

**The Role of Watershed Planning and Governance in Human Health and Well-being
in the Credit River Watershed in southern Ontario**

Iftekhar Ahmad

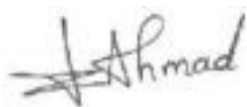
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York University

Toronto, Ontario, Canada

Student Signature:



Supervisor Signature: _____

Abstract

The role of watershed planning and governance is crucial in ecosystems health, and human health and well-being. This project particularly focuses on the assessment of the 12 human health and well-being indicators (identified in the governance stakeholders' workshop organized by CVC in collaboration with York University on November 6, 2014) and the identification of the roles of the governance stakeholders in monitoring these indicators. In this project, the indicators have been assessed in light of the information solicited through in-person and telephone interviews with the governance stakeholders working in municipalities, conservation authorities, public health agencies, not-for-profit organizations, community organizations and academic institutions mainly within the Region of Peel. The interviews were conducted using a semi-structured questionnaire which comprised questions pertaining to the mandate of the organizations of the stakeholders with respect to human health and well-being, general benefits of measuring these indicators, specific benefits to vulnerable groups for measuring the indicators, weaknesses of measuring the indicators, and uses of these indicators for different purposes.

The interviews' results identify the relationships between the indicators and partnerships among different stakeholders in monitoring or implementing these indicators. The results also impart that some indicators (e.g. % people using natural space) are hard to define and measure, some indicators (e.g. air quality index) can be employed at both local and provincial levels, some indicators (e.g. % imperviousness) are quantitative and cannot be easily understood by the general public, and some indicators (e.g. land cover change) are considered master variables and cannot be measured alone. The results also identify the need for defining natural and green spaces for consistent application of the indicators.

Foreword

Through this major project, I have achieved most of the learning objectives identified in my Plan of Study (POS). This major project is largely derived from the WEPGN's project entitled; "Human well-being, ecosystem services and watershed management in the Credit River Valley: Web-distributed mechanisms and indicators for communication and awareness," which is a joint venture between CVC and York University. I worked on this project in the capacity of a graduate assistant and achieved Learning Objectives 1.1, 1.2, and 1.3 of Component 1: Ecosystems and Community Health in my POS.

The most important part of the WEPGN's project for me was the governance stakeholders workshop which led to the achievement of my learning objectives. My role was to assist in organizing and facilitating this workshop. The workshop process comprised two main stages namely; preparation stage, and participation stage. While preparing for the workshop, I got a basic understanding of ecosystem components, ecosystem services and their relationships to human well-being, indicators related to human health and well-being, and the appreciative inquiry process through literature review and discussions with the workshop organizers (Learning Objectives 1.1, 1.2 and 1.3). The understanding of these concepts was strengthened during different working sessions of the workshop in which participants shared their expert knowledge. In addition, the semi-structured interview and content analysis approaches, used to expand on 12 indicators (finally selected in the workshop), were instrumental in getting deeper understanding of the indicators of human health and well-being (Learning Objective 1.2).

Acknowledgements

My heartfelt thanks go to my supervisor, Dr. Martin Bunch, who has been of immense help in providing me with the opportunity to work as a graduate assistant on the human health and well-being project in the Credit River Watershed to prepare the Water Economics, Policy and Governance Network (WEPGN's) knowledge mobilization proposal and organize the governance stakeholders workshop related to the WEPGN's health and well-being project. I would also like to thank him for his invaluable feedback on my research proposal and master's project. I want to extend my thanks to Mike Puddister and Tatiana Koshinkova from CVC for providing their expert input on my research proposal.

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1 Introduction

1.1 Project Background

This research project is a part of a larger project entitled "Human well-being, ecosystem services, and watershed management in the Credit River Valley: Web-distributed mechanisms and indicators for communication and awareness." This major project is a joint venture between York University and Credit Valley Conservation (CVC) and financed by the Water Economics, Policy and Governance Network (WEPGN). The problem statement addressed by that project, reproduced below, sets the stage for my project:

The importance of ecosystem services to human well-being, and of management of water and other watershed resources in maintaining such services, is not commonly understood by the general public, and not well-enough articulated by environmental management and governance organizations. This project will address both sides of this issue by identifying indicators of human well-being associated with ecosystem services, developing an internet-based tool to communicate these indicators to the communities to create awareness about key factors affecting their health and well-being, and assessing the efficacy of this tool in an application to the Credit River Watershed, southern Ontario. Concurrently, this project will contribute to enhancing community governance by encouraging engagement in stewardship activities. (Bunch et al, 2013)

In the larger project, a suite of indicators of human well-being were identified and refined through the governance stakeholders' one day workshop (Appendix 1 for the copy of the workshop report) held on November 6, 2014 (CVC and York University, 2015). The main objective of the workshop was to engage a broader internal and external group of experts and opinion leaders to assist in developing and refining the list of well-being indicators that relate to

the watershed’s environmental conditions. Prior to the workshop, a suite of indicators of human well-being had been reviewed and selected by the project partners¹. The list was later refined based on the discussions with the project team. While developing indicators, input was also solicited from local residents through the administration of a survey in one neighborhood in Mississauga (Meadowvale Village) and one in Brampton (Fletchers Creek) from October 2013 to January 2014 (Malette, 2014).

The workshop was conducted using an Appreciative Inquiry (AI) approach. AI is a four-pronged approach comprising Discovery (what is/what has been), Dream (what could be), Design (what should be), and Destiny (what will be) stages (Whitney et al, 2010). A total of 17 stakeholders from different organizations (City of Mississauga, City of Brampton, Region of Peel, CVC, Toronto and Region Conservation Authority etc.) participated in the workshop. At the end of the workshop, twelve indicators were finalized (Table 1.1).

Table 1.1 Final Indicators of the Governance Stakeholders' Workshop (CVC and York, 2015)

No	Indicator	No	Indicator
1	Air Quality	7	Water Quality Index
2	Traffic Patterns/Mode of Transportation	8	% People using Natural Space
3	Land Cover Change	9	Proximity to Green Space
4	Urban Heat Island	10	Connectivity of Green Spaces
5	% Imperviousness	11	Access to Green Spaces
6	% Canopy Cover	12	Wildlife (habitat)

Concurrently, the research team of the larger project has begun to populate its novel environmental well-being (EWB) Web-GIS tool to communicate these indicators to non-

¹Potential Indicators were brain-stormed at the Ecohealth & Watersheds: Indicators Meeting (Prince George, BC) in June 2013. The meeting was hosted by UNBC and involved local, provincial, national and international organizations that gathered to collaborate on the use of indicators and integrated frameworks to address the connections between health, environment and communities.

academic community (residents living in the watershed, practitioners and other interested parties) with data. CVC is a key partner in the project team – from the identification of indicators to the development of the tool.

1.2 Project Overview

The objective of my research project is to examine the role of watershed planning and governance in human health and well-being in the Credit River valley in southern Ontario. The governance stakeholders workshop's findings provided the basis for my research project. In the project, I have used the same indicators identified during the workshop and expanded on them in consultation with governance stakeholders such as environmental planners, parks planners, environmental specialist, environmental policy advisors, public health specialists, biologists, environmental educationist, and climate change specialist. The key questions, discussed with the stakeholders, were focused on the strategic mandate of the stakeholders' organizations with respect to human health and well-being, general and specific benefits of measuring human health and well-being indicators, weaknesses of the indicators, and uses and purposes of the indicators. Details about the process of identifying stakeholders and gathering information from them are provided in Chapter 3 (Research Method).

1.3 Project Objectives

The overall intent of my research is to explore the relationships between environmental quality and human health and well-being in the Credit River Watershed. The specific objectives of my project include the following:

- Assess human well-being indicators related to ecosystem services in the Credit River Watershed based on experts input; and
- Identify and describe the roles of governance stakeholders in measuring human well-being indicators.

1.4 Scope and Limitations

The scope of my major project is limited to the assessment of 12 human well-being indicators. A basic content analysis has been performed to analyze the information solicited from 19 professionals with different backgrounds and from different organizations. Given the size of the sample of the interviews and lack of the statistics power, a statistical analysis has not been conducted.

1.5 Organization of the Project Report

This report comprises six chapters. Chapter 1 includes the background of the project, brief overview of the project, objectives of the project and organization of the report. Chapter 2 presents the context of my research project. Chapter 3 reviews literature pertinent to my research project. Chapter 4 discusses the methods used, starting from gathering information from the stakeholders through to the results. Chapter 5 presents results of the interviews conducted with different governance stakeholders. Chapter 6 presents conclusions and recommendations.

2 Research Context

This chapter presents information about the Credit River Watershed, a regulatory agency managing the watershed, the importance of environmental and community health in relation to the land use planning framework, biodiversity strategy, public health strategies and standards. The purpose of this information is to contextualize the research project within which the interviews' results are presented.

2.1 Credit River Watershed

The Credit River Watershed is an area of land that drains into the Credit River. Figure 2.1 shows the map of the watershed. The salient features of the Credit River Watershed are described in detail in the CVC report on "Rising to the challenge: A handbook for understanding and protecting the Credit River Watershed" published in 2009 and a brief summary is presented here. The Credit River Watershed is situated in southern Ontario and encompasses a land area of 860 square kilometers. It originates from headwaters at Orangeville and finds its way to the Lake Ontario while traversing through natural features (valleys, forests, woodlands, wetlands etc.) and built up areas (Mississauga, Brampton, Caledon etc.). The most outstanding features of the Credit River Watershed include the Niagara Escarpment, Oak Ridges Moraine, and the Lake Ontario Shoreline. The watershed is divided into three zones (upper, middle and lower). The upper part of the watershed consists of 60 percent forest with agriculture being the primary land use. The middle part of the watershed is largely occupied by the Niagara Escarpment and Oak Ridges Moraine. The lower part of the watershed is mainly urbanized covering western side of Brampton, most parts of Mississauga, and eastern side of Oakville. The watershed is divided into 22 subwatersheds which represent streams and creeks falling into the Credit River. The Credit

River itself is 90 kilometers long and covers an area of more than 1,500 square kilometers comprising small streams and creeks. The Credit River ecosystem is valued in terms of its socio-economic, cultural, and ecological importance.

