A Conceptual Framework to Understand the Business Case for EcoHealth in Ontario

JANUARY 2020

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Ontario Trillium Foundation
Fondation Trillium de l'Ontario
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Acknowledgements

This report benefited from the contributions of a number of individuals and organizations. The Green Analytics Team and core contributors included Jeffrey S. Wilson (University of Waterloo), Jen McCutcheon (independent consultant), Jeff J. Wilson (Green Analytics) and Amy Taylor (Green Analytics).

Various iterations of the report, literature review, framework, and final documentation benefited from the detailed review and suggestions provided by the EcoHealth Ontario Steering Committee and the EcoHealth Ontario Research Workgroup. For more information on EcoHealth Ontario see www.ecohealthontario.ca.

Finally, thanks to the wide range of individuals and organization that participated in the workshop and provided expert input on the framework. Their contributions were instrumental in finalizing the framework. See Appendix A for a list of workshop participants.

Funding for this project was provided by the Greenbelt Foundation.

EcoHealth Ontario receives funding from the Ontario Trillium Foundation. An agency of the Government of Ontario, the Ontario Trillium Foundation (OTF) is one of Canada's largest granting foundations. With a budget of over $136 million, OTF awards grants to some 1,000 projects every year to build healthy and vibrant Ontario communities.

Contents

1. Introduction

Greenspaces offer opportunities for engagement with the natural environment and provide ecosystem services that contribute to positive health outcomes. Such opportunities include children's play, physical exercise and athletic activities, quiet relaxation and meditation, social engagement and reprieve from urban noise and heat (WHO, 2016). In addition, ecosystem services and vegetation cover from greenspaces mitigate air pollutants, reduce surface temperatures and urban heat island effect by creating shade and increasing evapotranspiration, mitigate flooding, and increase community resiliency to climate change.

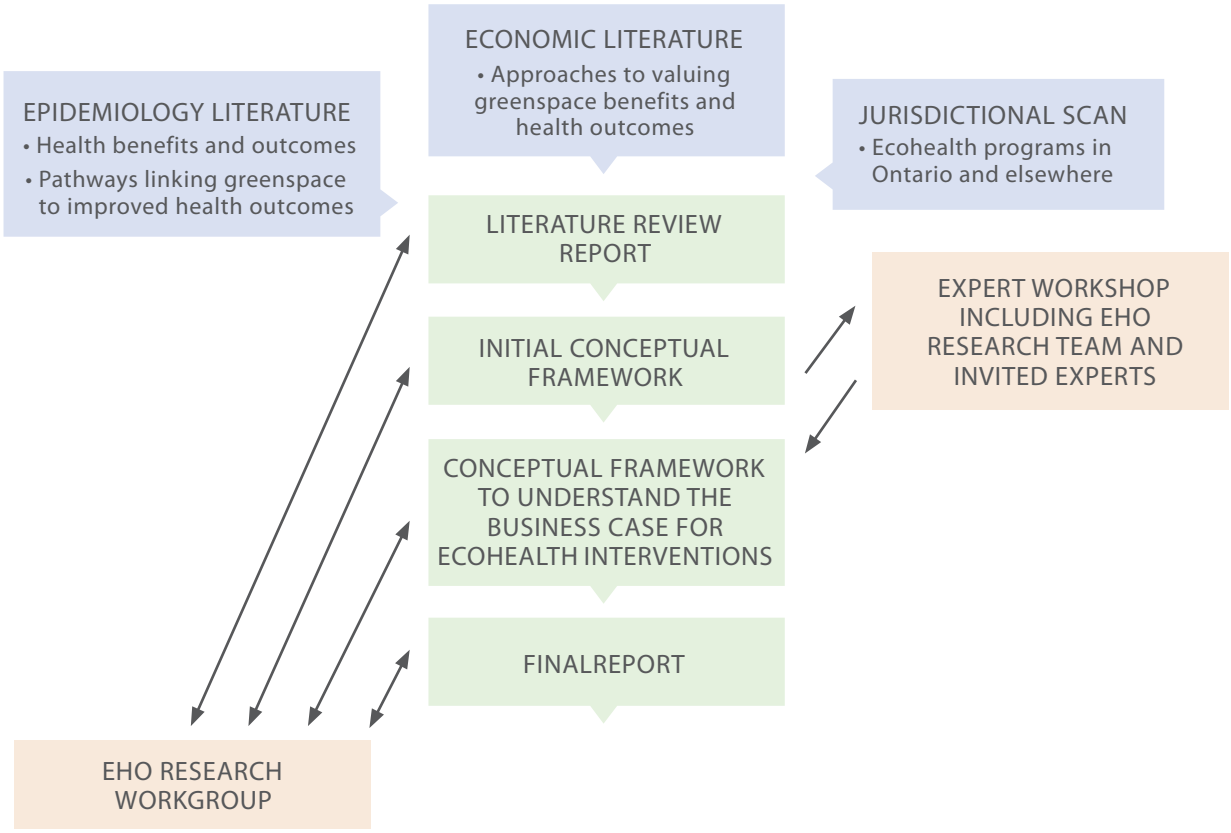
Greenspace investments lead to health benefits by increasing the number of users who experience positive physical and mental health outcomes and by increasing the amount of greenspace within an urban area thereby reducing exposure to negative impacts from air pollutants, heat, noise, and climate-related health risks. Greenspace investments include changes in the accessibility, size, amount, quality, type, and amenities present. These factors influence the number of greenspace users, how users engage with greenspaces, and exposure to environmental stressors. Taken together, greenspace use and protection from environmental stressors determine the potential magnitude of associated health benefits. The associated benefits of improvements in public health lead to economic savings associated with reduced burden of illness, decreased use of health services, and increased productivity.

The conceptual framework presented in this document connects investments in greenspaces to health benefits and the associated economic value of improvements in public health. Making these connections helps users better understand and communicate the value of greenspace investments and provides a mechanism to support informed program, policy and planning decisions. In addition to presenting a conceptual framework (Section 4), this document includes the results of a literature review and jurisdictional scan both of which informed the conceptual framework design. This is a living document with the intention that the literature review and conceptual framework will incorporate emerging research and evolve as the overall project advances.

1.1 APPROACH

Figure 1 illustrates the project stages and approach undertaken to develop the conceptual framework.

FIGURE 1. Approach Overview



The literature review included a review of epidemiology literature on health benefits and outcomes associated with greenspace and a review of the economic literature on approaches to valuing greenspace benefits. The literature review and findings from the jurisdictional scan of "ecohealth" programs in Ontario and elsewhere informed an initial conceptual framework that was shared with the EcoHealth Ontario (EHO) Working Group for input and direction. Indeed, the conceptual framework was developed with substantial input from the EHO Research Workgroup. Feedback and input were provided at five stages during the project:

1) Preliminary draft literature review
2) Completion of draft literature review
3) Completion of an initial draft conceptual framework
4) Expert workshop to seek feedback on the conceptual framework
5) Final report

In addition to input from the EHO Research Workgroup, an expert workshop was held specifically to seek input on the initial conceptual framework (Appendix A contains a list of workshop participants and their affiliation). The workshop was designed to introduce participants to the conceptual framework, seek input and feedback on how to improve the conceptual framework and gain an understanding of how participants may potentially use the framework in practice. The valuable input provided throughout the process was critical to informing the conceptual framework, understanding possible uses of the conceptual framework, and identifying next steps to validate the framework and create a functional tool for users across Ontario and elsewhere.

The project was focused on selected direct pathways between greenspaces and health outcomes. These were scoped to current pathways and did not include future climate considerations explicitly. Given the dynamic influence of a changing climate on our health and wellness, this is an important area to incorporate in future research.

2. Literature Review

The literature review outlines a number of health benefits associated with greenspaces, focusing primarily on human health benefits resulting from use or exposure to greenspaces (Appendix B contains a reference list for the literature review). The full range of the effects of climate change and environmental resiliency on human health were beyond the scope of the project and have therefore not been included in the detailed literature review. These include water quality, flood and fire mitigation, and other disaster risk reduction measures. Wherever possible, systematic reviews were used to identify key studies related to a particular outcome or pathway. These are identified as such in Appendix C, which is a spreadsheet summary of the literature review findings. The majority of the studies found were from peer reviewed literature, and in addition, where available, reports from the grey literature were included. Key search terms included a combination of green space (and greenspace), urban, health benefits and/or outcomes. Snowballing was also used: once one key paper, especially a systematic review was identified, this paper was used to explore additional papers referenced in the review. If limited literature was found on a specific health outcome, then a search based on that health outcome was conducted. The scope and goal of the literature review was such that not all papers related to each health outcome, pathway, or economic valuation method were identified. Rather, efforts were made to ensure that the most relevant studies were identified, and that key points were not overlooked. As mentioned above, the literature search focused on selected use and exposure relationships between green spaces and health outcomes. While undoubtably important, the full scope of climate change-related pathways (such as flooding, fires, and erosion) has not been included in the literature review, however, some components of the climate change-related pathway were included (e.g. extreme heat).

2.1 HEALTH BENEFITS AND OUTCOMES (EPIDEMIOLOGY REVIEW)

The 'health benefits and outcomes' tab of the literature review spreadsheet provides summary information on key articles examining the relationship between greenspace use and/or exposure and health benefits. The literature identifies a number of different health benefits and outcomes, namely: reductions in overweight, obesity and type 2 diabetes; improvements in mental health and wellbeing; better birth and developmental outcomes; and reductions in cardiovascular and respiratory illnesses and mortality. We also highlight articles in the literature review spreadsheet focused on inequalities and older adults as well as general review articles. The starting point for the health outcomes literature review, was an excellent literature review published in 2015 in the *Current Epidemiology Reports*, titled "A Review of Health Benefits of Greenness" by James et al. (available here).

Below, we provide a high-level overview of health outcomes attributed to greenspace use and or exposure by category. It is not intended to be a comprehensive summary of all articles examined. Refer to the literature review spreadsheet for details on individual articles. Table 1 provides a summary of the findings reported below. The strength of the relationship was determined through a process that involved reviewing the studies for each health outcome and considering both the strength of the evidence in the body of literature as well as the magnitude of the relationship (i.e., the size of the expected health benefit as a result of the exposure). It is important to note that the strength of the relationship is not based on a rigorous analysis of each health outcome, but rather a high-level assessment of the literature. Finally, greenspace exposure refers both to exposure from direct interaction or use, as well as to more systemic exposure, such as the pathway linking increased tree canopy to decreased air pollution (or noise pollution) and then to decreased respiratory illness.

TABLE 1. High level summary of the strength of relationships between greenspace exposure and improved health outcomes

HEALTH OUTCOMES ASSOCIATED WITH GREENSPACE EXPOSURE	STRENGTH OF THE RELATIONSHIP
Overweight and obesity	Moderate
Type II diabetes	Moderate
Mental health/wellbeing	Strong
Birth and development outcomes	Mixed
Cardiovascular disease	Strong
Respiratory Illnesses	Moderate

** NOTE: Table 1 should be interpreted with caution. Strength of relationship assessment is intended to be a starting point to inform prioritization based on existing evidence, not a statement of scientific fact.*

2.1.1 Overweight, Obesity and Type II Diabetes

Of the studies reviewed, findings were somewhat mixed with respect to the association between greenspace and being overweight or obese. In some cases, researchers found a *positive* relationship between exposure to greenspace and obesity/overweight (Prince et al., 2011; Cummins et al., 2012). However, in a systematic review of 60 studies from Canada, the United States, Australia, New Zealand and Europe, 68 percent of the papers reviewed showed that greenspace is associated with *reduced* obesity (Lachowycz & Jones, 2011). As is shown in the table above, this evidence led us to assign a moderate strength of relationship.

The literature review revealed an inverse relationship between greenspace exposure and type 2 diabetes. Various pathways contributing to this effect have been explored, including increased physical activity (Muller et al., 2018; Astell-Burt, 2009), and decreased exposure to traffic related air pollution (Bodicoat et al., 2014).

2.1.2 Mental Health and Wellbeing

A number of different mental health outcomes have been reported in the literature related to exposure to greenspaces. The greatest effects seem to be on depression and anxiety (Nutsfort et al., 2013; Triguero-Mas et al., 2015; Maas et al., 2009). While different researchers use different metrics to quantify exposure to greenspace, living within a 1km distance of greenspace was a commonly used metric (Younan et al., 2016; Maas et al., 2009; Stigsdotter et al., 2010). Unlike the research on obesity and overweight, a statistically significant association between increased exposure to greenspace and improved mental health outcomes in at least some segments of the studied populations were found in the vast majority of identified articles (all but: Sarkar et al., 2013 and Huynh et al., 2013).

2.1.3 Birth and Development Outcomes

In the majority of studies identified, greenspace was positively associated with increased birth weight, with stronger associations being seen in women with lower educational levels and socio-economic status (Dadvand, de Nazelle, et al., 2012; Markevych, Fuertes, et al., 2014). In some cases, an association was also found with gestational age, but the findings were not always significant for this health outcome. Proximity to urban greenspace was inversely related to hyperactivity in a study by Markevych, Tiesler et al., 2012. However, the number of studies found with this health outcome were limited.

