



STAFF REPORT ACTION REQUIRED

Green City: Why Nature Matters to Health

Date:	September 4, 2015
To:	Board of Health
From:	Medical Officer of Health
Wards:	All
Reference Number:	

SUMMARY

Abundant, diverse and well maintained green spaces are important features of a healthy city. Two recent systematic reviews, *Green City: Why Nature Matters to Health* and *The Impact of Green Space on Heat and Air Pollution in Urban Communities*, detail the health benefits of green space. These reviews fill a gap in the understanding of the relationship between green space and human health and highlight the importance of continued investments in Toronto's natural heritage.

Green space is a term that refers to a wide variety of natural and landscaped areas both publicly and privately owned. It includes parks, ravines, school yards, private yards, street trees, landscaped open spaces along streets and around buildings, cemeteries and green roofs. Having access to and using green spaces promotes physical activity and improves health and wellbeing. The presence of green space is associated with reduced mortality, obesity, depression, anxiety, cardiovascular disease and small for gestational age births. It also provides places for stress reduction, mental restoration and social interactions.

Green spaces have a number of environmental health benefits. They are associated with improved air quality, provide relief from extreme heat and lessen the urban heat island effect, which reduce the negative health impacts associated with a warmer climate. Green spaces also have important ecological functions, such as reducing the negative impacts of heavy rainfall events, which are expected to increase with climate change.

An increase in pollen allergies and risk of vector-borne diseases are potential negative health impacts related to exposure to green space. Public education, careful selection of species planted and adoption of protective measures can reduce these risks.

The available evidence shows that both small and large green spaces contribute to better health. There is also evidence that vulnerable groups, such as people with low income and children, gain the most benefit from increased access to green spaces. Implementing the City's *Official Plan, Parks Plan 2013-2017* and *Strategic Forest Management Plan (2012-2022)*, including improving access to green space for vulnerable groups, will help make Toronto a healthy city for all.

RECOMMENDATIONS

The Medical Officer of Health recommends that:

1. The Board of Health request City Council to dedicate sufficient resources to meet the strategic goal of increasing canopy cover in Toronto to 40% as set out by the 2013 Strategic Forest Management Plan;
2. The Board of Health request City Council to prioritize green space investment in the 31 Neighborhood Improvement Areas;
3. The Medical Officer of Health forward this report to the Chief Planner and Executive Director of City Planning, General Managers of Parks, Forestry and Recreation and Transportation Services, Executive Director of Social Development, Finance and Administration, and Director, Environment and Energy Division for their consideration;
4. The Board of Health urge the Minister of Municipal Affairs and Housing to strengthen policies for provision of green space in land-use planning documents under review in the "2015 Co-ordinated Review" which include The Growth Plan for the Greater Golden Horseshoe; The Green Belt Plan; The Oak Ridges Moraine Conservation Plan; and the Niagara Escarpment Plan;
5. The Board of Health urge the Minister of Education to recognize school sites as important community assets benefitting human health and the environment and to direct Toronto school boards to make every effort possible to ensure that any green space, open spaces, and sports facilities associated with schools remain accessible for use by the public when decisions are made on the future of school properties, especially those in high growth and Neighbourhood Improvement Areas; and
6. The Board of Health forward this report to Ministers of Health and Long-Term Care, Municipal Affairs and Housing, and Education, Chief Medical Officer of Health, Association of Local Public Health Agencies, Toronto and Region Conservation Authority, the Toronto District School Board, Toronto Catholic District School Board, le Conseil scolaire Viamonde, and le Conseil scolaire de district catholique Centre-Sud.

Financial Impact

There are no financial impacts arising from the adoption of this report.

ISSUE BACKGROUND

Toronto residents value the parks and other natural areas found within the city. Toronto Public Health's (TPH) 2011 report *Healthy Toronto by Design* identified green spaces as one of the factors that contribute to good health. At its meeting on November 21, 2011 the Board of Health adopted the report, *Improving Health and Health Equity through the Toronto Parks Plan* which affirmed the importance of the development of a renewed Parks Plan and identified strategies to improve health and reduce health inequities.