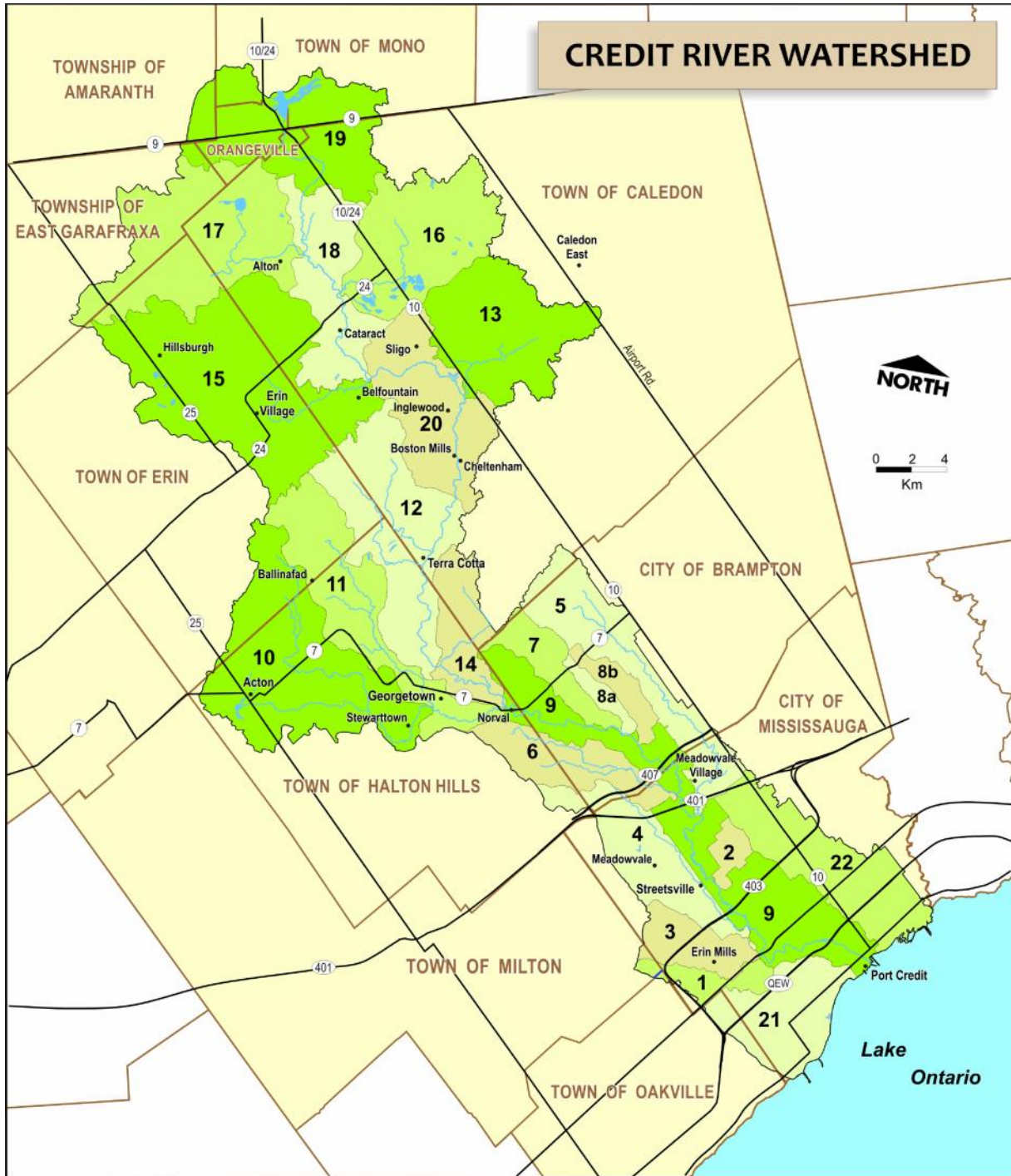


Figure 2.1 Map of the Credit River Watershed (Source: Groundspeak, Inc. 2000-2015)

2.2 Credit Valley Conservation

The Credit Valley Conservation (CVC) authority is a community based organization which was constituted under the Conservation Authorities Act of the province of Ontario in 1954 (CVC, 2009). It is one of 36 conservation authorities operating on a watershed wide scale (CVC, 2010). It works with its local and regional partners including the Region of Peel, Region of Halton, Town of Mono, Township of Amaranth, Town of Orangeville, Township of East Garafraxa, Town of Caledon, Town of Erin, Town of Halton Hills, City of Brampton, Town of Milton, Town of Oakville, and the City of Mississauga (CVC, 2008). Most of CVC's funding is sourced from these member municipalities. CVC also works in collaboration with community groups such as schools, fishing clubs, and naturalists on a variety of projects to improve health of the Credit River Watershed.²

CVC administers planning and development activities under the Planning Act and Conservation Authorities Act. Under the Planning Act, CVC provides "planning and technical advice to planning authorities to assist them in fulfilling their responsibilities regarding natural hazards, natural heritage, and other relevant policy areas." Under Section 28 of the Conservation Authorities Act, it regulates "development and interference with wetlands, shorelines and watercourses" (CVC, 2010).

The mandate of CVC under Section 20 of the Conservation Authorities Act is to conserve, restore, and manage natural resources within the Credit River Watershed (CVC, 2008 and 2010). CVC aims to achieve goals in five main areas including; water quantity, water quality, terrestrial

² <http://www.creditvalleyca.ca/about-cvc/about-the-organization/partner-organizations/>

and aquatic species, communities and ecosystems, natural hazards, and socio-economic (CVC, 2008).

One of the governing principles of CVC, derived from its 2008 Strategic Plan Update, is to understand the intimate relationship between the natural environment and human health. Given this importance, a study was conducted by CVC to understand the connection between human health and well-being and environmental conditions in the Credit River Watershed (CVC, 2011). One of the outcomes mentioned in this study includes the "development of the human well-being and environmental quality indicator framework for the watershed." Some example indicators used in this study include water quality index, urban canopy cover, and indicators related to the use of natural space for different purposes. One of the recommendations of this study was the "development of an indicator based framework to monitor and communicate the direct and indirect links between human well-being and environmental quality in the watershed" (CVC, 2011). This recommendation led to the initiation of a joint venture, entitled "Human well-being, ecosystem services and watershed management in the Credit River Watershed: Web-distributed mechanisms and indicators for communication and awareness," between CVC and York University in 2013. I have been involved in this project since then. My research project is drawn from that larger project and findings of my research will feed into that project too.

2.3 Demographics and Land Use in the Credit River Watershed

According to the CVC's Credit River Watershed Health Report (2012), urbanization and climate change are two major issues prevalent in the Credit River Watershed. It is mentioned in the report that population in the watershed increased from 573,000 to 758,000 from 1996 to 2006. More than half of the Credit River Watershed area falls within the Region of Peel (CVC, 2009).

Population in the Region of Peel is projected to increase from 1.3 million in 2011 to 1.4 million by 2031 (CVC, 2012). Further drawing from the CVC's health report, more than one third of the land in the Credit River Watershed is presently occupied by agricultural land and open space but this share of land cover is decreasing due to burgeoning population, particularly in the lower watershed.

2.4 Land Use Planning Framework

Land use planning is required for managing land and resources (MMAH, 2010). Under the land use planning system, the municipalities are empowered to administer land uses in the province of Ontario. Below is a brief description of the laws, regulations, and policies which indicate importance of protection of the natural environment and promotion of human health and well-being. This legislative framework provides a statutory basis for my research project.

2.4.1 Planning Act

The Planning Act is the principal law governing land use planning in Ontario (The Environmental Commissioner of Ontario, 2011). According to MMAH (2010), "the Planning Act sets out the ground rules for land use planning in Ontario and describes how land uses may be controlled, and who may control them." One of the objectives of the Act is "to promote sustainable economic development in a healthy natural environment within the policy and by the means provided under this Act" (Planning Act, R.S.O. 1990). The Planning Act shall have regard to matters of provincial interest such as: "the orderly development of safe and healthy communities" (Planning Act, R.S.O. 1990, Part I, 2.h).

2.4.2 Provincial Policy Statement

The land use planning system in Ontario is driven by the provincial policy under the Planning Act. The Provincial Policy Statement (PPS) was prepared under Section 3 of the Planning Act and lately revised in 2014. The objective of the PPS is "to provide for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural environment" (The Environmental Commissioner of Ontario, 2011). The PPS (2014) sets out three broad policies including; building strong healthy communities, wise use and management of resources, and protecting public health and safety. The vision for the land use planning system in Ontario is set out in Part IV of the PPS which is "the long-term prosperity and social well-being of Ontario depends upon planning for strong, sustainable and resilient communities for people of all ages, a clean and healthy environment, and a strong and competitive economy " (PPS, 2014).

2.4.3 Conservation Authorities Act

Section 28 of the Conservation Authorities Act empowers conservation authorities to make regulations for implementation within its jurisdiction (Conservation Authorities Act, R.S.O. 1990, C27, 28(1)). All conservation authorities have enacted the Regulations of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under different versions. Ontario Regulation (also called O. Reg.) 160/06 applies to the CVC authority.

2.4.4 Watershed Planning and Regulation Policies

These policies set parameters for CVC to administer the O. Reg. 160/06 and provide guidance on reviewing the official plans, zoning by-laws, planning applications as well as relaying comments

on the Canadian Environmental Assessment Act, Ontario Environmental Assessment Act, Lakes and Rivers Improvement Act, Fisheries Act, Clean Water Act, Endangered Species Act, Niagara Escarpment Planning and Development Act, Oak Ridges Moraine Conservation Act, Places to Grow Act, and the Greenbelt Act (CVC, 2010). This policy document introduces a natural heritage systems approach to watershed planning for the CVC's local and regional partner municipalities to protect natural environment and human health. Apart from assisting the staff and other agencies, it also facilitates its clients and the general public in understanding the requirements for undertaking developments in floodplains, on valley slopes and near environmental features such as wetlands and watercourses.

2.4.5 Ontario's Biological Diversity Strategy

Biodiversity or biological diversity is defined as: "variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species, and of ecosystems" (UN, 1992). Ontario's urban biodiversity (including trees, watercourses, parks) cater to ecosystem services which are beneficial for human health and well-being and this is the reason why biodiversity is considered to be a vital constituent of the community infrastructure (OBC, 2011). Further drawing from OBC (2011), there is a need to have a robust network of different partners (government organizations and non-government organizations) to understand the inextricable connection between biodiversity and human health and well-being for achieving the objective of mainstreaming biodiversity across all sectors.

2.4.6 Ontario's Public Health Strategy and Standards

The Public Health Leadership Council has developed a first and robust plan called "Make No Little Plans" for the public health sector in Ontario. One of the strategic goals of this plan is to promote healthy natural and built environments (OPH, 2013, p20). Particular importance is given to built environment in this plan because that can have many benefits such as; promotion of community health and well-being by fostering the use of active transportation (cycling, walking etc.) and discouraging reliance on automobiles, promotion of social cohesion, minimization of the likelihood of injuries, and reduction in healthcare cost. Local public health organizations work in close collaboration with municipal governments and are in a position to influence land use decision making by emphasizing the importance of the connection between community planning and health implications (OPH, 2013). Partnership and collaboration with other stakeholders is one of the four principles of the Ontario Public Health Standards (Ministry of Health and Long-Term Care, 2014).

2.4.7 Summary

This chapter illustrates statutory framework which provides the basis for human health and well-being. It also points out that CVC is a primary governing body in the Credit River Watershed and works in collaboration with its municipal partners. CVC derives its powers mainly from the Conservation Authorities Act. The next chapter provides information on other frameworks of human health and well-being and watershed planning and governance concepts.

3 Literature Review

This chapter covers important frameworks related to human health and well-being. It also includes information pertaining to a human well-being index. The concepts related to watershed planning and governance are also presented in this chapter.

3.1 Millennium Ecosystem Assessment Framework

Parkes et al (2008) state that watersheds provide an assortment of ecosystem services on which human health and well-being depend. The MA (2005) defines ecosystem services as "provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits."

According to the MA (2005), human well-being comprises different components including; "the basic material for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods; health, including feeling well and having a healthy physical environment, such as clean air and access to clean water; good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children; security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters; and freedom of choice and action such as the opportunity to be able to achieve what an individual values doing and being."

The MA (2005) presents a diagrammatic illustration of relationships in the form of intensity of linkages between ecosystem services and constituents of human well-being along with potential for mediation by socioeconomic factors (figure 4.1).



Figure 3.1 Linkages between Ecosystem Services and Human Well-being (Source: MA (2005))

3.2 Well-being Framework

The Canadian well-being index is an initiative taken to report on the well-being status of the Canadian population. Morgan (2011) states that this index measures well-being in different areas such as health, standard of living, time use, community vitality, leisure and culture, environment etc. The vision of this index is "to enable all Canadians to share in the highest well-being status by identifying, developing and publicizing statistical measures that offer clear, valid and regular

reporting on progress toward well-being goals and outcomes that Canadians seek as a nation" (Morgan, 2011).

