TREES ONTARIO

A Healthy Dose of Green: *A prescription for a healthy population*

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A Message from Trees Ontario

Trees Ontario is the largest not-for-profit tree planting partnership in North America committed to re-greening Ontario's landscape.

In the 1980s, planting levels were as high as 20-30 million trees per year on private rural properties in southern Ontario. That number declined in the early 1990s, primarily due to government cutbacks, to as low as two million trees per year.

Trees Ontario is leading efforts to re-build the infrastructure and capacity required to increase tree planting levels through a tree planting network consisting of Conservation Authorities, Ontario Stewardship Councils, forestry consultants, First Nation communities, municipal governments and community volunteer groups.

Trees Ontario promotes sustainable and scientifically-based tree planting and forestry practices. Through its programs and services, including the Ontario 50 Million Tree Program and our national Forest Recovery Canada program, we strive to enhance the capacity of our planting partners while reducing landowner planting costs by way of tree planting subsidies.

Since 2003, Trees Ontario's efforts to ensure that our environment is able to adapt to an ever-changing climate have resulted in a continuous rise in tree planting levels.

Environmental experts say that in order to achieve a healthy ecosystem, an absolute minimum of 30 per cent forest cover is required. In the settled landscape of Ontario, forest cover is as low as five per cent in some regions. To achieve a minimum forest cover in Ontario's settled regions, at least one billion more trees must be planted.

Trees Ontario's goal is to support the planting of 10 million trees a year by 2015. To further enhance and execute its forest restoration activities, Trees Ontario requires the ongoing financial support of individuals, corporations, small businesses and government. This support contributes to restoring the entire tree planting infrastructure including tree seed forecasting and collection, technical training and mentorship opportunities for new forestry staff, community outreach, as well as landowner tree planting subsidies.

A mounting volume of research over the past 30 years indicates that the health of our forests has a direct impact on our own personal health. Without a healthy ecosystem we can't sustain a healthy planet and we will surely compromise the health of our children and future generations. In order to improve our environment and our personal health, we must all be part of the solution.

For more information, please visit www.treesontario.ca.

Executive Summary

Our health and well-being are intimately interconnected with the health of our natural environment. Trees and forests are integral components of healthy ecosystems that support healthy human populations.

Enhancing our forest ecosystems contributes to the stability and resiliency of the ecosystems we inhabit. Focusing efforts on enhancing forest cover is an essential preventive health measure that could save lives and millions of dollars in treatment costs.

Trees help to reduce smog and pollution in our cities by filtering out many airborne pollutants that have negative impact on our health, such as carbon dioxide, carbon monoxide, lead, nitrogen dioxide, ozone, sulphur dioxide and intercepting particulates. These pollutants have been linked to heart disease, respiratory illnesses, diabetes and cancer.

Forests and green spaces have also been linked to a significant decline in stress, a decrease in the severity of symptoms in children with Attention Deficit/Hyperactivity Disorder, improved rehabilitation and faster hospital recovery rates.

Experts have determined that a minimum 30 per cent forest cover is required to maintain a healthy, sustainable ecosystem. Currently, forest cover is as low as five per cent in some regions of Ontario's settled landscape, compromising the health of our ecosystems and its inhabitants.

The decline in mature forest cover is evident in both rural and urban landscapes in Ontario. In the settled landscapes, rural forests have been diminished as a result of increased population density, agricultural land uses and a rapid growth in residential and commercial development. Trees and forests in urban areas face their share of challenges including pollution, climate change, introduced pests, competing demand for root space, disease and old age. Ontario now has severely fragmented forests in both rural and urban areas, threatening species migration, wildlife habitats, hydrological cycles and climate regulation.

To enhance the health of our ecosystems and to better prepare Ontario to adapt to climate change, tree planting efforts must involve both rural and urban initiatives in an attempt to recreate larger forest ecosystems.

Billions of dollars are spent annually on health care services to treat symptoms; however, comparatively little is invested in addressing the root causes of many commonly occurring diseases. One of these causes is environmental degradation, therefore restoring the health and integrity of our forests will directly benefit our collective health and well-being.