2.1.4 Cardiovascular and Respiratory Illnesses

The literature consistently identifies a protective effect of greenspace on cardiovascular disease, stroke and blood pressure. Methods for measuring exposure to greenspace vary across the studies, such as distance between one's home and a greenspace, or in the case of Karden et al.(2015), tree density: having 11 more trees in a city block, on average, decreases cardiometabolic conditions in ways comparable to an increase in annual personal income of $20,000 or moving to a neighborhood with $20,000 higher median income or being 1.4 years younger. Fewer studies were found identifying a link

between respiratory diseases and exposure to greenspaces. However, the strongest evidence supporting a relationship between greenspace exposure and respiratory illness is from an Ontario cohort study by Villeneuve et al. (2012). This study found reductions in mortality with increased residential greenspace for each underlying cause of death [in the Canadian Mortality Database]; the strongest association was for respiratory disease mortality (RR=0.91, 95% CI=0.89–0.93). In addition, Hu et al. (2008) found a decrease in mortality rates from both cardiovascular and respiratory diseases in men but not women.

2.2 PATHWAYS LINKING EXPOSURE TO GREENSPACE AND IMPROVED HEALTH OUTCOMES

The second tab in the literature review spreadsheet includes studies highlighting pathways between greenspace use and exposure and health outcomes. Studies have been organized into three general pathways linking greenspace use and exposure to health impacts identified in the literature: reduced exposure to environmental stressors; increased physical activity; and, decreased stress, and increased attention and social cohesion.

While the evidence that greenspace has a positive impact on health outcomes is generally strong, the pathways by which these improvements are made are still not fully understood. A consistent message in the literature is that further research is needed to better understand pathways linking greenspace exposure to specific health and wellbeing outcomes. Various review papers have offered useful models and explanations trying to identify causal pathways, but the variety of different exposures (types, doses and qualities of greenspaces), mediators and modifiers, and the complexities related to measuring longer term health outcomes make it difficult to explain clear pathways (James et al., 2015; Markevych et al., 2017; and WHO, 2016). The relationships are complex both within and among the various pathways, with studies showing mixed results for some key outcomes, variations in the pathways themselves, as well as mitigating factors influencing each pathway.

2.2.1 Pathway 1: Increased Physical Activity

Perhaps the most studied link between exposure to greenspaces and improved health and wellbeing outcomes is through increased physical activity. According to the Word Health Organization (WHO), physical inactivity is the fourth leading risk factor for global mortality (WHO, 2016). The evidence is clear that physical activity has a protective effect on a number of diseases and other adverse health outcomes, such as cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis and premature death (Warburton et al., 2006). Further, physical activity has been shown to positively impact mood and decrease stress (Annerstedt et al., 2012). In the majority of studies reviewed (and listed in the literature review spreadsheet), a positive association was found between exposure to greenspace and increased physical activity, most often measured by whether or not individuals meet the recommended dose of daily physical activity (for example: Richardson et al., 2013; Chaix et al., 2014; Sugiyama et al. 2013). Interestingly, despite the strong evidence to support the link between exposure to greenspaces and increased physical activity, findings on the protective effect of exposure to greenspace on being overweight or obese are somewhat mixed with two Canadian studies not finding a protective effect (Prince et al., 2011; Potestio et al., 2009).

2.2.2 Pathway 2: Decreasing Stress, Increasing Attention, and Facilitating Social Cohesion

Of the three pathways, this pathway is arguably the most complex – in part because of the three different components being grouped together. The components of decreased stress, increased attention, and facilitation of social cohesion, while separate factors, have been found to be interrelated in the literature. For example, in a cross-sectional study of 1,641 adults in the Netherlands, de Vries et al. (2013) found that overall, greenspace quality was associated with better mental health outcomes, but that both stress and social cohesion fully mediated the greenspace-mental health relationship for quantity (but not quality). Further, studies have linked exposure to greenspace and time spent in greenspace to lower levels of depression and anxiety and improved attention (Beyer et al., 2014; Astell-Burt et al., 2013; Nutsford et al., 2013). A cross-sectional Canadian study of 17,249 children, however, found that the relationships between greenness measures and positive emotional wellbeing were weak and inconsistent (Huynh et al., 2013). A study by de Vries et al. (2013), found that physical activity within greenspace partially explains the quality of the greenspace-mental health relationship.

More recently, Shanahan et al., (2016) found that depression, high blood pressure, social cohesion, and amount of physical activity were linked to both the duration and frequency of greenspace visits. The longer the greenspace visit, the lower the rates of depression and high blood pressure, and those who visited more frequently had greater social cohesion. Higher levels of physical activity were linked to both the duration and frequency of greenspace visits. A dose-response analysis for depression and high blood pressure suggests that visits to outdoor greenspaces of 30 minutes or more during the course of a week could reduce the population prevalence of these illnesses by up to 7% and 9%, respectively (Shanahan, 2016; WHO, 2016).

2.2.3 Pathway 3: Reducing Exposures to Environmental Pollution (Heat, Air, Noise)

This pathway links exposure to greenspaces with decreased exposure of individuals and communities to environmental stressors, specifically air pollution, heat, and noise pollution. Each of these are described below. For further details, please refer to the comprehensive Canadian report, *Impact of Greenspace on Heat and Air Pollution in Urban Communities*, by Zupancic et al. (2015). While the negative impact of heat, air pollution and to a lesser degree, noise pollution are generally accepted, mapping out the pathways of causality or even influence among greenspace exposure, exposure to environmental stressors and health is still challenging. Some of these challenges include a lack of studies on the impact of urban greenspace on nearby non-green areas, and lack of data on the optimal size, distribution and characteristics of greenspace (Bowler et al., 2010; Zupancic et al., 2015).

Air pollution is known to directly impact life expectancy, not only in cities with extreme levels of particulate matter, but also here in Canada. in 2019, Health Canada released the report: *Health impacts of air pollution in Canada: estimates of morbidity and premature mortality outcomes, 2019 report*. This report suggests the number of annual mortalities in Canada that can be attributed to air pollution from human sources in North America to be 14,600 deaths, with Ontario bearing the highest burden at 6,700 annual premature deaths. These figures make exposure to air pollution one of the most important risk factors for premature death in Canada. The link between vegetation (in greenspaces) and decreased air pollution is growing. In a 2018 study of the impact of urban tree canopy on air pollution in Canada, computer simulations with local environmental data reveal that trees in 86 Canadian cities removed 16,500 tonnes (t) of air pollution in 2010 (range: 7500–21,100 t), with human health effects valued at 227.2 million Canadian dollars (range: $52.5–402.6 million) (Nowak et al., 2018). In contrast, a review described in *Nature-based solutions to climate adaptation in urban areas*, indicated that the potential of regulating ecosystem services provided by urban green infrastructure to counteract air, heat and noise pollution is often limited and/or uncertain, especially at the city and metropolitan levels (Chapter 9 in Kabish et al., 2017).

In an era of increased global warming, heat and especially heat in urban settings, is becoming a growing health risk. A meta-analysis and systematic review of the literature by Bowler et al. (2010) found that urban parks provide an average decrease of 1°C in air temperatures within the park, (Bowler et al., 2010), and mitigate urban heat in surrounding areas (Zupancic et al., 2015). *Nature-based solutions to climate adaptation in urban areas (Kabish et al., 2017)* describe the main findings of Bowler's comprehensive meta-analysis as: (1) urban parks are, on average, around 1°C cooler than non-green sites in the day, with maximum difference values around 2°C or even higher (e.g., Jansson et al. 2007); (2) street trees have a cooling effect at the urban canyon level, but its magnitude depends on a number of factors such as tree species, canyon orientation or canyon width (Norton et al. 2015)[1]; (3) other types of urban green infrastructure elements such as green roofs and green walls can also regulate urban temperature at the site scale (Alexandri and Jones 2008); and (4) the extension of the cooling effect of green space beyond its boundaries is likely, but uncertain, especially at wider city and metropolitan scales (Chen et al., 2008) (meta-analysis findings above summarized in Chapter 9 in Kabish et al., 2017).

The WHO identifies noise pollution as "a major and increasing threat to human health, due to continuing urbanization, rising traffic volumes, industrial activities, and a decreasing availability of quiet places in cities" (WHO, 2016). While the research is less developed for this pathway, studies have shown that vegetation belts with a width of at least 1.5 to 3 meters, especially in the form of trees, have found significant reductions in traffic noise pollution (Pathak et al., 2008). The specific pathway linking noise pollution to decreased health outcomes is still under investigation.

1 According to Norton and colleagues (2015), urban streets can be viewed as canyons, with a floor (the road, walkway, verge and front yards) and two walls (the building frontages up to the top of the roof).

2.2.4 Pathway 4: Increased Climate Resiliency

The current climate emergency is resulting in increased resources being used in climate change mitigation, adaptation, and response to climate-related disasters. The role of greenspace and ecosystem services in addressing the climate emergency and improving health outcomes related to climate changes are diverse and multifaceted. Exposures related to air, heat, and noise pollution (pathway three described above) is one important aspect of climate change that has been shown to be fairly directly associated with improved health outcomes. Other health outcomes related to climate change, such as premature deaths or anxiety related to climate-related fires, flood or erosion are important, but fall outside the scope of this report. This pathway is mentioned and included in the conceptual framework so as not to lose sight of its importance.

2.3 ECONOMIC APPROACHES

This section of the literature review provides an overview of approaches typically used to value greenspace, assesses their applicability and relevance to health benefits, summarizes approaches typically used in health economics literature to value health outcomes, and summarizes some of the relevant results related to each of the 3 major pathways noted in Section 2.3.

The third tab in the literature review spreadsheet describes studies valuing the health and wellbeing benefits of greenspace proximity, access and use. Studies are organized by monetary valuation technique which are briefly introduced below.

2.3.1 Overview of Approaches to Valuing Greenspace Benefits

Typical approaches used to assign a monetary value to greenspace use and exposure to greenspace include: market valuation methods (avoided costs, preventative expenditure, human capital cost method), stated preference methods (contingent valuation (CV)); revealed preference methods (hedonic pricing, travel cost method); benefits transfer methods, and subjective wellbeing methods. Studies frequently use different approaches to value different benefit categories or to compare results from different valuation methods. For example, to estimate total economic value, direct use values may be estimated using market valuation methods or revealed preference methods (e.g. travel cost method) and indirect values and non-use values (i.e. existence value) may be estimated using CV techniques.

The applicability of the different approaches to valuing health outcomes resulting from greenspace use and exposure vary. In some cases, the health outcome is the primary focus of valuation. For instance, air quality improvements from increased greenspace is typically valued based on the anticipated change in health outcomes related to changes in air quality (see, for example, Nowak et al. (2013)). In other cases, it is not the health outcome that is measured but rather some other aspects of the economic value of greenspace. For example, measuring the contribution of greenspace to property values as a proxy for the aesthetic value of greenspace (see, for example, Dunse et al. (2007)). Table 2 summarizes the typical approaches used to value greenspace with notes on their potential application to health outcomes.

TABLE 2. Summary of monetary valuation tools

	DATA	STRENGTH	LIMITATION	MOST RELEVANT APPLICATION
MARKET VALUATION METHODS	Available in public accounts and other health information databases	Market prices integrate well into government decision-making frameworks and budgetary processes	Partial reflection of monetary value, considers use value only	Health system savings, avoided burden of illness
CONTINGENT VALUATION	Survey	Flexibility to evaluate future policy and planning scenarios	Measures stated behaviour as opposed to actual behaviour Vulnerable to survey design and other survey tool limitations	To determine willingness to pay to reduce risk of illness Evaluate hypothetical planning and policy scenarios
HEDONIC PRICING	Available through property sales and tax assessment data	Useful when valuing an individual park or greenspace	Difficult to control for all factors that influence property price differentials Not able to attribute to specific health outcome Difficult to link to specific greenspace functions	To determine the total economic value of a greenspace
TRAVEL COST METHOD	Survey or service use data	Offers a means to determine willingness to pay to access a service or benefit	Useful to estimate recreational benefit or overall use value Restricted in ability to link to direct health benefits	To estimate direct use value
BENEFITS TRANSFER METHOD	Prior studies	Estimate economic value in absence of resources or data to complete a direct valuation study	Depends on quality of primary studies and contextual relevance	When applied to study area of similar context and socio-economic conditions
SUBJECTIVE WELLBEING	Survey + health expenditure data	Wellbeing based approaches increasingly seen as important information to drive policy, program and planning decisions	Requires high level of statistical analysis, and difficult to determine if wellbeing gain is due entirely to greenspace use/exposure	To determine changes in wellbeing and corresponding health system savings

2.3.2 Overview of Approaches to Valuing Health Outcomes

To help inform the development of the ecohealth conceptual framework, this section answers the question: if greenspace investments can be considered a form of public health intervention, then how does the health economics literature typically value changes in health outcomes? The health economic literature does not focus on greenspace, but rather explores the valuation of specific health outcomes.