A strong component of leisure and culture is recreation. The Interprovincial Sport and Recreation Council (ISRC) and Canadian Parks and Recreation Association (CPRA) have jointly developed a "Framework for recreation in Canada: Pathways to well-being" which speaks volumes about recreation and its impacts on human health and well-being. It is mentioned in this report that recreation promotes well-being of individuals, community, and the built and natural environments. The key role players in the field of recreation include all levels of government departments and not-for-profit organizations who are handling matters pertaining to sports, health, urban planning, infrastructure development, rural development, aboriginal affairs, natural resources and conservation, tourism etc. (ISRC and CPRA, 2015). The framework for recreation also accentuates the need for partnership among all tiers of government (local, territorial, provincial, federal).

The Framework for Recreation in Canada discusses challenges including those health issues (chronic diseases, mental health issues), economic inequities (low income people with scanty recreational opportunities due to economic reasons), social challenges (lack of community cohesiveness), infrastructure deficit (lack of cycling and walking routes, facilities, proximity and accessibility to green spaces), threats to the natural environment (reduction of green spaces due to urban areas expansion). Considering the perceived benefits of recreation, these challenges can be overcome through the use of policies and best practices (ISRC and CPRA, 2015). Morgan (2011) argues that indicators are important in terms of measuring progress on well-being over time and taking informed planning and policy decisions. For example, a Water Quality Index is one of the indicators of the Canadian Wellbeing Index.

3.3 Watershed Planning

Gregersen et al (2007) add that a watershed is a complete ecosystem and should not be managed without considering ecosystem components such as land, water, and humans. Further, many developed and developing countries consider watershed planning important from environmental and economic standpoints. This type of planning comprises a plan or strategy prepared through involvement of local stakeholders and using principles of integrated water resources management in land use planning processes. Randhir (2007) states that watershed planning lays emphasis on a detailed analysis of both economic and ecological impacts to achieve sustainable development. The author adds that a watershed plan should be adaptive and involve communities and stakeholders living within a watershed.

Summers et al (2003) state that watershed planning is critical but effective only if its recommendations are duly considered in municipal official plans. Gregersen et al (2007) illustrate that watershed planning and municipal planning are two different processes. Authors argue that watershed boundaries are not the same as the political boundaries and most countries are heading towards integrated watershed management planning or larger river basin-level planning. They refer to different approaches, such as integrated watershed management, integrated catchment management, integrated natural resources management, and ecosystem management. Parkes et al (2008) uses the term integrated water resources management.

3.4 Watershed Governance

Watershed governance is an important factor affecting ecosystem health. Watershed boundaries are demarcated on the basis of natural topography and thus fall within different political jurisdictions in Ontario. Conservation authorities (such as CVC for the Credit River Watershed)

are primary watershed management bodies established under the Conservation Authorities Act at the request of local municipalities (Davidson and de Loe, 2014). In addition, there are other public and private actors (municipalities, regions, province, and non-government organizations) governing watersheds. Involvement of all these stakeholders is crucial for sustainable management of watersheds.

Parkes et al (2008) describe watershed governance as a "social process to constitute adaptive management, social learning and often collective decision-making." Minnes (2012) states that the watershed management approach requires a network governance structure (collaborative arrangement) which is defined as "...negotiated interaction between a plurality of public and private actors (provincial actors, non-government organizations, business interests, scientists), that takes place within relatively stable frameworks in a particular policy field."

Morrison et al (2012) argue that watershed management and governance are important factors affecting ecosystem health. Parkes et al (2008) argue that having multi-level, inter-sectoral, and multi-stakeholder governance structures is an old notion but the real challenge is to consider a watershed as a specific place based context in which health and sustainability can go hand in hand implying special emphasis on social and ecological determinants of health. Referring to the prism framework, Parkes et al (2008) describe four perspectives on ecohealth and watershed governance as a point of departure - "perspective on sustainable development, perspective on ecosystems and well-being, perspective on social determinants of health, and perspective on socio-ecological health." The authors argue that combination of these perspectives tends to develop socio-ecological resilience and improve determinants of health.

The MA (2005) states that current organizations have the power to cope with stresses on ecosystem services but yet face vital challenges. Pearson (2012) spells out key challenges associated with the current watershed management policy and governance framework in a white paper on "Watershed Management Futures for Ontario." These challenges are reproduced as: "legislative mandate of conservation authorities, declining provincial funding for provincial priorities, inconsistent provincial funding for provincial priorities, inconsistent provincial policy support and interpretation, and variability in conservation authority capacity to plan and implement watershed programs and services" (Pearson, 2012).

To cope with above-mentioned challenges, Pearson (2012) proposes to initiate discourses on roles and responsibilities of 'and renewed relationships between' conservation authorities and ministries for managing watersheds in southern Ontario. He also suggests that the province should take a leading role for these discourses by involving all stakeholders including municipalities and other interested parties. The author places emphasis on recognizing the mandate of conservation authorities and the vitality of their model (encouraging the use of an integrated watershed management approach), strengthening relationships between authorities and ministries, refining governance model so as to involve more stakeholders, devising a sustainability fund model, and improving the accountability framework which requires governance, mandate, funds, and accountability to be considered as an integrated whole.

CVC (2009) states that the Credit River Watershed is facing many challenges such as land use changes, climate change, poor water quality, declining biodiversity, declining natural areas etc. These challenges cannot be handled by an individual or organization. CVC is primarily a watershed management body. Other actors having stakes in this watershed include the provincial government, municipalities, and many different departments of the federal government such as

Department of Fisheries and Oceans. Davidson and de Loe (2014) argue that involvement of a variety of stakeholders in managing the watershed represents a complex, multi-level, and cross-scale setting which is likely to result in policysheds and problemsheds issues. Authors argue that policysheds issue exists due to complexity caused by a large number of provincial statutes and plans impacting the watershed geography. Discussing the problemsheds issue, the authors state that watershed boundaries are not in consonance with a multitude of environmental problems in terms of scale. CVC (2009) warrants the need for a strong collaborative working relationships among partners having stakes in the Credit River Watershed because CVC alone cannot overcome the challenges.

3.5 Summary

This chapter explains the link between ecosystem services and human health and well-being. It also shows the importance of partnership at all levels of the government to achieve human health and well-being. The next chapter presents details on the process of conducting my research project.

4 Research Method

This chapter presents details as to how the information was gathered for my research project. In particular, it outlines the semi-structured interview approach, the participants selection method, and research process (involving informed consent, data collection, and data presentation).

4.1 Semi-structured Interviews

For the purposes of my research, I have used the semi-structured interview approach to flesh out 12 indicators identified during the workshop. Barriball and While (1994) argue that this approach is most suitable if the intent of the research is to elicit viewpoints of interviewees about complicated and at times critical issues as well as to explore further information and clarity about the responses. Whiting (2008) states that a semi-structured interview is a detailed method which consists of open, direct, verbal questions to elicit detailed narratives and stories.

Describing the semi-structured interview approach, Whiting (2008) argues that this type of approach requires the identification of a 'good informant.' According to him, a good informant is characterized as the one who is knowledgeable about the subject, has practical experience in the areas being explored, and has willingness to share all this information. For the purposes of my research, good informants have been the people who were identified by CVC. These people are subject matter experts having professional expertise in areas such as environmental planning, forestry, natural heritage, public health, ecology and landscape, biology, and climate change. A list of the interviewees is provided in Appendix 2.

4.2 Selection of Participants

Concerning selection of participants for my research project, I would refer to the governance stakeholders' workshop stated earlier. CVC had prepared a list of the participants to be invited to attend the workshop. I contacted all the people in the list and got confirmations from 17 people to participate in the workshop. For the purposes of my research, I first contacted those people who participated in the workshop and then other people in the CVC's list. In addition, I approached other people through my connections established while volunteering at the planning department of CVC.

I was required to complete 20 interviews with good informants in government and community organizations and managed to complete 19 in light of consent received within the available time. This sample size was not determined by employing any sampling technique but rather was a representation of those stakeholders who were working in the Credit River Watershed directly or indirectly and had work associated with human health and well-being (Table 2.1). Silverman (2006) states that qualitative research is usually conducted with small sample size. He argues that instead of samples size, authenticity is mostly an issue in qualitative research. He adds that the purpose of authenticity is to gain authentic understanding of people's experiences and open ended questions are the most appropriate means to achieving that.

Table 4.1 Categories of Interviewees

Category	Number
Environmental Planner	2
Environmental Policy Planner	1
Policy Advisor (tourism, culture, sport)	1
Environmental Specialist	1
Parks Planners	2
Environmental Health Specialist	1
Public Health Specialist (Epidemiologist, Professors)	3
Watershed Specialists (Natural Heritage, Landowner Outreach)	3
Climate Change Specialist	1
Biological Researcher	1
Communications and Development	1
Environmental Educationist	1
Community Engagement	1
Total	19

4.3 Research Process

Prior to conducting the semi-structured interviews with the informants, the findings of the governance stakeholders' workshop (in the form of a report) were disseminated to them along with the consent forms to participate in my research project. An interview schedule was prepared in light of consent obtained from the informants. Since the summer season was relatively busy for most of the professionals, it took two months (May to June) to complete interviews. Depending upon the information shared by the interviewees, it took about 20 to 75 minutes to complete interviews with an average duration of 40 minutes. Whiting (2008) states that duration of semi-structured interviews usually ranges from 30 minutes to a number of hours.

4.3.1 Informed Consent

My research involved human participants so it was a requirement of York University to obtain approval on the informed consent letter from the Human Participants Review Sub-Committee

prior to conducting interviews. An informed consent form was prepared, submitted on the Dossier system of the University and approved by the committee. These consents, along with the semi-structured questionnaire, were sent to all potential interviewees. Approvals on the informed consent were received through email. Appendix 3 contains the approved informed consent form used for the purpose of my research.

4.3.2 Data Collection

A semi-structured questionnaire (Appendix 4) was designed to expand on information by administering questions pertinent to the human well-being indicators finalized in the November 6th governance stakeholders' workshop. The questionnaires were administered mainly through face to face interviews (13 out of 19) and partly through telephone interviews (6 out of 19). Except one question, all other questions in the questionnaire were open ended. The answers were recorded using a digital audio device.

Silverman (2006) states that interviews and audio recordings are some of the methods used in qualitative research. He argues that audio recording is an integral part of qualitative research. He adds that audio recordings and transcripts are considered as highly reliable records when compared to notes prepared on the basis of field observations. Barriball and While (1994) as well as Whiting (2008) state that audio recording is a frequently used method because it allows verbatim transcription of the recordings for the purposes of validity, reliability and accuracy of the information. Barriball and While (1994) state that audio recording also provides an opportunity to judge performance of both interviewers and interviewees. Whiting (2008) states that it enables the interviewer to focus on interacting with interviewees (rather than taking notes) and also building rapport with them. The author argues that the most crucial aspects of the audio

recording approach are true comprehension of the wording of the recorded conversations and the excessive amount of time consumed in transcription of recordings.

4.3.3 Data Analysis

The interview recordings were transcribed verbatim upon completion of the interview. Transcription of interviews was a time consuming process. Depending upon the depth of information shared by the interviewees, audio recording quality, and typing speed, it took about four to seven hours to complete transcriptions of interviews. I also sought help from another person to complete some transcriptions.

As soon as transcripts were ready, they were sent back to interviewees for reviewing and editing. Some of the interviewees (8 out of 19) reviewed transcripts and provided comments. Others did not provide feedback on their transcriptions. Transcripts were analyzed using qualitative content analysis (with an inductive approach) to gain an overall understanding and response of the relationship between environmental quality and human health and well-being.