To respond to these challenges, Trees Ontario intends to initiate an interdisciplinary dialogue where the health sector, forestry industry, research community, and governments can discuss and investigate the relationships between ecosystem health and human health. By highlighting the links between human health and the health of rural and urban forests, Trees Ontario hopes to increase support for tree planting initiatives and stimulate collaborative action to significantly restore forest cover across Ontario.

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1. Introduction

Healthy forests play an important role in the foundation of resilient ecosystems. Trees and other plants use the energy from sunlight and nutrients from soil and air to produce oxygen. Trees also act as biological buffers – they filter harmful particles that contribute to air pollution and protect us from solar radiation. They provide shelter against wind, help cool and moisten the air and offer renewable raw materials that sustain our economy.

Biodiversity encompasses all of earth's living things including plants, animals and the ecosystems they inhabit. Trees and forests form an integral part of this network. Conserving and enhancing urban and rural forests is a crucial step in protecting biodiversity, and an important part of promoting healthy ecosystems.

Rapid population growth and environmentally-taxing modern lifestyles have led to rising levels of air pollutants, carbon dioxide and other greenhouse gases which currently pose a serious threat to biodiversity. Forest ecosystems play a vital role in offsetting these emissions and filtering many of the pollutants from our atmosphere. Clearly, the health and well-being of human populations are intricately linked to the health and integrity of our trees and forests.

Over the past few decades, extensive research has been undertaken by scientists around the world to investigate the relationship between the environment, including forests and human health. The research has yielded a growing body of evidence indicating that a range of physical and psychological health benefits can be derived from natural systems.

Jared Diamond, acclaimed researcher, author and Professor of Geography and Physiology at UCLA, writes: "Human needs and a healthy environment are not opposing claims that must be balanced; instead, they are inexorably linked by chains of cause and effect. We need a healthy environment because we need clean water, clean air, wood and food, plus soil and sunlight to grow crops." [1]

According to Richard Louv, highly acclaimed journalist and author, increasing numbers of researchers consider that the decline in natural environments and disconnection from nature negatively impact human health and child development.[2] In fact, Louv has coined the term *nature-deficit disorder* to describe an increase in attention difficulties as well as physical and emotional illnesses as a result of human disconnection from nature.[3]

Modern medicine is continuously making progress in fighting disease and illness. However, there is an immediate need to take a more proactive approach and focus on disease prevention. This requires the acceleration of on-going efforts to reduce and eliminate pollution. It also requires investment in the restoration of our forest ecosystems in order for humans to benefit from their natural ability to filter and assimilate wastes from air and water.

The Ontario Biodiversity Strategy released in 2011 by the Ontario Biodiversity Council recognizes the dependence of human health and economic prosperity on healthy ecosystems. [4] It calls for all sectors of society to participate in restoring biodiversity and the many ecosystem services provided by natural

systems. One of its targets is that by 2015, 50 per cent of Ontarians understand biodiversity and its role in maintaining their health and well-being.

This paper contributes to our understanding of Ontario's natural environment and its critical impact on human physical and mental health. It is based on relevant research findings from the health and environmental disciplines that were compiled from print and online sources, including primary research papers from peer reviewed journals, government documents, books and other publications.

This paper is intended to initiate an interdisciplinary dialogue where the health sector, forestry industry, research community, environmental groups and government agencies discuss and investigate the myriad of relationships between ecosystem health and human health. By highlighting the links between human health and the health of both rural and urban forests, Trees Ontario hopes to increase support for tree planting initiatives and actions to enhance forest cover.

2. The State of Our Forests

Despite Canada's substantial forest reserves, human activities in Ontario's settled landscape have led to significantly reduced forest cover. In his 2009/2010 Annual Report, Environmental Commissioner of Ontario, Gordon Miller, stated that a minimum 30 per cent local forest cover is required to maintain a healthy, sustainable environment.[5] Dale Leadbeater, a senior ecologist and Ontario Society of Ecological Restoration board member, advises that this figure is the bare minimum. Leadbeater and other experts typically recommend 40 to 50 per cent forest cover for a healthy ecosystem.

