 jobs (City of Toronto, 2019). By 2041, the population is projected to nearly double to approximately 475,000 people and, together with southern areas just east and west of the core, the core has the potential to reach between 850,000 to 915,000 jobs (City of Toronto, 2019).

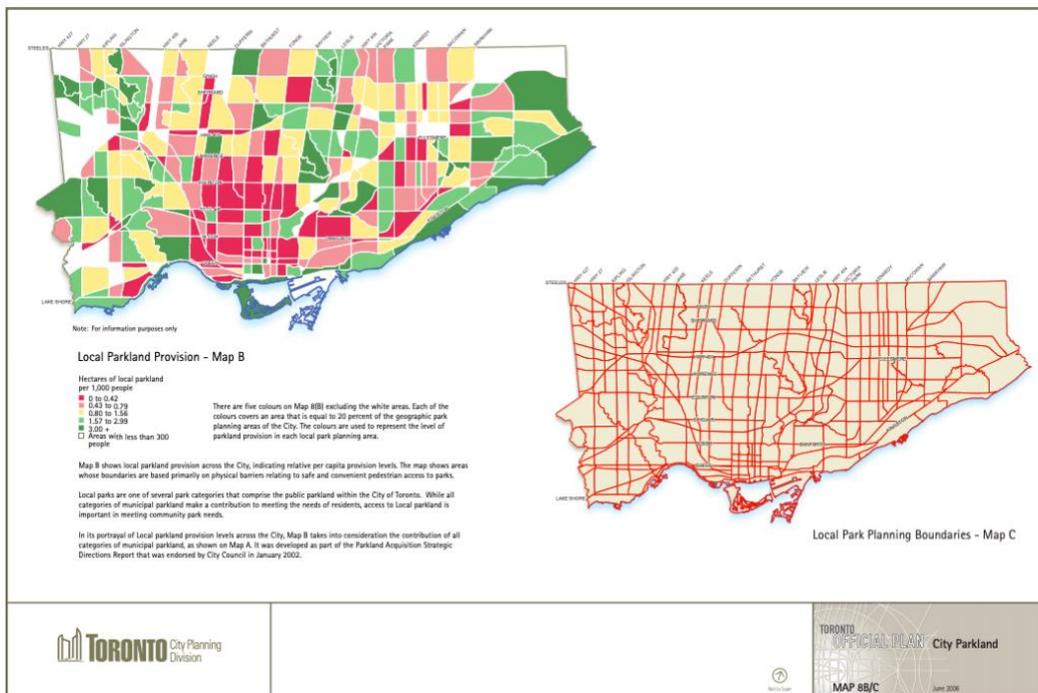


Figure 1: Map 8B/C of Toronto’s Official Plan showing Local Parkland Provision. Areas in red, concentrated in dense areas such as downtown, have less parkland per person. (City of Toronto, 2015).

With so much new density and development being introduced combined with insufficient acquisition of complimentary parkland, the gap between parkland provision and demand continues to widen. In fact, most of the Downtown currently falls within the City’s lowest local parkland provision rate at less than 0.45 hectares per 1,000 residents (City of Toronto, 2017). As of 2016, compared to the city-wide average of 18 square metre of park area per resident and employee, there are only 3.7 square metres per resident and employee in the Downtown Core (City of Toronto, 2017). To even maintain current parkland provision levels with the amount of predicted growth occurring, the City would need to acquire 165 hectares of new parkland in the Downtown core (City of Toronto, 2017).

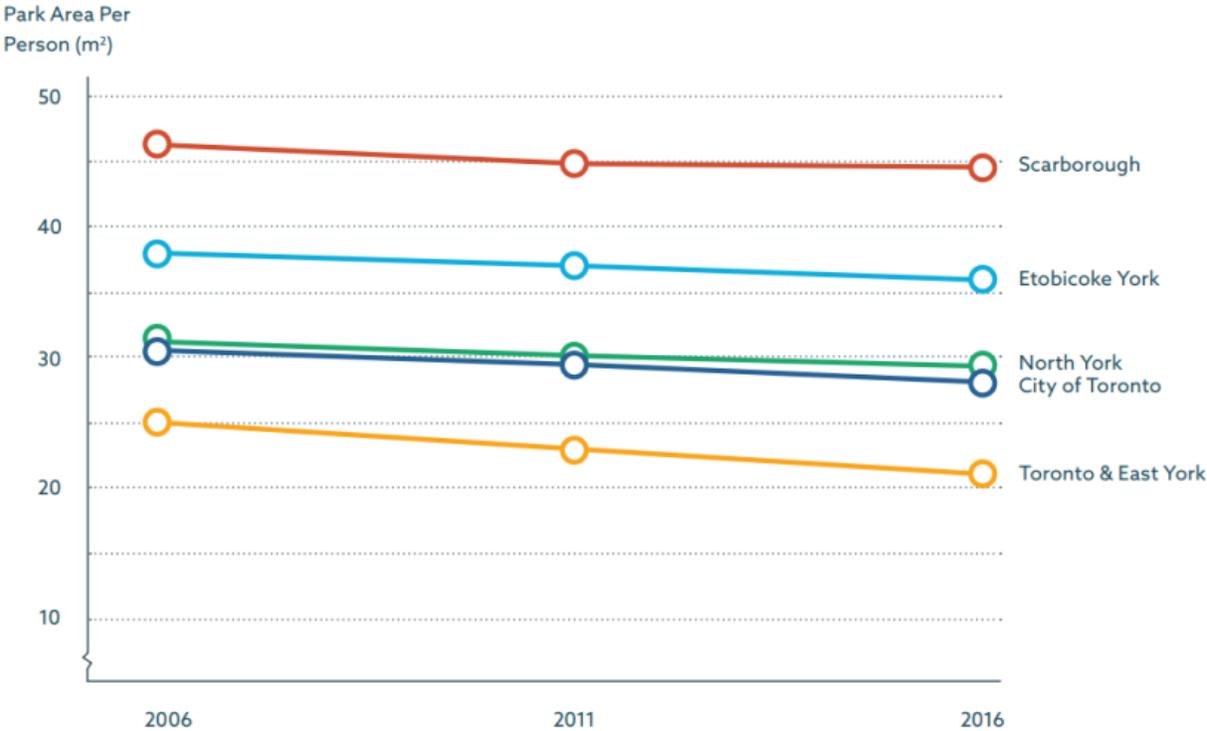


Figure 2: Parkland provision over time. This graph shows how, with a growing population, the City’s parkland provision per person has steadily declined. The rate of decline is greater in the former City of Toronto as it is experiencing greater rates of development and intensification. Please note that this is park area per person in square metres, whereas in the TOcore Parks and Public Realm strategy, they discuss park area per person and employee. (City of Toronto, 2017).

The City of Toronto has a couple of major planning tools it can enact to acquire parkland. Under Section 42 of the Ontario Planning Act, municipalities can ask developers to set aside a portion of property for parkland or cash-in-lieu (Ontario Planning Act, 2019). Additionally, for higher density development, Section 42 stipulates that an “alternative rate” can be developed (Ontario Planning Act, 2019). In the

City of Toronto, due to factors relating to the increase in land values, the small size of most land parcels and the preference towards a monetary transaction, developers usually opt to pay cash-in-lieu to the parkland acquisition reserve instead of providing on- or off-site parkland dedication (Lorinc et al., 2015; City of Toronto, 2017). As of 2017, the City had approximately \$221 million in its parkland acquisition reserve fund (Lorinc et al., 2015). While this may seem like a large sum, the City still cannot afford in-demand land and compete in a highly speculative downtown real estate market (Lorinc et al., 2015). As a result, there has been no guarantee that open spaces near new developments will be created or improved (Lorinc et al., 2015).



Figure 3: Growing pressures on existing parks and open spaces. The photo on the left shows Yorkville Park, a popular downtown park, crowded during winter programming. The photo on the right shows Queens Quay, a recently redesigned linear park and open space trail, with large crowds on summer days and weekends. (Zucker, 2015; Shutterstock, 2019).

Growing Pressure – The Need for Creative Solutions

Existing parks are also immediately under immense pressure to provide useable space to residents (City of Toronto, 2017). The variety of parks and open spaces in the City's repertoire offer unique experiences and a range of necessary functions that contribute to the City's identity and the liveability of the Downtown (City of Toronto, 2018). These places act as key city destinations for celebration, recreation, relaxation, mobility and natural experiences (City of Toronto, 2018). Though Downtown's parks, streets and open spaces are iconic and beloved, they are also some of the most heavily used destinations in the City (City of Toronto, 2018). This problem compounds on itself when planning for

anticipated growth, considering the varied needs of diverse residents, and providing high-quality maintenance and accessibility standards (City of Toronto, 2018).

With a lack of space for new and a growing demand for existing parks, the City of Toronto has come up with new strategies to provide parkland in high-growth areas. One solution, Rail Deck Park, would capitalize on the last site for a large Downtown park greater than 5 acres (City of Toronto, 2018). Rail Deck Park involves the engineering and construction of a decking structure over the rail corridor in downtown Toronto between Blue Jays Way and Bathurst street to facilitate the development of approximately 20 acres of new parkland (City of Toronto, 2017). It is comparable to other international examples and precedence of large-scale engineered, accessible green infrastructure, such as the Highline and Hudson Yards in New York and Millennium Park in Chicago. The total budget for the complete development of Rail Deck Park is estimated in the range of \$1.7 billion (City of Toronto, 2017).



Figure 4: Rendering of Rail Deck Park. Rail Deck Park would be an engineered structure above the rail corridor downtown. (City of Toronto, 2018).

While an innovative and complex solution may be needed to introduce large parks to a densely developed area, a network of other urban green spaces to compliment these larger spaces may prove

less costly and equally, if not more, effective. This is the core focus of this paper – humans have an innate connection to nature and a network strategy needs to be explored to improve access to it. By failing to provide adequate access to nature to its residents, the City may risk losing this connection and the inherent psychological and physiological benefits it provides.



Figure 5: The ravine network across the city. Other urban green spaces offer a unique opportunity to better connect to existing, unique natural systems, such as the ravines and watersheds that run through the city. (Park People, 2015).

Overview – Summary of this Paper

The need for a network of other urban green spaces, rather than large, traditional parks, is the main focus of this paper. Other urban green spaces are defined as anything that is not traditional parkland, ravines and formal green spaces. Instead, it is the natural spaces that lie between these areas, including street trees, green roofs, and other small, green pockets of the City. These spaces include both formal and informal urban green vegetation and support various habitat functions.

Biophilic design principles would support the enhancement and creation of other urban green spaces.