The City has various policies that guide the maintenance and enhancement of green space in Toronto. Among these are: the *Toronto Official Plan* includes policies to improve, protect and enhance Toronto's parks and open spaces, the urban forest and natural heritage; the *Strategic Forest Management Plan (2012-2022)* outlines actions to sustain and expand Toronto's urban forest, including City Council's July 2004 commitment to increase Toronto's tree canopy from current levels (about 28 percent) to 40 percent; the *Parks Plan 2013-2017* sets out a vision to connect the people of Toronto with parks, advance environmental sustainability and improve the quality of parks in Toronto.

Green space is a term that refers to a wide variety of natural and landscaped areas both publicly and privately owned. It includes parks, ravines, school yards, private yards, street trees, landscaped open spaces along streets and around buildings, cemeteries and green roofs.

There are ongoing challenges to maintaining and improving green spaces in Toronto. For example, the rapid growth and increasing density of the downtown core is resulting in a growing need for park space where land is limited and expensive. Trees are also experiencing pressures from extreme weather events (such as the 2013 ice storm damage) and from invasive pests, for instance the emerald ash borer. Parks, Forestry and Recreation states that this pest is expected to destroy Toronto's 860,000 ash trees (8.4 percent of all trees in Toronto) within the next 5 years.

It is because of these pressures, along with the mandate from the Ontario Public Health Standards and the Ontario Public Health Sector Strategic Plan which highlight the importance of promoting healthy natural and built environments, that TPH collaborated with EcoHealth Ontario to conduct a systematic review of the impacts of green space on health.

The review was completed in two parts. Toronto Public Health prepared *Green City: Why Nature Matters to Health* (Attachment 1) and the David Suzuki Foundation, *The Impact of Green Space on Heat and Air Pollution in Urban Communities* (Attachment 2). These reviews increase our understanding of the relationship between green space and health and highlight the importance of persevering, maintaining and protecting green space in Toronto.

This staff report was prepared in consultation with the City Planning, Parks, Forestry and Recreation (PFR), and Social Development, Finance and Administration divisions.