The State of Ontario Biodiversity Report (2010) states that due to continuous human settlement and rapid land development in Ontario, forest cover in southern Ontario averages at 22 per cent. [6] However, in some settled regions of the province, forest cover is as low as five per cent.[7]

During the period of early European settlement, more than 90 per cent of southern Ontario was forested. Today, the majority of land available for planting in southern Ontario is privately owned and does not fall under any regulatory framework of forest management, as is in place for Crown Land forest management practices (as per Crown Forest Sustainability Act, 1994).[8] Therefore, if action is to be taken on these lands, appropriate incentives must be made available for these landowners to encourage enhanced stewardship and tree planting initiatives.

Up until the early 1990's, rural landowners were able to offset planting costs through provincial subsidies. This resulted in the planting of approximately 20 million trees per year in southern Ontario. Due to the redirection of government programs and cuts to subsidies in the early 1990's, that number dropped to as low as two million trees per year by the end of the decade. Since then, efforts have been made to re-establish the tree planting infrastructure and to increase tree planting rates in the province. However, much more needs to be done to regain the forest cover needed to sustain a healthy ecosystem.

To achieve the minimum 30 per cent forest cover needed to sustain a healthy ecosystem, at least one billion more trees must be planted within Ontario's settled landscapes. This can be achieved by increasing tree planting rates on rural lands and in urban centres.

Ideally, rural and urban trees should function as components of a large and contiguous forest that extends beyond city boundaries and across the countryside. However the current forest fragmentation in the settled landscapes of Ontario is contributing to an unstable ecosystem resulting in habitat loss, environmental degradation and an inability to adapt to the effects of climate change.

Increasing forest cover will enhance the resiliency of our ecosystems in adapting to the effects of environmental change while sustaining a healthier human population.

3. A Healthy Dose of Green: Health Benefits of Trees and Forests

The sections that follow summarize the frequency and determinants of major diseases in Canada and explore the role that trees and forests can play in influencing the environmental factors that contribute to these health concerns.

3.1 Promotion of Physical Activity

A substantial volume of research indicates that physical activity has positive effects on both physical and mental health. [9,10] Regular physical activity can reduce the risk of heart disease[11], some cancers (notably colon[12, 13] and breast[14]) as well as musculoskeletal problems.[15] Physical activity has been shown to be an effective treatment for depression[16] and can even help in recovery from invasive medical treatments.[17]

Conversely, health issues may arise when physical activity is not a regular component in one's lifestyle. In particular, individuals who do not exert enough of the energy they acquire by way of eating and drinking will gain weight.[18] People who are overweight or obese are more likely to develop health problems such as type II diabetes, heart disease, stroke, certain cancers and musculoskeletal problems.[19,20]

In Canada, approximately 82 per cent of teenagers are not active enough to meet international guidelines for optimal growth and development.[21]

In 1999, physical inactivity led to $2.1 billion in direct health care costs. This represented approximately 21 per cent of the health care costs of coronary artery disease, stroke, high blood pressure, colon cancer, breast cancer and diabetes.[22]

To counter these issues, attention must be paid to evidence suggesting that people are more likely to engage in frequent physical activity when high quality green spaces are available. Researchers at the University of Wollongong's Faculty of Health and Behavioural Sciences in Australia reviewed literature on environmental factors associated with adults' participation in physical activity.[23] Their results show evidence for positive associations between physical activity and the presence of green spaces in close proximity to residential areas.

Anne Ellaway and her colleagues at the University of Glasgow found that more greenery in residential areas is linked to residents' tendency to being more physically active and less overweight and obese.[24] Residents in environments with visible greenery and vegetation were 3.3 times more likely to take up frequent physical exercise than those in the lowest greenery category.[25]

In Canada, there is a growing concern that our children are becoming more sedentary.[26] This is partly due to an increase in stationary activities such as watching television and playing video games. In fact, between 1977 and 1995, there was a 37 per cent decline in American children walking or biking to school.[27]

Norwegian researcher Ingunn Fjortoft, studied the effects of natural environments on children's play and motor development.[28] She observed children playing in a natural environment in comparison with a control group playing in a traditional playground. She found that when children were provided with a natural landscape to play in, they showed a statistically significant increase in motor fitness, especially in balance and coordination abilities.