Biophilia recognizes that, for all humans, including those living in urban areas, to live happy, productive

and meaningful lives they must have daily contact with nature. In an increasingly urban planet, this regular connection to nature is threatened. In the absence of other urban green spaces, it can therefore be argued that the reverse of positive health effects (discussed later in this paper) may be felt. To avoid these negative health outcomes, investment in preventative public health measures like the proliferation of other urban green spaces needs to be made.



Figure 6: An existing example of an other urban green space in the downtown core. Brunswick Avenue just north of College Street has a large pedestrian right of way that includes street trees, grass and shrubbery on both sides of the road. (Google Maps, 2019).

To emphasize the importance of other urban green spaces, a dedicated section will elaborate on the definition. Next, a summary of the history of urban parks in North America and the City of Toronto will be presented. In doing so, the paper will highlight how the traditions of urban parks no longer fit with ever-changing urban environments and populations. To highlight why other urban green spaces, provide as many benefits as traditional parkland does, an academic literature review of their biophilic benefits will be presented. This was divided into psychological, psychological and combination benefits derived from exposure to urban green space and nature. In fact, other urban green spaces can reduce mental fatigue, stress, loneliness, risk of diabetes, and mortality rates; improve cognitive performance, emotional well-being, behaviour, aspirations, cardiometabolic health, respiratory symptoms, immune

functioning, perceived health, and sleep duration; encourage active lifestyles and neighbourhood social ties; and balance health inequities. The paper concludes by discussing the implications of these findings for urban residents. Additionally, it makes recommendations to better incorporate other urban green spaces into development and green space policies and the cities' landscapes and design frameworks.



Figure 7: Photos illustrating benefits of other urban green spaces. A network of other urban green space has the ability to improve physical and mental health for city residents. (Trip Advisor, 2018; Crandall, 2017).

Overall, the objective of this paper is to showcase that other urban green spaces and biophilic design merit further exploration as a solution to a growing gap in access to nature in highly dense and urbanizing cities. The City of Toronto has many existing green assets; however, it struggles to ensure that all residents have equal access to these spaces. Through understanding the anthropological benefits associated with green space, which is largely underappreciated and underrecognized, Toronto will be able to make the case for protecting, enhancing and growing the network of urban green spaces.

Methods

The main goal of this paper is to explore how a network of other urban green space can complement traditional parkland and deliver physiological and mental health benefits to residents of an urban area and thus warrant further attention and exploration. Through this, a case can be made for the expansion

and proliferation of a network of urban green spaces in dense urban areas, such as the City of Toronto. To investigate this effectively, it is necessary to conduct a two-part secondary research review. The first will overview the historical background of parkland and the second will discuss literature that is focussed on finding correlations between urban green space and positive health outcomes. Both primary and secondary sources will be used in a synthetic way to offer new insights that may uncover new solutions and improve opportunities for other urban green spaces. Additionally, the synthetic literature review will make connections between and within the planning, landscape architecture and environmental psychology and health disciplines.

It is necessary to dive into a history of parks in order for the reader to understand how the present-day design and understanding of parkland has evolved (or, in this case, how it has failed to evolve enough). Most importantly, it is important to highlight how parks were and are still widely viewed as urban respites, places to heal and destinations for recreation and thus necessitate a very large footprint. In doing so, the paper can then use the comparison of other urban green spaces as providing a similar connection to nature and positive health outcomes without being as land intensive thereby being more suitable for dense urban areas. It also used a primary source from Frederick Law Olmsted one of the founders of parks and landscape architecture while examining the histories of the other founders of the profession. The history provides a background to the reader on how our design and general understanding of modern parks has formed and has not changed dramatically since inception.

The major focus of this paper is a literature review of the human health benefits associated with urban green space. A literature review was conducted instead of utilizing primary research for a couple of key reasons. Firstly, there are many scholarly articles and studies that exist that have found that exposure to urban green space has positive health outcomes. From a search, however, there were very little publications that focussed on agglomerating, summarizing and drawing conclusions from these findings relating to urban green space and health. On top of that, the articles that were found only summarized a few key articles and findings, rather than complete an exhaustive search and synthesis. There was

therefore a gap in the literature that could be filled to complete a thorough exploration, summary and analysis of journal publications related to urban green space and mental and physiological wellbeing.

Secondly, the time allotted for completion of this Major Research Paper (MRP) is approximately four to eight months. As such, there are timing constraints on approving, conducting and analyzing primary research. With a lot of secondary research readily available through online journal portals and little synthesized qualitative data available, it was conclusive that a literature review was the preferred route to explore the thesis and fill the gap in research.

A scan of online journals was conducted utilizing both Ryerson University and University of Toronto library databases as well as the Google Scholar search engine. Keywords used in the search included: biophilic benefits, urban green spaces, health benefits, physiological benefits, street trees, and neighbourhood green space. Major disciplines from which the majority of texts and articles derive from include landscape architecture, psychology, public health, and environment and psychology

Search Protocol and Selection Criteria	
Inclusion Criteria	Urban green spaces, biophilic benefits, mental and psychological benefits
Exclusion Criteria	Parkland, playgrounds, recreational facilities, indoor plants
Key Words	Biophilic benefits, urban green spaces, health benefits, psychological benefits, physiological benefits, street trees, neighbourhood green space, exposure to and immersion in nature
Electronic Databases (n=3)	Ryerson University Library, University of Toronto Library, Google Scholar
Major Disciplines Represented	Landscape architecture, urban planning, psychology, environment and psychology, public health
Quality Criteria	Positive health outcomes, measurable results, significant results

Figure 8: Search Protocol and Selection Criteria.

Articles were analyzed to determine the main purpose of study, thesis, method and conclusions.

Specifically, they were studied to identify if findings concluded that urban green spaces were linked to

positive health outcomes. Additionally, they were grouped together by themes, including roughly by geography and whether they pertained to mental and/or physiological wellbeing. Additionally, if studies covered similar topics or themes, they were discussed side by side or directly compared. If articles referenced other studies, they were flagged and, if those articles met the aforementioned criteria, they were included in the review and synthesized. Studies were also summarized in chart format to show the reader in a clear way the numerous benefits associated with other urban green space. This was done to provide an easy reference point for the reader as to how urban green spaces provide numerous health benefits.

In the discussion section, both literature reviews were utilized to highlight insights and opportunities for other urban green space to deliver essential human-centric benefits in growing urban areas. Key themes were presented through a discussion of implications around central themes, such as people, policies, landscapes and design. The conclusion outlined key next steps and the opportunity to conduct future research to further the key findings in this paper.

What is other urban green space?

The main focus of this paper is the human-centric, or biophilic, benefits of other urban green space. This focus is intended to make a case for the widespread proliferation and adoption of these other urban green spaces. Below is an overview of both other definitions of other urban green spaces as well as what will be the definition moving forward in this paper.

Definitions of Related Terms

According to the United States Environmental Protection Agency (US EPA) (2017), Open Space/Green Space is any open piece of land that is undeveloped (has no building or other built structures) and is accessible to the public. Open space can include green space (land covered by grass, trees, shrubs or other vegetation), schoolyards, playgrounds, public seating areas, public plazas and vacant lots (US EPA,

2017). Additionally, it provides recreational areas for residents and helps to enhance the beauty and environmental quality of neighbourhoods (US EPA, 2017). For the World Health Organization (WHO) (2019), urban green spaces include parks, sports fields, woods, natural meadows, wetlands and other ecosystems. Green urban areas facilitate physical activity and relaxation, filter harmful air pollution, act as a refuge from noise and help to cool down cities (WHO, 2019).

The Definition of Other Urban Green Space

Other urban green spaces as referred to in this paper incorporates aspects of the aforementioned definitions. In particular, they are undeveloped, accessible to the public and green. While the US EPA considers schoolyards and playgrounds, elements of traditional parks, as Open Space/Green Space, this paper does not. In fact, the definition of other urban green space in this paper mainly pertains to what it is not: traditional parkland. Below is a map of all of the parkland in the City of Toronto as dictated by the Official Plan. Anything in green represents parkland. While other urban green space may border on these parks and take the physical form of street trees, naturalized right of ways and other forms of green infrastructure, they are green areas that are not parks.

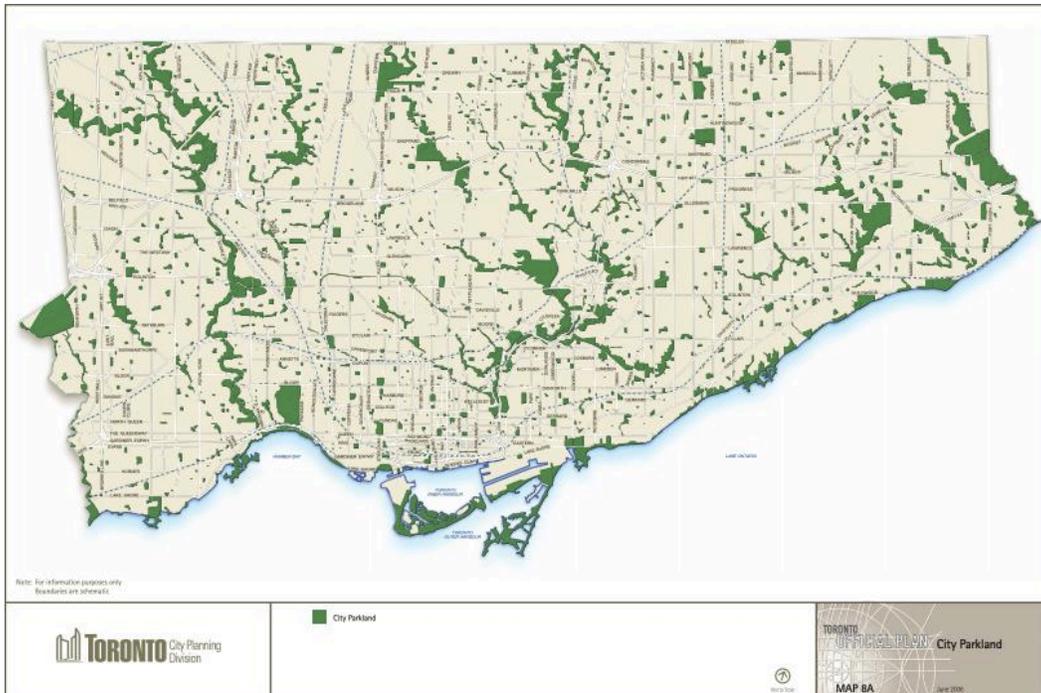


Figure 9: Map 8A of the Toronto Official Plan showing City Parkland. Other urban green space can act to provide connections and support Toronto’s existing parkland and ravine systems. (City of Toronto, 2015).