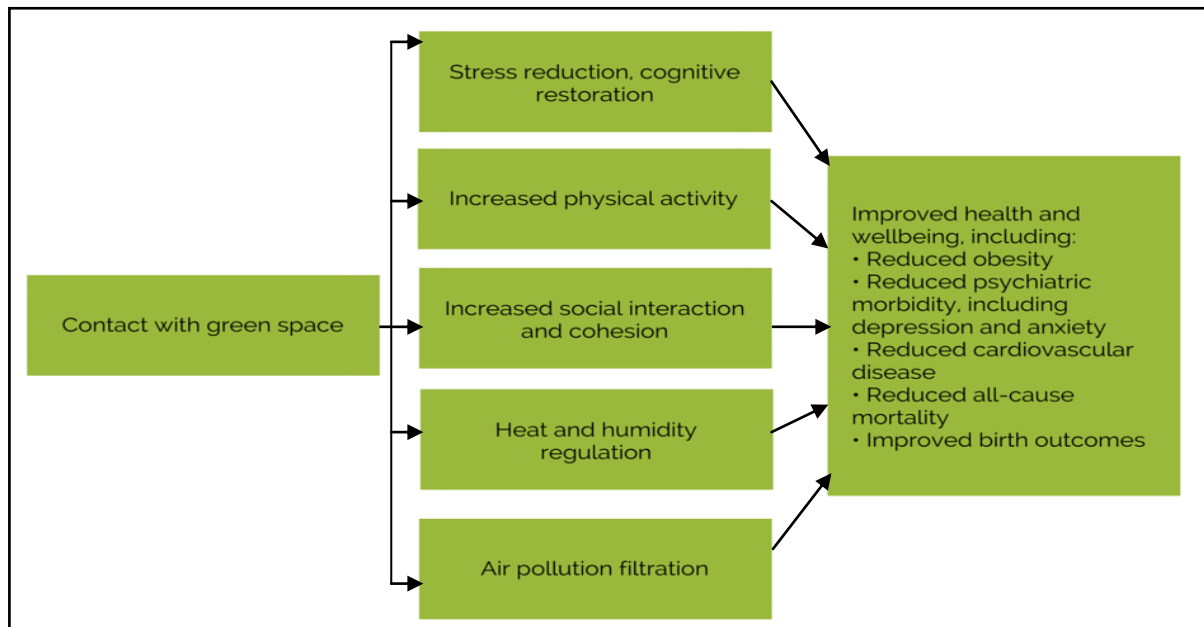
COMMENTS

The importance of maintaining natural areas to provide water, food, resources and other services needed for human wellbeing is well established. As cities continue to grow and encroach upon agricultural land and natural areas there is increasing interest in better understanding the health benefits of maintaining natural areas and enhancing green space in and around cities.

All types of green spaces, from single trees to large parks like the Rouge Valley and High Park, can provide health benefits. Green space influences health through different mechanisms: promoting physical activity, increasing social interaction and cohesion, increasing access to healthy food, stress reduction, cognitive restoration, creating shade, reducing outdoor air temperatures and improving air quality (see Figure 1).

Contact with green space has been shown to have health benefits through a range of experiences such as walking or cycling through a park, gardening, hiking and camping. Research has also shown that merely viewing nature through a window can result in benefits to health.

Figure 1: Associations and pathways through which green space benefits health
(adapted from James et al., 2015)¹



Green Space Improves Health and Wellbeing

The relationship between the presence of green space and health is complex and many factors influence the impact that green space has on health. Presence of green space may not always be enough; for example, the space must be easy to get to, inviting and perceived as attractive for it to be used. For these reasons and because of different ways green space has been measured, studies have come to different conclusions about the impact of green space on health. In spite of these limitations, the current evidence indicates an association between experience of, or exposure to, green space and the following positive health outcomes:

- Reduced all-cause mortality
- Reduced obesity
- Reduced cardiovascular disease
- Improved birth outcomes
- Reduced mental illness, including depression and anxiety.

Green Space and Physical Health

All-cause mortality in neighbourhoods with the highest amount of green space is lower when compared to neighbourhoods with the lowest amount of green space, even after taking into account socio-economic factors that are known to be related to increased mortality. This inverse relationship has been observed in studies conducted at the neighbourhood level in Canada, USA, UK and Spain. In particular, the risk of dying during a heat wave has been found to be higher in areas with little or no vegetation.

A recent study of green space in Toronto² looked at the relationship between the presence of street trees and health. It found that people who live in areas with higher street tree density report better health and fewer cardio-metabolic conditions, compared to people living in areas with lower street tree density. The study further estimated that planting 10 more trees on a city block would improve health perception and decrease cardio-metabolic conditions to the same extent as increasing the income of each household on that block by about \$10,000 per year. This increased sense of wellbeing would also be equivalent to feeling seven years younger on average.

Insufficient physical activity and obesity are risk factors for many chronic diseases. While studies have come to different conclusions, overall, available evidence suggests that access to and use of green space is associated with increased physical activity and lower rates of obesity. Children with a playground located within one kilometre of home were almost five times more likely to be classified as having a healthy weight than a child without a nearby playground, even after correcting for income. Gardening is also associated with having a healthier weight. Physical activity done in a green space has been found to be more beneficial to health than physical activity done indoors, possibly due to feelings of greater enjoyment and other psychological factors.

Studies report lower burden of cardiovascular disease with increasing amount of green space. While the cause of this relationship is not known, green space improves air quality and may influence the level of physical activity, factors which are known to impact the risk of heart disease. Several studies, which corrected for income, have found an

association between increased residential greenness and improved birth outcomes (higher term birth weight, decreased likelihood of preterm birth and being born small for gestational age). Why this would occur is not known. Some authors have suggested this could be related to increased physical activity, reduced stress, increased social contacts or other factors related to green space.