From an economic perspective, the valuation of health impacts should include the tangible costs of illness such as medical costs, lost income, and costs of averting expenditures, as well as the less tangible effects of illness on wellbeing such as pain, discomfort and lost leisure time.[2] There are two general approaches that can be used to create monetary estimates of health impacts:[3]

1) The revealed-preference approach uses methods such as avoided costs due to reduced burden of illness or disease, preventative expenditures due to improved health, and human capital cost methods based on lost productivity due to illness to value changes in health outcomes.
2) The stated-preference approach uses methods such as contingent valuation (CV) to value intangible changes in health outcomes.

A third approach, not frequently cited in the health economics literature, focuses on people self reporting their wellbeing. This approach is often used in connection with greenspace.

Revealed-preference Approaches

Market valuation methods are the most frequently used techniques to estimate the economic benefits of improvements in public health resulting from investments in greenspace. Such methods value avoided costs due to reduced burden of disease, preventative expenditures attributed to better health, and human capital costs resulting from lost productivity due to illness. Monetary values are based on market value equivalents and are typically expressed in terms of avoided costs (i.e. health system savings) or lost productivity.

Avoided cost techniques assume the value of a greenspace benefit is equal to the costs that are not incurred due to the health benefit (e.g. reduced burden of disease). The avoided cost method, for example, measures the costs that are avoided by implementing an investment. In the health economics literature, this method is often referred to as the cost of illness (COI) approach. It can be used to determine the health benefits associated with a health outcome attributed to greenspace use such as lower rates of obesity based on cost savings of avoided visits to general practitioners. The Living Trust (2018), for example, estimated that parks and greenspaces in the UK save the National Health Services around £111 million ($189 million CAD) per year based solely on a reduction in general practitioner visits.

Studies have estimated the burden of mental illness in Canada (Stephens and Joubert, 2001; Lim, 2008) and health costs of physical inactivity in Canada (Katzmarzyk et al., 2000; Janssen, 2012) using a combination of health care costs and estimates of lost productivity. The direct and indirect health care costs of physical inactivity in Canadian adults, for example, is estimated to be $6,757 million or $253 per adult (2009) (Janssen, 2012). The United Kingdom, Urban Natural Capital Accounts framework (eftec, 2017) as applied in Jon Sheaff and Associates (2017), estimated physical activity benefits attributed to greenspace by taking the number of users meeting weekly recommended physical health requirements via greenspace (150 minutes of moderate to vigorous activity per week, or portion thereof), multiplied by the direct and indirect costs of physical inactivity.

Estimates of avoided health care costs are often combined with other metrics as well. Nowak et al. (2013), for example, estimated the value of improved air quality provided by trees in the City of Toronto based on the avoided health-care expenses and productivity losses associated with specific adverse health events as well as the value of a statistical life in the case of mortality.

2 Fowler et al. (2016). Considerations for assessing the economic value of population health interventions. Social Research and Demonstration Corporation. http://www.srdc.org/media/200027/phac-report-en.pdf.

3 OECD (2006), Economic Valuation of Environmental Health Risks to Children, OECD Publishing, Paris, https://doi.org/10.1787/9789264013988-en.

Preventative expenditure techniques estimate the monetary value of a benefit by assuming it is equal in value to a preventative expenditure that would be required to achieve a similar outcome. For example, the physical activity health benefit provided by a greenspace could be based on the prevented expenditure of building a recreational facility to achieve the same level of physical activity. Similarly, the benefit greenspace provides in terms of flood mitigation could be based on the value of built infrastructure that would be required to provide the same level of benefit as suggested in a study on the natural capital value of Toronto's ravine system (Green Analytics, 2018).

The human capital cost method estimates the benefit of an investment or cost of an impact according to the value of lost productivity in the workplace. Smetanin and colleagues (2011) and Lim and colleagues (2008), for example, use human capital cost methods to estimate the indirect cost associated with poor mental health.

An advantage of market valuation methods is that they integrate easily into cost-benefit analysis and other budget-based decision-making tools. Market valuation estimates, however, typically reflect partial health cost savings given the complexity of pathways between health outcome and greenspace use and exposure. In addition, the focus is often on reduced use of the health care system neglecting other avoided costs or prevented expenditures. Market valuation methods are most commonly used to estimate direct savings to the health care system associated with improvements in physical and mental health and avoided lost productivity due to physical inactivity or depression and anxiety.

Stated-preference Methods

Stated-preference (SP) methods employ survey techniques to estimate the economic value that people attach to outcomes for which there is not a direct market value. Contingent valuation, is a widely used stated preference method that elicits the monetary value in the absence of markets by asking people their willingness to pay or willingness to accept a certain outcome (Bateman et al., 2002). In health economics, willingness to pay can be used to estimate the value people place on accessing health programs and services, to determine the value that people place on reducing health risks or to prevent a health condition. A study by Gafni (1997) argued that willingness to pay is the best approach, despite its limitations, to estimate the economic value of health programs and service use. Willingness to pay to reduce health risks has been applied in the context of air pollution, other pollutants, and climate change (Graham, 2019; Wei and Wu, 2017; Veronesi et al., 2014; Carlsson and Johansson-Stenman, 2000).

In the context of parks and greenspaces, CV uses surveys to create hypothetical situations where the benefits associated with continued access to, use of, or preservation of parks and greenspaces are contingent on the willingness to pay value that people hold for them or willingness to accept to lose access, use, or quality and subsequent benefits (Living Trust, 2018; Brandi and Prietto, 2014). Contingent valuation is often used to value willingness to pay for total perceived greenspace benefits. A survey could be designed, however, that asks what value you place on the mental health benefits you receive from using a greenspace. Contingent valuation is also useful to elicit willingness to pay for non-use values (i.e. existence value). For example, Haefele and colleagues (2016) estimated average annual willingness to pay for all US National Park Service Lands and Programmes to emphasize the value people place on non-use and existence values. A weakness of CV is that it measures stated behaviour based on hypothetical scenarios, rather than actual behaviour. Contingent valuation is also vulnerable to survey design limitations, hypothetical bias, framing limitations and other survey tool limitations (Makandya et al., 2018).

Wellbeing Valuation

The impact of greenspace use or exposure can be estimated in terms of the changes in wellbeing produced, as measured in self-reported assessments over a range of variables, including life satisfaction, happiness, state of mental health, state of physical health, and sense of belonging. White and colleagues, for example, estimated the wellbeing gain from living in an area with higher levels of greenspace (2013) and the wellbeing gain from weekly nature visits (2017). White et al. did not estimate an economic value for the changes in wellbeing.

Monetary values can be derived, however, by estimating the amount of money required to keep an individual just as satisfied, happy or in a similar state of self reported health in the absence of greenspace use or exposure (Fujiwara and MacKerron, 2015) or by looking at how those experiencing certain outcomes, such as regular usage of parks and greenspaces in the past 12 months, is associated with differences in people's wellbeing, quality of life, and other health outcomes compared to those who do not use parks and greenspaces regularly (Living trust, 2018).

The Living Trust (2018) notes the major limitations of wellbeing valuation are that it heavily relies on statistical analysis and may be subject to endogeneity due to selection bias. Wellbeing evaluations are based on survey data and subject to survey design limitations as well. Survey data, however, of life satisfaction, happiness, and self-reported mental and physical health and community engagement are reported by Statistics Canada adding a level of reliability. As of now, Statistics Canada data are not reported at a local level and are not linked to greenspace use.

2.3.3 Summary of Existing Canadian and Ontario Measured Health Benefits

Given the surge of interest and increasing evidence that greenspace contributes to health and wellbeing benefits, there are few studies measuring health benefits from greenspace with a specific focus on Canada and Ontario and only two of those studies place an economic value on those benefits (Karden et al., 2015; Nowak et al., 2013). This section highlights key Canadian studies linking exposure to greenspace and health outcomes and studies placing an economic value on those health outcomes. The gap, especially in the Canadian context, linking economic valuation of health outcomes to greenspace highlights the importance of developing frameworks and approaches to do so.

Exposure to Greenspace and Health Outcomes (Unspecified or Multi-pathway)

A study by Crouse (2017) on urban greenness and mortality in 30 Canadian cities found significant decreased risks of mortality in the range of 8–12% from all causes of death examined with increased greenness around participants' residences. A study by Villeneuve and colleagues (2012) of 575,000 adults in Ontario found statistically significant reductions in cardiopulmonary, cardiovascular disease, ischemic heart disease, and stroke mortality of respondents living in areas with more greenness as measured by the normalized difference vegetation index (NDVI). A similar type of study of greenness by Hystad and colleagues (2014) as measured by NDVI looking at birthweights found more greenness was associated with higher term birth weight and decreased likelihood of being small for gestational age.

Karden et al. (2015) in a study of Toronto found that people who live in neighbourhoods with a higher density of trees on their streets report significantly higher health perception and significantly less cardiometabolic conditions. The study combined high-resolution satellite imagery and individual tree data from Toronto with questionnaire-based self-reports of general health perception, cardio-metabolic conditions and mental illnesses from the Ontario Health Study. Karden then assigned an equivalent economic value to the improved health benefit provided by those living in tree dense neighbourhoods based on decreased use of health care services. The study found that having 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighborhood with $10,000 higher median income or being 7 years younger. The authors also found that having 11 more trees in a city block, on average, decreases cardiometabolic conditions in ways comparable to an increase in annual personal income of $20,000 and moving to a neighborhood with $20,000 higher median income or being 1.4 years younger.

Pathway: Physical Inactivity and Obesity

A review by Warburton and colleagues (2006) found evidence across studies of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases (e.g., cardiovascular disease, diabetes, cancer, hypertension, obesity, depression, and osteoporosis) and premature death. The direct and indirect health care costs of physical inactivity in Canadian adults has been estimated by Janssen (2012), which could be linked to health outcomes from increased physical activity attributed to greenspace access and amenities. While there is ample research linking greenspace to increased levels of physical activity, lower body mass index (BMI) and better health outcomes, a cross-sectional study by Prince and colleagues (2011) of 3,883 adults in Ottawa found higher greenspace was associated with decreased likelihood of overweight or obesity in women but the opposite in men.

Pathway: Mental Health

Three notable Canadian studies have attempted to estimate the cost of mental illness. A study by Smetanin (2011) estimated the direct health care costs and forgone gross domestic product (GDP) due to lost productivity resulting from depression to be $42.3 billion ($2012). This study conservatively estimated that the cost of mental illness was $42.3 billion in direct costs and $6.3 billion in indirect costs. The indirect economic costs reflect the impact of illness upon the productivity of the labour force (forgone wages due to the presence of mental illness). Lim et al. (2008) estimated that the burden of mental illness cost the Canadian economy about $51 billion in 2003. This includes health care costs, lost productivity, and reductions in health-related quality of life. The Conference Board of Canada (2016) estimates that improved treatment of depression among employed Canadians could boost Canada's economy by up to $32.3 billion a year. In addition, improved treatment of anxiety among Canadians could boost Canada's economy by up to $17.3 billion a year.

Pathway: Environmental Stressors

Nowak et al. (2013) estimated the value of improved air quality provided by trees in The City of Toronto. Across the City, it was estimated that trees and shrubs remove 1,430 metric tonnes of air pollution (CO, NO_2, O_3, PM10, SO_2) valued at $20.4 million in avoided health care costs. The valuation approach accounted for avoided health-care expenses (i.e. cost of illness and willingness to pay to avoid illness), productivity losses associated with specific adverse health events, and the value of a statistical life in the case of mortality.

TABLE 3. Summary of air quality improvement and avoided annual health care costs

VARIABLE	TORONTO-WIDE ESTIMATE ($M)
Pollutant removal rate (tonnes per year)	
- Carbon monoxide (CO)	10
- Nitrogen oxides (NOx)	297
- Ozone (O_3)	1180
- Particulate matter (PM)	357
- Sulphur dioxide (SO_2)	62
Total removal rate (tonnes per year)	1906
Avoided health care costs (dollars per year)	**$20.4 M**

Source: Novak et al. (2013)

In addition to improved air quality, greenspace has been linked to respite from heat related stress (Bowler et al., 2010; Lafortezza et al., 2009). A study by Pengelly et al. (2007) found that over a 50-year period (1954-2004), an average of 120 deaths per year in the City of Toronto were related to heat, the most common cause of mortality among weather related disaster types over the study period (Pengelly et al., 2007).

2.4 JURISDICTIONAL SCAN OF "ECOHEALTH" PROGRAMS

In addition to the literature review, a jurisdictional scan of "ecohealth" programs that exist in Ontario and elsewhere was conducted. The jurisdictional scan was informed by literature and internet searches. The objective was to identify programs with an explicit link between the use of greenspace and improved health outcomes. Priority was given to Ontario-based programs but initiatives from elsewhere in Canada and internationally were also considered.

The scan identified 8 programs that use nature-based programming or greenspace exposure or use to promote improved health and wellbeing. The examples offer an indication of the nature and range of programs with an ecohealth mandate. Among the examples, programs primarily target youth, vulnerable groups, or individuals dealing with addiction and mental health issues. Table 4 demonstrates the lines of enquiry that were explored for each of the programs.