This section presents an overview of the content analysis in general and qualitative content analysis in particular. Although only a basic analysis has been undertaken in my research project, it is vital to understand the concept and the most rudimentary elements of the content analysis.

a) Definition

Krippendorff (2004) defines content analysis as: "a research technique for making inferences by systematically and objectively identifying specified characteristics within a text." Elo and Kyngas (2008) describe content analysis as: "a method of analyzing written, verbal or visual communication messages."

b) Qualitative Content Analysis

Elo et al (2014) state that qualitative content analysis is one of the qualitative methods used for analyzing the data and expressing its meaning. Krippendorff (2004) argues that content analysis can be performed both qualitatively and quantitatively but it does not have to be necessarily quantitative because texts are descriptive in nature. He adds that quantitative analysis is considered to be an easy way of performing analysis and not a requirement of content analysis. Silverman (2006) states that the major strength of qualitative research lies in describing the research phenomena which cannot be found otherwise and the weakness is to overlook the research context.

Elo et al (2014) state that a qualitative content analysis can be performed in two ways, inductive and deductive. Krippendorff (2004) explains that the deductive approach is implied and conclusive in nature and moves from generalizations to particulars; whereas, the inductive approach is a complete opposite of the deductive inference. Elo and Kyngas (2008) argue that inductive content analysis is used where no previous studies are available pertaining to the research phenomenon or when knowledge is available only in bits and pieces. They add that this kind of analysis has been performed for environmental studies aimed at human well-being (particularly for the elderly). One of such studies is entitled; "The northern physical environment and the well-being of the elderly aged over 65 years" (Juvani et al, 2005).

Elo et al (2014) as well as Elo and Kyngas (2008) state that both inductive and deductive types of analyses consist of three stages namely; preparation, organization, and reporting of results. These authors argue that the preparation and reporting stages are the same for both types of analysis but the organization stage differs. Elo et al (2014) point out that the preparation stage

involves gathering relevant data, simplifying data, and unitizing data for the purposes of content analysis. Elo and Kyngas (2008) argue that a unit of analysis could be a word, sentence, portion of pages, the number of participants in discussion, time used for discussion, and whole interviews. The authors add that the analysis could consider either the hidden content or obvious content. According to Elo et al (2014) and Elo and Kyngas (2008), the organization stage for the inductive type of analysis includes open coding (preparing notes and headings while reading the text and identifying a list of categories), creating categories (putting these categories under main headings with the ultimate aim to produce knowledge by describing the facts), and abstraction (generating main category, generic category and sub-category). Further drawing from them, the organization stage for the deductive type of content analysis includes categorization matrix development (reviewing and coding data for content and illustrating selected categories). Elo et al (2014) state that the reporting stage includes discussion of results with respect to content of each category.

According to Krippendorff (2004), qualitative researchers do not like to follow any particular sequence (such as unitizing, sampling, recording/coding, reducing, inferring, narrating) and are rather flexible in using any of these components unlike quantitative researchers. Authors point out that qualitative researchers tend to unitize text in the form of differentiating words, quotes, examples, propositions; sample text by way of selecting the most relevant bits; look for interpretations by different knowledge experts; contextualize interpretations through readings pertinent to the text; and answer the particular research questions. Elo et al (2014) argue that a successful qualitative content analysis is contingent upon translation of data into concepts that are reflective of the research theme.

Krippendorff (2004) states that acceptance of results of qualitative content analysis research can be determined using this criteria; trustworthiness, credibility, transferability, accountability, reflexivity, embodiment, and emancipation instead of using terms of reliability and validity. However, Elo et al (2014) focus on the term trustworthiness (findings worth consideration) for evaluating the inductive type of qualitative content analysis. They add that trustworthiness can be assessed using this criteria; credibility, dependability, conformability, and transferability.

c) Transcripts Analysis

For the purpose of my research project, I analyzed information using qualitative content analysis (inductive approach). This research project comprised three stages namely; preparation stage, organization stage, and reporting stage as discussed by the authors. The preparation stage involved data collection (discussed in section 4.3.2) and transcriptions of the interviews. I considered complete transcripts of all the participants as a unit of analysis. At the organization stage, I used a little different approach. I preselected categories from my questionnaire and these included; relevance, general benefits, specific benefits to vulnerable groups, weaknesses, uses and purposes of measuring each indicator. I reviewed the information under each category for each indicator and prepared the list of key points in the excel sheet. Considering five categories for 12 indicators, I prepared 60 excel sheets identifying the key points of each indicator in each sheet. At the reporting stage, I explained those key points and also stated the number of people having the same or differing opinions.

4.3.4 Summary

This chapter indicates that qualitative content analysis is a qualitative method and can be used with inductive and deductive approaches. It also refers to the use of this type of analysis for

environmental studies concerning well-being for the elderly people especially. It also explains that inductive approach is suitable when the knowledge about a particular research phenomenon is either non-existent or scarcely available. It also presents details of the qualitative content analysis (inductive approach) used in my research project which would contribute to the existing body of knowledge on the well-being indicators by discussing the mandates, relevance, benefits and uses of the indicators in view of the governance stakeholders working in the Region of Peel in general and the Credit River Watershed in particular. The next chapter presents detailed research findings about the well-being indicators.

5 Research Findings

This chapter presents basic qualitative content analysis of the 12 human health and well-being indicators selected during the governance stakeholders' workshop. Each indicator is succinctly described in light of discussions with governance stakeholders. Mandates of the organizations of the stakeholders with respect to human health and well-being are also covered in this chapter. The material below consolidates the responses of governance stakeholders and represents their understanding in relation to the 12 indicators.

5.1 Analysis of Responses

For the purposes of my research project, I have not done rigorous content analysis due to the size of the sample and lack of statistical power (as already stated in Chapter 4). I have rather focused on explaining the responses based on the readings of the transcripts. The purpose of this simple analysis is to acquire basic understanding of the key points of the respondents about each indicator.

The semi-structured questionnaire, used for soliciting information from the governance stakeholders, comprised six questions pertinent to human health and well-being. These questions include the following:

- Can you tell me in your own words what is the strategic mandate of your organization?
- With respect to measuring progress toward this mandate, how relevant are the indicators on a scale of 1-5, where 1 is not relevant and 5 is very relevant? Please also state the reasons for your responses.

- Can you describe benefits of measuring an indicator to human health and well-being?
- Can you think of the specific benefits of measuring an indicator to vulnerable groups, such as infants/children, low income & homeless, seniors, people living off the land³, new immigrants, first nations?
- How would you describe weaknesses of each indicator?
- How can each indicator be employed to improve human well-being?

It is evident from the above list of questions that all the questions, except one, are open ended to gain authentic comprehension of the people's knowledge and experiences. The close-ended question is calculated as mean and standard deviation of the responses.

5.1.1 Strategic Mandate of the Organizations

The governance stakeholders, interviewed for my research project, have been working in different types of organizations. I have grouped these organizations into the following six broad categories for the purpose of sharing their mandates:

- Public health organizations
- Land use planning organizations
- Conservation authorities
- Ministries

³ "People living off the land could be farmers, homeless people or those who make conscious choice of living that lifestyle." (research participant)

- Community organizations/not-for-profit organizations
- Academic institutions

a) Public Health Organizations

The public health organizations included the public health department at the Region of Peel and Public Health Agency of Canada. Below is a brief description of the mandate of each organization.

Public Health Department at the Region of Peel

In Ontario, there are 36 public health departments mandated under the Health Protection Promotion Act and Ontario Public Health Standards. The key mandate of the Region of Peel is to elevate the health status of the population. The main components of this mandate include the following:

"to enhance the status of the population, to reduce disparities related to health within that population, and to respond to and prepare for emergencies or outbreaks in the community" (research participant).

Public Health Agency of Canada

The Public Health Agency of Canada operates Canada-wide. The key mandate of this agency is "to prevent chronic and infectious diseases as well as promotion of health in Canadians across the provinces" (research participant).

b) Land Use Planning Organizations

The land use planning organizations included the City of Mississauga, City of Brampton, and Town of Caledon. The strategic mandate of each of these organizations is interpreted in different ways. Below is a brief illustration of the key mandates of these organizations.

City of Mississauga

The strategic mandate of the City of Mississauga is based on its Strategic Plan and Living Green Master Plan. The strategic plan consists of five pillars: move, belong, connect, prosper and green. The City also has developed the vision and strategic goals for each of these pillars. The City's Living Green Master Plan is environmental sustainability plan. Its main mission is to make the City a world class "green" City where people can live, work and play.

City of Brampton

The strategic mandate of the City of Brampton is similar to the main mission of the City of Mississauga. According to its metrics, the City is to create a living environment which can meet the needs of the residents. One of these needs is health and well-being associated with different activities including active recreation, sports, and tourism at the neighborhood and city-wide scales. From the land use perspective, the intent is to promote walkable communities supported with a transit system and recreational opportunities. From the environmental perspective, the intent is to protect and plant trees to enrich natural heritage system. One of the participants commented; "we create health for the environment." In addition, engaging residents in environmental actions is part of the mandate of the City of Brampton.

Town of Caledon

The strategic mandate of the Town of Caledon is to provide services and facilities to achieve a high quality of life for its residents. For this purpose, economics, environment and culture are three pillars which need to be considered.

c) Conservation Authorities

The conservation authorities include Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). Below is a succinct description of the mandate of each organization.

TRCA

The strategic provincial mandates of TRCA are; protection of life and property from flooding and erosion and natural resource management (with the exception of oil and gas, and aggregates). This mandate is complemented with a 10-year strategic plan which covers the following:

"Human health and well-being is sort of woven throughout the strategic plan and series of deliberate ways basically around access to green space and having ecosystem goods and services and all of the benefits of those ecosystems goods and services along with the mandate of protection of human health and well-being through life and property." (research participant)

CVC

As regards CVC, their clear cut mandate is watershed management and the overall goal is to have a healthy watershed for human health, economy and society. To be precise, the mandate of CVC is "flood control and prevention for the protection of human health and well-being"

(research participant). Water quality, fishery and wildlife management are also components of the mandate.

d) Ministries

The ministries include the Ministry of Natural Resources and Forestry (MNRF) and Ministry of Tourism, Culture and Sport (MTCS). Below is a succinct description of the mandate of each organization.

MNRF

The mandate of the MNRF is natural resource management to achieve maximum benefits on a sustainable basis in the province of Ontario. Although the mandate does not clearly indicate human health and well-being, it does underscore the importance of the link between environment, social health, economy, and human health and well-being.

MTCS

The overall mandate of the MTCS is to provide leadership and services (fitness centers, beach parks, golf courses, and so on) indirectly through their partners (municipalities, conservation authorities, YMCA, Boys and Girls Clubs and the private sector) for better health of the people living in Ontario. The person interviewed in this ministry also shared the specific mandate with respect to sports because she was working in this area. The mandate is "to get people physically active and to establish a lifestyle, for life, of being physically active, engaged in the community for health and economic benefits" (research participant). She stated that healthy people lead to significant reductions in healthcare costs.

e) Community Organizations/Not-for-Profit Organizations

These organizations include Forests Ontario, EcoSource, Headwaters Communities in Action, and Brueckner Rhododendron Garden Stewardship Committee. The specific mandate of each of these organizations is given below.

Forests Ontario

Forest Ontario is a merger of two not-for-profit organizations named as Trees Ontario and Ontario Forestry Association. The key components of the mandate are tree plantations, forest restoration and youth education. The objectives of this mandate are to have healthy communities, robust economy and resilient ecosystems.

EcoSource

EcoSource is a charity organization. The mandate of this organization is to empower the community through education to become sensitized about environmental issues. This organization has been engaged in a number of areas such as waste reduction in the public, private and catholic school systems, active transportation, teacher education on environmental initiatives, community gardens and urban agriculture and food, and a sustainability education center in the city of Mississauga.

Headwaters Communities in Action

Headwaters Communities in Action is a citizens' group or citizens' coalition at the grass-root level within the catchment of the Credit River. The mandate of this organization is to ensure

health and well-being of the headwaters communities by championing those projects which are not within the ambit of other organizations.