Other urban green space differs from traditional parkland in three key areas: they do not necessarily require the same footprint, impose a non-existent, less strict or entirely different governance structure and require a less-stringent maintenance and operation regimen as traditional parkland. Other urban green spaces are typically smaller than parks, either occupying a small parcel or within an existing parcel of land. They have no minimum or maximum footprint and can be combined with any use. In relation, urban green spaces also have a different governance model than traditional parkland in that it is completely variable.



Figure 10: An example of other urban green space. St. George Street on the University of Toronto Campus includes street trees, a form of other urban green space as defined by this paper. (Brown and Storey, 2019).

Other urban green space may exist on private property, thus privately managed; be connected to parklands or ravines, thus managed by City or Conservation Authority staff; be completely organic, appearing in unexpected areas, parcels and streetscapes; or be some combination of all of these aforementioned possibilities. Traditional parks have a well-defined, strict governance structure and, for the most part, have to comply with rules set out by their governing municipality. While some constraints and requirements may apply to other urban green spaces, they are not as universal as for traditional parks. Lastly, by virtue of being under a more variable governance structure, their maintenance and operation schedule is not as regimented. Though it may exist, it would be dictated by many different overseeing and regulatory bodies.

Why focus on Other Urban Green Space?

Other urban green space is the focus of this paper for a few key reasons. Firstly, many scholarly publications and public reports already focus on the importance parks play in cities. This notion that parks are a valuable resource is widely accepted and is used to promote their creation, maintenance and

enhancement. Secondly, while this is well-understood, many urban areas are unable to provide adequate parkland to constituents due to a combination of factors relating to increased land values, quick rates of intensification and densification and, in simple terms, not enough space. While these limitations facing Toronto's parks expansion possibilities were discussed in more detail earlier in this paper, this is a problem facing other rapidly growing, dense cities, such as Vancouver, Chicago and New York, among others. Lastly, knowing that parks are critical for urban environments and residents, the understanding and proliferation of other urban green spaces can support and tie in existing policies and guidelines.

What is Toronto doing now?

It is important to overview the City of Toronto's current initiatives to protect and enhance green spaces. This paper proposes developing a network of urban green spaces to provide greater connectivity to Toronto's parkland and ravines and complement existing policies, standards and guidelines. The most relevant and applicable planning documents that speak to parkland, green initiatives and sustainability include: Toronto's Green Standard, which impacts green design elements in new developments; the Ravine Strategy, which promotes the significance of the ravine system; the Parkland strategy, which focusses on strategies to grow Toronto's parkland; the Green Streets Technical Guidelines, which promote green infrastructure and resiliency measures for Toronto's diverse street types; and the Downtown Parks and Public Realm Plan, which addresses key strategies for maintaining and growing parkland in a rapidly intensifying downtown core. A brief summary of relevant policies and their connection to biophilic principles is found below.

Current Initiatives in Toronto



Figure 11: Examples of current strategies and policies relating to green spaces in the City of Toronto. (City of Toronto, 2019; City of Toronto, 2017; City of Toronto, 2017; City of Toronto, 2017; City of Toronto, 2018)

Toronto Green Standard

The Toronto Green Standard promotes sustainable site and building design, by employing various tiers, performance measures and supportive guides (City of Toronto, 2019). The Standard aims to address Toronto's environmental priorities, including: improving air quality and reducing the urban heat island effect; protecting and enhancing ecological functions; integrating landscapes and habitats; and

decreasing bird collisions and mortalities from buildings (City of Toronto, 2019). The plan does not speak specifically about inherent connections residents have to nature and the subsequent role they have to improve the liveability and health of the City. The City could therefore promote the ethos of biophilic design in new developments to encourage the enhancement or growth of new urban green spaces.

Toronto Ravine Strategy

The Toronto Ravine Strategy promotes connections to this green space and outline strategies to ensure its successful future (City of Toronto, 2017). Completed in 2017, the Ravine Strategy has 5 major principles: protect, which focusses on restoring and maintaining ecological health; invest, which looks at ongoing investment and opportunities for system efficiency; connect, which improves physical opportunities to connect with the ravines; partner, which focusses on creating new and strengthening existing relationships with key stakeholders and decision makers; and celebrate, which aims to promote the uniqueness of this place and recognize the value of this system (City of Toronto, 2017). More urban green spaces could serve a role to connect to this system as well as provide residents with an overall greater connection to nature in areas that may not have easy access to a ravine area.

Parkland Strategy

Toronto's Parkland Strategy, still in preliminary stages, will guide long-term planning for new parks, expansions and improved access to existing parks throughout the city over the next 20 years (City of Toronto, 2017). The first phase (Phase 1) includes background studies, preliminary reports, and public consultation findings (City of Toronto, 2017). The Strategy is being developed with an understanding that parkland provision rates are negatively impacted by development as it places increased pressures on existing parkland (City of Toronto, 2017). This first phase confirmed the following findings: parkland supply is currently low; large parts of the city have a low supply of District and City parks (larger parks offering greater space, programming, attractions and amenities); there are pockets of very low parkland supply (under 4.0 square metres per person) throughout the city, but including the Downtown core;

and, without new parkland, estimated population growth will cause per capita supply to decline (City of Toronto, 2017). Phase 2 will focus on developing a planning, financial and policy framework for future parkland acquisition, reinvestment and development. While the Parkland Strategy aims to develop new avenues for parkland acquisition and development, it does not adequately explore the role that other urban green space could play in providing connections to new and existing parks.

Green Street Technical Guidelines

Toronto Green Streets Technical Guidelines were developed in coordination with multiple city, regional and provincial stakeholders, conservation authorities, working groups and advisory panels (City of Toronto, 2017). The Guidelines provide direction for the planning design, integration and maintenance of a range of green infrastructure options appropriate for varying Toronto street types and conditions (City of Toronto, 2017). Green infrastructure solutions can yield significant environmental benefits to improve air quality, achieve energy efficiency, enhance water quality and relieve urban pressures on ecological systems while ensuring that Toronto's streets remain efficient conduits for vital infrastructure and aesthetically pleasing, yet functional corridors for pedestrian, transportation and transit services (City of Toronto, 2017). The Guidelines were informed by other key documents, including the Complete Streets Guidelines, the Official Plan and the Green Standard (City of Toronto, 2017). Although the Green Street Guidelines recognizes the critical ecological services provided by green infrastructure, it could approach the promotion of green infrastructure from a connective, biophilic-focused and human-oriented perspective. Specifically, the guidelines could aim to promote connections to existing parkland and ravine systems.

Downtown Parks and Public Realm Plan

The Downtown Parks and Public Realm Plan is a 25-year vision, response and plan to address rapid growth in the core that is placing pressure on parks, streets and other open spaces (City of Toronto,

2018). The Plan suggests an update to Toronto's Alternative Parkland Dedication Rate as well as a framework for regional, district and local scale park (City of Toronto, 2018). In further detail, it discusses strategies for park districts, reconnecting the 'Core Circle', a series of public and open spaces bordering the defined downtown boundaries, and ameliorating the network of 'Great Streets' (City of Toronto, 2018). The Downtown Parks and Public Realm Plan successfully overviews strategies to enhance and protect the future of both parks and the streets and corridors that connect them; however, fine grain details about urban green space within and green connections to the core itself could be enhanced.

What is biophilia and a biophilic city?

Biophilia

The concept of biophilia stems from a growing recognition that happy, productive and meaningful lives are directly linked to daily contact with nature (Ulrich, 1993). More recently, architects, designers and planners have paid greater attention to biophilic design because, at its core, it acknowledges the power of nature (Beatley et al., 2013). Biophilic design emphasizes that good design at multiple scales (building, site, city and regional) must include nature and natural elements (Beatley, 2013). It is based on the concept of biophilia popularized by E.O. Wilson, a Harvard myrmecologist and sociobiologist (Wilson, 1984). Wilson recognized that humans have co-evolved with nature and, as a result, they carry in their brains the need to connect with and affiliate with nature in order to be happy and healthy (Wilson, 1984). The definition of biophilia according to Wilson involves the innately emotional affiliation of human beings to other living organisms (Wilson, 1984). Innate implies a hereditary link and is therefore part of human nature (Wilson, 1993; Wilson, 1984; Wilson, 2007)

In an increasingly urban planet, however, this connection to nature is at threat of being forgotten, lost and discarded (Ulrich, 1993). As such, more attention needs to be aimed at a connection to nature at the urban scale, through biophilic urbanism and our cities themselves (Ulrich, 1993; Beatley et al., 2013).

Biophilic cities stresses the individuals experience of nature in a city and its critical value to a high quality of human life (Birkeland, 2016). It also represents a creative mix of green urban design with a commitment to outdoor life and the protection and restoration of green infrastructure from the bioregional to neighbourhood level (Beatley, 2011).



Figure 12: Examples of biophilic design around the world. The photo on the left showcases the reflective weather and lighting conditions from the water sheets on the floor of the Smithsonian American Art Museum in Washington, D.C. The Thorncrowne Chapel constructed entirely out of wood takes advantage of an open-air structure. (Terrapin Bright Green, 2014).

Biophilic Cities Explained

In biophilic cities, residents are actively involved in experiencing nature (Ulrich, 1993; Beatley, 2013). As a result, a biophilic city will also foster sustainability and social and landscape resilience (Beatley et al., 2013). Additionally, they can help to strengthen commitments to place, enhance family and individual resilience and adaptive capacity, as well as build social capital and trust (Beatley et al., 2013). Beatley (2011), a large proponent of biophilic cities, also stresses the importance they serve in integrating larger, natural features with a smaller network. Specifically, biophilic cities should always be working to expand opportunities for its citizens to spend time outside and have nature at close proximity (Beatley, 2011). Other essential elements of biophilic neighbourhoods include: connected streets; abundant green areas to explore, play in and gather in; nature trails and connecting pathways; the ability to move by foot or bike; water; abundant nature throughout; edible trees and bushes; designated neighbourhood camping areas; one or more tree houses; and a neighbourhood nature centre (Beatley, 2011).



Figure 13: International examples of biophilic cities include Singapore. Singapore has abundant green areas and works to continuously add new sustainability projects. (Tan, 2014).

Toronto arguably has a lot of these features but struggles with ensuring that all residents, especially those in increasingly dense areas, have easy access to nature. Exposure to nature, even in an urban setting, provides many environmental and anthropological benefits, many of which will be discussed in a later section of this paper. It is therefore crucial for Toronto to protect, enhance and grow the network of urban green spaces to further the ideals of biophilic design and the biophilic city.