TABLE 4. Lines of enquiry for jurisdictional scan

LINE OF ENQUIRY	DESCRIPTION
Name	Name of the project or program
Jurisdiction	Location of the project or program
Target population	The population or sub-populations targeted by the project or program (e.g., specific age ranges, urban or peri-urban, socio-economic groups, etc.)
Type of greenspace	Any information that defines the type of greenspace or its characteristics
Program type	Is the program a government program, NGO, charity, or private business?
Year(s)	The year or years of implementation; is the project complete / ongoing?
Description	A brief description of the project or program
Objective	Original defined project or program objective, or intended outcomes
Health and wellbeing metrics	Metrics/ indicators used by the program
Outcomes	Actual achieved project or program outcomes
Return on investment	Any demonstrated or reported economic returns on program investment

Appendix D contains descriptions of the programs reviewed organized around the lines of enquiry identified above. After identifying and reviewing the examples, it became obvious that very few programs actually report program-specific health and wellbeing metrics or return on investment values. With respect to the former, programs are either silent on the metrics used to evaluate their programs or they cite the relevant literature to demonstrate that there are health benefits from participating in the particular program. Only one of the identified programs (the Pine River Institute) explicitly stated that it gathers data on participants before, during and for several years after their program. It is possible that other programs undertake similar monitoring programs, but from the research conducted, such practices are not obvious. Programs do, however, frequently report on participation rates, citing how many people they reach on an annual basis. Finally, the identified programs had limited connection to the identified pathways identified in the literature review.

With respect to return on investment, only the Pine River Institute appears to track such information stating that they realize a 700% return in social benefits for every dollar invested.[4] Based on the research undertaken, none of the other programs appear to calculate a return on investment or direct health system savings credited to their programs.

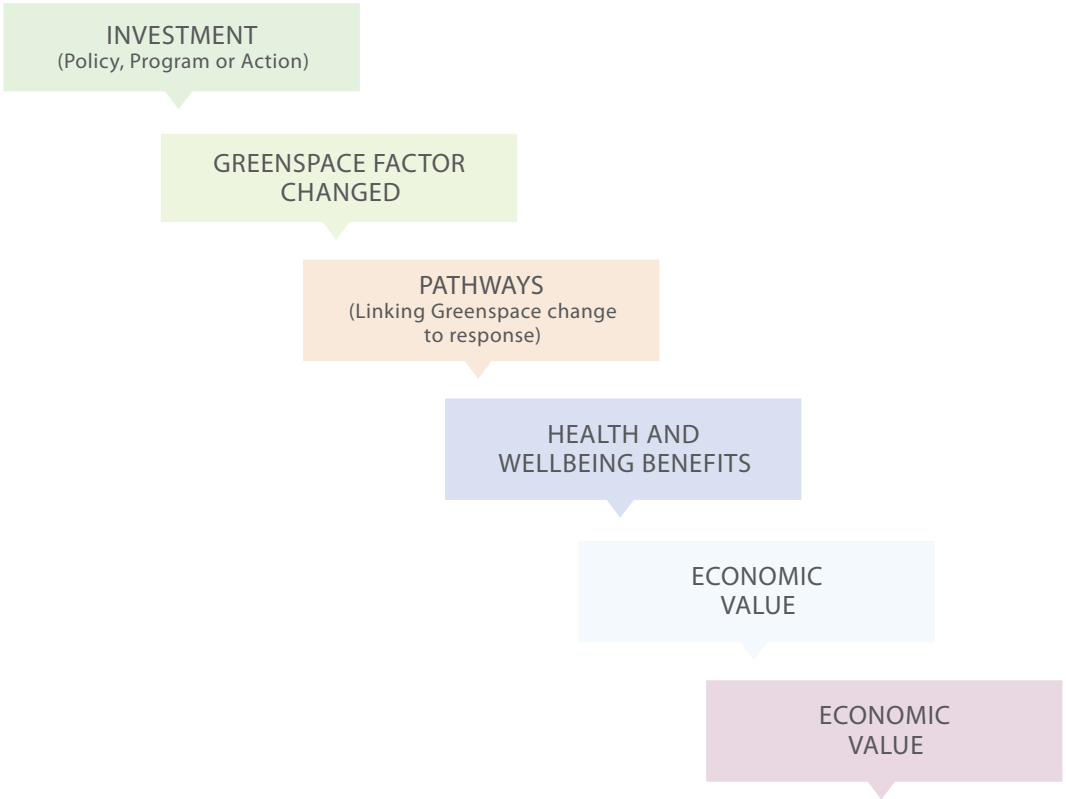
The jurisdictional scan also explored whether the programs identify a cost benefit gap resulting from a disconnect between those paying for the program and those reaping the benefits of the outcomes. We did not find examples where programs comment on the existence of such a gap. However, some conclusions can be drawn from the review in this regard. In the case of private programs, the cost of participating in the program is born by the participant and the benefits from the program are realized by the participant in terms of improved happiness and wellbeing and by the public sector in the form of reduced health care costs. For publicly funded programs, the cost of the program is born by a government entity and the benefits are again realized by the participant in terms of improved happiness and wellbeing as well as the public sector in the form of reduced health care costs. Here, there could be a disconnect between the government entities engaged in the programs. For example, when programs are funded by community groups (e.g. sports and recreation departments) and the benefits are realized by public health departments.

4 Hackett C. et. al. (2017). Pine River Institute: The Social Return on Investment for a Residential Treatment Program. DeGroote School of Business, McMaster University.

3. Conceptual Framework

This section builds on the literature review presented above by creating a conceptual framework to assist users in navigating the decision-making process for establishing a business case for greenspace investments in Ontario. The conceptual framework communicates pathways between greenspace investments and changes in green space factors, which result in health and wellbeing outcomes that lead to economic benefits resulting from reduced incidences of adverse health effects. The conceptual framework articulates the connections between greenspace investments and health returns. Decision-makers can use the conceptual framework as a guide to understand the business case of specific investments and to inform policies, programs and planning decisions to enhance greenspaces. The conceptual framework presented in Figure 2 provides a summary of the steps that users will need to think through when determining the strength of a business case for greenspace investments. In the paragraphs that follow, we expand and elaborate on the various components of this conceptual framework, ending with a more detailed version of this same figure.

FIGURE 2. High level overview linking greenspace investments to health outcomes



Prior to undertaking an assessment of a specific policy, program or action using the conceptual framework, understanding the context, stakeholders impacted and impact on broader social determinants of health must be considered. Box 1 presents a set of pre-screening questions to frame the use of the conceptual framework, determine who should be engaged in the process, and minimize unintended consequences.

BOX 1: Pre-Screening Tool

1. Clearly describe the greenspace investment/scenario under consideration
    - What are you intending to do?
    - What is the rationale for the project, program, or policy?
    - Who will the key users be? Distinguish type of users (demographic groups) and # of non-traditional users
    - How will users benefit? What are possible negative impacts of the greenspace investment?
    - What will it cost to implement? Who will fund it?
    - What is the scope and scale being considered?
    - List data sources and assumption.
2. Who is the intended audience?
    - What primary "level" of influence do you want to have: national, provincial, municipal, community, other _____
3. Who needs to be part of the discussion and process?
    - Consider: community members/groups; decision makers; other stakeholders such as planners, engineers, public health officials
4. What level of accuracy is needed (high/medium/lower) to justify the investment?
    - The more data-driven your audience is, the more precise you will need to be, which is good, but takes more time investment
5. Before working through the conceptual framework, consider how the social determinants of health may influence your decision. Social determinants of health include:
    - Income and social status
    - Employment and working conditions
    - Education and literacy
    - Childhood experiences
    - Physical environments
    - Social supports and coping skills
    - Healthy behaviours
    - Access to health services
    - Biology and genetic endowment
    - Gender
    - Culture
    - Race / Racism

    Consider: How will certain groups be positively or negatively affected by the program? What can be done to mitigate negative consequences?

3.1 PATHWAYS LINKING GREENSPACE INVESTMENTS TO GREENSPACE FACTORS

The first step in the conceptual framework connects a greenspace investment to corresponding changes in the attributes of a greenspace. This step is indicated in green in Figure 2 (above). Investments include adding new parks or expanding existing greenspaces leading to increased accessibility, increased climate-resiliency and reduced environmental stressors; enhancing greenspaces by providing new amenities (e.g., trails, facilities) or improving existing amenities; changing the environmental quality of the greenspace by increasing canopy cover; or changing the type of greenspace, by adding sports fields, for example. In addition to investments that focus on the physical attributes of greenspace, investments can also focus on increasing greenspace access and use, such as offering park programming targeting newcomers or increasing entry points to a park. Investments can change the physical attributes of greenspace (i.e. the size and amount of greenspace, types of uses, amenities, quality of greenspace), or focus on programming and policies to increase the number of people using existing greenspaces. Box 2 provides a list of examples.

These changes in greenspace factors can result in changes in the use of the greenspaces (i.e., a change in the number of green spaces and/or the frequency of green space users), a change in environmental quality, or both. In this case, changing environmental quality refers to changes that result in reduced environmental stressors such as air pollution and heat exposure.

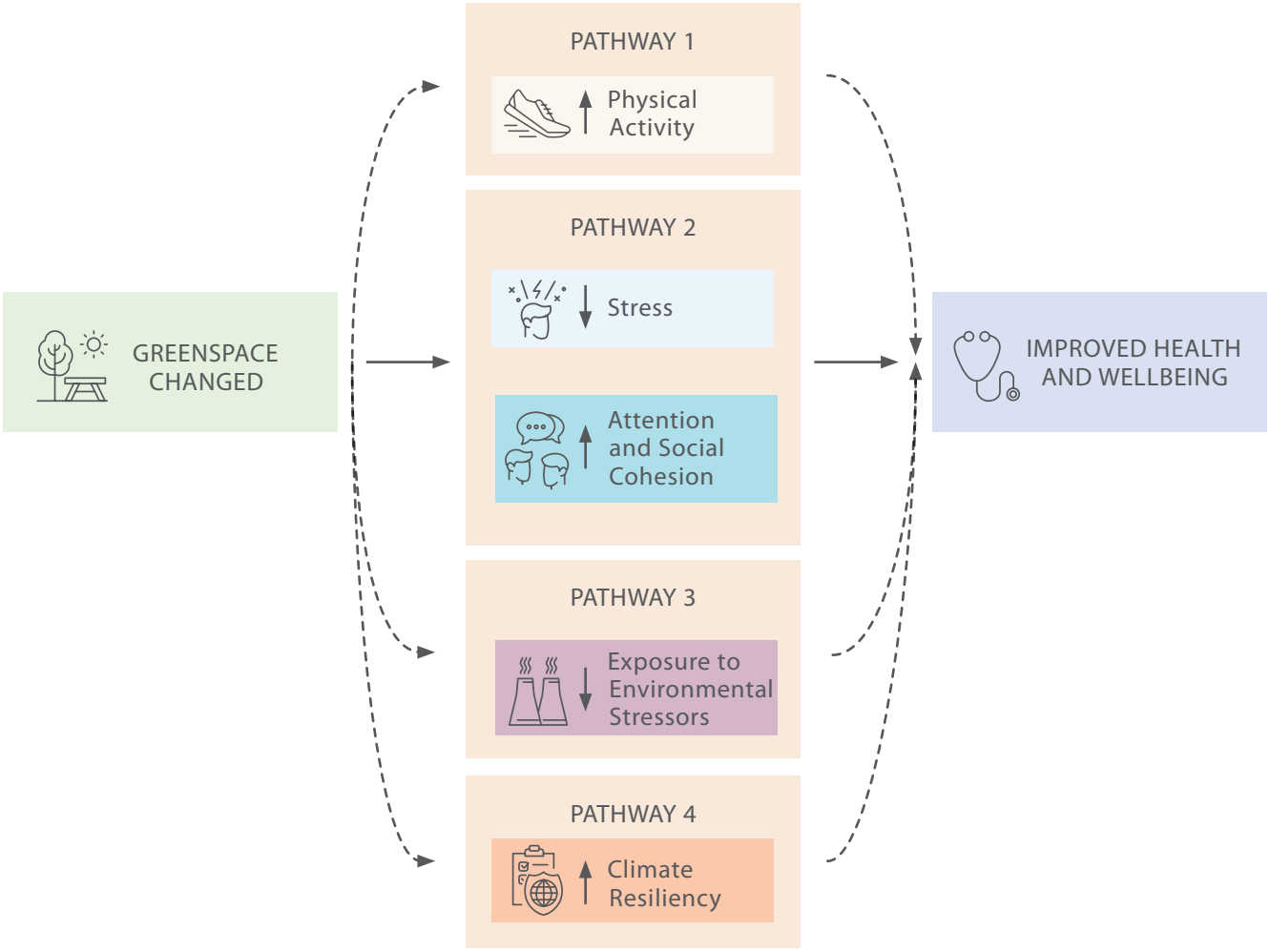
BOX 2: Examples of Greenspace Investments

- Adding 20 hectares of forest greenspace to an existing park
- Planting 100 trees in a nature-deprived neighbourhood
- Developing a trail network in a park
- Building a cricket pitch
- Introducing a program targeting outdoor recreational activities to newcomers
- Implementing a green roof bylaw

3.2 PATHWAYS LINKING GREENSPACE CHANGE TO IMPROVED HEALTH OUTCOMES

A greenspace investment can result in a change in use (i.e. a change in the number or size of greenspaces and/or the frequency of greenspace users), a change in green space quality, or both. Figure 3 describes pathways linking greenspace investments with health outcomes. For the purposes of the conceptual framework, the pathways linking greenspace investments to improved health outcomes have been simplified into four groups: (1) physical health, (2) mental health and wellbeing, (3) exposure to environmental stressors such as air, heat, and noise pollution, and (4) environmental changes exacerbated by climate change, such as flooding, fire, and erosion. Pathways one and two are primarily a result of changes in use, and pathway three and four are the result of a change in greenspace quality. Details of the various components of each pathway are described in the literature review section, with the exception of the climate change-related pathway, which, as stated above, is important, but outside of the scope of this project, with the exception of heat-related exposures as described in the third pathway.