Brueckner Rhododendron Garden Stewardship Committee

Brueckner Rhododendron Garden Stewardship Committee is a stewardship group established at Brueckner Rhododendron Garden. The objective of this group is to reinstate parks and turn them into gardens with the help of volunteers. One of the examples is Brueckner Rhododendron Garden itself.

f) Academic Institutions⁴

Dalla Lana School of Public Health (University of Toronto)

The mandate of this school is to work with practitioners and policy makers and also impart education to students as to how they can engage themselves in practice and policy and carry out research work broadly in public health.

Department of Environment and Resource Studies (University of Waterloo)

The mandate of this department in general and the participant in particular is to work on chronic diseases in relation to environmental impacts.

5.1.2 Indicators Analysis

This subsection presents the most important bits of discussions with the respondents on all the indicators. Each indicator is discussed in detail below in light of the questions outlined in Section

⁴ Academic institutions were really about researchers. Since they were situated within departments, the departmental missions were collected for completeness.

5.1. To determine relevance of the indicators on a scale of 1 to 5 where 1 is not relevant and 5 is very relevant, mean and standard deviation of the responses have been calculated (Table 5.1).

Table 5.1 Mean and Standard Deviation of Indicators

#	Indicator	Mean	Standard Deviation
1	Air Quality	4.05	1.31
2	Traffic Patterns/Mode of Transportation	3.53	1.47
3	Land Cover Change	4.11	1.29
4	Urban Heat Island	3.26	1.48
5	% Imperviousness	3.00	1.56
6	% Canopy Cover	3.68	1.11
7	Water Quality Index	3.84	1.38
8	% People using Natural Space	3.58	1.43
9	Proximity to Green Space	3.68	1.38
10	Connectivity of Green Spaces	3.74	1.56
11	Access to Green Spaces	3.84	1.30
12	Wildlife (habitat)	3.74	1.41

The information presented for each indicator has been used to update the tables prepared for the governance stakeholders' workshop report. The revised tables are presented as summaries at the end of the findings of the respective indicators.

a) Air Quality Indicator

Relevance of the air quality indicator

The mean response for the air quality indicator was 4.05 with a standard deviation of 1.31. Air quality is a "high indicator of a good quality of life" (research participant). It is directly related to human health. It influences the ability of the people to recreate. According to three respondents, this indicator is relevant due to the issues of climate change, allergies, and chronic diseases within the Canadian population. Apart from human health, it also has impacts on plants (e.g.

scanty growth of most mosses in polluted air) and water bodies (e.g. acid rain). Improved air quality is also beneficial for reducing public health budgets.

There is a little control over sources of air pollution. Two respondents commented that half of our air pollution comes from the Ohio valley and some from 400 series highways. One of the respondents remarked that air quality monitoring is primarily the mandate of the Ministry of Environment and Climate Change (MoE&CC) which carries out air quality monitoring at a large scale. She added that the Peel Health Department is also actively engaged in monitoring air quality and does extensive air quality monitoring and modeling on a 1K x 1K grid (for higher resolution) in order to understand the local inputs into air quality. One of the respondents indicated that municipalities control air pollution through idling control by-laws (for minimizing emissions), public transit system (trying to keep the cars off the road), and tree planting.

General benefits of the air quality indicator

Two respondents stated that indicators are important because they allow us to understand the issue, compare and contrast numerical data, measure progress to resolve the issue over time and make necessary interventions whenever needed. Three respondents commented that the air quality indicator is directly linked to human health. One of the participants said: "if you cannot measure, you cannot monitor and manage it." She added that the problem with most of the indicators is to find one which can be easily measured. She continued that indicators should be tested on a pilot scale to determine their effectiveness. According to her, the air quality indicator is measured at different levels such as federal (Environment Canada), provincial (MoE&CC) and local (health department). She further stated that the health department works in collaboration with all relevant stakeholders (such as municipalities, MoE&CC, Environment Canada) to discuss the air quality issue and its solutions.

One of the respondents commented that this indicator is relatively easy to measure (at least some aspects of it). According to three respondents, the air quality indicator is important because air quality affects people with respiratory problems and reducing instances of asthma and other diseases. One of the respondents stated that this indicator is also beneficial for wildlife health. According to two respondents, this indicator is useful for informing people about bad days (with high smog). One respondent remarked that this information can also help people carry out research on chronic diseases and take informed policy decisions. Another respondent remarked that the better air quality is beneficial in terms of reducing the public health budget.

Specific benefits to vulnerable groups of the air quality indicator

Air quality is split into ambient air quality and indoor air quality. Two respondents commented that almost all groups can benefit from good air quality. According to 12 respondents, vulnerable groups, such as infants, children, and seniors benefit the most from good ambient air quality for the reasons of having breathing issues, chronic diseases and high risk of falling sick. One of the respondents stated that ambient air quality is important for children studying in schools near roadways and suffering from learning abilities. Another respondent stated that low income and homeless people can also benefit from good ambient air quality because they are more vulnerable to automobile exhausts. According to another respondent, ambient air quality is also critical to the health of the first nations people living in the Chemical Valley (one of Canada's most industrialized areas in the city of Sarnia in southwestern Ontario). One of the respondents stated that indoor air quality is important for first nations because they may still be using kerosene, wood and other kinds of high pollutant fuels indoors. According to one respondent, low income people and most likely new immigrants often live in poor housing conditions with mould and can benefit from good indoor quality too.

According to a respondent at the Peel Health Department, a number of health studies are available on the Peel health's website⁵ and some of them include Comprehensive Health Status Report 2008 (identifying a whole suite of health indicators across the board and strategies), Healthy Peel by Design (analyzing changes in the built environment), and the GTA's medical officers health report on transportation.

Weaknesses of the air quality indicator

According to one respondent, the air quality indicator has no weaknesses. She added that the City of Mississauga has been using the air quality index without any hitch. One of the participants stated that "an indicator is trying to indicate something and it is not trying to measure everything." Two respondents remarked that the air quality is a transboundary issue and municipalities have less control over it. Another two respondents argued that it is an expensive indicator. One of the respondents indicated that understanding the reasons that contribute to bad air quality is a challenge. According to four respondents, the weakness is the lack of understanding of the indicator by the general public and the action required by them. One of these respondents explained that if a layman is relayed information about the air quality index, he or she will not understand what it means to him or her or kids and what they are supposed to do with this information unless the indicator is simplified and clearly communicated to the general public. Another respondent stated that there is a lot to measure in terms of air quality but what to measure is a question. This respondent explained that a few parameters are measured for the air quality and those not measured can be relevant too. One of the respondents indicated that the air quality indicator is tied to other indicators such as traffic patterns and modes of transportation as

⁵ Region of Peel. Retrieved June 2, 2015 from <http://www.peelregion.ca/health/resources/healthbydesign/our-initiatives.htm>

well as urban heat island and the challenge is how to measure this indicator independent of other indicators. Another respondent stated that being a service providing organization, the Peel health department has to rely on self reporting data for the number of patients with asthma (a widely reported implication of air quality) and epidemiological studies (for mortality). She explained that the self reporting data and the epidemiological studies have a number of challenges in terms of reliability of the information. She further stated that the department has to carefully review these documents and make prudent decisions accordingly.

Other reported weaknesses are inadequate measurement coverage, decrease in the number of monitoring stations, quantitative measurability (not readily measurable for most municipalities) and correlation of measurement on different scales (municipal, regional, provincial). One of the respondents stated that TRCA is measuring air quality on a regional scale using different methodology and parameters than the MoE&CC and the challenge is how to compare or transform information across these scales. According to a respondent, real issue is that it is almost not possible to take into account the cumulative effects of air quality or consider a holistic perspective of this issue. One of the respondents argued that spiritual feeling connected to the space should also be considered while measuring the indicator for first nations groups because some of these groups are holistic in nature and require an interconnected metrics that represents something like a "Cultural Health Index (CHI)" of the space. He pointed out that this CHI concept is not captured in any of the indicators in this research project.

Uses and purposes of the air quality indicator

According to six respondents, the MoE&CC is mainly responsible for employing this indicator to improve human well-being at the provincial level. Two of the respondents commented that the MoE&CC sets standards for emissions and issues warnings for smog days. Another respondent

remarked that the health department at the Region of Peel also employs this indicator for human well-being at the local level. She added that apart from air monitoring and modeling, the department also issues warnings at the local level. She continued that although it is not the prime mandate of health units to do air quality monitoring and modeling, the regional council provided funding for a 5 year project to fill the data gaps on the air quality issues at the local level. She explained that under normal circumstances, the health department plays the role of an advocate and works in partnerships and collaborations with other stakeholders to resolve health related issues. She referred to Ecohealth Ontario as an example of collaboration and partnership. She elaborated that it is such a platform where a number of public health units and other groups get together and discuss health issues.

According to the responses, others who can use this indicator include: the federal government (Environment Canada), Ministry of Health and Long-term Care, conservation authorities, municipalities, environmental activist groups, industries, car owners, planners, physicians in emergency rooms, public health practitioners, newscasters, schools (school boards, teachers, parents), employers, social workers, prenatal service workers, parents, citizens, and decision makers in organizations at local and provincial levels. One of these respondents indicated that Environment Canada employs this indicator because it sets the overall policy for the region. Another respondent stated that conservation authorities may employ this indicator for identifying impacts on habitat and biodiversity. According to another respondent, municipalities can use this information for forming professional opinion in policy making and issuing warnings about smog days. Another respondent explained that industries, car owners, planners, and public health practitioners can use this information to reduce emissions, share information with public on potential impacts on hot and smog days, provide advice and become active to confront the health

issues. One respondent commented that newscasters can play a pivotal role in relaying simplified information about the air quality index and action required by the people. According to another respondent, parents, citizens, and decision makers can use this information for personal behavior and research and policy. According to another respondent, environmental activist groups can use the information to influence decision makers about the importance of factors contributing to good air quality.

Summary

Table 5.2 presents summary of the air quality indicator by updating the table included in the workshop report.