Researchers in Chicago conducted a study in a deprived neighbourhood in the city and observed that the amount of trees and grass in playgrounds is directly correlated with a higher frequency of play.[29] Furthermore, children displayed more creative playing behaviour and had more contact with adults.

Promotion of children's physical activity is important to combat the existing obesity epidemic and to establish an early habit of incorporating physical activity into daily life.[30] By increasing natural spaces through restoration activities and establishing green spaces, we can provide enhanced natural playgrounds and encourage our children to lead more physically active and healthier lives.

3.2 Cardiovascular and Respiratory Diseases

Over the last decade, a growing body of epidemiological and clinical evidence has led to increasing concern about the role of air pollution as a risk factor for both cardiovascular and respiratory diseases.[31, 32]

Outdoor air pollution is composed of a mixture of gases, liquids and particulate matter.[33] Air pollutants with known health effects on the cardiorespiratory system include ground level ozone (O_3), particulate matter (PM) especially $PM_{2.5}$ and PM_{10}, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and carbon monoxide (CO) [34, 35, 36]. They have been shown to contribute to increased hospitalization and mortality.[37, 38, 39] In 2008, there were 9,500 premature deaths in Ontario associated with exposure to sulphur dioxide, nitrogen dioxide and carbon monoxide.[40]

These pollutants are emitted from a variety of urban and rural sources and some can travel hundreds of kilometres.[41] Coal-burning plants release sulphur dioxide, sulphate pollutants, nitrogen oxides and particles during the process of generating electricity. Nitrogen oxides are also emitted by engines of cars and heavy-duty diesel vehicles.[42] As these pollutants travel through the atmosphere, they interact with water vapour and sunlight to form acid aerosols that are known to irritate the respiratory system.

Suspended particles (TSP, PM_{10}) are also emitted from cement plants, mining operations, residential wood combustion and dust emissions from fields and roads.[43]

Ozone (O_3) is a common component of the upper atmosphere and poses little risk to human health at low and stable concentrations.[44] As O_3 concentrations increase, the threat to health becomes a concern.[45, 46] At ground level, ozone is the key component of smog and is produced through a reaction with pollutants, mainly nitrogen oxides.[47, 48]

The Ontario Medical Association (OMA) has developed the Illness Cost of Air Pollution (ICAP) model to estimate the health and economic impacts of smog in Ontario. [49,50] The 2005 report estimated that the number of hospital admissions related to air pollution exposure was approximately 17,000 while the number of emergency room visits was almost 60,000.[51] By 2026, these rates are expected to jump to more than 24,000 and 88,000 respectively.[52]

Cardiovascular Disease

Cardiovascular disease (CVD), which includes heart disease and stroke, is the leading cause of mortality in Ontario.[53] Every year, approximately 24,000 deaths in Ontario are associated with cardiovascular disease. [54, 55] It is estimated that CVD costs Ontario $5.5 billion per year in direct and indirect costs. [56, 57] This cost is expected to double to $11 billion by 2018 due to an aging population and an increase in the prevalence of CVD risk factors including diabetes, obesity, physical inactivity and hypertension, to name a few.[58,59]

Evidence supports the linkages between air pollution, heart attacks, strokes and cardiovascular death.[60] Evidence also suggests that there is an association between air pollution and irregular heartbeats, cardiac arrest and peripheral vascular diseases.[61]

Respiratory Disease

Air pollution has been linked to negative respiratory health with more than three million Canadians suffering from serious respiratory diseases.[62]

