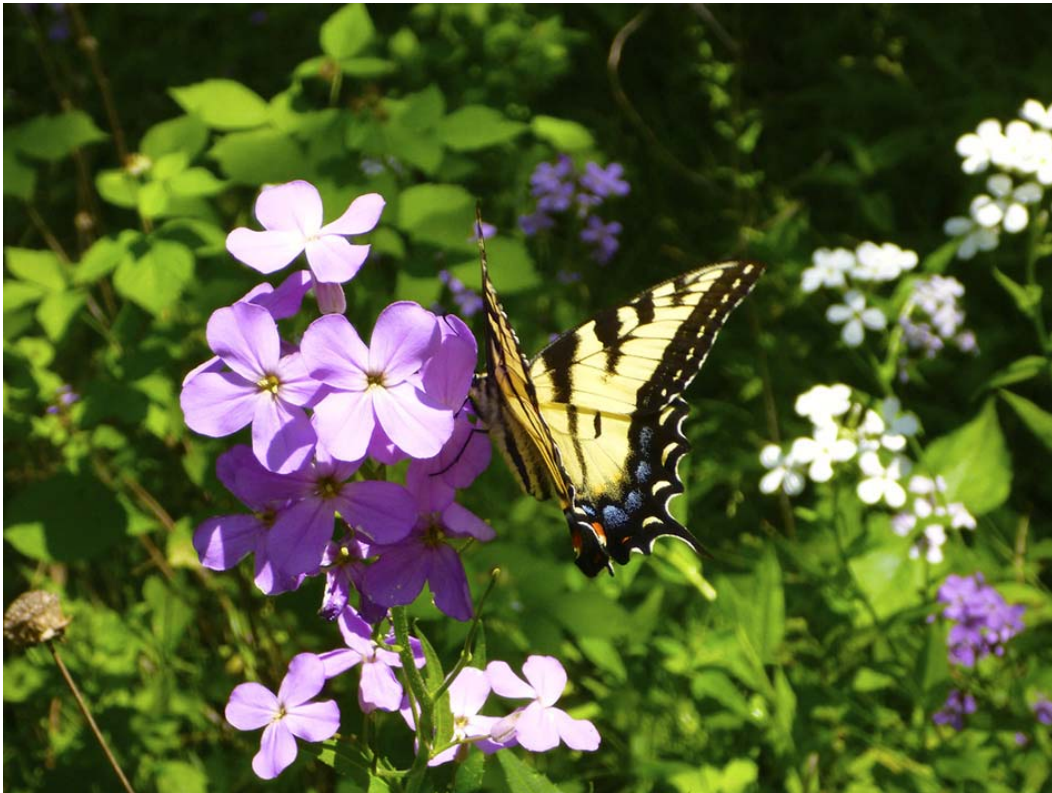


The McMaster Forest

A White Paper by Nicole Graziano, Brian Baetz and Wayne Terryberry



(Hemsworth, 2016)

Land Acknowledgement

The land within the Dundas Valley and the Cootes to Escarpment EcoPark System (C2EP), discussed throughout this white paper is in the traditional territories of the Mississauga and Haudenosaunee nations. This territory is protected by the Dish with One Spoon Wampum Belt Covenant, an agreement between the Iroquois Confederacy, the Ojibwe and allied nations to peaceably share the resources around the Great Lakes. McMaster University and all C2EP Partners and stakeholders must recognize our role as guests on this land and respect the intimate and meaningful relationship that Indigenous peoples have with this traditional territory.

Executive Summary

Environmental protection, indigenous reconciliation, cultural conservation, medical research and public health benefits are amalgamated together into the McMaster Forest, thus making it worthy of expansion and widespread recognition. The McMaster Forest and the natural lands it protects have the capacity to enhance McMaster's promises to its student body and the broader Hamilton community. By conserving this land, McMaster is enhancing physical and mental health, furthering broad-spectrum medical research and prioritizing preventive healthcare. McMaster also has the ability to conserve and protect the natural environment, mitigate climate change and manage stormwater, all through an expanded forest and nature reserve that can reduce costs around energy use, provide financial capital, reduce crime, promote tourism and attract progressive companies. Outside of the vast medical, social and research related benefits, an expanded McMaster Forest Nature Reserve can enhance culture through the preservation of historical sites and through the promotion of reconciliation initiatives. Moreover, alumni and friends of McMaster will be inspired by the gravity of this meaningful project and contribute to this progressive and diverse cause. In light of the ongoing COVID-19 pandemic, an expanded McMaster Forest can reinvigorate the McMaster and Hamilton communities, offering a beacon of hope for the future.

Introduction:

Stunning natural lands, culturally rich historical sites and a diverse array of animal and plant life; these are just some of the traits that make up the Cootes to Escarpment EcoPark System (C2EP). Established in 2013, C2EP covers “one of the most biologically rich areas of Canada” and is the last intact natural connection between Lake Ontario’s wetlands and the Niagara Escarpment (MHBC, 2014, p.9). The biological diversity and valuable history of this land has led to its formal recognition at international, national, provincial and local levels (Cootes to Escarpment EcoPark System, n.d; Galbraith, 2014; MHBC, 2014). C2EP extends from the western end of Lake Ontario from Highway 403 westwards into Dundas and consists of diverse and fragmented land parcels, owned by a number of local partners. Parcels within C2EP have a broad range of uses including conservation, recreation, restoration, research and agriculture. C2EP also contains major roadways and residential areas, making it a distinct blend of urban and natural landscapes. The diversity of the EcoPark System is notable as it “presents virtually the entire spectrum of land use patterns found across southern Canada in one area” (Galbraith, 2014, p.1). C2EP has been called a “living laboratory” and offers novel and meaningful research opportunities within the fields of “medicine, public health, civil engineering, ecology, anthropology, archaeology, history, economics, recreation, and community and natural resources planning” (Galbraith, 2014, p.1).

As the climate crisis worsens and extreme weather events continue to devastate communities, the need to protect vulnerable land only heightens. Currently, through C2EP, McMaster is united with nine other local governmental and non-profit agencies, which own and maintain various land parcels in the EcoPark System (Cootes to Escarpment EcoPark System, n.d.) (see Figure 1). Although not owned by one sole body, the various stakeholders have collaborated to acquire and protect land within C2EP. Currently, approximately half of the land is owned and protected by EcoPark stakeholders. This designation extends to the McMaster Forest and the McMaster Conservation Corridor. Protecting the existing McMaster Forest, which is nestled between Dundas and Ancaster, was an important step towards safeguarding vulnerable land. Despite the undeniable importance of the existing McMaster Forest, there is a legacy setting opportunity for McMaster to strengthen its role in the Cootes to Escarpment EcoPark by acquiring

more parcels within the C2EP. Purchasing and protecting what is currently privately held land from future development will simultaneously maintain the integrity of the C2EP and provide McMaster with valuable opportunities to expand the McMaster Forest Nature Reserve.

COOTES TO ESCARPMENT ECOPARK PARTNERS

BRUCE TRAIL CONSERVANCY
CITY OF BURLINGTON
CITY OF HAMILTON
CONSERVATION HALTON
HALTON REGION
HAMILTON CONSERVATION AUTHORITY
HAMILTON NATURALISTS CLUB
MCMASTER UNIVERSITY
ROYAL BOTANICAL GARDENS

Figure 1: C2EP Partners

The existing McMaster Forest is a former potato farm that was purchased by the university in the late 1960s. This 115-acre (48 hectare) plot is now dominated by an old-growth forest, two cold-water creeks, and a prairie-like grassland (Dudley & Harvey, n.d.; Hemsworth, 2016; Nature at McMaster, 2020). The forest has become a hub for research, education, conservation, natural exploration and art (Dudley & Harvey, n.d.; Hemsworth, 2016; Nature at McMaster, 2020). Students, faculty and the broader Hamilton community experience countless benefits from this forest, all of which will be heightened with its expansion. By acquiring more land in the C2EP, McMaster will be afforded the rare and immensely important opportunity to protect vulnerable biodiversity, directly combat climate change and contribute to the social and cultural wellbeing of the broader Hamilton community. Moreover, through the protection of land with significant ties to Indigenous communities, McMaster has the ability to actively strengthen its commitment to the Dish with One Spoon Wampum agreement.