Table 5.2 Summary of the Air Quality Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weaknesses of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating: air filtration 	<ul style="list-style-type: none"> ▪ Health 	<ul style="list-style-type: none"> ▪ Clean air through pollutant removal ▪ Healthy lungs and bodies* ▪ Healthier plants and animals* ▪ Healthier water and soil ▪ Ability to exercise outdoors* ▪ Improved cardiovascular and respiratory health* 	<ul style="list-style-type: none"> ▪ All groups (except those suffering from respiratory disease)* ▪ Infants/children** ▪ Seniors*** ▪ Low income * ▪ Homeless people* ▪ People living off the land* ▪ New Canadians* ▪ First nation communities* ▪ Those suffering from respiratory disease 	<ul style="list-style-type: none"> ▪ Smog day announcements (MoE&CC)** ▪ Human well-being at the local level (Peel Health Unit)* ▪ Set emission standards (MoE&CC)* ▪ Set overall policy for the region (Environment Canada)* ▪ Identify impacts on habitat and biodiversity (Conservation Authorities)* ▪ Experts opinion 	<ul style="list-style-type: none"> ▪ Direct effect on physical health ▪ Effect on lifestyle ▪ Ability to spend time outdoors ▪ Mass awareness (newscasters)* ▪ Personal behavior changes (parents, citizens)* ▪ Reduce emissions (industries and car owners)* ▪ Influence decision makers (environmental 	<ul style="list-style-type: none"> ▪ MoE&CC* ▪ Peel Health Unit* ▪ Environment Canada* 	<ul style="list-style-type: none"> ▪ No weakness* ▪ Expensive* ▪ Not inclusive (not covering all parameters)* ▪ Inadequate monitoring stations and coverage* ▪ Correlation issue of readings on different scales* ▪ Not possible to have

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weaknesses of the indicator
					making (municipalities)* <ul style="list-style-type: none"> ▪ Research and policy (decision makers)* 	activist groups)*		holistic perspective of the issue* <ul style="list-style-type: none"> ▪ Lack of effective communicat -ion to the general public** ▪ Unreliable data on asthmatic patients (Peel Health Unit)*

* reported by 3 or fewer respondents

** reported by 4-9 respondents

*** reported by the majority of respondents (10 or more)

b) Traffic Patterns and Mode of Transportation Indicator

Relevance of the traffic patterns and mode of transportation indicator

The mean response for the traffic patterns and mode of transportation indicator was 3.53 with a standard deviation of 1.47. One of the respondents mentioned that traffic patterns and mode of transportation is a local issue and most of the work is being done at the local level. It has a direct impact on air quality and indirectly human health. Another respondent indicated that this indicator also has impacts on biodiversity because transportation corridors affect wildlife movement. According to four respondents, active transportation and public transit are the key issues in cities. A lot of work is taking place on traffic patterns and active modes of transportation (cycling) within the health units of the Region of Peel, municipalities and the MTCS. The health unit of the Region of Peel is looking at traffic related emissions and mitigation strategies. One of the respondents commented that active transportation is of paramount importance for preventing chronic diseases and development of sustainable communities. Another respondent stated that municipalities measure this indicator to a great extent. According to another respondent, the MTCS is working with the Ministry of Transportation on the cycling strategy (provincial cycling route in particular). One respondent remarked that to promote active modes of transportation and transit, a number of events are organized in the City of Mississauga and these events include Green Amazing Ways (an annual event) and fun community events through which prizes (such as presto cards) are doled out to the participants to encourage them to use these alternatives. One respondent indicated that rural areas heavily depend on cars and require a robust public transportation system mainly for poor people, seniors and people with disabilities.

General Benefits of the traffic patterns and mode of transportation indicator

According to four respondents, it is a good measure and has an impact on human health or quality of life. One of the respondents argued that this indicator has an indirect relationship with human health. Two respondents mentioned that active modes of transportation (cycling, walking) are very important. Another two respondents indicated that active modes of transportation are better for human health and environment. One respondent pointed out that Ontario is moving its people to mass transit because it reduces emissions. Another respondent explained that a number of initiatives are being taken in the cities e.g. the City of Mississauga offers Bus Rapid Transit (BRT) along the 403 from east to west and also has got approval on Light Rail Transit (LRT) on Dundas and Lakeshore. Another respondent mentioned that reduction in traffic congestion can minimize mental health issues such as stress. One respondent explained that benefits depend on the purpose of the transport e.g. if the indicator also refers to recreational modes of transportation (hiking trails, canoeing), the conservation authorities are also involved. He further stated that these modes of transportation also impact quality of life. Another respondent stated that measuring this indicator helps inform decision making on wildlife habitat connectivity and movement of goods and services. One of the respondents highlighted the importance of communication of this indicator to general public in a more concrete way rather than quantifying it for policy making purposes.

Specific benefits to vulnerable groups of the traffic patterns and mode of transportation indicator

According to six respondents, benefits of measuring the indicator apply to all groups for happier and healthier society. One of the respondents mentioned that improvement in modes of transportation will provide more opportunities to low income, homeless, seniors and youth to roam around the city. Another respondent mentioned that new immigrants may also get benefits

because they face economic hardships in the beginning. One of the respondents mentioned that people with disability should also be considered as a vulnerable group.

Weaknesses of the traffic patterns and mode of transportation indicator

One of the respondents mentioned that municipalities have the most data on this indicator. One of the respondents in the City of Brampton pointed out that we can create good urban design (with cycling routes, mass transit options) but we cannot change the behavior of the people. He added that measuring mode split is a good measure but it is very hard to get reliable data on mode splits. According to a respondent at the City of Mississauga, it is not hard to capture information on the mode of transportation but we need to know; how you are capturing, how much are you capturing, is it just cars, is it public transportation, do you include cycling, do you include other modes of active transportation? Another respondent in the City of Mississauga stated that we measure this indicator on a municipal basis and how it can be used on a watershed scale is a question. She added that another challenge is that all municipalities are not measuring the same thing.

According to four respondents, people's perception about the indicator is very important so this indicator should be used qualitatively. One of the respondents stated that the weakness is the dependence of the people on vehicular traffic. Another respondent mentioned that it is hard to measure traffic patterns because they are subject to change. Other challenges reported by the respondents include; what is being measured, where is it being measured, is it being measured at the local level or the provincial level, what type of transportation is being used versus what type of transportation is acceptable in terms of proximity and cost?

Uses and purposes of the traffic patterns and mode of transportation indicator

According to 12 respondents, municipalities employ this indicator - one of them mentioned for the purposes of pollution control, health, quality of life and economic reasons, another respondent indicated for the purpose of infrastructure changes, one responded to changes in traffic patterns and reduction in congestion. One respondent remarked that traffic patterns are applicable at the city level. Another respondent commented that mode of transportation is not a municipal issue and neighborhood or community groups may take some initiatives to alter traffic patterns. According to a respondent, the data on mode of transportation is obtained from the University of Toronto which conducts a study called the Transportation Tomorrow Survey every five years but this data has some issues for the city of Brampton. The respondent explained that the survey shows that car mileage or vehicle kilometer travel for the City of Brampton is very low compared to the City of Toronto but it should be higher because Brampton is a suburban area. He added that Smart Commute Brampton-Caledon is also actively engaged in this kind of research as well.

One of the respondents mentioned that in the city of Mississauga, there is a program, called Smart Commute, which launches campaigns to get people out of their cars and convince them to use carpooling to help sustain mobility. Another respondent mentioned that the MTCS has some trails through different agencies such as Royal Botanical Gardens, Saint Lawrence Parks Commission. One respondent remarked that the MNRF has Ontario parks for the purposes of strategic planning and investment. Another respondent commented that doctors can use this indicator to educate their patients about active modes of transportation. One respondent stated that this indicator can be used at the provincial level by the Ministry of Transportation for inter-city connectivity. According to one respondent, this indicator can be used by parents, citizens

and decision makers (at the local and provincial levels) for the purposes of changes in personal behavior and personal choices for any mode of transportation as well as research and policy. One respondent mentioned that the Public Works Department and people, who are interested in environment, can use this information for the purpose of impressing upon decision makers the need for modes of transportation and providing access.

Summary

Table 5.3 presents summary of the traffic patterns and mode of transportation indicator by updating the table included the workshop report.

Table 5.3 Summary of the Traffic Patterns/Mode of Transportation Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well- being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Manicured & semi-manicured open green spaces ▪ Trails (important since they add access to natural surroundings) 	<ul style="list-style-type: none"> ▪ Regulating: air filtration ▪ Cultural: recreation (active lifestyle) 	<ul style="list-style-type: none"> ▪ Health 	<ul style="list-style-type: none"> ▪ Mobility and interconnectivity (including bike/walk, public transit, car pool, hiking trails, canoeing)* ▪ Improved physical health by promoting walkability* ▪ Improved air quality by reducing traffic* ▪ Minimized mental health issues (stress) due to reduction in traffic congestion* 	<ul style="list-style-type: none"> ▪ All groups (except second last)** ▪ Infants/children* ▪ Seniors* ▪ Low income* ▪ Homeless people* ▪ People living off the land ▪ New Canadians* ▪ Those suffering from respiratory disease ▪ People with disability* 	<ul style="list-style-type: none"> ▪ Promotion of walkable neighborhoods, changes in traffic patterns and reduction in traffic congestion, pollution control, health, quality of life, economic reasons, (municipalities)** ▪ Understanding of impacts of traffic on wildlife (CVC)* ▪ Inter-city connectivity 	<ul style="list-style-type: none"> ▪ Livable and walkable cities ▪ Improved health resulting from active lifestyle* 	<ul style="list-style-type: none"> ▪ CVC ▪ Region of Peel ▪ Municipalities*** ▪ University of Toronto (for mode of transportation)* ▪ Smart Commute Brampton-Caledon* ▪ Smart Commute (city of Mississauga)* ▪ MTCS (trails)* ▪ MNRF (Ontario's parks)* 	<ul style="list-style-type: none"> ▪ Change in people's behaviors* ▪ Hard to get reliable data on mode splits (City of Brampton)* ▪ Measure this indicator on a watershed scale* ▪ Lack of people's perception about the indicator** ▪ Hard to measure traffic

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well- being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
			<ul style="list-style-type: none"> ▪ Informed decision making on wildlife habitat connectivity and movement of goods and services* 		(Ministry of Transportation)*			patterns*
<p>* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)</p>								

c) Land Cover Change Indicator

Relevance of the land cover change indicator

The mean response for the land cover change indicator was 4.11 with a standard deviation of 1.29. This indicator is relevant for a number of reasons. One respondent stated that it is a very important indicator of ecohealth. One of the respondents stated that land use change and climate change are two major stressors affecting the natural environment. He added that we monitor land use changes regularly by using ecological land classification. Another respondent stated that efforts are underway to reinstate and re-establish those lands (wetlands) which are degraded and lost to improve ecological and hydrological functions, and to focus on Low Impact Developments (LIDs) by way of green development. One respondent commented that our natural resources are heavily impacted by land cover changes and this indicator is important for us to protect them. Another respondent remarked that this indicator is a high priority for us because of our mandate to protect natural cover. According to one respondent, this indicator is important because it has impacts on transportation and both transportation and urban form go hand in hand. One respondent commented that it is important because it has a lot of health implications in terms of drivers of change in infectious diseases. Another respondent stated that it is also relevant because it is aligned with the community gardens programming in the city of Mississauga.

General benefits of the land cover change indicator

One of the respondents defines land cover change as; "something which has to do with human well-being, sense of place and sense of community." Benefits of land cover change depend on how this change occurs. According to two respondents, it is likely a good indicator. Another

respondent commented that from a human health viewpoint, it can have a greater benefit if the greener communities are built with buildings considered human health friendly. Two respondents remarked that it is an overall measure of habitat quality. One respondent argued that that it is a good measure of sustainability of the province because it is a master variable. Another respondent stated that it is correlated with many attributes. One respondent indicated that there is a paucity of natural cover in the southern Ontario. He added that benefit of measuring this indicator is enhancement of ecological health which is linked to human health and well-being. One respondent argued that measuring this indicator alone would not serve the purpose so it should be comprehended in the context of other measures. Another respondent indicated that an additional benefit of measuring the land cover change is to control and manage change through striking a fine balance between urbanized and non-urbanized land cover. He added that LID practices can also minimize the impact of land cover change to some extent. According to three respondents, measuring this indicator would not be beneficial for communicating with general public and can be used for research and policy purposes.

Specific benefits to vulnerable groups of the land cover change indicator

According to two respondents, this indicators benefits all groups. One of the respondents considered this indicator a big indicator. He explained that when land use changes, this big indicator is broken down into other indicators such as the increase in urban cover, increase in natural areas, increase in farm lands. Another respondent considered it a planning indicator. He explained that it is more important to know its connection with other indicators. Another respondent stated that this indicator feeds into environmental quality. According to another respondent, land use changes (e.g. increase in urban areas) provide more opportunities for seniors. According to four respondents, this indicator benefits low income groups. According to

six respondents, this indicator would benefit people living off the land and according to five respondents, this one would benefit first nations who might be dependent on a particular use that changes. One of the respondents stated that benefits depend on the type of change whether it is urban sprawl, densification or mode of transportation. One respondent commented that if land use changes for more green space then it is better for all groups. Another respondent argued that this indicator is more of a modeling thing and has nothing to do with the general public because for them land cover change (e.g. 30 percent change over 10 years) is something not easily understood.