In 2004, respiratory diseases were responsible for 37,260 deaths in Ontario.[63] In 2008, close to 36,800 emergency department visits due to respiratory illness were associated with air pollution issues in Ontario.[64] This number is predicted to rise to 60,800 visits by 2031.[65]

Respiratory diseases also impose an economic burden on the Canadian health care system. It is estimated that in 2000, nearly $5.70 billion were related to respiratory diseases in direct health care costs, including hospitalization and physician visits. There was an additional $6.70 billion in indirect expenses associated with disability and mortality. [66]

Air pollution is one of the most important and preventable risk factors for respiratory disease. Exposure to air pollution has been associated with adverse health outcomes that range from subtle biochemical and physiological changes to difficulty breathing, wheezing, coughing, aggravation of existing respiratory diseases and infections and allergies of the respiratory tract.[67, 68]

Exposure to pollutants such as ground-level ozone, inhalable particulates and sulphates results in a range of adverse health effects in Ontarians:

- Ground level ozone (O_3) is linked to lung inflammation, decreased lung function, airway hyper-reactivity, respiratory symptoms, increased hospital admissions and possible increased mortality.[69, 70, 71]
- Fine particulate matters (PM_{10} and $PM_{2.5}$) are suspended in air and penetrate deep into our airways when inhaled. Elevated PM_{10} levels are associated with increased respiratory hospital admissions and increased mortality. [72, 73, 74]
- Sulphates, extremely small acidic particles that can become imbedded deep in lung tissue, are known respiratory irritants and have been linked to respiratory disease. The Ontario Smog Plan Workgroup has estimated that inhalable particles can be blamed for nearly 1,800 premature mortalities and 1,400 hospital admissions each year in Ontario.[75, 76, 77]

Asthma, a chronic respiratory illness, is now the leading cause of hospital admission and school absenteeism for children in Ontario.[78] According to the Lung Association, more than 2.7 million Canadians have asthma. [79, 80]

Elevated concentrations of ground level ozone and particulates in southern Ontario cause the region to have the worst air quality problems in Canada.[81] Strong associations between premature mortality due to respiratory disease and levels of airborne particles, ground-level ozone and nitrogen dioxide have been observed in Toronto.[82]

Children's exposure and risk to air pollution can be greater than adults because they breathe more rapidly and spend relatively more time playing outdoors. In rural Ontario communities with the highest levels of airborne acids, children are significantly more likely to experience at least one episode of bronchitis.[83]

The elderly and people who work or exercise outdoors are also highly vulnerable to the respiratory effects of air pollution. [84, 85]

Air quality benefits of trees and forests

Given the known relationships between poor air quality and human cardiorespiratory system, it is clear that improving air quality would play a key role in lowering the rate of cardiovascular and respiratory disease in Canada.

Trees are natural filters and help to reduce smog and pollution in our cities by removing carbon monoxide, lead, nitrogen dioxide, particulate matter and other pollutants through their leaves and other surface areas.[86, 87, 88, 89]

Studies have demonstrated that trees remove large quantities of sulphur dioxide and carbon dioxide from the atmosphere. [90,91] For example, researchers observed that in 1991 approximately 9.8 tonnes of PM_{10}, 4 tonnes of SO_2 and 11.9 tonnes of O_3 were removed daily by an estimated 50.8 million trees across the Chicago area.[92]

Trees can also remove large quantities of ozone from the atmosphere.[93, 94] In the United States it has been calculated that a 20 per cent loss of forest cover due to urbanization in Los Angeles leads to a 14 per cent increase in ozone concentrations.[95,96,97]

Researchers at Columbia University have found that for every additional 343 trees per square km, asthma rates drop by 25 per cent in young children. [98] The correlation between the number of trees and the number of asthma cases remained consistent regardless of population density, levels of affluence and sources of pollution.

Investing in tree planting infrastructure and increasing forest cover will reduce human exposure to air pollutants, thereby reducing the risk factors for cardiovascular and respiratory disease and in turn reducing provincial health care costs.