Green Space and Mental Health

There is increasing recognition of the burden illness and large economic and social cost to society of poor mental health. The presence of green space is associated with improved mental health. In fact, 92 percent (34 out of 37) of the studies reviewed found statistically significant associations between green space and reported mental health. In particular, four large high quality studies found statistically significant positive associations between green space and wellbeing. A study comparing different cities in the UK found that people living in environments with more green space reported lower mental distress and higher wellbeing. A similar study in the Netherlands found that people who lived in areas with higher percentage of green space within one or three kilometres of their home complained less and felt better after stressful life events. A study in Chicago found that public housing residents living in a building surrounded by trees and grass reported less aggression, violence and mental fatigue than residents living in relatively barren buildings.

One characteristic of green space that has received particular attention is the positive impacts of community gardens. People who participate in community gardening report increased physical activity, improved mental health, enhanced social health and community cohesion.

Health Risks of Green Space

While green space offers many important health benefits, there are also some potential health risks associated with green space including: increased incidence of pollen allergies, skin cancer, contact with poisonous plants and vector-borne diseases. While there are insufficient data to quantify this, the evidence suggests that the overall benefits of green space likely outweigh these adverse effects. The adoption of protective measures can reduce these risks.

Plants produce pollen which can trigger allergies and trigger or exacerbate asthma symptoms. There is some evidence that suggests that increased tree canopy may increase pollen allergies in children. Toronto Public Health is currently undertaking a review to evaluate the impact of pollen exposure on allergies and asthma, including potential for increased risk under a changing climate.

Some studies have found an association between time spent in green spaces and an increased risk of skin cancer. Time spent outdoors results in increased exposure to ultraviolet radiation (UVR) and without sun safety measures (for example, sunscreen or hat) this increases the risk of skin cancer. As described in Toronto's *Shade Policy and Guidelines*, the shade from trees and structures reduces the exposure to sun and the risk of cancer related to excessive sun exposure.

Time spent in natural areas can result in contact with poisonous plants, such as giant hogweed and poison ivy. Public education campaigns, including improving the ability of people to recognize such plants, will reduce this risk. Green spaces can also provide habitat for the mosquitoes and ticks that carry vector-borne diseases such as West Nile virus and Lyme disease. Climate change is expected to increase the risk of some vector-borne diseases, for example by expanding the range of the species that carry these diseases. Surveillance, vector control programs and personal protective measures are among the ways to reduce the risk of transmission of these diseases.

Perceived lack of care of green space is associated with poorer self-reported health, neighbourhood dissatisfaction, stress, feelings of exclusion and poorer mental health. Ensuring parks and other green spaces are well maintained will address these negative impacts on health.

Green Space and Air Quality

Air quality in Toronto continues to result in negative health impacts. In its 2014 report, *Path to Healthier Air: Toronto Air Pollution Burden of Illness Update*, TPH estimated that current levels of air pollution leads to 1,300 premature deaths and 3,550 hospitalizations each year in Toronto. Green spaces and trees in particular, have been found to improve air quality.

Green spaces in urban ecosystems improve the air quality through the uptake of gases by leaf stomata, absorption and adsorption of pollutants to plant surfaces and improved urban ventilation, which increases the dispersal of pollutants. Air pollutants removed by trees include particulate matter (PM), sulphur dioxide (SO₂), ground-level ozone (O₃), nitrogen dioxide (NO₂) and carbon monoxide (CO), which are associated with the burden of illness for air pollution. It has been estimated that trees in Toronto remove about 1900 tonnes of air pollutants per year which provides residents with over \$80 million worth of environmental benefits and cost savings each year.³ This translates into a benefit or cost savings of \$1.35 to \$3.20 for every dollar spent on tree maintenance.

The majority of studies that have looked at the impact of urban green space on air pollution have focused on trees. Since the amount of pollutants removed varies by tree types and season, a mix of tree species, both evergreen and deciduous is likely to offer the most benefit. Larger trees also have a greater pollutant removal capacity. Studies indicate that, even if the impact is smaller than for trees, green roofs and parks (small and large) also contribute to improved air quality.