Figure 2: McMaster Forest Nature Reserve is a mix of open prairie-like fields and old growth forests (Hemsworth, 2016).

The ongoing protection of trees and natural lands restoration is a multifaceted call to action that deeply connects economic, cultural, and environmental wellness. The expansion of McMaster Forest invigorates alumni, current students, friends and neighbours of McMaster, and community members. The growing need to protect vulnerable natural lands coupled with the vast benefits that can be attributed to conservation efforts, indicate the potential for McMaster to enhance its role as a leading contributor to the local, national, and international communities. In light of this, this white paper will analyse the benefits associated with the expansion of the McMaster Forest Nature Reserve through the acquisition of several privately held land parcels.



Figure 3: Map of privately held parcels in the Hamilton portion of the C2EP as proposed additions to the McMaster Forest Nature Reserve (Graphics credit to Shawn Shi).

Objectives:

The main objective of acquiring more land parcels in the C2EP System is to expand the McMaster Forest Nature Reserve, heightening its capacity for both academic studies and recreational use. This expansion will enhance research potential, strengthen McMaster's role as a C2EP partner, and protect vulnerable land. In turn, McMaster's commitment to both Hamilton's ongoing success and environmentalism will be highlighted. More broadly, McMaster can aim to transform the current forest so that it mirrors the success of conservation projects successfully implemented by other peer institutions. By protecting land, McMaster also ensures that the rich cultural history attached to the lands is preserved. Although expansions will be divided amongst various land parcels, McMaster Forest and the broader C2EP System have the ability to rival national parks. A bountiful amount of biodiversity exists within the C2EP System, making it home to over 1,580 documented species and 50 species at risk (Cootes to Escarpment EcoPark System, n.d.). The high concentration of plant and animal makes the C2EP one of the most biodiverse areas in Canada, "home to nearly a quarter of the country's wild plants" (Cootes to Escarpment EcoPark System, n.d.). Additionally, by acquiring more land, McMaster has the ability to connect the

Dundas Valley to the C2EP System. The Dundas Valley is a designated World Biosphere Reserve by the United Nations Educational, Scientific and Cultural Organization (UNESCO) (Hamilton Conservation Authority, n.d.). The Dundas Valley can act as a gateway to the C2EP and the expanded McMaster Forest Nature Reserve. Combining these renowned natural areas elevates it beyond a park, making it a connected and diverse ecosystem of national significance. Through the acquisition of privately-owned land parcels McMaster has the capacity to significantly elevate the C2EP System and make meaningful and lasting changes on the local and national, social and environmental landscapes.

Best Practices from Peer Institutions:

The University of Toronto (UofT), University of British Columbia (UBC) and Duke University each possess notable research forests. Although each forest is unique and varies in accordance with regional climate, the success of ecological protection projects pursued by other universities can be explored and applied to the McMaster Forest Nature Reserve.

University of British Columbia- Malcolm Knapp Research Forest

The Malcolm Knapp Research Forest (MKRF) was established in 1949 and is approximately 12,750 acres (5,157 hectares) large (University of British Columbia, n.d.). The forest contains more than 200 km of trails and roads and is used for research, animal and plant conservation and traditional indigenous practices (University of British Columbia, 2020). Like the McMaster Forest, the MKRF was once originally working land, owned by logging companies in the 1920s-1930s (University of British Columbia, 2020). In addition to conservation and research efforts, UBC uses MKRF to participate in sustainable lumber harvesting (University of British Columbia, 2020). All revenue generated through forest harvesting is reinvested into the forest in order to ensure that it is maintained, protected and improved (University of British Columbia, 2020).

Although McMaster Forest and MKRF have similar missions, the large size of MKRF opens it to a number of more extensive research projects and allows it to protect significantly more natural lands. MKRF acts as a crucial acknowledgement of the need to protect natural lands for environmental, social and reconciliation-related reasons. By acquiring more land, the McMaster Forest can expand its own commitment to ecological preservation. Of course, the MKRF is in a completely different climate and has a much larger amount of natural land available. Comparatively, the McMaster Forest and C2EP more generally, are fragmented by urban growth

and roads. With the placement of the McMaster Forest in mind, it is important to recognize that the McMaster Forest cannot exactly mirror MKRF. Moreover, the McMaster Forest is unique and part of a stunning mosaic of natural land parcels, connected through the C2EP. However, the success of MKRF reminds us of a university's ability to take serious action towards protecting biodiversity and in turn, use this land to better the surrounding environment. In light of the success of MKRF it is reasonable to aspire towards the expansion of the McMaster Forest.

University of Toronto- Koffler Scientific Reserve at Jokers Hill

Compared to MKRF, the University of Toronto Koffler Scientific Reserve is located in closer proximity to McMaster University and shares a similar climate. The Koffler Scientific Reserve is approximately 865 acres (350 hectares) large and is dominated by wetlands, old-growth forests and an extensive trail system (University of Toronto, n.d.). Like other university-affiliated forests, the Koffler Scientific Reserve is used for research and ecosystem preservation. Research goals involve ecology, evolution, genetics, environmental science and cognate areas of study (University of Toronto, n.d.). Research permits extend outside the university to private corporations and community organizations (University of Toronto, n.d.).

Although there is a slight divide between land parcels (see Figure 4), the Koffler Scientific Reserve is relatively well connected. On the other hand, extensions to the McMaster Forest will not be continuous, meaning there will be a break between parcels. McMaster Forest is currently surrounded by other C2EP parcels owned by public agencies and some urbanized areas. Although expanding the McMaster Forest will not result in the creation of a continuous naturalized area owned by McMaster, purchasing private land will protect the parcels as part of the broader C2EP. Moreover, as demonstrated by Duke University, a fragmented forest does not belittle its importance or value to the university community.