3.3 Diabetes

According to the Canadian Diabetes Association, approximately 8.3 per cent of the population in Ontario – an estimated 1,169,000 people – have been diagnosed with either type 1 or type 2 diabetes in 2010.[99] This number is expected to rise to a staggering 1,903,000 by 2020.[100] The economic impact of diabetes in Ontario is estimated to be $4.9 billion in 2010.[101] By 2020, this cost is expected to increase to more than $6.9 billion.[102]

Medical researchers have found a strong linear relationship between adult diabetes and smog – the higher the exposure to air pollution and smog, the higher the incidence of diabetes. [103, 104] Although the exact mechanisms are unknown, this correlation was statistically significant even after taking into account other risk factors such as obesity and ethnicity.

Trees are effective natural tools for absorbing air pollutants and reducing smog and could therefore play a potential role in reducing the environmental factors that lead to or exacerbate diabetes in adult populations.

3.4 Cancer

Cancer, the uncontrolled growth of abnormal cells in the body, has become one of the leading causes of disease and death worldwide.[105] An estimated 177,800 new cancer cases and 75,000 cancer-related deaths will occur in Canada in 2011.[106]

Every day, we come into contact with carcinogenic substances that have been linked to cancer. In urban areas, hazardous pollutants in the air, including particulate matter (PM_{10}) are known to carry carcinogenic compounds into the lungs. [107, 108] Trees and forests cleanse our atmosphere by filtering out these substances, thereby protecting us from their harmful effects.[109]

Overexposure to the sun's ultraviolet radiation has been deemed a major cause of skin cancer.[110] The amount of human exposure to the sun's rays is dependent on a variety of factors including altitude, latitude, time of day and amount of tree cover.[111] Increased tree cover can protect the skin from the sun's damaging radiation.[112] For example, if a person is shaded by a tree that provides 50 per cent

shade, it will take 50 minutes to burn rather than 20 minutes.[113] And if the tree provides full shade, the individual could remain outside for double that amount of time (100 minutes) without burning.[114]

As a result of an interesting set of studies, phytoncides (essential oils) derived from trees have been suggested to exert a preventative effect on cancer generation and development.[115, 116, 117] Phytoncides such as α-pinene and limonene, which are antimicrobial unstable organic compounds, have been linked to an increase in 'Natural Killer' (NK) cell activity.[118,119,120] NK cells are believed to kill tumour cells by releasing anti-cancer proteins such as perforin, granulysin, granzyme A, granzyme B-expressing cells.[121,122,123] Although more research needs to be conducted to verify the validity of these findings, some investigators believe that contact with trees helps to prevent the development of various types of cancers. .[124,125,126]

The Ministry of Agriculture, Forestry and Fisheries in Japan coined the term Shinrin-yoku, or 'forest bathing' in 1982.[127] A forest bathing trip involves a visit to a forest for relaxation and recreational purposes where visitors breathe in fresh air and phytoncides released by the trees.[128] Forest bathing trips are suggested to reduce stress and to increase NK cell activity [129, 130, 131] and are regarded as a potential cancer prevention tool in Japan.

3.5 Attention Deficit/Hyperactivity Disorder

Attention Deficit/Hyperactivity Disorder (AD/HD) is the most common neurobehavioral disorder in children.[132] The most common symptoms of AD/HD include inattention, hyperactivity and/or impulsive behaviours.[133]

Several studies suggest that contact with nature may contribute to improved attention and function in children with ADHD symptoms. For example, data obtained by researchers at the Department of Natural Resources and Environmental Sciences and the Department of Psychology at the University of Illinois indicate that children playing in greener and relatively more natural settings exhibit less severe AD/HD symptoms. [134, 135]

In a research experiment conducted by Anne Faber Taylor and colleagues at the University of Illinois, parents of children with AD/HD were surveyed with questions regarding their children's attention after activities in a number of settings, including indoor and green space settings. [136] The results indicated that when children played in greener and more natural settings, their attention deficit symptoms were less severe.