FIGURE 3. Summary of pathways between connecting greenspaces and improved health and wellbeing outcomes



Adapted from: Markevych et al., 2017; WHO, 2016; and James et al., 2013

**As noted previously, due to the indirect and complex nature of the pathway linking greenspace to climate resiliency to health outcomes, this pathway has not been explored in depth. It is included here, however, to highlight its importance.*

BOX 3: Health Outcomes Attributed to Greenspace Investments

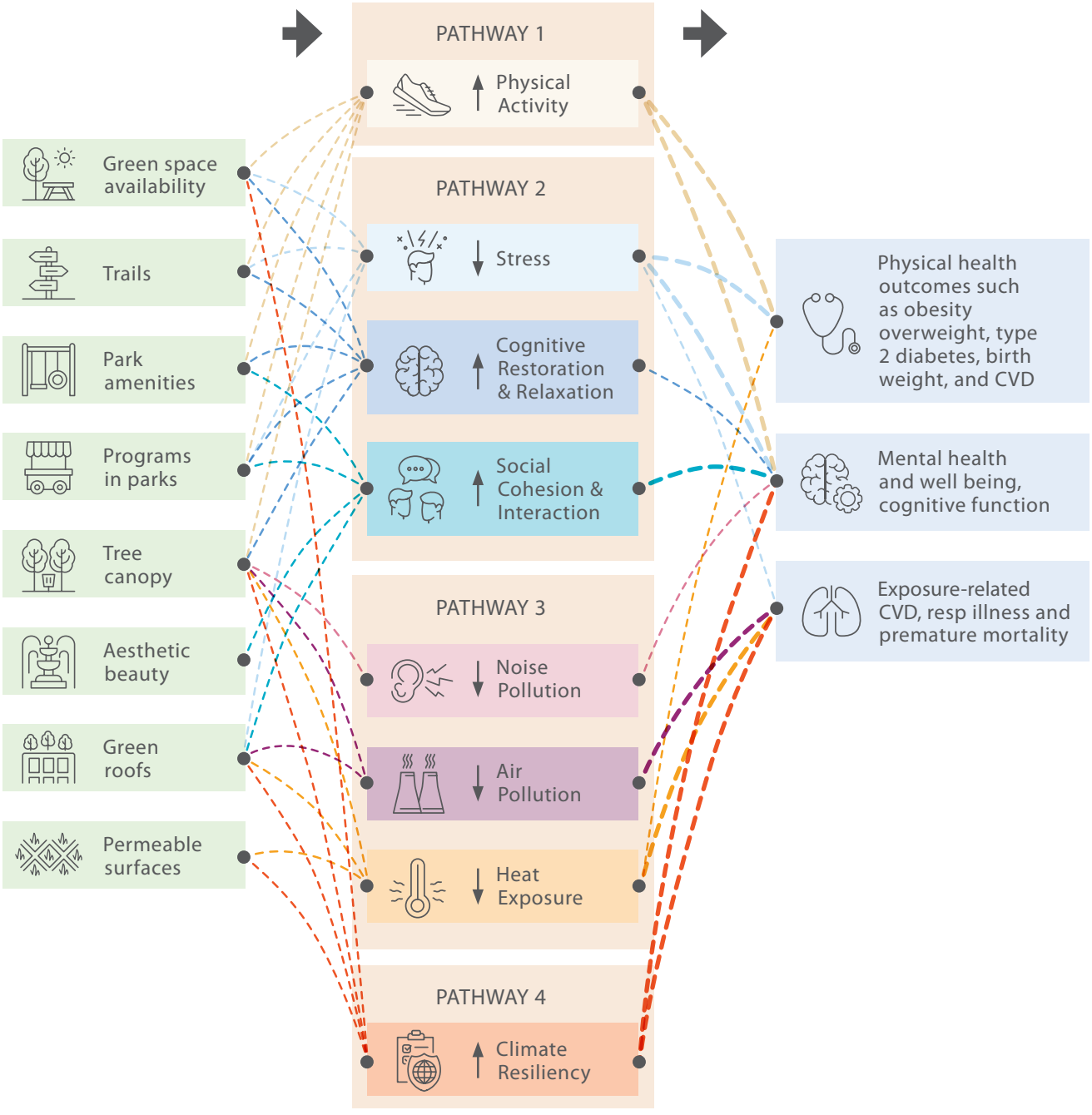
Decreased rates of: obesity/overweight, type 2 diabetes, depression, cardiovascular disease (CVD), respiratory illnesses, low birth weight, premature morbidity

As the conceptual framework is built out, Figure 4, introduces the links found in the literature between the pathways outlined above, and specific health outcomes. These resulting health outcomes are summarized in Box 3. Understanding how changes in health responses connect to improved health and wellbeing are not straightforward. As documented in the literature review, while there is substantial evidence that greenspace has a positive impact on health outcomes, the pathways by which these improvements are made are still not fully understood.

The variety of different exposures (types, doses and qualities of greenspaces), mediators and modifiers, and the complexities related to measuring longer term health outcomes make it difficult to clearly identify pathways (James et al., 2015; Markevych et al., 2017; and WHO, 2016). Despite this, the evidence is stronger for several of the pathways as communicated by the thickness of the arrows. This includes physical activity (Warburton et al., 2005; Shanahan et al., 2016), stress (Nutsfort et al., 2013; Triguero-Mas et al., 2015; Maas et al., 2009), and air pollution (Beckerman et al., 2012). For further information on the studies that contributed to the strength of the relationships shown in Figure 4, refer to the literature review (Section 2).

Figure 4 illustrates the complexity and overlapping nature of the relationships and is not meant to be considered in isolation. It is the basis of a process that users of the conceptual framework can apply to compare the relative benefits of various greenspace investments. This figure also depicts the relative strength of the evidence supporting the link between an intermediate pathway, such as decreasing stress or increasing physical activity and improved health outcomes. Specifically, the strength of these relationships is shown using thin, medium and thick arrows to depict weak, moderate and strong relationships. Given the diverse metrics that are used in the various studies, these arrows merely provide a guide.

FIGURE 4. Illustration of the complexity of the relationships between greenspace investments and improved health outcomes

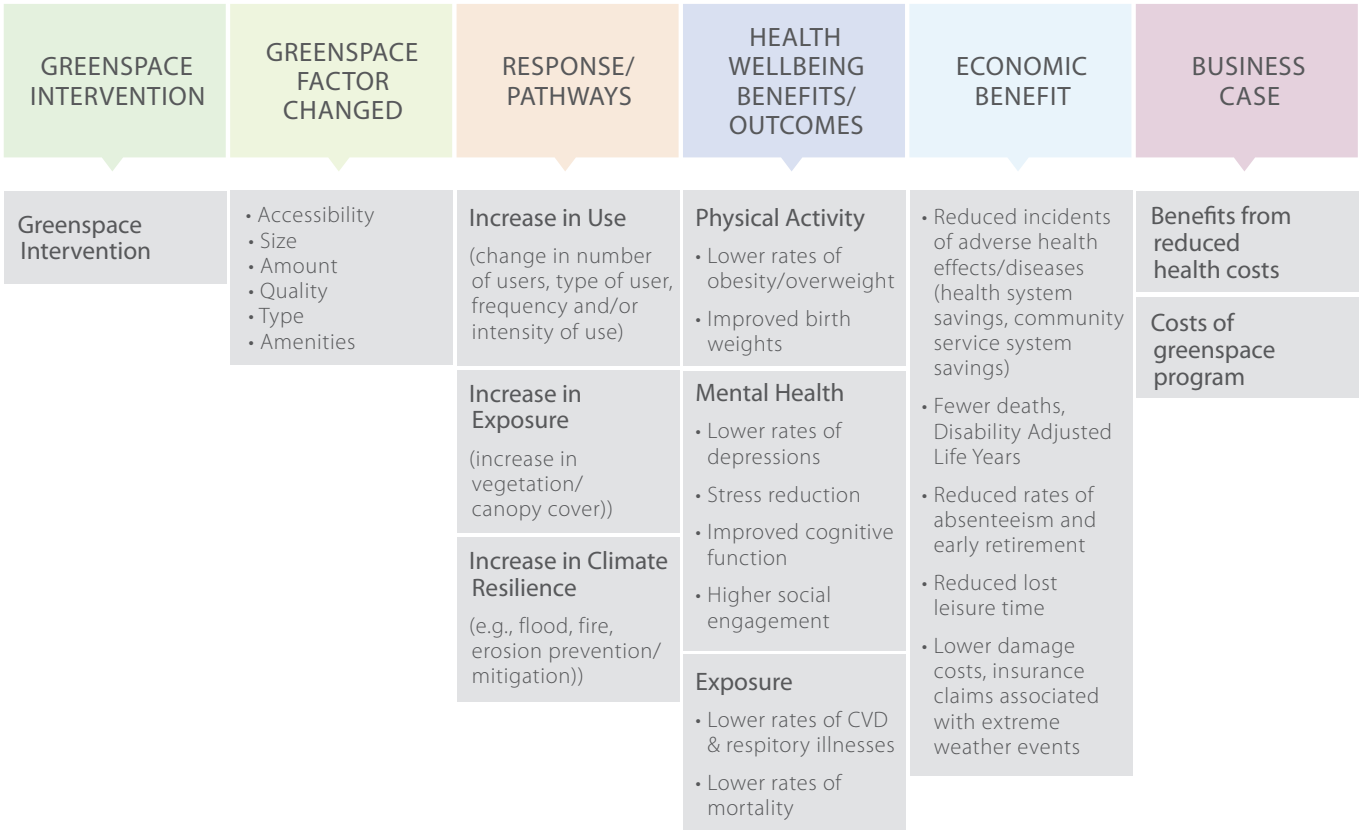


3.3 ATTRIBUTING A MONETARY VALUE TO ASSOCIATED HEALTH OUTCOMES

The connections depicted in Figure 4 help users understand that health improvements result from greenspace investments and what the pathways between these factors look like. Figure 5 demonstrates examples of the pathways between greenspace investments and economic returns. The conceptual framework communicates that greenspace investments lead to improvements in health and wellbeing resulting in, for example, health system savings, prevented lost productivity associated with poor health and illness, and reduced mortality.

The conceptual framework provides analysts and decision-makers information on the ecohealth benefits of potential greenspace investments when evaluating policies, programs and actions. It is meant to enhance the decision-making process by complementing other factors and information under consideration. The conceptual framework makes links between green space investments, health outcomes, and economic benefits to inform the decision-making process.

FIGURE 5. Pathway linking greenspace investment to economic benefits



Assigning a monetary value to greenspace investments is challenging, given the difficulties in identifying quantifiable health outcomes attributed to a policy, program, or planning decision as described in the literature review and depicted in Figure 5. The evidence connecting greenspace investments to health outcomes is strongest in three areas, namely:

1. Physical health improvements associated with higher levels of physical activity
2. Mental health improvements associated with spending time in nature
3. Health improvements associated with lower levels of air pollution and specifically reduced respiratory symptoms and incidences of cardiovascular disease

For these areas, we provide examples of simplified scenarios and calculations to demonstrate how the conceptual framework can help users understand health benefits and associated economic benefits attributed to greenspace investments. Completing detailed analyses of specific examples falls outside the scope of this project. The examples that follow are for illustrative purposes only to show the potential utility of the framework and to stimulate ideas about how users can apply the framework in their work context. They are intended to help connect the dots of how one navigates from greenspace investment to economic benefits using the conceptual framework.

An important next step in this field of study is to carry out detailed analyzes to validate the utility of the framework and develop a set of case study examples for the broader community of practitioners to draw upon.

3.3.1 Increased Physical Health Attributed to Higher Levels of Physical Activity

Greenspace accessibility, amenities, and size are known to influence greenspace use. The number of people engaging in physical activity in greenspace is a function of use. Investments that result in increased use and subsequently higher levels of physical activity result in avoided health care costs and prevented lost productivity due to inactivity.