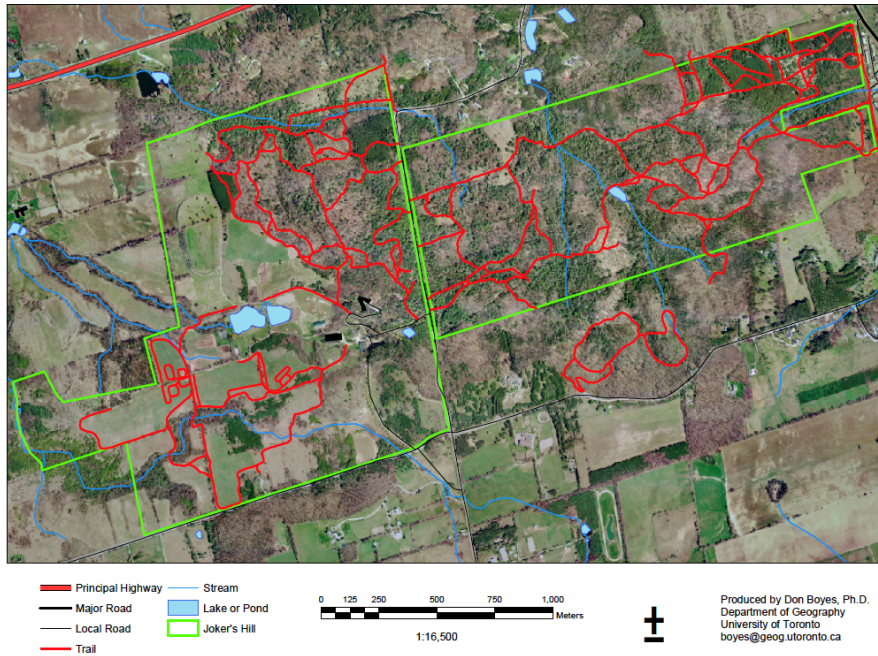


Figure 4: Aerial map of Koffler Scientific Reserve

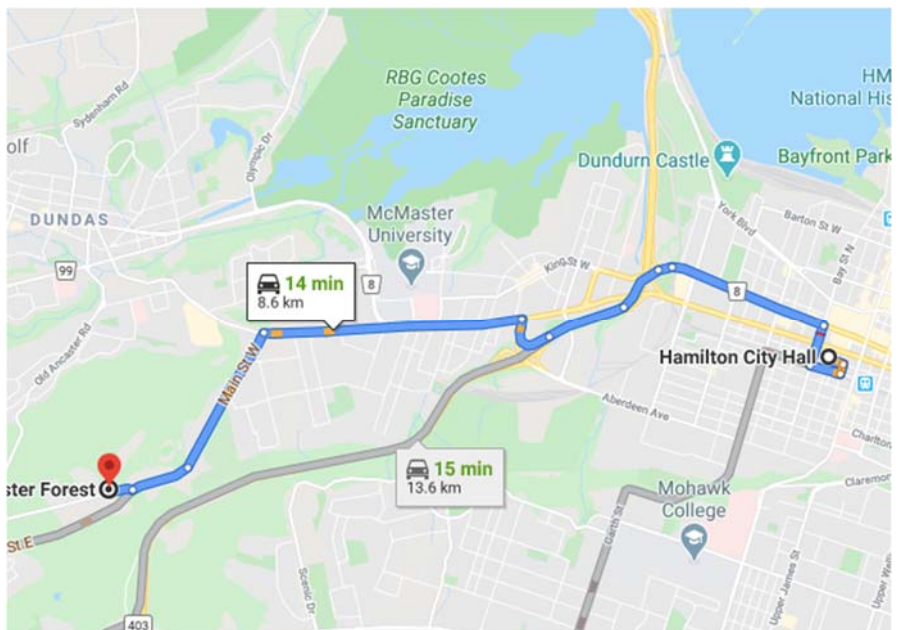
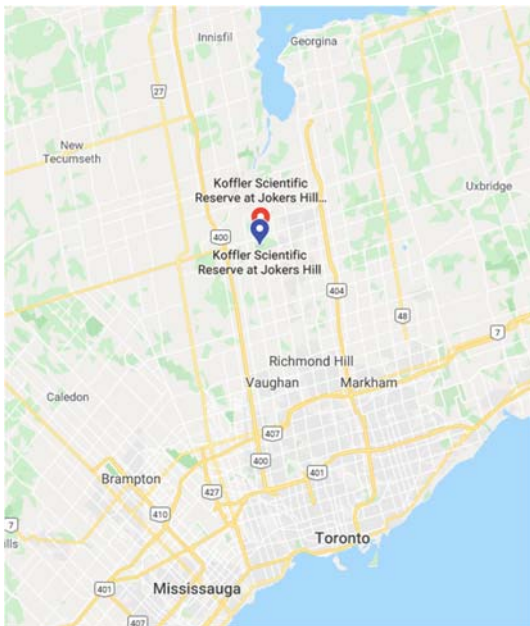


Figure 5: Koffler Scientific Reserve is about a 50-minute drive from downtown Toronto and the main University of Toronto campuses.

Figure 6: Comparatively, the existing McMaster Forest is less than a ten-minute drive from McMaster University and a fifteen-minute drive from downtown Hamilton. The greening of the West Campus will mean that the McMaster Forest Nature Reserve will be mere footsteps away from the main campus.

Duke University- Duke Forest Teaching and Research Laboratory

Duke Forest in the state of North Carolina, consists of over 7,000 acres of protected natural lands, spreading across Durham, Orange and Alamance counties (Office of the Duke Forest, 2020). It has been utilized for research since 1931 and there are over 75 years' worth of collected, scientific data (Office of the Duke Forest, 2020). Duke couples the desire to actualize its academic mission with the protection of natural resources and biodiversity. Duke Forest is unique as the parcels of forest are separate and divided amongst several counties (see Figure 7) (Office of the Duke Forest, 2020). Even though the forest is divided by urbanized areas and privately-owned land, it still is a prolific hub for research and sustainability.

Although the Duke Forest is of a different size and climate than the McMaster Forest, both can expand through the acquisition of privately held land parcels, separate from the main body of the forest. Future expansion of the McMaster Forest would require that the privately held land parcels in C2EP be purchased by McMaster University. As proven by Duke, the distance between parcels does not lessen the value of this land or the mission it seeks to address. The parcels, although separate, can reaffirm McMaster's commitment to the C2EP and all it promises.

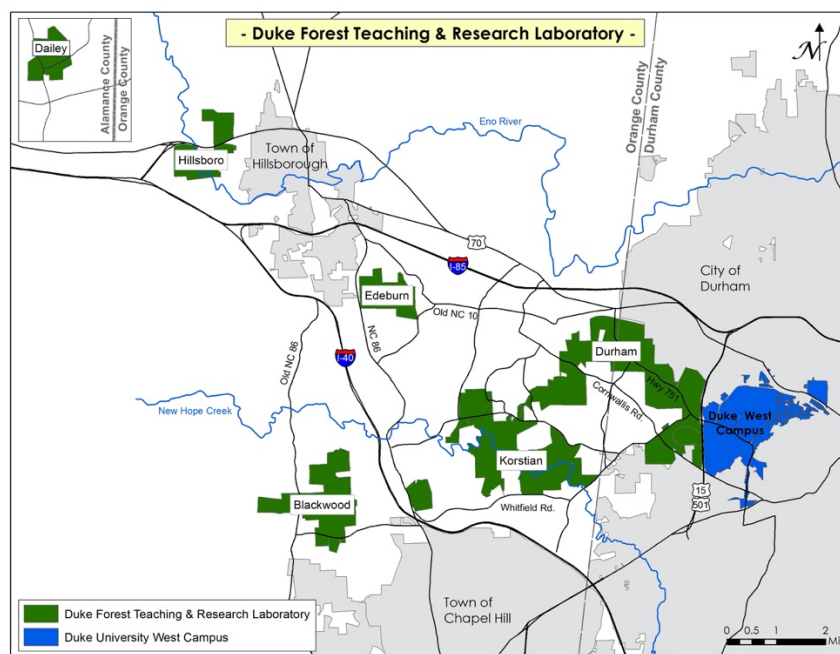


Figure 7: Duke Forest, which is divided amongst several regions, towns and cities. Any expansion to the McMaster Forest Nature Reserve will be equally non-contiguous in terms of ownership, but cooperation across public agency C2EP stakeholders will assure a unified eco-system.

Name	Approximate Size in Acres
Malcolm Knapp Research Forest (UBC)	12,750
Duke Forest Teaching and Research Laboratory (Duke)	7,000
Koffler Scientific Reserve at Jokers Hill (UofT)	865
McMaster Forest Nature Reserve (McMaster)	Currently: 115 With proposed addition of parcels on the Hamilton side of C2EP: 338

Figure 8: Comparison of various peer institutions

Benefits of Expanding the McMaster Forest Nature Reserve:

Health Benefits of Natural Space

Physical Health

Air Pollution: As urban sprawl reduces natural land and industrial practices continue to pollute the environment, the health impacts of anthropogenic climate change are becoming more apparent. According to the World Health Organization (WHO) (2020a) air pollution alone is responsible for about seven million deaths annually. Globally, nine out of ten people breathe polluted air (WHO, 2020a). Moreover, air pollution has been definitively linked to bronchitic symptoms, glaucoma, heart attacks, blood pressure issues, cognitive development problems in children heart failure, and mortality (Turner-Skoff & Cavender, 2019). As the air is becoming increasingly more polluted, experts call for the global reduction and mitigation of emissions. A well-known means of managing air pollution is by the planting and protection of trees. Trees purify the air by trapping air-borne pollutants and carbon emissions through their leaves and the process of photosynthesis (Halifax, 2020). In turn, trees produce clean oxygen, necessary for humanity's survival. Experts estimate that in the contiguous United States, trees planted in urban areas remove 711,000 metric tons of air pollution each year (Turner-Skoff & Cavender, 2019). Within Halifax alone, trees capture about 1,478 metric tons of air pollution annually, which can be equated to "\$9.6 million each year in air pollution mitigation benefits" (Halifax, 2020). Even when there are

no other successful efforts to combat climate change, a reduction in air pollution alone could save millions of lives each year (WHO, 2020a).