Weaknesses of the land cover change indicator

According to two respondents, this indicator has no weakness and one of the respondents stated that satellite imageries and air photos are available. Another two respondents emphasized that understanding and importance of the indicator by the general public is a major weakness because it is more of a policy indicator. According to one respondent, the weaknesses could be ad hoc measurement because each municipality is probably measuring it but there is no systematic approach and regional or provincial scales may be helpful in this regard. Other weaknesses reported are that it is expensive to report on, it is difficult to capture minor changes (e.g. widening a driveway), and it is not good as a short term indicator.

Uses and purposes of the land cover change indicator

According to 10 respondents, municipalities are the ones who can use this indicator because they are responsible for controlling land uses, managing key landscapes which are vital for human and ecological health and impressing upon decision makers the importance of probably higher density development in urban areas while minimizing impact on rural landscapes. Other

responses included; conservation authorities, province, developers, citizen groups (for advocacy), researchers (for research), and policy makers (for policy).

Summary

Table 5.4 presents summary of the land cover change indicator by updating the table included in the workshop report.

Table 5.4 Summary of the Land Cover Change Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/Lakes ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating: all ▪ Provisioning: all ▪ Cultural: all ▪ Supporting: all 	<ul style="list-style-type: none"> ▪ Basic materials ▪ Security ▪ Health ▪ Good social relations ▪ Freedom of choice and action 	<ul style="list-style-type: none"> ▪ Less risk to humans and more resilience) ▪ Better land use planning* ▪ Helps maintain natural habitats for wildlife* ▪ Maintains a healthy ecosystem and provision of services* ▪ Food security (from new development) 	<ul style="list-style-type: none"> ▪ All groups* ▪ Infants/children ▪ Seniors* ▪ Low income** ▪ Homeless people* ▪ People living off the land** ▪ New Canadians ▪ First nation communities** 	<ul style="list-style-type: none"> ▪ Land use planning (municipalities)*** ▪ Natural resources management (CVC, MNR)* 	<ul style="list-style-type: none"> ▪ Pictorial depiction of change over time 	<ul style="list-style-type: none"> ▪ CVC* ▪ Municipalities*** ▪ MNRF* 	<ul style="list-style-type: none"> ▪ No weaknesses with having satellite data* ▪ Lack of effective communication to the public** ▪ Ad hoc measurement by municipality* ▪ Expensive to report on* ▪ Hard to see minor changes* ▪ Not good on short term*
<p>* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)</p>								

d) Urban Heat Island Indicator

Relevance of the urban heat island indicator

The mean response for the urban heat island indicator was 3.26 with a standard deviation of 1.48. This indicator is particularly relevant for the health units of the Region of Peel because they have done significant work on mapping existing urban heat islands in the region with the help of landsat data from Natural Resources Canada and use this information for different purposes (e.g. driving policy toward environmentally sustainable development). They also have been working in collaboration with forestry folks at the municipal and regional levels. Health Canada has funded a study to analyze whether urban heat islands can be used as a decision making criteria for identifying priority areas for tree plantation. The health units also have mapped vulnerable populations (especially elderly) to urban heat islands using landsat data and GIS. According to the respondent's information, most of the development in the region has taken place northward severely affecting Brampton and north Mississauga (which has the most industries).

Two respondents stated that this indicator is relevant due to mental and physical health implications. According to four respondents, municipalities use this indicator to identify the need for increases in canopy cover to offset the impacts of urban heat islands. For instance, the City of Mississauga has taken a number of initiatives such as One Million Trees (by 2032) campaign and green building standards. According to the respondent from a conservation authority, this indicator is relevant if it also covers water quality and he also talks about the agriculture related heat island effect. Another respondent indicated that this indicator has an impact on vegetation, imperviousness and air quality. Other reasons of relevance shared by a respondent include; environmental health and good planning.

General benefits of the urban heat island indicator

According to one respondent, it is an indicator of heat stress on humans, plants and animals, and urban forestry health. Another respondent commented that it goes hand in hand with land cover change and % imperviousness indicators. Two respondents stated that measurement of this indicator can identify the areas requiring measures (such as tree plantation, increase in green space, green roofs, white roofs) to reduce urban heat island effects so as to have positive impact on humans, streams, wetlands and aquatic life (fish). According to another two respondents, the meaning and benefits of this indicator should be relayed to the general public. One of the respondents considered it a "unique communication tool." One respondent stated that this tool can also be used for research and policy purposes.

Specific benefits to vulnerable groups of the urban heat island indicator

Two respondents indicated that almost all groups can benefit from reduction of urban heat island effects. According to eight respondents, infants/children and seniors (also including those with chronic conditions) are greatly impacted due to the effects of urban heat island and would benefit the most upon its reduction. Three respondents indicated that low income people (also including those with chronic conditions) would benefit from the reduced effects. According to three respondents, homeless people would benefit from the reduced urban heat island effects. One respondent remarked that the specific benefits to the vulnerable groups can be realized if the information about excessive heat conditions is relayed to these groups.

Weaknesses of the urban heat island indicator

Three respondents commented that the general public should know what this indicator means to them and what they can do about this information. Two respondents stated that it has no

weakness because of the availability of pretty good maps. One of the respondents indicated that there is a direct impact of land cover change on the urban heat island. According to respondents, other weaknesses are; exclusion of thermal impacts, lack of understanding of this indicator, lack of understanding on measuring this indicator, less number of people measuring it and not on a regular basis.

Uses and purposes of the urban heat island indicator

According to five respondents, this indicator can be employed at the municipal and provincial scales. One of these respondents indicated that municipalities use this indicator for the purpose of planting trees (such as the One Million Tree campaign referred to earlier) and keeping the cities cooler. Only one respondent stated that this indicator can be employed at the regional and provincial scales only because the urban heat island studies are expensive. Another respondent commented that it can be used by conservation authorities. Three respondents stated that it can be used at the federal level too - one of these respondents pointed out that this information should not just be held in the Environment Canada record. One of the respondents remarked that the MoE&CC and Ministry of Health and Long-term Care can work with planners and architects to reduce the effects of urban heat islands. Another respondent remarked that public health units, municipal governments, and libraries can employ this indicator for different purposes such as communication of the indicator to the local residents for understanding and having more support on environmental and green space initiatives. One respondent remarked that policy makers or land use decision makers can use this indicator for setting building codes, deciding about the state-of-the-art technologies in new developments and types of retrofit to reduce urban heat island effects.

Summary

Table 5.5 presents summary of the urban heat island indicator by updating the table included in the workshop report.

Table 5.5 Summary of the Urban Heat Island Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating: micro-climate regulation 	<ul style="list-style-type: none"> ▪ Health ▪ Security 	<ul style="list-style-type: none"> ▪ Improved air quality* ▪ Decreased illnesses and mortalities due to high temperatures 	<ul style="list-style-type: none"> ▪ All groups* ▪ Infants/children** ▪ Low income* ▪ Homeless people* ▪ Seniors** 	<ul style="list-style-type: none"> ▪ Monitoring and mitigating urban heat island and its effects through tree plantation (municipalities, MoE&CC, CVC, Ministry of Health & Long-term Care)* ▪ Awareness of the indicator to the local residents (Peel health unit, municipalities, libraries)* ▪ Setting building codes, deciding about the state- 	<ul style="list-style-type: none"> ▪ Imagery of heat island spots in order to illustrate potential effects/causes/mediation of heat 	<ul style="list-style-type: none"> ▪ Peel health unit* 	<ul style="list-style-type: none"> ▪ No weakness due to availability of pretty good maps* ▪ Expensive studies* ▪ Lack of effective communication to the general public* ▪ Exclusion of thermal impacts* ▪ lack of understanding on measuring

					of-the-art technologies in new developments and types of retrofit (policy makers)*			this indicator* <ul style="list-style-type: none"> ▪ Less number of people measuring it and not on a regular basis*
* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)								

e) % Imperviousness Indicator

Relevance of the % imperviousness indicator

The mean response for the % imperviousness indicator was 3.00 with a standard deviation of 1.56. Three respondents considered it a very important indicator because more impervious surfaces cause more runoff and flooding. It is tied to stormwater management programs. The stormwater charge to be implemented by the City of Mississauga later this year is an important initiative in this regard. One of the respondents commented that the purpose of this initiative is to increase pervious areas by incenting through a charge for LIDs in order to eliminate big parking lots. Another respondent held the view that this indicator affects the natural heritage system. One respondent remarked that it affects environmental health more than human health. One of the respondents stated that this indicator is hard to define and measure. Another respondent stated that this indicator is linked to urban heat islands. One respondent commented that it is also considered a master variable which is currently used as a coarse measure of asphalt and concrete.

General benefits of the % imperviousness indicator

According to three respondents, the benefits of reducing % imperviousness include; recharge of groundwater, reduction in urban heat island effect, improvement in water quality. Two respondents remarked that it is vital for stormwater management. One respondent related it to LID and another respondent related it to healthier life of urban trees. According to five respondents, this indicator is not directly linked to human health and well-being. One of the respondents stated that it can be used for research and policy.

Specific benefits to vulnerable groups of the % imperviousness indicator

According to five respondents, this indicator is beneficial for all vulnerable groups. One respondent stated that this indicator can have benefits in the form of having pervious concrete areas, increased tree plantations, and better planning. Another respondent remarked that it is important for creating awareness about flood events and ability to avoid flooding. One of the respondents indicated that this indicator does not have direct benefits to vulnerable groups. One respondent commented that this indicator would benefit infants and children. Another respondent stated that it will surely affect people living off the land (farmers) and homeless in terms of their living conditions. One respondent commented that it would affect low income people because they often live in the basements which might get flooded due to large runoff.

Weaknesses of the % imperviousness indicator

Two respondents remarked that it is an important and strong indicator but hard to measure due to an assortment of surface types and due to questions such as; What are you measuring? Are you measuring the amount of runoff but that can also include groundwater information? One of the respondents commented that it is more of an estimate which could be misleading. He added that it may be easier to use % urban. He explained that 50 percent watershed in the headwaters with impervious cover can be very different than 50 percent cover at the mouth of the river because in the headwaters, it may affect the hydrology of the whole watershed but that may not be the case on the other end. This is the reason that one respondent considered it a coarse measure. Another important point raised by respondents is the understanding of this indicator by the general public.

Uses and purposes of the % imperviousness indicator

According to three respondents, both municipalities and conservation authorities can work together to employ this indicator. They explained that municipalities can use this indicator for the purposes of supporting action in response to climate change, and managing roads - new road diets⁶ is an example concerning imperviousness and stormwater management. They further stated that municipalities and conservation authorities can also encourage the development community to include more pervious pavement and LID measures in its projects to curtail impacts on the environment. One respondent commented that the stormwater charge by the City of Mississauga is a good indication of the use of this indicator. One of the respondents identified the need for an incentive for the use of permeable pavement. According to three respondents, community groups can also play an important role in identifying gaps and advocating for funding and policy change. One of these respondents commented that some community groups are active in installing permeable pavements around heritage trees. Another respondent stated that this indicator can be used for research and policy purposes.

Summary

Table 5.6 presents summary of the % imperviousness by updating the table included in the workshop report.