3.7 Stress

Nearly 23 per cent of Canadians report a high degree of life stress. [137] It is estimated that more than 70 per cent of doctor visits have a stress-related component and it is known that chronic stress in adults increases the likelihood and severity of depression, diabetes, heart problems, arteriosclerosis, bone loss, obesity, impaired immune system and infections.[138, 190, 191, 192] Numerous studies have shown that there is a direct correlation between the presence of trees and a decline in stress levels. [139, 140, 141] Contact with nature can have a powerful therapeutic effect by reducing the stress response of the body and the mind thereby helping to improve both physical and mental abilities.[142,143,144]

Researchers from around the world have found that clinics, hospitals, nursing homes, and even prisons that incorporate some element of nature, even just a simple view of trees, show higher rehabilitation rates.[145, 146] Studies have also shown that hospital patients who can see trees from their windows need less medication and enjoy faster recovery times following surgery.[147, 148]

Finally, the results of a study undertaken by Japanese researchers using the Profile of Mood States (POMS) test demonstrated that a visit to a forest (see section 3.4) significantly increases the score for vigour and decreases the scores for anxiety, depression, and anger.[149] The findings suggested that forest environments promote lower concentrations of cortisol, lower pulse rate, lower blood pressure, greater parasympathetic nerve activity, and lower sympathetic nerve activity than do city environments.[150]

The observed associations between contact with nature and a subsequent reduction in stress suggest that conserving and restoring woodlands and forests in accessible parks and conservation areas can play a significant role in increasing human health and well-being in both urban and rural settings.

4. Conclusions and Recommendations

Forests are complex ecosystems that provide a wide range of ecosystem services to benefit humans and all other species. Among these ecosystem services are the many roles of trees and forests in sustaining human health and well-being. This paper highlights the growing body of evidence for specific benefits to people in terms of opportunities for physical activity, cardiovascular and respiratory health, cancer prevention, stress reduction and others.

In Ontario, our rural and urban forests are in serious jeopardy due to many factors including displacement by other land uses, climate change, invasive species and pollution. Ongoing population growth will add to these pressures, making it increasingly urgent to expand and intensify tree planting and forest restoration initiatives. To achieve the minimum 30 per cent forest cover in southern Ontario needed for a healthy ecosystem, we must plant one billion more trees. This will be a major task, but the costs of inaction are high, as this paper demonstrates, for the health sector alone. The good news is that a relatively modest investment in trees and forests can reap great rewards in terms of reductions in long term health care costs and increases in the health, well-being and productivity of current and future generations of Ontarians.

The Ontario Biodiversity Strategy provides a valuable framework for understanding the importance of diverse, healthy ecosystems and taking actions to sustain them. It recommends actions to increase our understanding of the linkages between biodiversity and human health and well-being and to restore ecosystem functions in urban and rural areas.

Trees Ontario, Conservation Authorities, stewardship groups and many other organizations are already working on ecosystem restoration in Ontario. However, efforts must be significantly intensified if we are to fully reap the benefits of healthy forest ecosystems. To raise awareness and encourage action on all fronts, the following recommendations are presented:

Current Status

- Take stock of current restoration initiatives and identify the infrastructure required to meet future targets.

Infrastructure Development

- Develop and support, on a long-term and sustainable basis, the infrastructure required to enhance and maintain our natural environment for human health benefits.

Dialogue and collaboration

- Develop a forum to facilitate dialogue and collaboration among existing and new partners from all relevant disciplines including Conservation Authorities, stewardship groups, forest industry, environmental advocates, academia, health professionals, landowners, politicians, etc.

Research

- Support new and ongoing research to determine the quality, quantity, and proximity of natural spaces, particularly forests, that are needed to achieve a sustainable natural environment capable of providing ecosystem services at levels necessary for optimal human health.

Awareness

- Increase awareness of the health benefits of trees and forests and support for reforestation initiatives. Focus on the media, general public and political representatives.

Policy

- Create a provincial inter-ministerial committee to improve the policy and planning framework for land use, natural environments, and forest planning/management through greater understanding of the linkages with human health and well-being. Include ministries such as Health and Long-term Care, Natural Resources, Environment, Municipal Affairs and others.

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