The role of trees in reducing air pollutions is broadly recognized by scientists, environmentalists and politicians (Turner-Skoff & Cavender, 2019). They play an imperative role in combatting the detrimental effects of pollution and planting trees is a meaningful step towards climate mitigation and adaptation. Thanks to C2EP, McMaster University is in close proximity to protected trees and natural lands. The McMaster Forest represents an important foundation that must be built upon and further developed through the acquisition of additional land parcels. Once acquired, these private lands can be restored to their natural, wetland, prairie or forested states. The expansion of McMaster Forest not only benefits the university through the creation of an increased capacity for research but will also benefit the health of the Hamilton community and reduce pollution levels.

Exercise: More broadly, open natural lands and trails can be used for physical exercise which has bountiful benefits. Exercise has been tied to extended life spans, reduction of illness and resiliency towards disease (Government of Canada, 2011). The McMaster Forest and the remaining privately held land parcels on the Hamilton side of C2EP are in close proximity to McMaster University and downtown Hamilton, making this space accessible to students and the Hamilton community. Unlike gym and club memberships that can be costly, the McMaster Forest is freely open to the public for responsible use. Expanding this financially accessible land combats socioeconomic divides and makes healthy living more affordable.

Health and Mortality: Eric Windhorst has written on the connection between green spaces and wellbeing, specifically focused on the C2EP (2014). In addition to the vast mental health benefits which will be discussed, exposure to green space has been linked to improved physical wellbeing (Windhorst, 2014). Citing E.O Wilson's *biophilia hypothesis*, Windhorst asserts "that the ever-increasing urbanization of human life is detrimental to our health: just like all humans need social contact with other people, we also need nature contact with other living things" (2014).

Just as the presence of trees helps prevent and heal illnesses, the absence of trees has been linked to an increased mortality rate. A study by Donovan, Butry, Yvonne, Prestemon, Liebhold, Gatzolis, & Mao (2013), illustrated that when 100 million trees were infested by the emerald ash borer, an invasive forest pest, mortality rates related to cardiovascular and lower-respiratory disease rose. Donovan et al., found that across the fifteen states studied, the presence of the asg

borer and the consequential loss of trees was tied “an additional 6113 deaths related to illness of the lower respiratory system, and 15,080 cardiovascular-related deaths” (2013). Within Canada, millions of ash trees both in urban and rural areas have been destroyed by the ash borer, and managing this invasive pest has become an issue of ongoing national and provincial concern (Government of Canada, 2019). By acquiring more land, McMaster has the ability to protect existing trees and replace those that have been destroyed by the ash borer. Protecting trees can help combat cardiovascular and lower-respiratory related mortality.

Mental Health

Exposure to greenspace impacts extend from improved physical wellbeing, to enhanced mental and psychological health. In a collection of major academic reports, Turner-Skoff and Cavender (2019) found that environments with more trees and natural space are strongly linked to reduced depression, increased life satisfaction and reduced stress. In past studies, exposure to trees has helped hospitalized research participants recover from their physical ailments, reduced blood diastolic pressure and simultaneously improved moods (Li, 2012; Turner-Skoff & Cavender, 2019). In general, residents that live in communities with more trees or in close proximity to trees feel healthier, happier and “have fewer cardio-metabolic conditions than their counterparts” (Turner-Skoff & Cavender, 2019). The mental health benefits associated with trees, especially the reduction in anxiety and depression, is particularly relevant as students face an increase in mental health related illnesses when compared to the general population. Ontario’s Universities (2020) found that 65% of postsecondary student reported experiencing overwhelming anxiety and 46% of students reported extreme depression. Comparatively, in any given year about 20% of the adult population will experience a mental health issue (Canadian Mental health Association, 2020; Stallman, 2010). Post-secondary students experience mental illness at a higher rate than the general population and it is the duty of academic institutions to fully support their student bodies. The proximity of the McMaster Forest to McMaster University makes it an accessible means of combating mental health issues amongst students. By expanding the McMaster Forest, students will have an increased ability to enjoy nature and experience its benefits for mental and physical health.

Medicinal Use

Historically, trees and plants played a major role in the creation of natural medicines. Now, as questions grow around public health in the 21st century in relation to COVID-19, trees and nature continue to be an important part of the healthcare landscape (Cooke, 2018; Li, 2012; Tree

Canada, n.d.). Besides the mental and physical benefits associated with trees, they have been linked to a number of medicinal purposes and use in pharmaceuticals. Today, about one in four pharmaceutical products are plant-based and some of the most well-known medicines, including aspirin, morphine, penicillin and Taxol (used in chemotherapy) originally came from plants (Cooke, 2018; Tree Canada, n.d.). This is relevant to McMaster for two reasons:

1. As McMaster is a leading source of research and education in healthcare, the benefits associated with plants and trees can be used to further McMaster's medical innovation. Medical research should be grounded in both laboratory work and the natural environment. The term Forest Medicine was coined in Japan in 2006 and represents a growing field of interdisciplinary science which addresses the connection between forests, preventive medicine, therapy and recovery medicine (Li, 2012).
2. As the COVID-19 pandemic continues to devastate global communities, the search for a cure is ongoing (WHO, 2020b). Although any vaccine or cure will need to undergo rigorous testing and clinical trials, medicine to address coronavirus may be plant-based. The availability of natural lands coupled with McMaster's industry-leading research capacities provide a valuable opportunity to investigate cures to infectious diseases and its ties to natural medicine.



Figure 9: Trees and plants have vast medicinal potential and have been used in both natural medicines and modern pharmaceuticals (Khosla, 2016).

The McMaster Forest and the entire the C2EP have broad, untapped medical potential. This is not a novel premise, as the research capacities of Cootes Paradise were recognized long ago by Sir William Osler. Osler is known as the Father of Modern Medicine and hailed for his advancements to the medical school curriculum in both the United States and Canada. Much of McMaster's "innovative approach to teaching can be traced to forward-looking suggestions and practices stemming from Osler's work from 1889 through 1905" (Roland, n.d.). Less well known is Osler's early work on microbiology within Cootes Paradise. Osler was raised in Dundas and was eager to explore the surrounding area (Buchanan, 2001) When he was 19, he obtained a sample of water from Cootes Paradise and used a microscope to study the organisms within the water (Buchanan, 2001). His findings were published in the journal *Hardwicke's Science-Gossip* (Buchanan, 2001). Osler's early work spurred his interest in natural science and comparative pathology and were a formative part of his renowned career. Interestingly, Osler also convinced John D. Rockefeller to donate money to medical science, thus leading to the establishment of the Rockefeller Institute in New York City. Osler understood the importance of well-funded medical research and the integral role natural sciences and biology played in this. By protecting the natural waterways and land around Cootes Paradise, McMaster University can reaffirm its commitment to the ground-breaking teachings of Osler.