Biophilic design actions can fix many biophysical and social problems (Birkeland, 2016). While regulations, policies and politics can often be a barrier to biophilic design, it is important to challenge the anti-ecological biases in environmental governance, decision making, design and urban planning (Birkeland, 2016). In doing so, Toronto will be able to grow its urban green spaces, a critical asset in an increasingly urban city.

Contemporary Park Approaches

The Rise of the Urban Park

The evolution of parks arguably came as a response to what was deemed appalling urban conditions from the development of industrial cities in both Britain and America (Hough, 1985). Cities in the early 19th century were filled with unplanned growth, resulting in slums, epidemics and an overall lack of sanitation (Hough, 1985; Rohde et al, 1994). Life in the city had then been viewed as contrived, grotesque, lonely and disturbed (Fischer, 1976).

In the United States, Andrew Jackson Downing crusaded for public parks by underlining the health and educational value that they would have for residents of overcrowded American cities (Hough, 1985). These ideas were then carried forward by Frederick Law Olmsted and Calvert Vaux (Hough, 1985; Blossom, 1917). All are considered to be the fathers of American landscape architecture and are famous for setting out the plans for and/or designing several well-known parks, including Central Park in New York City and the Emerald Necklace in Boston (Hough, 1985). Their traditions and subsequent impacts on the field of landscape architecture and the overall history of the urban park is specific to colonial North America yet modelled on the British tradition.

Parks as Public Health

Olmsted believed that parks were critical to maintain a “temperate, good natured and healthy state of mind” (Olmsted, 1870). He believed that they played a critical role in public health and kept men from having less frequent breakdowns (Olmsted, 1870). As such, Olmsted and Victorian-era park advocates did somewhat understand biophilic principles. They knew access to green space had positive health impacts on urban city dwellers but did not quite have the resources to fully understand the science or rationale underlying their claims.



Figure 14: A historic photo of Central Park. Central Park was conceived from a notion that green space would play a pivotal and positive role in public health and behaviours. (Library of Congress, 1902).

In a historical overview of Central Park, it was cited that the large green space would cleanse the air of dangerous smoke and miasmas (Fisher, 2011). It was believed that a large park in New York would convince the overworked sons and daughters of puritans to leave their homes and offices, get exposed to sun and fresh air and indulge in health (Fisher, 2011). Additionally, Olmsted believed that the most regenerative properties of nature were captured if experienced contemplatively, quietly and through the eye (Fisher, 2011). In fact, it was a common and widespread belief at the time that providing the opportunity to contemplate nature would improve moral standards (Hough, 1985).

This belief of parks as healing places was firmly rooted in Victorian ethical standards—they were seen as places of retreat from the sinful influences of the city (Hough, 1985). They would be places for all people of different social divisions to engage in healthy and restorative Victorian nature Tourism (Fisher, 2011). They were first developed to benefit health, reduce disease, crime and social unrest as well as provide “green lungs” for the city (Rohde et al., 1994).

The belief that the city had a detrimental psychological effect on its inhabitants was also rooted in Wirthian Theory (Wirth, 1938). Wirthian Theory alleges that cities alter people’s psychological conditions, thereby isolating and “disordering” them (Rohde et al., 1994). The theory itself was developed to account for distressing urban phenomenon, such as deviance, social turmoil and

intergroup (Rohde et al., 1994). Contact with nature was seen as a way to find relief from these negative phenomena and as a possible way to enhance moral goodness (Nicholson-Lord, 1987).

Olmsted also discussed the parks ability to heal specific groups of people (Olmsted, 1870). Particularly, he thought they could help to save the lives of women and children too poor to be sent to the countryside (Olmsted, 1870). It was also believed that parks would draw workers and immigrants away from “dissipating” and “uncivilized” leisure practices, such as drinking in saloons, gambling and cock fighting (Fisher, 2011). In doing so, they would add culture to cities far from Europe and, in the long run, would make citizens more productive workers (Fisher, 2011). Overall, early parks were seen as dedicated places of beauty and health where nature could be appreciated (Hough, 1985).

“A great object of all that is done in a park, of all the art of a park, is to influence the mind of men through their imagination.” - Olmsted, 1870, pg 82

Early Parks Design

Early parks idealized scenery of natural surroundings by emulating their informality and irregularity, but were modified for practical purposes (Hough, 1985). Examples of such landscaping practices include: meadows surrounded by woods, meandering paths next to calm stretches of water and settings for decorous behaviour where different classes could interact (Hough, 1985). Downing believed that three key elements of landscape gardening should be present and indispensable to form the picturesque urban park (Blossom, 1917). These elements include a velvety, rolling lawn; large and massive trees; and a river or lake in which these trees could be reflected (Blossom, 1917).

Early landscape architecture was rooted in British and colonial traditions (Blossom, 1917). Specifically, Downing emphasized the heritage of picturesque landscapes when he wrote that,

“All travelers agree, that while the English people are far from being remarkable for their tastes in the arts generally, they are unrivalled in their taste for landscape gardening. So completely is this true that wherever on the continent one finds a garden, conspicuous for the taste of its design, one is certain to learn that it is laid out in the ‘English style,’ and usually kept by an English gardener” (Blossom, 1917, pg 264)

The park would be a place where excluded groups converge to re-establish their identity and where complete strangers have the ability to cross lines of race, class, ethnicity, generation and neighbourhood to create new forms of community (Fisher, 2011). Most of parks design was not picturesque, but pastoral and characterized by rolling stretches of grass framed by uneven groupings of trees (Fisher, 2011). As Olmsted (1870) noted, what is needed is “the beauty of fields, the meadow, the prairie, of green pastures, and the still waters. What we want to gain is tranquility and rest to the mind” (pg 81).

The transformation of wilderness to human-made landscapes has persisted as the basis for design determinants for parks to present day (Hough, 1985). These features aimed to emphasize the experience of a pastoral landscape, while separating them from the utilitarian, hard-surfaced urban centre (Hough, 1985).

The concept of the urban park was that a piece of natural landscape and countryside could be imported into the city (Hough, 1985). The urban park, however, had no comparable productive functions (Hough, 1985). Instead, its function was to provide leisure and relaxation opportunities as well as recreational and aesthetic benefits for an urban population (Hough, 1985). The urban park was built around nostalgia and the urge to escape the realities of the industrial city (Hough, 1985).

Eventually, a separation occurred, and parks became places either dedicated to landscape appreciation or for active participation (Hough, 1985). This transformation of the urban park from passive, naturalistic settings to recreation facilities for group activities has had a radical effect on its visual and

spatial character (Hough, 1985). This has influenced the understanding of parks as large, open spaces that must accommodate active uses and large groups and thus require a greater volume and dedicated parcel of land.



Figure 15: Active uses in present-day Toronto parks. Pictured on the left is tennis courts in Cedarvale Park and on the right is a basketball court in David Crombie Park. Recreation facilities impact the spatial characteristics of a park and may require a large parcel of land. (City of Toronto, 2019; Reddit, 2018).

Downing, Olmsted and Todd, the pioneers of landscape architecture and modern urban parks, in North America saw contact with nature as a source of pleasure and educative benefit to society and a means of improving cities.

The Evolution of Urban Parks in Canada

During the nineteenth century, the English park, like other English innovations, spread well beyond the Isles (Fisher, 2011). Landscape architects working in continental Europe began working in continental Europe, the United States and throughout the British Empire (Fisher, 2011).

By the 1850s, Canadian cities were less industrialized, more politically stable and small enough to permit easy access to the countryside compared with their American counterparts (Hough, 1985). Unlike Britain, there was no profound malaise or urgent urban crisis that precipitated urban parks in Canada

(Wright, 1983). In fact, the existing concept of the urban park was simply brought to a new country, yet applied under vastly different social conditions (Wright, 1983).

While the physical and social conditions of 19th century Canada differed from those elsewhere, the underlying motivations and philosophies underlying parks development were similar (Hough, 1985). The era saw the rise of romanticism, which came from a growing sense of isolation from industrialization and concern over the biology and study of the organic world (Worster, 1979). Romanticism draws parallels with biophilia in that it recognizes the inherent connection between humans and the natural world.



Figure 16: Mont Royal Park in Montreal, Quebec. A notable Canadian example of an early urban park, Park Mont Royal was designed by Frederick Law Olmsted. The park features English-style landscape architecture and is well-loved and well-used today. (MTL, 2019).

Facilitated by the passing of the Public Parks Act of 1883 by the Ontario Provincial Government, the public park became an accepted part of urban growth (Hough, 1985). The first parks began to pop up, with the first cited to be instated by Kingston City Council (Hough, 1985). These parks followed a very English style of landscape gardening and architecture (Hough, 1985). A notable Canadian example

includes Park Mont Royal, designed by Frederick Law Olmsted himself (Hough, 1985). Stanley Park, in Vancouver, provided token natural scenery for town building (Hough, 1985).

The Evolution of Urban Parks in Toronto

Toronto itself is named for an Iroquoian term that translates to “a place where trees grow in water” and alludes to its expansive parks and extensive system of ravines (TCLF, 2018). As such, Toronto is appropriately dubbed the “City within a Park” (TCLF, 2018). For historical context, many large parks were land dedications. High Park, for instance, was dedicated to the City of Toronto in 1873 by John Howard (Martin, 1983). Similar to other cities as well, parks were also viewed as centres for healing and respite. The Lakeside Home, for example, was run in connection with the Hospital for Sick Children and occupied a site on the west point of Toronto Island (Mulvany, 1884). It was situated in a picturesque setting with the hope of providing little sick children with invigorating and healthy-giving breezes of Lake Ontario (Mulvany, 1884).



Figure 17: Sick Kids Lakeside Home located on Toronto Island. (Mulvany, 1884).

More recently, parks have popped up in Toronto that showcase a more modern interpretation of landscape architecture. Winning several landscape architecture awards after its construction, Yorkville Park was designed by Shwartz/Smith/Meyer as well as Oleson Worland (Tate, 2001). While it faced criticism related to its cost, it was described as a perfect concept for an urban park and an example of placemaking (Tate, 2001). It was seen as the emergence of Toronto as a municipality committed to investment in its public realm (Tate, 2001).

Since the 1990s, Toronto has introduced many new urban parks to the city. In particular, partner organization Waterfront Toronto has opened 25 new or improved parks and public spaces, including iconic HtO Park, Canada's Sugar Beach, Rees WaveDeck and Underpass Park (Waterfront Toronto, 2019). Including these parks, according to the Cultural Landscape Foundation (2018), Toronto has over 80 examples of cultural landscapes. These examples span the entire city and include examples such as Cloud Gardens, Aga Khan Park, Don Valley Brickworks, Lawrence Park, Mount Pleasant Cemetery, Mel Lastman Square and many more (TCLF, 2018). Many of these examples are not traditional parklands and instead include significant community features, public spaces, design elements and destinations. These green features contribute to the success of these landscapes and their popularity amongst residents and visitors alike.