Avoided costs attributed to negative heath impacts can be estimated based on the number of users that meet weekly recommended physical health requirements (150 minutes of moderate to vigorous activity per week, or portion thereof) multiplied by the direct and indirect costs of inactivity. This approach is proposed in the United Kingdom, Urban Natural Capital Accounts framework and applied in the Corporate Natural Capital Accounting (CNCA) framework (eftec, 2017; Jon Sheaff and Associates, 2017). The direct and indirect health care costs of physical inactivity in Canadian adults are estimated to be $6,757 million or $253 per adult (2009) or $293.25 per adult in 2018 (Janssen, 2012). Direct costs in Janssen's (2012) study refer to the value of goods and services for which payment was made and resources used in treatment, care, and rehabilitation related to illness or injury (hospital care expenditures, drug expenditures, physician care expenditures, expenditures for care in other institutions, and additional direct health expenditures). Indirect costs refer to the value of economic output lost because of illness, injury-related work disability, or premature death.

Not all park users engage in physical activity. They may be engaged in passive activity such as relaxing, reading, or enjoying the company of friends or family. Based on the literature, the percent of park users engaged in moderate to vigorous activity is estimated to range from 18% to 62% of total park users (Hamilton et al., 2017; Holliday et al., 2017; Cohen et al., 2007). The adjustment applied could also be determined using local greenspace data if available.

Physical health benefit calculation:

*= New greenspace users resulting from greenspace investment * percent of those who engage in physical activity in greenspace * avoided direct and indirect costs of inactivity per year ($293.25 per adult)*

Example, Installation of a New Cricket Pitch

Figure 6 depicts an example of how a greenspace investment, in this case installing a cricket pitch, connects to health benefits and associated economic returns using the conceptual framework. The cost data and user data in this example are from the City of Waterloo, Outdoor Sports Field Strategy, 2012-2031. See Table 5 for a list of data used.

FIGURE 6. Conceptual framework, example – cricket pitch

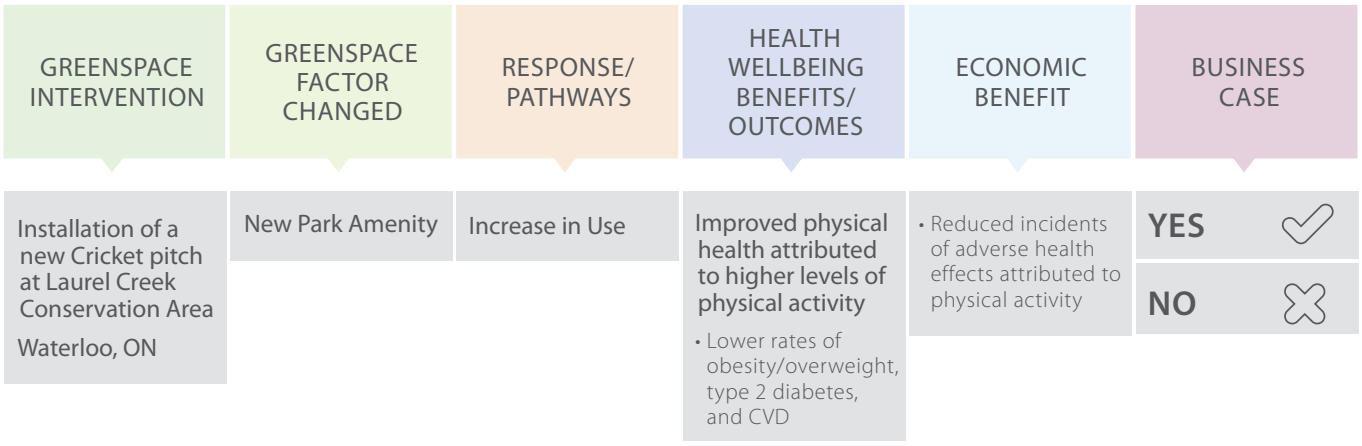


TABLE 5. Calculation data

GREENSPACE INVESTMENT		USER INFORMATION	
Capital cost of a new cricket pitch:	$15,000	Average field use per week:	27.1 hours
Life span of cricket pitch:	20 years	Season length:	21 weeks
Cost, straight line depreciation method:	$750 per year	Estimated number of users:	150 per week
Maintenance, rectangular field:	$8,000 per year		
Capital investment and maintenance cost:	$8,750 per year		

The cost to install a new cricket pitch is estimated to be $15,000 with a life span of 20 years. The annual maintenance of a rectangular field is $8,000 per year. The estimated average use per week is 27.1 hours per week based on bookings data for the Waterloo park cricket pitch. The season length for a cricket pitch is 21 weeks, May to September. The above calculation does not include 'non-booked' field use nor field use during other times of year. The Waterloo field strategy projects that a cricket pitch at Laurel Creek Conservation Area will serve 150 additional cricket users primarily serving University of Waterloo student club and the growing number of teams in the region. The estimated number of users is consistent with data from the Sunrise Cricket Club which estimates 140 distinct people use the Waterloo park pitch per week based on membership and teams playing at least one match per week. Matches can last 6 hours or more.

Physical health benefit calculation:

*= New greenspace users resulting from greenspace investment (150 users) * percent of those who engage in physical activity in greenspace (100%) * avoided direct and indirect costs of inactivity per year ($293.25 per adult) * portion of the year that greenspace is used (21/52)*

= $17,764.18 per year

The annual health return on investment (HROI) attributed to increased physical activity associated with installing a cricket pitch in this scenario is = **$9,014.18 per year.**

This simplified scenario assumes that the users would not have otherwise attained their weekly recommended physical health requirements of 150 minutes of moderate to vigorous activity per week. It also only considers physical activity of cricket users using the field in booked times during the field season. It does not consider that people may engage in physical activity using the field in non-booked times and outside of the 21 week field season.

3.3.2 Increased Mental Wellness Attributed to Time Spent in Nature

Spending time in greenspace has been shown to reduce stress, reduce rates of depression, increase cognitive function, increase sense of personal wellbeing, and increase social interactions. Maller, a leading authority on the health benefits of nature, contends that increasing access and time spent in greenspace and natural areas may be the most effective population wide strategy for promoting mental health (Maller et al., 2006). A study by Shanahan and colleagues found that spending 30 minutes per week in greenspace reduces the population prevalence of depression by 7% (Shanahan et al., 2016). To estimate some of the mental health benefits of spending time in greenspace, we can estimate the monetary value associated with reduced rates of depression. The direct health care costs and forgone GDP due to lost productivity resulting from depression are estimated to be $1.5 billion ($2009) and $32.3 billion ($2012), respectively (Smetanin et al. 2011, Conference Board of Canada, 2016). The costs per person are $51.68 ($2018) and $999.48 ($2018), respectively.[5]

5 Statistics Canada. *Table 051-0001 - Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted),* CANSIM (database). Accessed April 2018.

Mental wellness benefit calculation:

*= New greenspace users spending on average 30 minutes or more per week in greenspace and portion of existing users increasing time spent in greenspace to 30 minutes or more per week * the prevalence rate of depression * the direct health care costs and forgone GDP due to lost productivity resulting from depression per person ($1051.16)*

Example, Offering a Weekly Mood Walk Program at a University

This example explores the potential economic return of organizing a weekly guided walk in nature targeting university students experiencing stress and depression. Figure 7 depicts how a nature walk program connects to health benefits and associated economic returns using the conceptual framework.

FIGURE 7. Conceptual framework, example – moodwalk program

GREENSPACE INTERVENTION	GREENSPACE FACTOR CHANGED	RESPONSE/ PATHWAYS	HEALTH WELLBEING BENEFITS/ OUTCOMES	ECONOMIC BENEFIT	BUSINESS CASE
Implementation of a university mood walk program	Access	Increase in Use	Improved mental health • Lower rates of depressions • Stress reduction • Improved cognitive funtion • Higher social engagement	• Reduced incidents of adverse health effects attributed to depression	YES ✓ NO ✗

The cost of the program is estimated to be $884 assuming it is offered once per week over a 26 week period and an hourly pay rate for the guide of $34.

The benefit of the program is based on the estimated monetary value associated with reduced rates of depression attributed to spending time in nature among program participants. In this example, we assume the average number of weekly participants is 10.

Mental wellness benefit calculation:

*= New greenspace users spending on average 30 minutes or more per week in greenspace and portion of existing users increasing time spent in greenspace to 30 minutes or more per week (10) * the prevalence rate of depression among users (100%) * the direct health care costs and forgone GDP due to lost productivity resulting from depression per person per year ($1051.16) * portion of year program is offered (26/52)*

= $5,288.80 per year

The annual health return on investment (HROI) attributed to improved mental health by offering a weekly mood walk program is = **$4,371.80 per year.**

3.3.3 Reduced Exposure to Air Pollution

Greenspace investments that increase vegetation and canopy cover reduce exposure to air pollutants. Health incidents caused by air pollutants include acute respiratory symptoms, lower and upper respiratory systems, acute myocardial infarction, acute bronchitis, chronic bronchitis, asthma exacerbation, emergency visits, hospital admissions, mortality,

and work loss days. Table 6 provides a breakdown of health incidences by pollutant type including the incidents reduced per additional 1% canopy cover and the number of trees needed to reduce a single incident. Data is derived from supplemental materials from Nowak et al. (2018).[6]

TABLE 6. Reduced health incidents by air pollutant type, per 1% change in canopy cover and # of trees[7]

POLLUTANTS	HEALTH INCIDENCES	INCIDENTS REDUCED PER ADDITIONAL 1% TOTAL CANOPY COVERAGE	NUMBER OF TREES NEEDED TO REDUCE A SINGLE INCIDENT
NO_2	Acute Respiratory Symptoms	10.95	51,187
	Asthma Exacerbation	162.54	3,448
	Emergency Room Visits	0.14	3,938,224
	Hospital Admissions	0.37	1,506,647
O_3	Acute Respiratory Symptoms	154.93	3,617
	Emergency Room Visits	0.05	11,590,909
	Hospital Admissions	0.45	1,234,867
	Mortality	0.09	6,219,512
$PM_{2.5}$	Acute Bronchitis	0.11	5,204,082
	Acute Myocardial Infarction	0.05	12,289,157
	Acute Respiratory Symptoms	68.26	8,210
	Asthma Exacerbation	49.75	11,264
	Chronic Bronchitis	0.06	9,444,444
	Emergency Room Visits	0.07	8,095,238
	Hospital Admissions,	0.02	31,875,000
	Cardiovascular		
	Hospital Admissions,	0.01	63,750,000
	Respiratory		
	Lower Respiratory Symptoms	1.34	419,753
	Mortality	0.09	6,035,503
	Upper Respiratory Symptoms	1.02	551,948
	Work Loss Days	11.41	49,133
SO_2	Acute Respiratory Symptoms	1.37	409,146
	Asthma Exacerbation	10.64	52,678
	Emergency Room Visits	0.06	10,000,000
	Hospital Admissions	0.08	7,445,255

6 Nowak, D. J., Hirabayashi, S., Doyle, M., McGovern, M., & Pasher, J. (2018). Air pollution removal by urban forests in Canada and its effect on air quality and human health. Urban Forestry & Urban Greening, 29, 40-48.

7 The U.S. EPA's Environmental Benefits Mapping and Analysis Program (BenMAP) was used to estimate the incidence of adverse health effects (i.e., mortality and morbidity) and associated monetary value that result from changes in NO2, O3, PM2.5 and SO2 concentrations due to pollution removal by trees in the United States (Nowak et al., 2014). Economic values due to avoided adverse health incidences are calculated based on the Air Quality Benefits Assessment Tool (AQBAT) Release 2.01 values (Judek et al., 2006). The AQBAT is a computer simulation program developed by Health Canada that is similar to BenMAP in estimating human health costs and/or benefits associated with changes in ambient air quality.

The challenge when estimating the monetary value of reduced exposure to air pollution is that it is population and spatially dependent. Nowak et al. (2018) estimated pollutants removed and health benefits attributed to canopy cover (trees) for 86 Canadian cities. Table 6 provides an example using Toronto as a reference city. Data presented are derived from supplemental materials from Nowak et al. (2018).

A greenspace investment that increases canopy cover would result in reduced exposure to air pollutants and subsequently reduced respiratory related health incidences.

Reduced exposure to air pollutant calculation:

*= # of trees planted or percent additional canopy cover * health benefit value due to reduced air pollutants*

Example, Increasing Canopy Cover in Toronto by 1%

This example explores the potential economic return of increasing canopy cover in Toronto by 1%. Figure 8 depicts how increasing canopy cover connects to health benefits and associated economic returns using the conceptual framework. In this example, we focus on improved air quality. Increasing canopy cover also reduces the effects of extreme heat, improves climate resiliency and as noted in the literature review, has been linked to higher levels of self reported mental health.