Proactive and Reactive Healthcare

In the wake of the COVID-19 Global Pandemic people are understandably concerned about their health and wellbeing. The desire to survive, which is rarely consciously considered, has become paramount and now colours worldviews. As businesses slowly begin to reopen and a sense of normalcy begins to return, the need to stay healthy is of the utmost importance. In addition to practicing good hygiene and social distancing, leading a healthy lifestyle may increase your ability to fight and survive the coronavirus. Those most at risk of developing severe complications from COVID-19 suffer from underlying health conditions, weakened immune systems or are older adults. Although some variables cannot be controlled, spending sufficient time outdoors and exercise has been linked to reduced heart disease, hypertension and diabetes. Notably, people who suffer from any of these conditions are more likely to suffer severe illness from COVID-19. The need to manage existing illnesses, avoid worsening conditions and protect oneself from COVID-19 highlights the importance of proactive and preventive healthcare. Proactive healthcare "seeks to protect, promote, and maintain the health and well-being of individuals and defined populations

and to prevent disease, disability, and premature death” by not only preventing infections, but also improving the environment and community wellbeing (DeHart, 2019). This is coupled with the traditional, reactive healthcare system, which reacts to and treats infections and chronic illnesses once they have already contracted (DeHart, 2019; Wise, MacIntosh, Rajaklendran, Khayat, 2016). Although both healthcare models are important and necessary, ensuring people are healthy through preventive medicine and care reduces their potential to contract serious illnesses, increases their ability to fight infections like COVID-19, and directly leads to financial benefits as less sick people reduces strain on the healthcare system. As part of an internationally recognized and innovative body of healthcare facilities, McMaster can continue to practice industry-leading reactive medicine, while fostering the development of preventive healthcare. By enhancing the McMaster Forest, McMaster University and the McMaster Hospital can transform the healthcare landscape and strengthen the community’s wellbeing and ability to fight infection. The need for both preventive and reactive healthcare will only become more relevant in the post-COVID-19 world.



Figure 10 (edited): The differences between reactive and proactive healthcare (Wise, MacIntosh, Rajaklendran, Khayat, 2016).

Environmental Benefits of Natural Space:

- **Conservation and Protection:** The benefits of protected natural space to the environment are bountiful. In addition to leading conservation efforts, formally protected natural space ensures that biodiversity and vulnerable plant and animal species are safe guarded from aggressive urbanization (Cootes to Escarpment EcoPark System, n.d.). C2EP is a habitat for more than 50 species at risk, known for its nationally-recognized biological diversity and encompasses the Niagara Escarpment which is a UNESCO World Biosphere Reserve (Cootes to Escarpment EcoPark System, n.d.). McMaster can enhance their commitment to this partnership by purchasing and protecting more land in the C2EP. Moreover, McMaster can closely connect the McMaster Forest Nature Reserve to Edmund John Zavitz, known as the “Father of Reforestration in Ontario”. Zavitz graduated with a BA from McMaster in 1903 at the age of 28, where he was captain of the Caledonia Cup champions soccer team and also played on championship McMaster hockey teams. He attended McMaster at the same time as Jessie Dryden, his future wife and daughter of John Dryden, a Minister of Agriculture in three Liberal governments and one of the founders of the McMaster campus on Bloor Street in Toronto (Bacher, 2011). Zavitz went on to Yale and ultimately earned his masters degree in Forestry from the University of Michigan, rising in the Ontario Public Service to become the Deputy Minister of Forests (Bacher, 2011). During his tenure in the Ontario Public Service, he led the ambitious project of planting two-billion trees (the white pine and the tulip tree were his dominant choice), over lands ravaged by natural disasters and industrialization (Bacher, 2011). One of Zavitz’ fire rangers in the Algonquin area was the famed Group of Seven painter, Tommy Thomson. Zavitz is credited with launching the Conservation Authorities Act of 1946, which led to the establishment of watershed-based protection of our natural areas, and the promotion of protective tree-cutting bylaws throughout many Ontario municipalities. Locally, the very significant protection of the Dundas Valley was facilitated by Drs. Ben Vanderbrug and Thomas

Beckett (both McMaster alumni) through their tireless work with the Hamilton Conservation Authority in the 1960s and 70s. Edmund Zavitz was honoured for his pioneering work in the conservation area with a Doctor of Laws degree from McMaster in 1952 and the same honour from the University of Toronto in 1957. Near the end of his life in 1968, Zavitz was honoured by Premier John Robarts, whose government had created the Niagara Escarpment Commission, the Parkway Belt West Plan and many new Provincial Parks. Much of the land conservation success in Hamilton can be directly or indirectly attributed to Zavitz (the Dundas Valley was facilitated by the Hamilton Conservation Authority, and the C2EP has been protected by both the Niagara Escarpment Commission and the Parkway Belt West Plan, both of which can be tied to his influence on the Robarts government). McMaster can continue the legacy of this prominent alumnus by protecting his life's work in ecological conservation through an expansion of the McMaster Forest Nature Reserve.

- **Climate Change Mitigation:** Although meaningfully addressing climate change requires extensive and diverse work and serious changes in human and corporate behaviour, trees are a well-known means of trapping pollutants. By removing emissions from the air and producing oxygen, trees act as powerful air purifiers (Buis, 2020). Greenhouse Gas Emissions are directly tied to climate change and their reduction is an important part of protecting people and the planet from the dangerous effects of climate change (Buis, 2020).
- **Stormwater Management:** Trees and natural lands provide important natural infrastructure that can address a major concern of Hamilton's municipal government: stormwater. As climate change continues and extreme weather events become more frequent, storm water is becoming a growing issue. Trees and natural lands not only absorb excess storm water that would otherwise gather on streets, they also intercept and improve the quality of runoff water (Donovan, 2017; Turner-Skoff & Cavender, 2019). Whatever water is not absorbed is filtered through trees, cooled through this process, and possesses less pollution when it enters local waterways (Donovan, 2017; Turner-Skoff & Cavender, 2019). As the C2EP has a number of vulnerable aquatic ecosystems, ensuring the water is cleaner before entering bodies of water is important.

The environmental benefits alone warrant serious consideration. Environmentally conscious efforts are becoming increasingly poignant in light of the recent 24-billion-litre sewage spill into Cootes Paradise, which McMaster backs onto (The Hamilton Spectator, 2019). Cootes Paradise is one of the most ecologically diverse and vulnerable sections of the C2EP system and it is imperative that C2EP partners do all they can to protect Cootes and the surrounding area. In light of this, as a responsible steward of the earth and valuable C2EP partner, McMaster should do everything in its power to protect already damaged and vulnerable land.

Economic and Social Benefits:

In addition to enhancing health and happiness amongst the local population, the ongoing protection of natural lands has a number of social and economic benefits. The C2EP extends between completely natural and urbanized areas. In turn, this mixed spatial demographic allows C2EP lands to provide advantages that are associated with traditional forested areas and the urban tree canopy. The McMaster Forest and the whole of C2EP is unique as they are not an isolated parcel of land, but instead are closely connected to major urban areas. Even though C2EP cannot be classified as an urban tree canopy it still offers many of the same benefits:

- **Energy Moderation and Cooling:** Trees provide valuable temperature management services that function year-round. In the hotter months, trees provide shade and shelter. They also transpire large amounts of water, which in turn cools the air of the surrounding area (Halifax, 2020). In cooler months, once the leaves have fallen, trees provide protection from winter winds (Halifax, 2020). The trees in sections of the C2EP that run through urban areas can directly reduce the urban heat island effect, a process through which the many reflective and heat-producing surfaces within a city emit more heat, during the already hot, summer months (Halifax, 2020)
- **Economic Return:** In addition to reducing the economic burdens associated with managing the temperature of the surrounding area, natural lands and the trees within them present a number of economic benefits. In particular, trees can enhance the value of a neighbourhood by 25% (Halifax, 2020). Moreover, as the built infrastructure depreciates over time, as trees mature, they rise in value (Turner-Skoff & Cavender, 2019). It is estimated that for every one dollar invested in trees, one can expect to receive eight dollars in return (Halifax, 2020).