Figure 18: Canada's Sugar Beach and HtO Park, some of Toronto's parks added along the Waterfront in the past decade. (Waterfront Toronto, 2019; City of Toronto, 2019)

There are many proposed parks that are also promised for Toronto. Proposed parks, including the Green Line, the Meadoway and the new College Park, signify that new parks can be added to areas outside of the previously-industrialized waterfront (Urban Toronto, 2019). Even with these new and proposed parks and identified cultural landscapes, however, there is still a large disparity in access to and square metres of parkland per person.

New Trends to Consider

With a larger trend towards active recreation, High Park was required to accommodate group sports facilities, floral and exotic plant displays, bathing pools, ice rinks and extensive turfing areas by 1955 (Martin, 1983). Other trends that resulted in changes to usage of and views towards parks included: relaxation of liquor laws (and the subsequent breakdown of rigid Victorian codes), civic spaces being seen as places to enjoy and physical fitness previously contained to parks being done throughout the entirety of the city (Hough, 1985). In addition, post war immigration brought thousands of people from different ethnic origins to Canada's large cities and, with them, came differing traditions and values about how city life and parks themselves can be enjoyed (Hough, 1985).

There exists an inherent dichotomy between accommodating different users and group activities as well as appreciation for landscaping, horticulture and nature. The park is connected to the larger city ecologically; however, this may not be actualized and celebrated inside parks themselves (Fisher, 2011). In addition, one could argue that this connection between the urban fabric and nature is also not being celebrated elsewhere in the city.



Figure 19: Toronto parks accommodating different, diverse user groups. The photo on the left shows the tandoori oven in Thorncliffe Park and the photo on the right showcases an overcrowded Trinity Bellwoods park with growing demand for space. (Public Bake Ovens, 2019; CBC News, 2015).

With a colonial park influence and traditionally large footprint, the traditional parks are not serving community needs today. There are new ethnic and cultural groups in urban areas, greater competing pressures for uses and for spaces. As such, new urban parks should be advocated for; however, supplementary strategies related to urban green space are needed to compliment them. Other urban green space can help complement existing, traditional parkland and built a natural network of new spaces in increasingly dense neighbourhoods, cities and regions.

The Benefits of Other Urban Green Spaces: A Biophilic Perspective

Through understanding the various biophilic benefits achieved by interacting with nature, it can strengthen arguments for the acquisition, maintenance and proliferation of new and existing other urban green spaces. Many articles focus on the biophilic benefits of parkland. Key studies include a paper published by Sturm and Cohen in 2014, which found that mental health declined in relation to residential distance from parks. Vachaspati, Lloyd, Delia, Tulloch and Yedidia (2013) found significant associations between children's weight and the presence of a large park within an 800 metre radius. Potwarka, Kacynski and Flack (2008) used a city in Ontario to show that children with a park playground

located within one kilometre of their home were almost five times more likely to be classified as being of a healthy weight than those without nearby playgrounds.

While it is important to understand the mental and physical health benefits of parkland, it is the focus on this paper to develop an in-depth understanding of the biophilic benefits of other urban green spaces. As discussed, cities like Toronto, which are facing challenges related to urban growth, are increasingly unable to deliver traditional parkland due to development pressures and increasing land values. It is therefore critical to build evidence around the fact that smaller, other urban green spaces, which are easier to procure in an urban area, deliver human health benefits. This is supported by a number of academic articles, which argue that human residents do not need to be in the midst of a park to reap benefits from green space (Han 2009; Kaplan 2001; Kaplan and Peterson 1993; Larsen et al. 1998; Leather et al. 1998; Moore 1981; Tennessen and Cimprich 1995; Ulrich 1984).

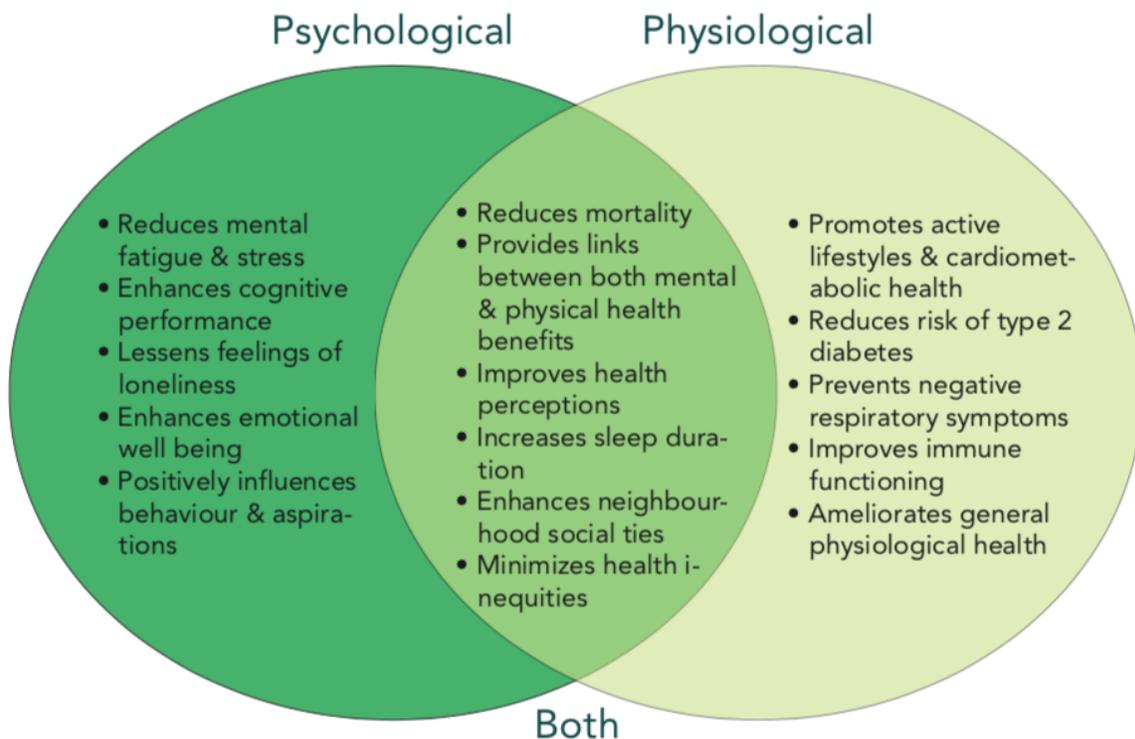


Figure 20: Venn diagram summarizing biophilic or health benefits associated with other urban green space and exposure to nature.

Below is a literature review discussing both the mental and physical health benefits of other urban green spaces and exposure to nature to illustrate this point.

Psychological Health Benefits

Landscapes have the potential to foster healthy behaviour and emotional well-being if they offer the possibility of meeting and engaging with other people in public open spaces (Abraham et al., 2010). This ethos ties back to the concept of biophilic cities itself in that humans and city dwellers have an innate connection to nature that needs to be fostered. In doing so, this can lower levels of mental fatigue and stress, increase cognitive performance, reduce feelings of loneliness, ameliorate emotional well-being, and encourage generous behaviours.

Mental Fatigue and Stress

A few articles focussed on the positive association between access to green space and the alleviation of mental fatigue and stress. Hartig and Mang (1991), for example, focus on mental fatigue in their study, concluding that natural environment experiences result in restorative effects. Specifically, they note that natural environments can facilitate recovery from mental fatigue, which can be measured by psychophysiological tests (Hartig and Mang, 1991).

Next, Kuo and Sullivan (2001) found that residents living in relatively barren buildings (69 participants) reported more aggression, violence and mental fatigue than did their counterparts living in greener buildings (75 of the 145 participants) (Kuo and Sullivan, 2001). It can therefore be concluded from this study that contact with nature appears to mitigate mental fatigue and may consequently reduce feelings of aggression and violence (Kuo and Sullivan, 2001).

In a separate exploratory study utilizing 25 participants, salivary cortisol was used to determine if it could act as a biomarker for variation in stress levels, which may be associated with varying levels of

exposure to green spaces (Ward Thompson et al., 2012). Salivary cortisol levels were compared to self-reported indicators of stress (Ward Thompson et al., 2012). This study shows how ecologically valid methodologies, such as salivary cortisol measurements, which offer an objective indicator of stress, can be developed to confirm and extend findings in deprived city areas to illuminate why provision of green space close to home might enhance health (Ward Thompson et al., 2012). The study concludes by arguing for the need for adequate levels of nearby green space as a way to combat indicators of stress (Ward Thomson et al., 2012) Specifically, they call upon landscape architects and urban planners who, when designing new residential developments, renovating existing infrastructure or consulting on land use priorities, should prioritize green space (Ward Thomson et al., 2012).

Diurnal patterns of cortisol creation were also used in a study linking them to lower levels of perceived stress and improved physiological stress in deprived urban neighbourhoods in Scotland that had more green space (Roe et al., 2013). Confirming earlier findings from a similar study, Roe et al. (2013) showed that there is a significant relationship between higher green space levels and a steeper (healthier) diurnal cortisol decline, linked with lower perceived stress levels. It can therefore be concluded that living in areas with a higher percentage of green space is associated with lower stress (Roe et al., 2013).

In a 2004 review conducted by the Health Council of the Netherlands, the restorative influence of nature was judged to be quite strong (Ruimtelijk, 2004). This is supported by several studies, including a 2010 review by de Vries, a 2015 review by Kuo and a 2014 assessment of 59 reviews by Hartig et al. Hartig et al. (2014) also focusses in on a growing concern that health benefits of nature have been lost in urbanized societies and that the relationship pathways between the two can include air quality, physical activity, social cohesion and stress reduction.

Cognitive Performance

Directed attention plays an important role in how humans process information (Kaplan, 1995). Exposure to and interactions with nature provide restorative effects on cognitive functions (Berman et al., 2012).

This is explained further in Attention Restoration Theory, which provides an analysis of the kinds of experiences that lead to recovery from mental fatigue (Kaplan, 1995). Increased exposure to green space is therefore rich in the characteristics necessary for restorative experiences and allow one's attention capabilities a chance to replenish (Berman et al., 2012; Kaplan, 1995). It is therefore noted that exposure to nature enhances cognitive performance (Berman et al., 2012; Kaplan, 1995).

Loneliness

In Maas, van Dillen, Verheij and Groenewegen (2009), green space in a living environment resulted in reporting of less loneliness, which can consequently have negative health impacts. This relation was strongest for children and people with a lower socioeconomic status (Maas et al., 2009).