FIGURE 8. Conceptual framework, example – increasing canopy cover

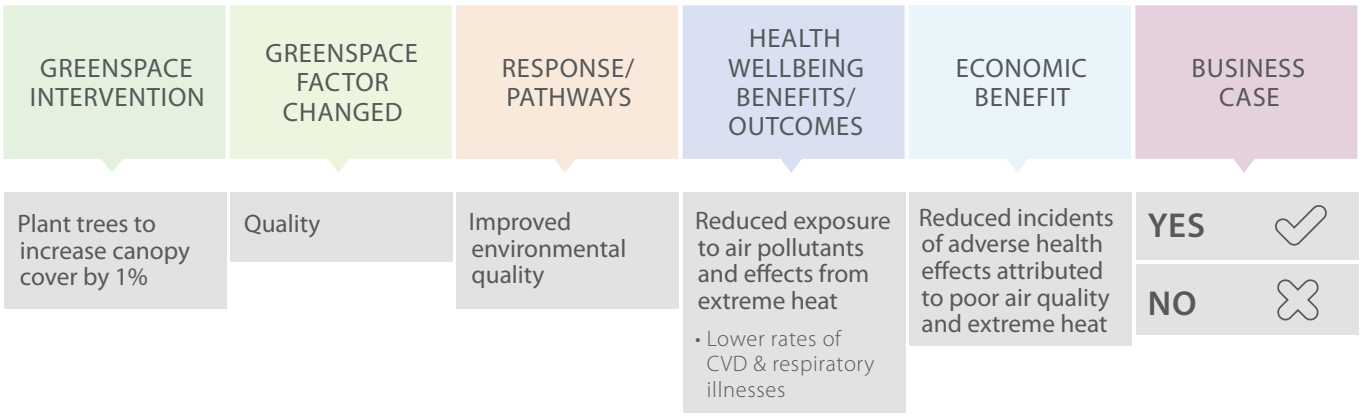


Table 7 summarizes the data used to estimate the economic health returns attributed to increasing canopy cover by 1% in Toronto. Data from 2019 Staff Recommended Operating and Capital Budget Notes - Parks, Forestry and Recreation.

TABLE 7. Calculation data

CALCULATION DATA	
# of trees planted required to increase canopy cover by 1%	102,000
Average cost per tree	$146
Life span of urban tree (based on top five most commonly planted trees in Toronto)	75 years
Cost per tree (Straight line depreciation method)	$1.95 per year
Annual maintenance	$4.71 per tree
Capital investment and maintenance cost	$6.66 per tree per year

The costs associated with increasing the canopy cover by 1% is estimated to be $6.66 per tree per year or $679,320 per year. Based on data from Nowak et al. (2018), presented in Table 8, the health benefits attributed to reduced exposure to air pollution in Toronto by increasing canopy cover equals $13.69 per tree planted or $1,642,800 per year.

TABLE 8. Health benefits attributed to reduced exposure to air pollutants, Toronto

CURRENT CONTRIBUTION OF TORONTO TREES	
Area (ha)	176,340
Population	5,132,794
# of trees	10,200,000
Absolute Tree Cover (ha)	32,093
Total removed pollutants (kg)	8,111,640
Pollutants removed (kg/ha)	46
Health savings / kg pollutants removed	0.07
Health Saving / ha tree coverage	$792.00
Health system savings (new trees/ additional canopy cover)	
Per ha canopy coverage	$7,673,696.70
Per 1 tonne pollutants removed	$167,286,588.13
Per planted tree	$13.69

Reduced exposure to air pollutant calculation:

*= # of trees planted (102,000) * (health benefit value due to reduced air pollutants associated with trees planted per tree per year ($13.69)*

= $1,642,800 per year

The annual health return on investment (HROI) attributed to improved air quality by increasing the canopy cover by 1% = **$683,400 or $6.70 per tree per year**

Box 4 provides a summary of the monetary value calculations for each of the three pathways: (1) physical health benefits, (2) mental wellness benefits, and (3) reduced exposure to air pollutants.

BOX 4: Summary of Monetary Value Calculations

Physical health benefit
*= new greenspace users resulting from greenspace investment * percent of those who engage in physical activity in greenspace * avoided direct and indirect costs of inactivity*

Mental wellness benefit
*= new greenspace users spending on average 30 minutes or more per week in greenspace and portion of existing users increasing time spent in greenspace to 30 minutes or more per week * the prevalence rate of depression * the direct health care costs and forgone GDP due to lost productivity resulting from depression per person*

Reduced exposure to air pollutants
*= number of trees planted or percent addition of canopy cover * health benefit value due to reduced air pollutants associated with trees planted or additional canopy cover*

4. Considerations When Using the Conceptual Framework

The conceptual framework offers users a mechanism to highlight economic benefits associated with improved health outcomes attributed to greenspace investment. At this stage, it is a roadmap to inform decision-making by making apparent the connections between greenspace, improved health outcomes and economic savings resulting from better health. It is not intended to be prescriptive. Rather, it is intended to be a tool to help users consider the potential benefits of greenspace investments.

The conceptual framework currently focuses on health benefits associated with greenspace investments only. We acknowledge that greenspace investments can contribute to harm as well, for example increased time in greenspace increases sun exposure or heightened risk of being exposed to ticks carrying Lyme disease. Increasing the urban canopy cover could lead to higher damage and cleanup costs associated with severe storm events. While the pre-screening questions ask to identify possible harms, the next rendition of the framework should integrate negative outcomes and associated costs as well.

The conceptual framework does not consider non-direct health related impacts associated with greenspace investments, such as the potential for ecological marginalization or social justice issues. Increasing the amount of greenspace or improving the quality of greenspace, for example, can lead to a neighbourhood being more desirable to live in resulting in higher rents and housing prices. The pre-screening tool asks users to consider social justice issues. Future iterations of the framework, however, should look more explicitly into how to integrate costs associated with these issues and strategies to mitigate or avoid potential unintended consequences.

5. Implementing the Conceptual Framework

This section of the report summarizes the primary outcomes from the expert workshop and outlines a range of key implementation options based on possible target user groups. The workshop had three key objectives: validate the conceptual framework; understand how users think they would use the conceptual framework; and identify key recommendations to guide next steps to increase utility and functionality of the framework.

To identify potential uses and recommendations, experts were divided into three user groups, namely planning, conservation and parks and public health. In the sub-sections that follow, conceptual framework uses by these user groups are described. Given the overlap, recommendations and next steps are reported for the expert group as a whole.

5.1 PLANNING USER GROUP

The planning group identified two distinct users for the conceptual framework, the provincial government and municipal staff.

Provincial Government

The conceptual framework should be used to engage in a dialogue on changes to the Provincial Policy Statements (PPS) that have implications for incorporating ecohealth into official plans, secondary plans and design standards. The provincial government is an ideal level of government to engage with since reducing health care costs benefits the provincial government. It is in their best interest to provide direction through PPS to improve access to greenspace. The group also saw a role for applying an ecohealth lens to the Growth Plan for the Greater Golden Horseshoe to communicate the potential ecohealth implications of development and greenspace loss.

Municipal Staff

The planning user group identified several uses of the conceptual framework to support municipal staff including:

- Demonstrating to council and community groups that enhancing greenspace has community health benefits
- Educating developers on the importance of greenspace and making a business case for green living
- Supporting municipal planners to defend or justify changes to planning policies or by-laws
- Understanding which municipal recreation facilities provide the most cost-effective services to the widest range of users (for example, trails vs public pools vs arenas)
- Informing the official plan review process and setting official plan priorities
- Educating and empowering the public on links between greenspace and health outcomes
- Supporting urban forest policy

5.2 PARKS AND CONSERVATION USER GROUP

The conservation and parks user group saw an important role for the conceptual framework in demonstrating the economic benefit of existing parks and new parks or park expansions. Adopting the framework as a decision support tool will demonstrate the monetary value of park co-benefits. The conceptual framework clearly demonstrates to policy makers that parks are in the health business. Additionally, it conveys to the public the important health value of spending time in parks. Applications of the framework should be undertaken to develop information targeted at public officials and relevant decision makers.

Other uses identified by the group include:

- Supporting the Greenbelt study "Into the Greenbelt" and understanding uses and impact for newcomers
- Supporting Conservation Authority strategic plans and funding requests
- Gathering and solidifying municipality support for the work Conservation Authorities are doing
- Justifying ecological restoration projects, riparian investment and watershed management
- Supporting projects and programs aimed at increasing use

5.3 PUBLIC HEALTH USER GROUP

The public health user group saw an important role for the conceptual framework in supporting investments in population health and promoting healthy behaviours. The group felt that the conceptual framework helps make the case that health is important to community development, comparable to food, housing security and sufficiency. In addition, they saw the conceptual framework as being useful to connect community health and development to healthcare system sustainability. The public health group identified carrying out a research project that looks at greenspace and ecohealth across the province under business as usual versus increased greenspace to demonstrate the importance and benefit to the Ontario Government from reduced health care costs.

In terms of uses for different groups, medical officers of health should use the framework to help tell their story and advocate for more resources. Health units should use it to engage in conversations with public works and other departments. Community health centres should use it to bring forth economic arguments to community development. Community healthcare providers who do community development should use the framework to decide what kinds of development initiatives to prioritize.

Other uses raised by the group include:

- Promoting time spent in nature as part of the school curriculum
- Engaging with media and help them understand these important connections
- Promoting investment in tree canopy
- Supporting assessments of climate change vulnerability

The group also saw a role for the framework as a bridge to help different stakeholders "speak the same language" and to hold elected officials accountable. The group noted that while municipalities are not responsible for health care costs, they should use the framework to express outcomes of greenspace investment in terms of social capital and public health, for which they are responsible.

6. Recommendations and Next steps

As is described in the Approach section, the focus of this project was to develop a conceptual framework based on a literature review and expert input of the EHO advisory team and workshop attendees. In addition, a key objective was to identify recommendations and next steps to continue building a business case for ecohealth in Ontario.

The recommendations listed below reflect the extensive research completed as part of this project, input from the EHO advisory team, and expert guidance provided by workshop attendees. The final session of the workshop was explicitly designed to seek recommendations and guidance on next steps. Recommendations are organized into four groupings, namely, validating the framework, framework considerations, further research, and dissemination to other users. There were several recommendations and next steps expressed by all user groups and echoed frequently throughout the workshop. These recommendations are critical to advance the framework from concept to practice.

Priority Recommendations

1. Add a climate change-related pathway linking greenspace to climate resiliency and associated health outcomes.
2. Include potential negative outcomes and harms attributed to greenspace investments in subsequent iterations of the framework.
3. Include benefits in addition to the reduction of adverse health effects such as role of greenspace in recovery and overall sense of wellbeing in subsequent iterations of the framework.
4. Validate the conceptual framework by conducting detailed analyses of case studies examining potential future interventions to demonstrate proof of concept and build an inventory of input data, especially economic data. The case studies will display uses of the framework and lay important groundwork for wider adoption. Case studies should explicitly target the different intended uses identified by the user groups: planning, public health, and parks and conservation.
5. Seek partnerships and collaborations to advance case studies, address gaps in the research, and build supporting databases to advance the framework.
6. Transition the framework into an online tool with supporting databases with economic and health data.

Validating the Framework

As expressed in priority recommendations 4 and 5, validating the framework by conducting detailed case studies is critical to help refine the framework and encourage wider use. An inventory of examples will provide proof of concept to guide users. In addition, developing an inventory of input data to support other applications is an important next step. To validate the framework, we recommend the following:

- EHO should carry out case studies targeting the different intended uses identified by the user groups (planning, public health, and parks and conservation).
- EHO should collaborate with partners including the academic community, agencies, conservation authorities, municipalities, community groups, developers, and other prominent stakeholders to advance cases studies and test applications.

Research to Improve the Framework

Building on the recommended additions to the conceptual framework outlined in priority recommendations 1, 2 and 3, EHO should consider the following additions and refinements in the next iteration of the framework:

- Include a variable that captures quality in terms of ecosystem richness or that accounts for the fact that different greenspaces will have different ecological service values and biodiversity values.
- Include bluespace. Blue space as an urban design term stands for visible water, e.g., harbour front parks, rivers, ponds, lakes, ports, canals, fountains, etc.8
- Connect with Health Canada modellers to explore integrating health impacts and benefits with Air Quality Benefits Assessment Tool (AQBAT), urban heat island mapping and other health costing tools.
- Add screening questions specific to application categories, for example, if the focus is on implementing a green roof, acknowledge factors such as building height, and roof accessibility.

The following recommendations relate to the need for more research to improve the framework:

- EHO should conduct a literature review on climate-related health impacts and monetary costs for inclusion in the conceptual framework to support the development of climate resiliency pathway.
- EHO should conduct further research on the strength/magnitude of the relationship between exposure and outcome and the implications for potential conclusions.
- EHO should develop a database of resources and information to source input values for carrying out calculations including economic values that link to epidemiology research.
- EHO should support studies that improve quality and rigor of economic data in partnership with universities, the Canadian Institute for Health Information, and other relevant agencies.
- EHO should explore breaking down "mental health" in more detail to consider the impacts of greenspace on different mental conditions/disorders.
- EHO should engage its partners who have larger member networks that could be surveyed to help gather survey data.