- **Crime Reduction:** Vegetation, including trees and natural areas, have been found to reduce crime in the surrounding area. A study by Sullivan and Kuo illustrated that “the greener a building’s surroundings are, the fewer crimes are reported” (2001, p.343). Moreover, this pattern exists is evident in the reduction of both property and violent crimes (Donovan, 2017; Sullivan & Kuo, 2001). Thus, enhancing natural space can increase the safety of the McMaster and Hamilton communities.
- **Tourism:** Hamilton is well known for its collection of trails and has been named the “waterfall capital of the world” (Shortsleeve, 2017). Further protecting natural land heightens Hamilton’s esteemed collection of natural lands and creates valuable economic opportunities through ecotourism. Ecotourism encourages tourism in natural areas and is aimed towards conservation and sustainability (Clarkin & Kähler, 2020). Moreover, ecotourism gives governments and agencies incentive to protect wilderness areas through revenue generated from tourism activities (Clarkin & Kähler, 2020). In the Ecuadoran rain forest, ecotourism generated income for indigenous peoples and deter oil exploration (Clarkin & Kähler, 2020).
- **Attraction of Progressive Companies:** According to a poll of 50 senior executives from a range of Fortune 500 companies, quality of life and the availability of outdoor recreation amenities, is ranked as one of the main driving forces considered when companies choose a location (The Nature Conservancy, 2016). Moreover, companies have become inclined to follow talented workforces, with highly educated workers choosing cities to live in based on “lifestyle considerations, and integrated green space” (The Nature Conservancy, 2016, p. 25). By amplifying green space in and around the city, McMaster can help attract companies, researchers, workforces and students that value natural land. Progressive companies who are attracted to the Hamilton area, thanks in part to an extended McMaster Forest, may be inclined to help protect and acquire more natural land.
- **McMaster’s Community Engagement Initiatives:** Expanding and enhancing the McMaster Forest aligns with existing goals and outreach missions. Currently, McMaster students, faculty and artists are reclaiming and redesigning McMaster’s West Campus (Daily News, 2020). In a project entitled *Designing Paradise*, McMaster aims to integrate environmentally sustainable infrastructure into campus design (Daily News, 2020). Previous projects across the West Campus and Lot M involved restoring surrounding

wetlands, which are now known as MACMarsh and reducing toxic run-off into the nearby Coldwater Creek (Daily News, 2020). Maintaining both the temperature and cleanliness of Coldwater Creek is imperative as it runs into Cootes Paradise and can impact vulnerable fish and wildlife populations (Daily News, 2020). MACMarsh, an enhanced McMaster Forest and a West Campus Redesign are closely aligned, engage McMaster with the broader community and further McMaster's research and discovery.



Figure 11: Some of the many benefits of the social, economic and environmental benefits of trees in Halifax (Halifax, 2020).

Cultural Importance:

The C2EP has several sites of great historical significance that have been nationally and provincially recognized. Protecting these lands provides grounds for archeological and anthropological research as well as cultural preservation.

War of 1812: C2EP has more than 50 registered archeological sites and numerous areas with vast archeological potential (Cootes to Escarpment EcoPark System, n.d.). Notable sites include Burlington Heights, Dundurn Castle and National Historic Site, Hamilton Cemetery and Desjardins Canal (MHBC, 2014). During the War of 1812 Burlington Heights was occupied by the British, when naval fleets positioned themselves throughout Lake Ontario (MHBC, 2014). Burlington Heights and the surrounding area in what is now C2EP, played a major role in the Battle of Stoney Creek 1813 and the seizure of Fort Niagara 1813 (MHBC, 2014). Acquiring additional land in the C2EP allows McMaster University to protect and research artifacts that remain from the War of 1812. Owning this land would enhance McMaster's ability to directly study historically relevant plots of land.

Dundurn Castle and the Royal Family: Her Royal Highness The Duchess of Cornwall, wife to Prince Charles, visited Hamilton's Dundurn Castle during the couple's 2009 Canadian tour. Duchess Camilla's great-great-great grandfather was Sir Allan Napier MacNab, Canada's prime minister from 1854 to 1856. Sir Allan MacNab was the first to live in Dundurn Castle which is the opening to Burlington Heights, the gateway between Hamilton and C2EP. By protecting land throughout the C2EP, Canada's relationship with the monarch can be displayed in a new light, one founded on contemporary principles of ecological preservation. The relationship can be renewed and grounded on modern Canadian values and the importance of the natural environment. Moreover, the connections between the Royal Family and C2EP may encourage advancement funds from the provincial, federal and community levels.

Reconciliation: In addition to relics of the 1800s with military significance, there is a long chronology of continuous use by indigenous peoples (Cootes to Escarpment EcoPark System, n.d.). There is evidence that there was significant human presence in Cootes Paradise and the surrounding area 10,000 years ago (Cootes to Escarpment EcoPark System, n.d.; MHBC, 2014). The indigenous groups created what is now known as the Princess Point Culture and were the first to bring agriculture into this region (Cootes to Escarpment EcoPark System, n.d.; MHBC, 2014). A major C2EP partner, Royal Botanical Gardens, has formally recognized the significance of the land and dedicated trails and plants to the Anishinaabe peoples. As a fellow C2EP partner who is similarly committed to reconciliation efforts, McMaster must mobilize to protect the land and its history. Simply recognizing indigenous rights and history through land acknowledgements is not enough; McMaster must actively contribute to reconciliation by protecting land. Reconciliation is

an ongoing process. If this land is not protected and eventually developed, the spiritual history attached to it will be severely damaged or destroyed. Preserving and restoring this land can

<i>BENEFIT TYPE</i>	<i>SPECIFIC BENEFIT</i>
<i>Health Benefits</i>	Physical Health
	Mental Health
	Medicinal Use
	Preventive and Reactive Healthcare
<i>Environmental Benefits</i>	Conservation and Protection
	Climate Change Mitigation
	Stormwater Management
<i>Economic and Social Benefits</i>	Energy Moderation and Cooling
	Economic Return
	Crime Reduction
	Tourism
	Attraction of Progressive Companies
<i>Cultural Importance</i>	War of 1812
	Dundurn Castle
	Reconciliation

represent a renewed commitment to reconciliation.

Figure 12: Summary of Benefits of expanding the McMaster Forest Nature Reserve

Timeline

The timeline of this project will heavily rely on the securing of resources for land acquisition. The proposed expansion of the McMaster Forest Nature Reserve, beyond the existing McMaster Forest and the West Campus restoration project, will add approximately 223 acres to its size with the acquisition of the five remaining privately held parcels on the Hamilton side of the C2EP System. The projected cost of the land acquisition is estimated to be in the 4-5M\$ range,

and this would need to be added to the West Campus restoration costs to set a total project fundraising level. The project campaign could be targeted to a small number of high-capacity donors or through a broader effort with a large number of supportive alumni and community friends.

The acquisition of the land parcels on the Hamilton side will be part of an integrated green space of land owned by the public agency stakeholders of the C2EP. The land parcels are already in a natural state or can be restored by non-invasive and inexpensive processes, such as succession. Through the cyclical process of succession, grass and shrubs naturally give way to trees, which mature over time (Pieri, 2017). If left undisturbed and aided through McMaster Forests' conservation efforts, natural grass lands, will continue to grow and can be restored to forested or prairie land. As the Hamilton side of the C2EP comes fully into public agency or institutional hands, there will be potential for its further expansion through the acquisition of privately-owned land parcels on the Burlington side of the C2EP. Moving forward, McMaster can aim to acquire these lands and further strengthen its role as a C2EP stakeholder partner. Moreover, extending the McMaster Forest Nature Reserve into Burlington will benefit local residents, enhance McMaster partnerships and academic endeavours, and strengthen McMaster's role within the community that houses McMaster's Ron Joyce Centre for the DeGroot School of Business.