Emotional Well-Being

A couple of studies by Flouri et al. (2014) and Beyer et al. (2014) link neighbourhood green space and emotional well-being. Flouri, Midouhas and Joshi concluded that poor children in urban neighbourhoods with more greenery had fewer emotional problems than their counterparts in less green neighbourhoods (Flouri et al., 2014). Neighbourhood green space may therefore promote emotional well-being in poor urban children in early childhood (Flouri et al., 2014).

In the United States, Beyer, Kaltenbach, Szabo, Bogar, Nieto and Malecki (2014) found that, after controlling for a wide range of factors, higher levels of neighborhood green space were associated with significantly lower levels of symptoms of depression, anxiety, stress and other indicators of emotional well-being (Beyer et al., 2014). The authors conclude by suggesting that neighbourhood "greening" could be a potential population mental health improvement strategy in the United States (Beyer et al., 2014).

Taylor et al. (2015) examined the relationship between prescribing antidepressant and urban greenery, specifically street trees. Their findings suggest that street trees are linked to a decrease in prescriptions

and may therefore be a positive urban asset to decrease the risk of negative mental health outcomes (Taylor et al., 2015).

Barton and Pretty (2010) show that exposures to facilitated green exercise improves both self-esteem and mood irrespective of duration, intensity, location, gender, age and health status. This finding suggests that there is an immediate effect obtained just simply through engaging in green exercise, rather than simply receiving benefits from the exercise itself (Barton and Pretty, 2010). The authors concluded by noting that participants, especially those with mental illnesses, should be encouraged to participate in green exercise in both rural and urban environments to improve these functions of mental health (Barton and Pretty, 2010).

Using immersion in a brief nature experience, participants in one study reported decreases in rumination and neural activity in the sub genial prefrontal cortex, which is linked to an increased risk in depression and other mental illnesses (Bratman et al., 2015). Rumination is a prolonged and often maladaptive attentional focus on the consequences and causes of emotions, most often negative (Bratman et al., 2015). Using 38 participants, this finding suggests a pathway by which nature experience may improve mental well-being and suggests that accessible natural areas within urban contexts may be a critical resource for mental health in a rapidly urbanizing world (Bratman et al., 2015).

Behaviour and Aspirations

Studies have also focussed on the effects on nature on valuing intrinsic and extrinsic aspirations (Weinstein et al., 2009). Weinstein, Przybylski and Ryan (2009) summarize four studies that conclude that participants immersed in natural environments report higher valuing of intrinsic aspirations and lower valuing of extrinsic aspirations, whereas those immersed in non-natural environments reported increased valuing of extrinsic aspirations and no change of intrinsic aspirations. In more simplistic terms, this shows that people immersed in nature exhibit more generous behaviour (Weinstein et al., 2009).

Repke et al. (2018) tested the link between exposure to nature and impulsivity. Specifically, they determined that nature exposure was predictive of health outcomes and impulsive decision-making that may mediate their effect (Repke et al., 2018). They suggest that health benefits of nature exposure are related to a reduction in impulsivity (Repke et al., 2018).

Conclusion – The need for other urban green space to provide mental health benefits to residents

In Maas et al. (2006), the authors conclude by arguing that green space provision should not be a luxury and limited and therefore the development of green space should be allocated a more central position in spatial planning policy. This conclusion aligns with the thesis of this paper, which is looking at how other urban green spaces (i.e. everything that is not considered a traditional ‘park’) can be given more weight by decision makers, planning practitioners and city-builders. As discussed, Ward Thompson et al. (2012) also argue for prioritization of green space for positive public health outcomes (Ward Thomson et al., 2012). It is therefore critical to understand the link between positive psychological health outcomes and other urban green spaces in order to influence decision makers to advocate for its widespread acceptance and adoption.

Physiological Health Benefits

According to Abraham, Sommerhalder and Abel (2010), landscapes and neighbourhoods have the capacity to directly influence human wellbeing through the easy access to natural landscapes and the availability of nearby (green) public open spaces (Abraham et al., 2010). Through design, neighbourhoods need to provide a general functionality to promote walkability and, in doing so, will promote healthy physical behavior through easy access (Abraham et al., 2010). Many studies below focus on the physiological health benefits linked to other urban green spaces. Specifically, these studies show that other urban green spaces promote active lifestyles and cardiometabolic health, reduce risks of type 2 diabetes, lower negative respiratory symptoms, and improve immune functioning and general health outcomes.

Active Lifestyles and Cardiometabolic Health

Neighbourhood green space may help encourage physical activity and decrease sedentary behaviour for children (Sanders et al., 2015). Specifically, boys living in areas with 10% more neighbourhood green space had a 7% greater likelihood of choosing physically active pastimes, 8% lower odds of not enjoying physical activity, a 23-minute reduction in weekend television viewing and a 7% and 9% greater likelihood of meeting physical activity guidelines on weekdays and weekends (Sanders et al., 2015). The authors also note that a greater emphasis needs to be put on exploring what types of green space promote active lifestyles in all children (Sanders et al., 2015).

A study conducted by Paquet, Orschulok, Coffee, Howard, Hugo and Taylor (2013) suggests that the characteristics of locally accessible public open space are related to cardiometabolic health and, to some degree, physical activity. This relates to both physical health benefits to residents as well as quality of other urban green space features, discussed further in a subsequent section.

Diabetes

Another study from Astell-Burt, Feng and Kolt (2014) examines the relationship between neighbourhood green space and type 2 diabetes. Risk of type 2 diabetes was significantly lower in greener neighbourhoods, controlling for demographic and cultural factors (Astell-Burt et al., 2014). In neighbourhoods with 41-60% green space land use, this significance was more pronounced (Astell-Burt et al., 2014).

Respiratory Symptoms

A study by Nowak et al. (2013) examines particulate air pollution (PM_{2.5}). Findings suggest that a PM_{2.5} reduction from tree canopy in the ten cities in the U.S. saves on average one life per year per city. They estimate that urban trees remove enough air pollution in the United States to account for 850 fewer deaths and 670,000 fewer incidence of acute respiratory symptoms (Nowak et al., 2013). Nowak later

ran computer simulations with the same data to reveal that trees and forests removed 17.4 million tonnes of air pollution in 2010, with human health effects valued from 1.5 – 13 billion USD (Nowak et al., 2014). This led Nowak et al. (2013) to conclude that trees remove substantial amounts of air pollution and can produce substantial health benefits and monetary values across the United States, with most of the health values derived from urban tree canopy.

Immune Functioning and General Physiological Health Outcomes (Including some of the above)

Li et al. (2011) found that Didehydroepiandrosterone (DHEA) increases after a forest walk, but not an urban walk. DHEA has cardio protective, anti-obesity and anti-diabetic properties (Bjornerem et al., 2004). Additionally, the same study found that time in nature increases adiponectin, a protection against atherosclerosis and the immune system's anti-cancer cells, which can be linked to playing a protective role in cancer, viral infections, pregnancy and other health outcomes (Li et al., 2011; Orange and Ballas, 2006). A study by Kuo also provides a central pathway for analyzing nature's impact on health, specifically enhanced immune functioning (Kuo, 2015).

Both Psychological and Physiological Health Benefits

A number of studies examined both mental and physiological health benefits of green spaces. In some instances, studies looked to examine one of those factors yet found their findings related more to the other. This is especially apparent in Ord et al. (2013) discussed further below. Through examining relevant literature pieces, it is found that authors link exposure to other urban green space with positive health outcomes, such as a long-term reduction in mortality, direct physiological and psychological health improvements, perceived health, ameliorated sleep functions, increased neighbourhood social ties and decreases in health inequities.

Reduction in Mortality

Villeneuve et al. (2012) suggests that green space in urban environments is important to human health for psychological and physiological reasons and associated with long-term reduction in mortality (Villeneuve et al., 2012). The authors conclude that further research is needed to confirm these findings to better understand the relationships between access to green space and behavioral risk factors for mortality (Villeneuve et al., 2012). Similar to Astell-Burt et al. (2013), findings from this study may be linked to residual localized, sociodemographic and lifestyle factors.

Maas et al. (2009) examined whether physician-assessed morbidity is related to green space in people's living environment. It was found that the relation was the strongest for those living with anxiety disorder and depression as well as for children and people with a lower socioeconomic status (Maas et al., 2009). It is therefore important for green space to be located close to people's homes to reduce physician-assessed morbidity (Maas et al., 2009).

Relationship between both Physiological and Psychological Health

For Ord, Mitchel and Pearce (2013), associations between green space availability and both total physical activity and activity within green space were explored (Ord et al., 2013). The authors found that the availability of green space in a neighbourhood was not associated with total physical activity; however, they note that the direct effect of perceiving a natural environment on physiological and psychological health may offer an alternative explanation (Ord et al., 2013).

Astell-Burt, Feng and Kolt (2013) analyze whether the psychological benefits of physical activity are amplified if participation occurs within greener environments for middle-to-older aged adults. They find that, in comparison to residents of the least green areas, those in the greenest neighbourhoods were at a lower risk of psychological distress and were less sedentary (Astell-Burt et al., 2013). Mental health, however, did not appear to better with more green space among the least active, but it did result in protective association for the more physically active (Astell-Burt et al., 2013). Greener environments

therefore promote physical activity for adults and are also linked to the mental health benefits contingent upon active lifestyles (Astell Burt et al., 2013).

In a study conducted in 2015, Kuo examines ten studies tying greener residential areas with lower rates of obesity. Although there may be a link between obesity and a lack of physical activity, the findings note that there is a greater likelihood that other contributors explain the nature-health link (Kuo, 2015). Specifically, nature contact is linked with reduced stress, impulse control and adiponectin levels, a protein involved in regulating glucose levels and fatty acid breakdown (Kuo, 2015). Kuo also notes deep relaxation, attention restoration, sleep and social ties seem to be supportive of nature-health pathways (2015).

In a study related to one discussed above, walks in forested areas, but not urban areas, were shown to reduce the levels of health risk factors, specifically inflammatory cytokines and elevated blood glucose (Mao et al., 2012; Ohtsuka et al., 1999). Inflammatory cytokines are linked to diabetes, cardiovascular disease and depression whereas chronically elevated blood glucose can be factors relating to blindness, nerve damage and kidney failure (Mao et al., 2012; Ohtsuka et al., 1999). There are very strong and positive links between the effects of a walk in a forest on blood glucose (Ohtsuka et al., 1998).