Urban street trees have a potential negative impact due to their effect on air movements. In a few limited cases, the trees have been found to keep air pollutants at street level. However, this is very site specific and relates to street and building design as well as type of vegetation planted. A site assessment can help address this potential negative impact. It has been suggested that instead of planting trees, green walls could be used to get the benefits of vegetation and minimize entrapment of pollutants in these cases.

Volatile organic compounds (VOCs) are released in varying amounts from trees. These VOCs can react with nitrogen which can increase the production of ground-level ozone

especially on streets with high traffic. The reaction between nitrogen oxides and VOCs is complex and depends on the relative abundance of both of these groups pollutants. In areas with high traffic, planting tree species that emit lower amounts of VOCs has been shown to reduce the impact on ozone formation. Some researchers suggest that trees will nevertheless result in a net reduction in air pollutants.

Green Space and Climate Change

Potential health impacts of climate change include increased incidence of heat/cold-related illness and premature death; severe weather resulting in direct impacts such as injury and indirect impacts such as water-borne diseases; increases in vector-borne diseases; food system impacts including food insecurity and food-borne illness and degraded air quality increasing cardiovascular and respiratory illness.

Cities such as Toronto have large thermal storage capacity, localized heat sources, such as vehicles and often poor air circulation. This results in higher day- and night-time temperatures, which can lead to heat stress during periods of hot weather. Available data show that green space can provide heat reductions of between 1°C and 7°C compared to the adjacent non-green areas. The range of cooling provided depends on several factors and green space characteristics, including size, type of vegetation and proximity to other green spaces. In particular, trees (including street trees planted along the sidewalk) and closely spaced, connected smaller green spaces provide greater cooling to adjacent urban areas than large, disconnected individual parks with open grass areas.

Green space density is another factor that contributes to the amount of cooling that green spaces provide. There are different measures of density but all provide an indication of the overall proportion of an area that is vegetation or under tree cover. Studies consistently find strong and significant positive associations between increasing green space density (of any measure) and cooling effects. Evidence shows that dense urban areas with high vegetation cover can be cooler than lower density but less well vegetated areas.

Green spaces also have an important role in storm water management. Plants, especially trees, help to stabilize steep slopes and take up water through their roots, thereby controlling erosion, improve surface water quality and reduce the risk of flooding. This can mitigate the negative impacts of heavy rainfall events.

Green Space and Health Inequities

Green spaces in areas near vulnerable populations, including people living on low income, racialized groups, older adults and children have been found to be particularly important. Evidence suggests that the health benefits of green space are more pronounced for lower socioeconomic groups and other vulnerable groups. Children benefit considerably from well maintained parks with playgrounds close to where they live. Even modest increases in nearby green space density have been shown to improve health in vulnerable populations.

Seniors, people living on a low income and those living without access to air conditioning are among the most vulnerable to heat. TPH has identified areas of greater heat

vulnerability in Toronto; improving green space in these areas, planting trees in particular, would help reduce this vulnerability.

Green Space Features that Promote Health

Cities benefit from a mixture of types of green spaces, large or small, natural or designed. Several factors contribute to this the benefit:

- **Proximity:** The health benefits of green space are more strongly associated with green space that is in close proximity (less than 1 km) to residential areas. Health gains have been documented with modest increases in nearby green space because people generally do not compensate for a lack of nearby green space by visiting public parks or green spaces that are farther away. Toronto has largely exceeded this target, with the vast majority of Toronto residents living within 500 metres of parkland.

Few studies have looked at health and proximity of green space to schools or workplaces; however, there is evidence that indoor plants and views to the outdoors are associated with improved learning in students and productivity in workers.

- **Playgrounds:** Playgrounds close to home (within 1 km) have been found to promote healthy weights in children.
- **Community gardens (urban agriculture):** People who have access to and use community gardens to grow food report many benefits, including increased physical activity and a greater sense of wellbeing.
- **Green space density (vegetation coverage of at least one third of total land area):** High neighbourhood green space density with connected spaces that include trees provide the most cooling effects and air quality improvements.
- **Perceived safety and good upkeep:** In order for a green space to provide health benefits, it needs to be perceived as safe and well maintained.