Summary

The McMaster Forest Nature Reserve expansion is a multifaceted project that will meet a diverse range of needs and benefit the community in multiple ways. An expanded McMaster Forest will cement McMaster's role as an environmentally and socially conscious institution, dedicated to improving the world around it. Through ongoing research, academics and medical services, McMaster has become a valued presence within the Hamilton landscape. It is only fitting that McMaster find new ways to help the surrounding community in the post-COVID19 world, through an expanded McMaster Forest Nature Reserve. Expanding the McMaster Forest will directly combat climate change, offer a myriad of social benefits, conserve biodiversity and species at risk, provide enhanced opportunities for outdoor recreation, heighten McMaster's capacity for research in a post COVID-19 world and strengthen relationships with indigenous communities. As a C2EP partner and organization that prides itself "as a hub for innovation, discovery and growth"

(McMaster University, n.d.), it is imperative that McMaster renews its commitment to the C2EP and Hamilton, more broadly.

Appendix A

Fundraising for Land acquisition:

The first phase of this project is focused on airing a number of privately held land parcels within Hamilton, Ontario which will cost approximately \$5 million. Within Hamilton, the McMaster Forest Nature Reserve can increase by approximately 223 acres. As a number of C2EP partners are non-profit, community-based organizations, McMaster is best equipped to acquire funding for these parcels. McMaster can acquire funding for parcels through several methods, which can be used independently or in combination with each other. By highlighting the vast benefits of an expanded McMaster Forest, McMaster can appeal to a variety of individuals and organizations interested in protecting the natural environment, mitigating climate change, enhancing public health and continuing to beautify the McMaster, and more broadly the Hamilton, community.

1. Appealing to Large Private Donors

Donors, alumni and community members are inspired to improve McMaster and the surrounding area through generous gifts. By illustrating the heightening need for protected, natural lands, friends of McMaster will be exhilarated and encouraged to partake in in the expansion project. The McMaster Forest expansion will invigorate donors and inspire contributions to this meaningful and much needed conservation project that simultaneously supports the environment, education, ground-breaking research and culture. Past donations and McMaster's continued ability to generate enhancement funds illustrate the viability of this project, from a financial perspective. In 2003, McMaster University received a donation of \$105 million (Lewington, 2017); this donation alone could cover the cost of privately held land acquisition over twenty times. Moreover, McMaster continues to receive advancement funds from notable contributors, many of which are interested in environmental protection and academic enhancement. McMaster University has also received donations from David Braley, who has made significant contributions to the Royal Botanical Gardens (RBG), which is one of the major C2EP partners and landowners. Through the RBG, David Braley and other donors have an existing connection to C2EP, making the McMaster Forest expansion a project that aligns with pre-existing values. In light of the ongoing climate crisis many large donors are committing to the acquirement and preservation of natural lands. Recently, Hansjörg Wyss, a Swiss billionaire, pledge to donate \$1 billion to conserve land and waters across the planet (Kotecki, 2018). Currently, about 15% of the Earth's natural lands have been formally protected but by 2030, Wyss aims to help conserve 30% of the Earth's natural land (Kotecki,

2018). However, many scientists estimate that unless 50% of the Earth is conserved, the vast majority of wild species will go extinct. Amazingly, just one billionaire will bring the Earth 15% closer to this crucial goal (Kotecki, 2018). By exploring Wyss' philanthropy, it is clear that the growing calls for conservation are not going completely unheard by those who have the financial resources to positively contribute towards environmentally conscious causes (Kotecki, 2018).

2. Public Agencies and Government Grants

The expansion of the McMaster Research Forest and its large array of uses open it to a diverse set of charitable donations and research grants from private individuals and the Canadian government. Many research and charitable grants are available at the Provincial and Federal level. As the McMaster Forest can be used for environmental conservation, recreation, academic research, public art, indigenous reconciliation and many other projects, it is eligible for a variety of grants. In respect to the environment, the Canadian government offers funding for programs which protect species at risk, the environment and the Great Lakes (Cootes Paradise is one of Lake Ontario's last intact wetlands). The C2EP already plays a large role in each of these initiatives, therefore McMaster's renewed commitment to this partnership would allow the McMaster Forest expansion to be eligible for a variety of government grants. Moreover, acquiring privately held land and naturalizing it either through succession or tree-planting, aligns with the current Federal Government's goal to plant two billion trees over the next ten years (Liberal, 2019). It is worth noting that the need to protect and enhance natural lands is valued by the Federal Government, thus aligning the McMaster Forest expansion with pre-existing Canadian values. By appealing to large donors and applying for significant government grants, McMaster will be able to acquire the financial capital needed to purchase land relatively quickly. Thus far the outlined methods will require a smaller number of overall donations, with a high value. More details on federal environment grants can be found at: <https://www.canada.ca/en/environment-climate-change/services/environmental-funding/programs.html>

3. Square Foot Campaigns and In-Memoriam Dedications

A square foot campaign is a grassroots, community-focused movement that can provide aggregated resources to acquire land within the C2EP. This method can raise both modest and

large donations for land acquisition by directly linking each donation to a certain piece of land. The request will not be ‘how much would you like to donate’, but rather ‘how many square feet will you protect?’” Once the number of square feet is established by the person, then the exchange of money is straightforward. The equivalence unit will be one dollar per square foot of land protected. In this part of the world at this time, this will allow sufficient resources for the fair and reasonable acquisition of the land and for sufficient resources for the long-term stewardship of the land. By donating to protect a specific amount of land, people can easily envision the tangible impact of their contribution. By visualizing the land in terms of square feet, donors will be able to foster a connection with the land and understand their donation’s immense value. One-dollar results in one square foot of land protected so that plant and animal life can be conserved and protected. A square foot campaign is financially accessible and will encourage participation from a variety of people.

Another advancement project that looks to smaller, individual donations are in-memoriam dedications. By donating a specific amount of money to the McMaster Forest Nature Reserve expansion project, an individual will have the ability to dedicate a tree or trail section to a loved one. Although specific prices can be altered depending on needs, a gift of \$2,500 will allow someone to dedicate a particular tree to someone, signified by a small tribute plaque placed at its base. Similarly, a gift of \$5,000 will allow someone to dedicate a portion of a trail or look out point as a tribute to someone. To generate awareness and support for the expanded McMaster Forest project, a campaign similar to either of these options will be directed towards alumni and friends of McMaster.

Appendix B

Givens/ Assumptions:

There are fundamental assumptions that underly this white paper that must be recognized. First, it is assumed that the privately-owned land parcels in C2EP can be purchased by McMaster University and that the private owners are willing to sell the land. Second, it is assumed that the land does not have any serious issues that would be detrimental to the state of this project or visitor health. This is unlikely as the land likely mirrors existing publicly owned parcels, although what is currently privately held land may require significant restoration and conservation efforts. The third underlying assumption is that McMaster is interested in expanding its role as a C2EP partner, thus renewing its commitment to environmental preservation and community wellness.

Constraints:

As exhibited by Duke University, the separation of forest land parcels does not belittle a forest's importance or value to the academic community. However, fragmented land does somewhat constrain design. Rather than have continuous trail systems, paths will be divided amongst different properties and urbanized areas. Another constraint that this project must abide by is the City of Hamilton Zoning By-Laws. Furthermore, the McMaster Forest expansion involves sensitive natural lands that must be protected and left relatively undisturbed.