The practice of Japanese forest bathing exemplifies the remarkable ways in which contact with nature can make us happier and healthier as well as contribute to meaningful lives (Wang et al. 2016). Findings show that a walk through a forest or greenspace has discernible mental health benefits, including reducing stress hormone levels and boosting immune systems (Wang et al., 2016). The authors discuss the critical role that nature and natural design cues play in the health and well-being of urban residents and that, although provision of green space cannot replace conventional public health care, it must be viewed as a critical support for health in the Anthropocene (Wang et al., 2016)

Perceived Health

Interestingly, green space has an impact on perceived general health. Maas, Verheij, Groenewegen, De Vries and Spreeuwenberg (2006) investigated the strength of the relation between the amount of green space in people's living environment and their perceived general health (Maas et al., 2006). Their research exemplifies that the percentage of green space in people's living environment has a positive association with the perceived general health of residents (Maas et al., 2006).

De Vries, Verheij and Spreeuwenberg (2003) found significant and sizable relationships between green elements in living environments and higher levels of self-reported physical and mental health (de Vries et al., 2003). The authors conclude the article by noting that "in a greener environment people report fewer symptoms and have better perceived general health. Also, people's mental health appears to be better" (de Vries et al., pg 1726, 2003). They also note that 10% more greenspace in the living environment leads to a decrease in the number of symptoms that is comparable with a decrease in age by 5 years (de Vries et al., 2003).

Sleep Duration

In another study using the same dataset from New South Wales, Australia, Astell-Burt, Feng and Kolt (2013) explore whether exposure to parks and other green spaces promote favourable psychological and physiological outcomes. They found that those in greener neighbourhoods were at lower risk of a short sleep (less than six hours a night) (Astell-Burt et al., 2013). They note that short sleep duration is a correlate of obesity, chronic disease and mortality and that further research in the role of green spaces in promoting healthier sleep durations and patterns is needed (Astell-Burt et al., 2013). The authors conclude by stating that green space planning policies may have wider public health benefits than previously recognized, which directly relates to the thesis and purpose of this paper (Astell-Burt et al., 2013).

Neighbourhood Social Ties

Neighbourhood social ties (have been found to be higher among individuals living next to greener common spaces (Kuo et al., 1998). Neighbourhood social ties are characterized by more social activities and visitors, knowing more neighbours, more concern with helping and supporting one another and stronger feelings of belonging (Kuo et al., 1998; Kim et al., 2013; Wilson et al., 2004; and Kweon et al., 1998). Utilizing statistical tests, greater use of green spaces has been linked to neighbourhood social ties (Kuo et al., 1998). Specifically, neighbourhood social ties have been linked to a lower risk of stroke, chronic health impairments and emotional distress (Kim et al., 2013 and Wilson et al., 2004).

These findings on the benefits of green spaces are critical for vulnerable populations, such as the elderly (Kweon et al., 1998). Kweon et al. (1998) showed through their study that green outdoor common spaces predicted both neighbourhood social ties as well as a strong sense of community.

Health Inequity

Mitchell and Popham (2008) tested whether income-related inequality in health would be less pronounced in populations with greater exposure to green space, since access to such areas can modify pathways through which low socioeconomic positions can lead to disease. They concluded that populations that are exposed to the greenest environments tend to have the lowest levels of health inequity related to income deprivation (Mitchell et al., 2008). It can therefore be concluded that green physical environments that promote good health are important in reducing socioeconomic health inequities (Mitchell et al., 2008).

Essential Characteristics of Other Urban Green Spaces

Many of the articles explored above also noted that, in order to achieve these biophilic benefits, certain characteristics of other urban green spaces have to be present. Neilson and Hansen (2007), who looked at access and use of green areas and the impact of experienced stress and obesity, found that access to a garden or the presence of green areas within short distances from a dwelling are associated with less

stress and a lower likelihood of obesity (Neilson et al., 2007). This stresses the importance and presence of specific green features, mainly access and proximity, to encourage positive health outcomes (Neilson et al., 2007). It was also noted in Barton and Pretty (2010) that all green environments improved both the self-esteem and mood of the six subgroups analyze, but the presence of water generated greater improvements (Barton and Pretty, 2010).

A study conducted by Paquet, Orschulok, Coffee, Howard, Hugo and Taylor (2013) investigated clinical risk markers for cardiometabolic diseases and its relationship to public open space characteristics (Paquet et al., 2013). Specifically, they examined the associations between accessibility, greenness, size and type (passive vs active) of public open spaces (POS) and the relationships to physical activity and psychological well-being (Paquet et al., 2013). Findings suggest that the characteristics of locally accessible public open space are related to cardiometabolic health and, to some degree, physical activity (Paquet et al., 2013). The authors therefore conclude that improving the quality of locally available public open spaces might be a more effective strategy to support cardiometabolic health than efforts to increase accessibility (Paquet et al., 2013).

While characteristics of other urban green space is not the core focus of this paper, it is worth noting that it does have an impact on the achievement of positive psychological and physiological health outcomes. Future research could aim to focus directly on characteristics needed in other urban green space to deliver positive health outcomes. This could also be used to inform future policies and design guidelines.

Biophilic or Human-Centric Benefits Associated with Green Space and Nature		
Author	Date	Description
Psychological Health Benefits		
Abraham, Sommerhalder and Abel	2010	Green neighbourhood landscapes have the potential to foster healthy behavior and emotional well-being through engagement in open spaces.
Mental Fatigue and Stress		
Hartig and Mang	1991	Natural environment experiences can facilitate restorative effects and recovery from mental fatigue.

Kuo and Sullivan	2001	Contact with nature can mitigate mental fatigue and feelings of aggression and violence.
Ward Thompson, Roe, Aspinall, Mitchell, Clow, and Miller	2012	A percentage of green space in a living environment is a significant predictor of the circadian cortisol cycle, an indicator of stress.
Roe, Thompson, Aspinall, Brewer, Duff, Miller, and Clow	2013	Areas with a higher percentage of green space are associated with a decline in cortisol levels and therefore lower stress.
Ruimteljik	2004	Restorative influence of nature is judged to be quite strong.
Cognitive Performance		
Kaplan	1995	Increased exposure to green spaces is rich in characteristics needed for restorative experiences and attention restoration.
Berman, Jonides and Kaplan	2012	Exposure to nature enhances cognitive performance.
Loneliness		
Maas, van Dillen, Verheij and Groenewegen	2009	Green space in a living environment resulted in reporting of less loneliness, which can consequently have negative health impacts (anxiety disorder, depression etc.)
Emotional Well-Being		
Flouri, Midouhas and Joshi	2014	Neighbourhood green space may promote emotional well-being in poor urban children in early childhood.
Beyer, Kaltenbach, Szabo, Bogar, Nieto and Malecki	2014	Higher levels of neighbourhood green space were associated with significantly lower levels of symptoms of depression, anxiety and stress.
Taylor, M.S., Wheeler, B.W., White, M.P., Economou, T., and Osborne, N.	2015	Street trees are linked to a decrease in anti-depressant prescriptions and may therefore be a positive urban asset to decrease the risk of negative mental health outcomes.
Barton and Pretty	2010	Exposure to green exercise improves both self-esteem and mood.
Bratman, Hamilton, Hahn, Daily & Gross	2015	Immersion in nature results in decreases in risks of depression and other mental illness.
Behaviour and Aspirations		
Weinstein, Przybylski and Ryan	2009	Immersion in natural environments results in higher values of intrinsic aspirations and exhibition of more generous behavior.
Repke, Berry, Conway, Metcalf, Henson and Phelan	2018	Nature exposure may mediate impulsive decision-making
Physiological Health Benefits		
Abraham, Sommerhalder and Abel	2010	Green neighbourhood design promotes walkability and healthy physical behavior.
Active Lifestyles and Cardiometabolic Health		
Sanders, Feng, Fahey, Lonsdale and Astell-Burt	2015	Green spaces are more likely to promote active lifestyles among boys than girls.
Paquet, Orschulok, Coffee, Howard, Hugo and Taylor	2013	Quality of locally accessible public open space supports good cardiometabolic health and physical activity
Diabetes		
Astell-Burt, Feng and Kolt	2014	Risk of type 2 diabetes was significantly lower in greener neighbourhoods.
Respiratory Symptoms		
Nowak, Hirabayashi, Bodine, Hoehn	2013	Urban tree canopy reduces incidences of acute respiratory symptoms and death.
Nowak, Hirabayashi, Bodine, Hoehn	2014	Urban tree canopy reduces air pollution and can produce substantial health benefits and related monetary values in the United States.
Immune Functioning		
Li, Otsuka, Kobayashi, Wakayama, Inagaki, Katsumata, Hirata, Li, Hirata, Shimizu, Suzuki, Kawada, and Kagawa	2011	Time in nature increases adiponectin rates, which protects against the immune system's anti-cancer cells and therefore linked to playing a protective role in cancer, viral infections, pregnancy and other health outcomes.
Kuo	2015	Enhanced immune functioning may be a central pathway to explore nature's impact on health.
Both Psychological and Physiological benefits		

Reduction in Mortality		
Villeneuve, Jerrett, Burnett, Chen, Wheeler and Goldberg	2012	Green space is associated with long-term reduction in mortality, related to both psychological and physiological factors of human health.
Maas, Verheij, Groenewegen, de Vries, Spreeuwenberg, Schellevis and Groenewegen	2009	Green space located close to one's home reduces physician-assessed morbidity
Relationship between Psychological and Physiological health		
Ord, Mitchel and Pearce	2013	Direct effect of perceiving a natural environment on physiological and psychological health.
Astell-Burt, Feng and Kolt	2013	Greener environments promote physical activity and the mental health benefits related to active lifestyles for adults.
Kuo	2015	Nature-health pathway may be explained by stress, impulse control, adiponectin levels, deep relaxation, attention restoration, sleep and social ties rather than simply obesity and a lack of physical activity.
Mao, Cao, Lan, He, Chen, Wang, Hu, Lv, Wang, and Yan	2012	Walks in forested areas reduce health risk factor levels, specifically those linked to diabetes, cardiovascular disease, depression, blindness, nerve damage and kidney failure.
Ohtsuka, Yabunaka, and Takayama	1998	There are very strong, positive links between forest walks and blood glucose levels.
Wang, Tsunetsugu and Africa	2016	A walk-through greenspace has mental health benefits, including reducing stress hormone levels and boosting immune systems.
Perceived Health		
Maas, Verheij, Groenewegen, De Vries and Spreeuwenberg	2006	Green space has a positive association with the perceived general health of residents.
De Vries, Verheig, Spreeuwenberg	2003	Significant relationship between green elements in a living environment and higher levels of self-reported physical and mental health.
Sleep Duration		
Astell-Burt, Feng and Kolt	2013	Those in greener neighbourhoods were at lower risk of a short sleep (less than six hours a night), which can be linked to other favourable psychological and physiological outcomes.
Neighbourhood Social Ties		
Kuo, Sullivan, Levine Coley, and Brunson	1998	Greener common spaces are linked to greater neighbourhood social ties.
Kim, Park and Peterson	2013	Neighborhood social ties are linked with a lower risk of stroke.
Wilson, Elliot, Law, Eyles, Jerret and Keller-Olaman	2004	Neighborhood social ties are linked to a lower risk of chronic health impairments and emotional distress.
Kweon, Sullivan and Wiley	1998	Green outdoor common spaces predicted both neighbourhood social ties as well as a strong sense of community.
Health Inequity		
Mitchell and Popham	2008	Populations in the greenest environments tend to have the lowest levels of health inequity related to income deprivation.