Improving Access to Green Spaces in Toronto

Toronto has long recognized the importance of the urban forest and the benefits it provides and over the past decade has adopted policies, by-laws and guidelines to better support the protection and enhancement of green spaces in Toronto. The Parks Plan notes that a good urban green space system is one that encompasses many different land uses and ensures that inclusivity and accessibility are factored into the design and planning of spaces. Land uses for parks can also create tensions between competing needs, such as requests for a community garden that may push out more inclusive use activities. Innovative solutions to meet the public needs are required, for example finding alternate spaces like rooftops to accommodate more exclusive use activities.

Achieving City Council's commitment to a 40 percent tree canopy would improve the health of residents in number of ways, including providing relief from high heat and

improving air quality. Attaining this tree cover will require sufficient resources are dedicated not only for planting new trees but also for the maintenance of the existing urban forest. The evidence shows that the quality of green space is important. In order to fully realize the health benefits of green space it is essential to make available adequate funding for park maintenance.

Green spaces close to where people live offer greater benefit to vulnerable populations than to the general population. As part of its Strong Neighbourhood Strategy the City will invest \$12 million in Toronto's 31 neighbourhood improvement areas (NIAs) to create new facilities such as playgrounds, parks, basketball courts and other infrastructure improvements. This provides an opportunity to increase tree cover and improve green space in these areas, which will contribute to wellbeing and help reduce health disparities. This supports the ongoing Park Plan initiatives to identify and enhance the City's capacity to expand the park system. Consideration of the provision of parkland in and accessible to NIAs can be included in the Parkland Acquisition Update, anticipated to begin in 2016.

School properties and their associated green space help create complete communities which conform to the Provincial Policy Statement under the Planning Act and the Toronto Official Plan. These sites serve community needs, benefitting health and environment. Changing needs require school boards to review their property portfolios and make decisions on the future use of current properties.

Ontario Regulation 444-98 of the Education Act sets out a procedure for declaring properties as surplus. As directed by the Minister of Education, the Toronto District School Board is in the process of reviewing its properties and declaring some properties as surplus. Parks, Forestry and Recreation along with City Planning, Children Services and other Divisions, are currently reviewing 61 surplus sites. Although PFR is interested in retaining the active outdoor green fields at most locations (or the whole site without the school building), the City does not currently have the financial resources to acquire them all. To help ensure that the sale of school properties and/or associated green space enhance community wellbeing in Toronto, the provincial government and school boards should take into account not only their value as educational institution but also their full value as essential community assets before declaring them as surplus. Particular consideration should be given to the needs for green space in high growth neighbourhoods and Neighbourhood Improvement Areas.

Improved access to green spaces provides an opportunity to improve health in Toronto. Providing every child in Toronto with a safe, green space with shade to play in will promote healthy weights and help form healthy lifelong physical activity habits. Connected green spaces provide the most cooling benefits and green spaces that are close to residences provide physical and mental health benefits. Well maintained green spaces are important for health. The City needs to ensure that sufficient resources are allocated to maintain green spaces, both existing and new. The health evidence provided in these two reviews supports various other City initiatives, including the Complete Streets guidelines, the Ravine Strategy and planning studies such as TOcore.

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SIGNATURE

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ATTACHMENTS

Attachment 1: Green City: Why Nature Matters to Health - An Evidence Review
Attachment 2: The Impact of Green Space on Heat and Air Pollution in Urban
Communities: A meta-narrative systematic review

REFERENCES

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2. Kardan, O., Gozdyra, P., Mistic, B., Moola, F., Palmer, L.J., Paus, T. and Berman, M.G. (2015). Neighborhood greenspace and health in a large urban centre. *Scientific Reports*, doi:10.1038/srep11610.
3. Alexander, C. and McDonald, C. (2014). *Urban forests: The value of trees in the City of Toronto*. Toronto: TD Economics.