References

- Bacher, J. (2011). *Two Billion Trees And Counting: the legacy of Edmund Zavitz*. READHOWYOUWANT COM LTD. Retrieved from:
<https://www.dundurn.com/books/Two-Billion-Trees-and-Counting>
- Buchan , W. W. (2001). Sir William Osler (1849-1919): The Early Years, With Special Reference to His Boyhood Days in Dundas, Canada. *Proc R Coll Physicians Edinb.*, 31(2), 155–168. <https://pubmed.ncbi.nlm.nih.gov/11706854/>.
- Buis, A. (2019, November 7). *Examining the Viability of Planting Trees to Help Mitigate Climate Change – Climate Change: Vital Signs of the Planet*. Global Climate Change Vital Signs of the Planet . <https://climate.nasa.gov/news/2927/examining-the-viability-of-planting-trees-to-help-mitigate-climate-change/>.
- Canadian Mental Health Association. *Fast Facts about Mental Illness*. CMHA National.
<https://cmha.ca/fast-facts-about-mental-illness>.
- Clarkin, T., & Kähler, K. N. (2020). Ecotourism: Pros and Cons. *Salem Press Encyclopedia*.
- Cooke, J. (2018, June 22). *9 Famous Examples of Drugs That Came From Plants*. The Sunlight Experiment. <https://thesunlightexperiment.com/blog/2018/6/7/9-famous-examples-of-drugs-that-came-from-plants>.
- Cootes to Escarpment EcoPark System . *Naturally Connected*. Naturally Connected | Cootes to Escarpment. <https://www.cootestoescarpmentpark.ca/>.
- Daily News. (2020, January 9). *They'll design paradise and unpave a parking lot*.
<https://dailynews.mcmaster.ca/articles/theyll-unpave-a-parking-lot-and-put-up-paradise/>.
- DeGroote School of Business. *Ron Joyce Center*. DeGroote School of Business.
<https://rjc.degroote.mcmaster.ca/>.
- DeHart, R. L., MD. (2020). Preventive medicine. *Magill's Medical Guide (Online Edition)*.

- Donovan, G. H. (2017). Including public-health benefits of trees in urban-forestry decision making. *Urban Forestry & Urban Greening*, 22, 120–123.
<https://doi.org/10.1016/j.ufug.2017.02.010>
- Donovan, G. H., Butry, D. T., Michael, Y. L., Prestemon, J. P., Liebhold, A. M., Gatziolis, D., & Mao, M. Y. (2013). The Relationship Between Trees and Human Health: Evidence from the Spread of the Emerald Ash Borer. *American Journal of Preventive Medicine*, 44(2), 139–145. <https://www.sciencedirect.com/science/article/abs/pii/S0749379712008045>.
- Galbraith, D. (2014, November 7). CTE Research Agenda. Burlington.
- Government of Canada. (2011, March 7). *Physical Activity*. Canada.ca.
<https://www.canada.ca/en/health-canada/services/healthy-living/physical-activity.html>.
- Government of Canada. (2019, August 16). *Environment and Climate Change Funding Programs*. ECCC funding programs - Canada.ca. <https://www.canada.ca/en/environment-climate-change/services/environmental-funding.html>.
- Government of Canada. (2019, June 28). *Emerald ash borer*. Natural Resources Canada.
<https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/wildland-fires-insects-disturban/top-forest-insects-diseases-cana/emerald-ash-borer/13377>.
- Government of Canada. (2020, June 26). *People who are at high risk for severe illness from COVID-19*. (Factsheet) - Canada.ca. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/people-high-risk-for-severe-illness-covid-19.html>.
- Halifax. (2020, February 7). *Urban Forestry*. Halifax.
<https://www.halifax.ca/transportation/streets-sidewalks/urban-forestry>.
- Hamilton Conservation Authority. *Dundas Valley Conservation Area*. Hamilton Conservation Authority. <https://conservationhamilton.ca/conservation-areas-2/dundas-valley/>.

- Hamilton Spectator. (2019, December 3). *Sewergate: Hamilton faces new provincial order over sewage spill into Cootes Paradise*. thespec.com. <https://www.thespec.com/news/hamilton-region/2019/12/03/sewergate-hamilton-faces-new-provincial-order-over-sewage-spill-into-cootes-paradise.html>.
- Harvey, C., & Dudley, S. *The McMaster Forest*. McMaster Conservation Corridor Teaching and Research Facility. <http://mcmasterforest.weebly.com/>.
- Hemsworth, W. (2016, April 22). *McMaster Forest rises from the ashes of neglected former potato farm*. Daily News. <https://dailynews.mcmaster.ca/articles/mcmaster-forest-rises-from-the-ashes-of-neglected-former-potato-farm/>.
- <https://fhs.mcmaster.ca/healthcarehistory/people/osler.html>.
- Khosla , I. (2016). *Diet diary: The immense power of medicinal plants*. <https://indianexpress.com/article/lifestyle/health/diet-diary-the-immense-power-of-medicinal-plants-2930563/>.
- Kotecki, P. (2018, October 31). *A Swiss billionaire is donating \$1 billion in an attempt to save the planet's wild lands and waters from destruction*. Business Insider. <https://www.businessinsider.com/swiss-billionaire-hansjoerg-wyss-donates-1-billion-to-help-save-earth-2018-10>.
- Kuo, F. E., & Sullivan, W. C. (2001). Environment and Crime in the Inner City. *Environment and Behavior*, 33(3), 343–367. <https://doi.org/10.1177/00139165013333002>
- Lewington, J. (2017, June 27). *What McMaster University learned from a record donation*. The Globe and Mail. <https://www.theglobeandmail.com/report-on-business/what-mcmaster-university-learned-from-a-record-donation/article35475855/>.
- Li, Q. (2012). *Forest medicine*. Nova Science Publishers.
- McMaster University. *University Student Life: McMaster*. DISCOVER McMASTER. <https://discover.mcmaster.ca/>.

- News Staff. (2009, November 5). *Camilla Explores Her Canadian Roots At Hamilton's Dundurn Castle*. CityNews Toronto. <https://toronto.citynews.ca/2009/11/05/camilla-explores-her-canadian-roots-at-hamiltons-dundurn-castle/>.
- Office of the Duke Forest. (2020). *Teaching and Research Laboratory*. Duke Forest. <https://dukeforest.duke.edu/>.
- Ontario's Universities. (2020). *Mental Health*. Ontario's Universities. <https://ontariosuniversities.ca/issues-priorities/student-supports>.
- Pieri, N. (2017). *Forest Succession: Definition & Stages*. Study.com. <https://study.com/academy/lesson/forest-succession-definition-stages.html>.
- Roland, C. G. *Dr. William Osler*. History of Health Care in Hamilton.
- Shortsleeve, C. (2017, July 24). *This Is the Waterfall Capital of the World*. Condé Nast Traveler. <https://www.cntraveler.com/story/why-hamilton-canada-is-the-waterfall-capital-of-the-world>.
- Stallman, H. M. (2011). Psychological distress in university students: A comparison with general population data. *Australian Psychologist*, 45(4), 249–257. <https://doi.org/10.1080/00050067.2010.482109>
- The Nature Conservancy. (2016). *Outside Our Doors The benefits of cities where people and nature thrive*. Washington .
- Turner-Skoff, J. B., & Cavender, N. (2019). The benefits of trees for livable and sustainable communities. *Plants, People, Planet*, 1(4), 323–335. <https://doi.org/10.1002/ppp3.39>
- University of British Columbia. (2020, January 9). *Malcolm Knapp Research Forest*. Faculty of Forestry . <https://www.mkrf.forestry.ubc.ca/>.
- University of Toronto. *About Us*. Koffler Scientific Reserve at Jokers Hill. <https://ksr.utoronto.ca/about-us/>.

- Windhorst, E. (2014, July 21). Natural approach to health care. *The Hamilton Spectator*.
<https://www.thespec.com/opinion/columnists/2014/07/21/natural-approach-to-health-care.html>.
- Wise , A., MacIntosh, E., Rajakulendran, N., & Khayat, Z. (2016, March 29). *Transforming health: Shifting from reactive to proactive and predictive care*. MaRS Discovery District.
<https://www.marsdd.com/news/transforming-health-shifting-from-reactive-to-proactive-and-predictive-care/>.
- World Health Organization. (2020). *Coronavirus disease (COVID-19) pandemic*. World Health Organization. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/>.
- World Health Organization. (2020a). *How air pollution is destroying our health*. World Health Organization. <https://www.who.int/airpollution/news-and-events/how-air-pollution-is-destroying-our-health>.