Figure 21: Summary table showcasing biophilic benefits explored in a synthetic literature review associated with green space.

Discussion and Next Steps

Thus far, this paper has discussed both the history of urban parks as well as the biophilic benefits associated with other urban green space and exposure to nature. The first section, contemporary parks history, has highlighted that the park came from colonial ties, features pastoral landscapes not necessarily linked to local ecological functions, and has evolved to include many different recreational

and passive uses thus necessitating a large overall footprint. As overviewed in the introduction, these traditional parks are no by themselves sufficient in an increasingly intensifying city. Though it is understood they provide health and well-being benefits to citizens, new solutions must be developed and promoted to continue to provide green space to a rapidly growing city.

Cue in other urban green space. As demonstrated in the literature review section, other urban green spaces deliver biophilic, or human centric, benefits. This section also highlighted that, regardless of size or duration, simply being exposed to or immersed in nature temporarily can result in benefits to humans. These findings can transform into a shift in thinking, design and policy. Specifically, rather than just an emphasis on urban parks, a network of complimentary other urban green spaces must be promoted to increase access to nature and facilitate human benefits across all of the city's urban fabric.

Design Intervention Examples



Figure 22: Possible design interventions to increase the number and network of other urban green spaces in the City of Toronto. (City of Toronto, 2019; City of Toronto, 2019; BRENS and O2 Planning + Design, 2018; Katsarov, 2017; Green Roofs, 2019; Google Maps, 2019)

Implications for People

More other urban green space is needed for people. As demonstrated in the previous section, exposure to other urban green spaces provides physiological and psychological benefits to constituents.

Particularly, urban green spaces can reduce mental fatigue, stress, loneliness, risk of diabetes, and mortality rates; improve cognitive performance, emotional well-being, behaviour, aspirations, cardiometabolic health, respiratory symptoms, immune functioning, perceived health, and sleep duration; encourage active lifestyles and neighbourhood social ties; and balance health inequities. In the absence of other urban green space, it can be argued that the reverse of these effects is felt. In other words, other urban green spaces can prevent negative health outcomes. Investment in the widespread adoption and proliferation of urban green spaces can therefore be seen as a type of preventative public health investment.

Next, through the promotion of other urban green spaces and achieving these biophilic benefits, a city can foster a stronger sense of community among residents. As noted by Beatley (2011), a biophilic city can foster social resilience. As proven in literary publications, other urban green spaces are directly tied to the psychological well-being of users, visitors and residents. By growing the prevalence of them, it will enhance the well-being of community members, strengthen community ties and grow social capital. In many ways, growing the number of other urban green spaces will act as a positive feedback loop, continuously improving health benefits and anthropological and community resiliency.

Implications for Growth and Green Space Policies

The understanding that other urban green spaces, not just traditional parkland, deliver psychological and physiological benefits to residents has implications on existing and potential policies. As mentioned, the City of Toronto has a number of policies aimed at enhancing parkland, ravines and green development standards. By considering the biophilic benefits achieved from other urban green space, it provides an impetus to ameliorate these policy frameworks. Additionally, in many ways, other urban

green space not only can act to provide connections to ravines, parks and developments themselves, but also to the various policies that govern them.

In Toronto Green Standard, more emphasis can be placed on a holistic approach to other urban green space on site. This would place a larger emphasis on delivering biophilic benefits to the tenants of the new building while tying together the existing development requirements mandated by the Green Standard.

Toronto's Ravine Strategy aims to protect and enhance Toronto's unique ravine system. But what about the important connections to them and everything else in between? By including stipulations on the importance of other urban green space and better natural connections throughout the city, the City of Toronto can truly live up to its name as a "city within a park."

The Parkland Strategy aims to acknowledge the need for new parkland acquisition strategies in lieu of rapid growth and development pressures. Similar to the critique of the Ravine Strategy above, there needs to be a greater emphasis placed on the connective tissue and network of potential green spaces between parks at all scales. This could support proposed parkland acquisition strategies that may be proposed in subsequent phases of the Parkland Strategy.

The Toronto Green Streets Technical Guidelines approach green infrastructure from a methodological and scientific perspective. While they do acknowledge the positive ecosystem, services associated with greener streets, the connection to human-centric benefits, biophilic design and the overall innate connection to nature residents have could be further emphasized. This focus would further emphasize the importance of green infrastructure in rapidly urbanizing areas.

Lastly, the Downtown Parks and Public Realm Plan can play a role in specifically defining and mentioning other urban green spaces and the important role they play to bring in nature and its associated benefits.

The Downtown Parks and Public Realm Plan acknowledges the need to grow the amount of green space in the downtown core where demand for it is already high and projected to trend upwards.

Acknowledging the role that other urban green space plays in delivering benefits to residents would strengthen this plan and allow for more other urban green space to connect to the larger-scale ideas proposed in the plan, such as the Rail Deck Park and the redesign of University Avenue.

While each of these policies can individually address and tackle the absence of other urban green space in the city, an overarching policy can also aim to connect them all together. Other urban green space therefore not only plays a role in the physical realm of the city to connect existing parkland and ravine systems, but also within the policy realm. By perhaps adding an overarching policy layer of other urban green spaces to which these existing four policies fall under, it will facilitate deeper institutional, political and policy connections and allow for the prioritization of all types of green spaces and infrastructure in the city.

Implications for Design and Landscapes

The understanding of the importance of other urban green space, and not just traditional parkland, has implications on the widespread understanding of design and landscapes. For one, the idea that other urban green spaces are worthy as infrastructure investments, shifts commonly held perspectives on urban landscapes. Specifically, urban parcels of land are traditionally identified as being dedicated towards green (parkland, parkettes, recreational facilities) or grey (buildings, roads, civic squares). But what if these two categories were more nuanced and integrated, rather than kept separate and in conflict with one another? Other urban green space could achieve this objective by facilitating the success of natural landscapes outside of parks.

Green roofs, for example, could become more accessible spaces to promote these public health objectives. Green roofs, a strategy already employed by the City to reduce the effects of urban heat and

stormwater, could be classified as other urban green space (City of Toronto, 2019). By improving their inherent accessibility and visibility challenges through new design considerations, this could act as a network of other urban green spaces in areas with large concentrations of new grey infrastructure developments.

Another example, street trees, can act to provide valuable shade cover for pedestrians, while providing connective tissue for community gatherings and a link to existing public open spaces. This will also allow the City of Toronto, currently at 28% tree canopy, to reach its tree canopy goal of 40% (City of Toronto, 2016). As previously discussed, along with other urban green space more generally, street trees deliver specific benefits to citizens related to improved respiratory conditions. Street trees can deepen one's connection to nature, a key principle of biophilia, on a daily basis. Traditional parkland, on the other hand, may not be as readily accessible for urban residents. Lastly, street trees are an easy first step to building a new green space landscape in the City. Toronto, a city aligned with a grid, would be completely transformed with more street trees and complimentary greenery added.



Figure 23: International examples of parklets. Pictured on the left is an example from San Francisco and on the right an example in Cincinnati. There is a large opportunity in Toronto for parklets, especially with the introduction of new public realm initiatives like the King Street Pilot Project. (Baldocchi, 2011; Taylor, 2016).

Parklets are another tool for introducing nature in dense areas and have been successfully implemented in San Francisco (Byrne and Rupprecht, 2014). Though slow, there is a momentum shift away from

vehicle-dominant transportation methods. This will leave gaps, specifically parking spaces and lots usually in the public realm domain, that will need to be filled. Additionally, public realm improvement projects like the King Street Pilot present large opportunities for incorporating more natural and green landscaping and design elements into what was once hard, grey infrastructure.

Green roofs, street trees and parklets all provide examples of design and landscaping elements that incorporate green and natural features. In turn, these elements contribute to one’s connection to nature as well as deliver key health objectives without the space constraints associated with creating and designing a new park. Instead, they act as key connective tissues between new and existing parkland to allow access to green space across the entire urban fabric.



Figure 24: Next steps summary table for Toronto in incorporating other urban green spaces broken up by short, medium- and long-term steps to achieve the ultimate goal of a green network.

Conclusion

Creating additional parkland to accommodate a growing population may no longer be an available option for cities like Toronto, which are experiencing incredibly significant development pressures.

While the City should continue to advocate for more parkland to work towards a high level of access to

green space per person no matter where in the city they live, the promotion of other urban green space is a feasible and complimentary strategy. Characterized as natural landscaping that is not traditional parkland, other urban green space requires less of a dedicated footprint and is therefore more feasible in rapidly urbanizing regions. While Toronto has a number of strategies geared towards planning the future of parks and ravines, other urban green spaces fill in both policy and physical gaps to support existing these existing spaces. In doing so, other urban green spaces would increase residents' connection to nature and their community as a whole.

According to principles of biophilia, humans have an inherent connection to the environment. To achieve a true biophilic city, citizens should nurture this relationship while also receiving benefits in return. It is well understood in academic literature that parkland delivers positive human health outcomes; however, this paper began to explore the psychological and physiological benefits associated with other urban green space. In doing so, it was revealed that one does not have to be within a park to experience the immersive benefits of nature. Additionally, when discussing the historical context of the modern urban park, it was revealed that parks as we understand them today come from a colonial past rooted in English landscape architecture with public health objectives that were poorly linked to their design, uses and science itself.

With a greater understanding of other urban green space and its biophilic benefits, cities can begin to advocate for their proliferation based on public health outcomes relative to their size and ease of implementation. In the discussion section, policy and design strategies to support this implementation were presented. Specifically, a network of other open green spaces is presented as a long-term goal for the City to work towards. Overall, through exploring these biophilic connections between nature and human prosperity, it is understood that urban residents have a lot to gain from even a little natural space. In turn, politicians, designers and planners must work to support the advancement of nature in cities so that this symbiotic relationship can continue to grow and thrive.

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