Knowledge Translation

EcoHealth Ontario should carry out several actions to encourage use of the conceptual framework. These include:

- Share the conceptual framework with groups identified by the EHO advisory team and workshop attendees. For example, health groups should include the Association of Local Public Health Agencies (alPHa), Ontario Public Health Association (OPHA) members, boards of health, medical officers of health, and public health unit staff.
- Provide knowledge translation (eg videos, slide decks and webinars) to teach organizations and other users on how to apply the conceptual framework.
- Provide guidance and information tools on how to use the framework in community consultation especially with marginalized groups.
- Share detailed case studies with media.
- Develop a robust central website of best research practices and case studies.

8 For a more elaborate definition and context see https://2016-2017.nclurbandesign.org/2017/01/urban-design-public-health-blue-space/

Appendix A: Workshop Participants

ATTENDEE	ORGANIZATION	ROLE
Anna Shortly	Greenbelt Foundation	Research and Policy Analyst
Anne Craig	Ontario Parks	Sr. Marketing Specialist
Carol Oitment	Ontario Ministry Tourism, Culture & Sport	Senior Policy Advisor
Catherine MacDonald	Alliance for Healthier Communities	Knowledge Translation Specialist
Chantal Cory	Forests Ontario	Director of Marketing and Business Development
Connie Pinto	City of Toronto, Urban Forestry	Forestry Policy and Planning
Ezgi Tas	Greenbelt Foundation	Research and Policy Assistant
Helen Doyle	Ontario Public Health Association	Environmental Health Work Group Chair
Heather Hewitt	Regional Planning and Growth Management Division (Region of Peel)	Intermediate Planner
Jeff Wilson	Green Analytics	Chief Executive Officer
Jeffrey Wilson	University of Waterloo	Assistant Professor
Jenn Court	Green Infrastructure Ontario Coalition	Executive Director
Jen Capell McCutcheon	Green Analytics	Health Specialist
Kathy Macpherson	Greenbelt Foundation	VP, Research and Policy
Kelly Drew	Toronto Public Health	Health Policy Specialist
Katie Hayes	Healthy Environments -Environmental Health Department	Climate Change Project Associate
Loretta Ryan	Association of Local Public Health Agencies	Executive Director
Marie Worobec	Chronic Disease and Injury Prevention -Region of Peel	Health Planner
Mallory Nievas	Regent Park	Career Mentoring Program Facilitator
Meaghan Eastwood	Toronto and Region Conservation Authority	Senior Research Scientist
Morgan Levison	York Region Public Health	Environmental Health Program Coordinator
MJ Kettleborough	Forests Ontario	Communication Assistant
Noor Shahid	Ministry's Public Health Division	Senior Policy and Program Advisor
Robert Hyland	Forests Ontario	Board Member
Stephanie Gower	Healthy City, Assessment and Analysis (Acting) Toronto Public Health	Manager in the Policy Unit
Suzanne Barrett	EcoHealth Ontario	Coordinator
Tatiana Koveshnikova	Credit Valley Conservation	Project Coordinator
Tara Coley	City of Toronto, Parks Branch	Project Coordinator & Landscape Architect
Thomas Bowers	Greenbelt Foundation	Research Manager
Jane Lewington	Conservation Ontario	Marketing & Communications Specialist

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Appendix C: Literature review matrix

A supplemental spreadsheet is available upon request from EcoHealth Ontario containing a detailed listing of core studies reviewed as part of the literature. Note all studies referenced in this report are in the matrix.

The spreadsheet is divided into three tabs. The first tab covers health benefits and outcomes, the second tab identifies studies that discuss pathways between greenspace use and exposure and health outcomes, and the third tab highlights specific studies that have attempted to monetize the benefits of greenspace use and exposure. For each study in the spreadsheet, the full citation and year of publication are given, as well as a summary of the study design, outcomes of interest, exposure and the main findings of the study. In addition, we have summarized specific populations included in the study, as well as the location of the research. The greenspace valuation tab does not include an exposure column as this is more suited to epidemiological studies. Findings related to each of the tabs are summarized below. All studies referenced can be found in the literature review spreadsheet.

Appendix D: Jurisdictional scan

EcoHealth Ontario's definition of ecohealth was used to guide the identification of ecohealth programs. This definition is based on understanding the relationships between human and environmental health with a focus on *'improved health and wellbeing outcomes for Ontarians through the provision of better ecosystem quality, increased green space and enhanced access to nature'.*

Please note: this is not intended to be a comprehensive jurisdictional scan, nor to include all the pathways discussed in this framework.

Program Name: Aptus Teaching landscape[9]

Jurisdiction: Greater Toronto Area, Ontario

Target population: Students with developmental disabilities

Type of greenspace: Private (Aptus Teaching Landscape) and public (de Havilland "Mossie" park)

Program type: Canadian registered charity

Years: 2016-present

Description: Aptus offers a nature-focused educational environment and activity hub for students with developmental disabilities. At the Aptus Teaching Landscape, Aptus offers disability focused programing, student volunteering opportunities, and an urban agriculture vocational certificate program. The area includes a heated greenhouse, orchard, edible garden and mini-arboretum, connecting to the Mossie Park splashpad and playground.

Objectives:

- Offer a greenspace designed to promote wellbeing.
- Provide services, supports, inclusionary activities, and clinical expertise for students with developmental disabilities

Outcomes:

- Each year, Aptus Treatment Centre provides school supports, clinical services, community programs and residential services impacting over 2700 people.
- Outcomes for the 2017 year include:
  - School program offered to 66 students aged 4 to 21.
  - Adult supports provided to 91 people.
  - After school and school based respite provided to 40 children.
  - Supports at home provided to 53 adults.
  - Environmental programming provided to 1,600 individuals.
  - Camp program provided to 40 children and 37 adults
- Aptus sites evidence that sensory forest has increased learning focus for students suffering from anxiety.[10]

9 Aptus (2016). Aptus Teaching Landscape. Retrieved from: http://www.aptustc.com/TeachingLandscape/Home/TeachingLandscape/Home.aspx

10 Aptus (2017). Annual Report 2016-2017.

Program Name: Association of Nature & Forest Therapy Guides & Programs[11]

Jurisdiction: Canada, 3 companies in Ontario

Type of Green Space: Forest trails

Target population: Open

Program type: Private companies

Years: currently 3 certified companies in Ontario

Description: Forest Therapy is a research-based framework for supporting healing and wellness through immersion in forests and other natural environments. Forest Therapy is inspired by the Japanese practice of Shinrin-Yoku, which translates to 'forest bathing'.

Objectives:

- Reconnect with nature
- Counter high pace of society/urban environment
- Enhance health, wellness and happiness

Outcomes: None reported specifically for the guides and programs, however, there is a significant body of research that demonstrates the health benefits of spending time in forests and nature that are cited on the Forest Therapy website.

Program Name: Camp Kerry Society[12]

Jurisdiction: British Columbia, Ontario, New Brunswick

Target population: Families impacted by life-threatening illness, grief, and loss

Type of greenspace: Camps and outdoor centres such as the Kinark Outdoor Centre in Peterborough

Program type: Canada registered charity, fee-for-service

Years: Started in 2007

Description: Family bereavement retreat program in natural setting based on an ecological framework with councilors. Program activities include: peer group sharing circles, nature hikes, music and art therapy, adventure challenges, campfires and a candlelight memory service.

Objectives:

To provide education, support, and counseling services in nature to individuals, families and groups who are grieving the death of a loved one or coping with a life-threatening illness.

Outcomes:

- Decrease sense of isolation
- Space and time to grieve and heal in natural setting

11 https://www.natureandforesttherapy.org/
12 https://campkerrysociety.org/

Program Name: Enaahting Healing Lodge & Learning Centre[13]

Jurisdiction: Ontario (Midland, Oshawa, Victoria Harbour, Alban)

Target population: Aboriginal communities

Type of greenspace: Little Lake Park, Oshawa Valleylands Conservation Area, Crown land

Program type: Government Program

Years: Started in 1995

Description: Healing and wellness lodges offering culturally appropriate services to members of the Aboriginal community. Services provided include: support/healing circles, group therapy, workshop/seminars, life skills training, family and individual counselling, preventative children and youth programs, traditional teaching and healing techniques including: sweat lodges, fasting, vision questing, ceremonies. All services are designed and delivered by trained Aboriginal Professionals with input from the Enaahtig's Elder's Advisory Circle.

Objectives:

- To promote traditional Aboriginal values and beliefs so as to encourage and foster the healing, rebuilding, and strengthening of Aboriginal communities.
- To promote the spiritual, emotional, mental, and physical wellbeing of Aboriginal individuals, families and communities.
- To provide programs and activities responding to the social, cultural, educational, and language needs of Aboriginal communities.
- To provide opportunities for individuals and families to re-connect with the natural world through land based cultural activities.

Outcomes: Programs and services respond to individual and family needs and generally cover the spiritual, emotional, mental, and physical wellbeing of Aboriginal individuals, families and communities. The program reaches hundreds of individuals and families through a combination of residential and day programming.

Program Name: KidActive[14]

Jurisdiction: Canada

Type of Green Space: School grounds, community spaces

Target population: Kids, families and primary and secondary education providers

Program type: Canada registered charity

Years: 2009-2019

Description: Kidactive partners with local communities and schools to enhance and create natural/outdoor play space, promote active transportation, and provide programs, workshops, resources, consulting, and professional development on natural/outdoor play space and learning.

Objectives:

- Contribute to healthy, active communities that value accessible and well used natural and built environments.
- Build collaborative multi sector partnerships that address children's health and the link to outdoor environments.
- Support policy development that increases access to and use of natural outdoor spaces.
- To ensure all children can access 90 minutes of outdoor physical activity per day.

13 http://www.enaahtig.ca/about.php
14 http://www.kidactive.ca/

Outcomes: Program contends that spending outdoor physical activity time in natural settings increases self-esteem, promotes creativity, increases motivation, improves academic performance, prevents chronic disease, and enhances overall physical and mental health.

Program Name: Mood Walks for Campus Mental Health[15]

Jurisdiction: Ontario

Target population: Post secondary students

Type of greenspace: Hiking trails

Program type: Partnership, with funding from Ontario Ministry of Tourism, Culture and Sport

Years: Current

Description: Mood Walks for Campus Mental Health is a province-wide initiative that promotes physical activity in nature, or "green exercise," as a way to improve both physical and mental health. The initiative is led by the Canadian Mental Health Association, Ontario, in partnership with Hike Ontario, Conservation Ontario, the Centre for Innovation in Campus Mental Health, and the Ontario Council of Agencies Serving Immigrants. Mood Walks provides training and support for postsecondary institutions to launch educational hiking programs, connect with local resources, find volunteers, and explore nearby trails and green spaces.

Objectives:

- Promote exercise and fitness
- Support mental health and wellbeing
- Reduce Social exclusion

Outcomes: Participation in physical activity in a group setting. Benefits from exposure to the healing effects of nature.

Program Name: Just Walk Hamilton-Burlington, Powered by Walk With A Doc[16]

Description: Through the Walk With A Doc program, individuals are invited to take a walk with a registered doctor. The program was born from the notion that participants would be encouraged to lead active, healthy lives more effectively than by being advised by a doctor to walk on their own.

Years: The Walk With A Doc program began in the United States in 2005. There are 7 chapters of the program in Canada.

Objectives: Increase access within the community to credible health information and safe opportunities to exercise at no cost to participants.

Jurisdiction: Hamilton, Burlington and surrounding areas

Target Population: All

Type of Greenspace: local parks and trails

Outcomes: The program website lists 100 health benefits for participating in the Walk With A Doc program. Other outcomes include access to renowned scenery, access to credible information and experiencing a safe, positive, social environment.

15 https://www.moodwalks.ca/about-mood-walks/
16 https://justwalk-hb.weebly.com/

Program Name: Pine River Institute[17]

Jurisdiction: Shelburn, Ontario

Target population: Youth (13-19) struggling with addiction

Type of greenspace: Algonquin Park

Program type: Canada registered charity, fee-for-service

Years: Started 2006

Description: The Pine River Institute is a residential treatment center and outdoor leadership centre. The Institute offers a 4 phase program: Outdoor Leadership Experience at Algonquin Park; followed by residence, at the Pine River Campus in Shelburne, transition to the kids homes, and lastly, aftercare in the home.

Objectives:

- help adolescents suffering from addiction to regain healthy life skills and over-come their addictions.

Outcomes: The 2018 Evaluation report states: *"Most parents are 'satisfied' or 'very satisfied' with PRI treatment*. Results of the report state:

Substance Use: reduced, particularity for those who completed the program

Academics: youths re-engaged with school with good grades and attendance.

Police Contact: 54% at time of program admissions; <11% among those completing program

Hospital visits for substance abuse or mental health: 20% at time of program admissions; <6% o among those completing program.

17 Pine River Institute (2019). About. Retrieved from: http://pineriverinstitute.com/

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