⁶ "Road diet is like there is a 3.5 meters lane and 0.5 meter of this lane is converted into bike lanes leaving just 3 meters lane for driving. The purpose is to make everything more economically feasible by considering alternative modes of transportation and getting more people on the road but by different means using the same space." (research participant from the City of Brampton)

Table 5.6 Summary of the % Imperviousness Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Forests (urban & natural) ▪ Wetlands ▪ Manicured & semi-manicured open green spaces ▪ Green Infrastructure 	<ul style="list-style-type: none"> ▪ Regulating: water storage and regulation ▪ Regulating: water filtration 	<ul style="list-style-type: none"> ▪ Security ▪ Health 	<ul style="list-style-type: none"> ▪ More permeable less stress ▪ Improved water quality and quantity* ▪ Mitigated flooding potential through LIDs, tree plantation* 	<ul style="list-style-type: none"> ▪ All groups (except last two)** ▪ Infants and children* ▪ Low income* ▪ Homeless people* ▪ People living off the land* ▪ Those living in flood and erosion vulnerable areas ▪ Those dependant on sensitive groundwater systems 	<ul style="list-style-type: none"> ▪ Land use planning (municipalities)* ▪ Monitoring and mitigating impacts of floods (municipalities and CVC)* 	<ul style="list-style-type: none"> ▪ Show changes over time in order to illustrate potential effects / causes / remediation 	<ul style="list-style-type: none"> ▪ CVC* ▪ Municipalities* 	<ul style="list-style-type: none"> ▪ Strong indicator but hard to measure (easier to use % urban instead)* ▪ Lack of effective communication to the general public*

* reported by 3 or fewer respondents

** reported by 4-9 respondents

*** reported by the majority of respondents (10 or more)

f) % Canopy Cover Indicator

Relevance of the % canopy cover indicator

The mean response for the % canopy cover indicator was 3.68 with a standard deviation of 1.11. One of the respondents defined it as: "a way of thinking about the opportunities for shade and therefore reducing sun exposure." It is considered relevant for different reasons by different people. For municipalities, this indicator is relevant because they are spending a colossal amount in trees plantation in parks, streets and natural areas. For example, the City of Brampton spends a lot of money on aerial photos to look at the canopy cover every five years. The One Million Trees campaign in the city of Mississauga is another example. Trees are instrumental in improving the air quality and also reducing the urban heat island effect. One of the respondents indicated that it is in their mandate to achieve 30 percent canopy cover to sustain a healthy population, wildlife and forest in the province of Ontario. Another respondent commented that for natural spaces, the % canopy cover is considered a part of the forest cover and the MNRF monitors changes at the forest level. One of the respondents held the opinion that this indicator is easy to understand and use. One of the respondents stated that to increase canopy cover, there have been local level initiatives such as tree cover (instead of grass) on roadsides and especially slopes in some parts of the city of Mississauga.

General benefits of the % canopy cover indicator

Based on information from the respondents, general benefits include shade, aesthetic value, better air quality, better water quality, carbon storage, climate moderation, climate change mitigation, measure of habitat, natural cooling, flood control, soil conservation, reduction in urban heat island effects, and improvement in mental health. One of the respondents remarked

that it does not have direct impact on human health. Another respondent commented that it is a relatively easy indicator to measure. One respondent stated that it is a good indicator to determine long term trends. Another comment by a respondent was that it is important depending how it is communicated to the public. She explained that if it is just percentage, it might not be helpful but if it is like that there is a beautiful place to walk under the trees when it is hot then this information would be more relevant to them.

Specific benefits to vulnerable groups of the % canopy cover indicator

According to four respondents, specific benefits (more green space, more tree cover) apply to all groups. Four respondents remarked that benefits apply to infants, children and seniors because they are more vulnerable to solar radiation. Two respondents responded in favor of low income, homeless people and people living off the land in terms of providing necessary shelter. One respondent commented that benefits would apply to first nations.

Weaknesses of the % canopy cover indicator

Two respondents commented that it is a good indicator and easy to measure but sometimes it is out of control due to invasive species and terrific weather events. One of the respondents added that cost and maintenance is another weakness of this indicator. Two respondents commented that no data is available for most communities. Another weakness reported by a respondent is the lack of understanding of this indicator in general and 30 percent canopy cover plus forest cover by the general public in particular. One respondent explained that from the maps, it is not possible to check what is underneath the canopy cover nor is it possible to differentiate between native and non-native species. He added that apparently a good canopy cover of Norway Maple can be devoid of wildlife or good vegetation communities underneath.

Uses and purposes of the % canopy cover indicator

Ten respondents stated that municipalities employ this indicator for the purposes of energy, water, water absorption, improving and increasing canopy cover, reducing heat island effects, and improving air quality. Two respondents commented that conservation authorities employ this indicator for the purposes of conservation, water purification, and wildlife habitat, One of the ten respondents explained that municipalities (forestry departments) already have long term strategies and are investing a huge amount to maintain canopy cover. According to one respondent, % canopy cover denotes urban environment by municipalities and % forest cover is used by conservation authorities. Two respondents commented that land or home owners should be sensitized about the importance of trees and its effects on human health and well-being because most of the trees are on private lands. Two respondents indicated the use of this indicator by the province and one by the federal agency. One of the respondents stated that environmental activists can also use this indicator for advocacy purposes and for describing the importance of canopy cover to landowners.

Summary

Table 5.7 presents summary of the % canopy cover indicator by updating the table included in the workshop report.

Table 5.7 Summary of the % Canopy Cover Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating ▪ Cultural ▪ Supporting 	<ul style="list-style-type: none"> ▪ Health ▪ Security ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Decreased air temperature ▪ Improved air quality and water quality, carbon storage, climate moderation, climate change mitigation, measure of habitat, natural cooling, soil conservation, reduction in urban heat island effects* ▪ Energy cost savings 	<ul style="list-style-type: none"> ▪ All groups (except last three)** ▪ Infants/children** ▪ Low income* ▪ Homeless people* ▪ Seniors** ▪ People living off the land* ▪ First nation communities* ▪ New Canadians ▪ Those living in flood vulnerable areas ▪ Those with respiratory disease 	<ul style="list-style-type: none"> ▪ Monitoring and mitigating ▪ Prioritize areas for protection and restoration ▪ Energy, water, water absorption, improving and increasing canopy cover, reducing heat island effects, and improving air quality (municipalities)* ** ▪ Conservation, water purification, and 	<ul style="list-style-type: none"> ▪ Promotes walkability ▪ Increases property value ▪ Directly and indirectly affects physical, mental, and social health and well-being ▪ Saves \$ on energy ▪ Improves air quality and decreases temperature ▪ Reduces potential of flooding 	<ul style="list-style-type: none"> ▪ Municipalities* ▪ CVC* 	<ul style="list-style-type: none"> ▪ No weakness (easy to measure)* ▪ Cost and maintenance* ▪ Lack of data for most communities* ▪ Inadequate interpretation from the maps (field observation is necessary)* ▪ Lack of effective communication to the general public (30% plus forest cover)

			<ul style="list-style-type: none"> ▪ Improved physical, social and mental health and well-being* ▪ Reduced peak flows* 	<ul style="list-style-type: none"> ▪ Heat sensitive individuals 	wildlife habitat (CVC)*			in particular)*
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* reported by 3 or fewer respondents

** reported by 4-9 respondents

*** reported by the majority of respondents (10 or more)

g) Water Quality Index Indicator

Relevance of the water quality index indicator

The mean response for the water quality index indicator was 3.84 with a standard deviation of 1.38. According to six respondents, water quality is a good or important indicator of environmental health. For public health units, groundwater is more relevant especially for those who have private wells. These units get actively involved in drinking water standards and source water protection. One of the public health professionals stated that "it is an essential determinant of health" and important for drinking water and beach water quality. He added that it falls very much within the ambit of public health. For municipalities, this indicator is relevant primarily for surface water related to stormwater management and water quality. For conservation authorities, this indicator is relevant because it is their prime mandate to managing water quality, water quantity, wildlife and biodiversity through different means. One respondent explained that one of the means regarding water quality is to work with farmers to employ agricultural best management practices to keep nutrients and chemicals away from the river. For public health agencies, it is relevant because they consider water quality as an important social determinant of health. For the MTCS, it is relevant due to water quality of beaches for swimming. For forests related organizations, it is relevant because trees and forests play a pivotal role in reducing runoff and indirectly preventing pollution of surface water bodies.

General benefits of the water quality index indicator

Two respondents remarked that this is a good indicator, very important for all aspects of human health and generally recognized as a public health indicator - one of them commented that it is an easy measure. One of the respondents stated that the water quality index has two levels - one is

the understanding of ecosystem health and the other is to identify direct relationships to human health and well-being (through bacterial counts, E. Coli). Another indicated that the water quality index is used for groundwater and surface water but human health depends on potable water which is received through the water distribution system. According to another respondent, this indicator might be used to alert people about storm events and water quality so that they can decide whether to go for swimming or drink water.

Specific benefits to vulnerable groups of the water quality index indicator

Six respondents indicated that specific benefits apply to all groups. According to two respondents, it is particularly relevant to infants, children and seniors because they are more susceptible to poor water quality. Three respondents commented that this indicator is very important for first nations and people living off the land in terms of water quality in wells or taps and streams or rivers (for fishing).

Weaknesses of the water quality index indicator

Four respondents commented that the weakness is how we collect the data and what we measure. They explained that currently we focus on E. Coli and do not cover other parameters such as temperature and dissolved oxygen (for fish), viruses and parasites (important for immunosuppressed people), biological contaminants (e.g. cryptosporidium which is not well treated by primary water treatment facilities), pollutants (sulphates, phosphates, chloride, particulate matter), actual possible pesticides or chemicals, and microbeads (used in cosmetics). One of these respondents further explained that water quality is measured for bacterial contamination and monitoring eutrophication related to use of fertilizers (by the MoE&CC) but not for chronic diseases and low dose pollution aspects. Two respondents stated that finding

sources of water pollution is a weakness. Another two respondents stated that education is perhaps a weakness because people need to understand what this indicator means to them, and where the water comes from before they get the hang of water quality. One of the respondents indicated that it is a good indicator on a watershed scale but not municipal wide so it is hard to translate the information on the municipal scale. Another respondent stated that the MoE&CC monitors this indicator for recreational purposes on a provincial scale and conservation authorities measure it for biodiversity for fish and wildlife on a watershed scale so both are two different things. One respondent stated that the weakness is related to a number of monitoring stations in our streams.

Uses and purposes of the water quality index indicator

Currently, this indicator is used by local and regional municipalities, conservation authorities, MoE&CC, public health authorities (health units and Ministry of Health and Long-term Care). Six respondents remarked that this indicator can be used or is used by conservation authorities for the purposes of increasing monitoring stations, monitoring fish habitat, ensuring overall health of the watershed and reporting information to the policy decision makers. One of these respondents explained that public health authorities, MoE&CC, regional municipalities, municipal authorities and conservation authorities can employ this information to prevent outbreaks and issue water advisories in an attempt to move more upstream for management of the ecosystem. Another respondent indicated that this is a provincial indicator which is used for human consumption, recreation, wildlife and fish.

Three respondents remarked that communication of this indicator is very important and currently a number of organizations are engaged in this activity. For instance, conservation authorities are

propagating this information to homeowners through stewardship activities. Lake Ontario Waterkeeper is a not-for-profit organization accomplishing this task. One of the respondents stated that city-wide groups can use this information for the purposes of drinking water, beaches, swimming, and water advisory at the local level. Another respondent remarked that policy makers and community members can use this information for the purposes of identifying; "how people feel connected with waterways, confident going fishing, swimming, drinking tap water when the water quality is good."

One of the representatives of a municipality explained that this indicator directly ties in with our beaches. He explained that "there is a unfounded fear about swimming in Lake Ontario" although a lot of clean-up work has been done in this lake. Another respondent stated that the Region of Peel uses this indicator because they have their water treatment facilities for portable water.

Summary

Table 5.8 presents summary of the water quality index indicator by updating the table included in the workshop report.

Table 5.8 Summary of the Water Quality Index Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows 	<ul style="list-style-type: none"> ▪ Regulating: water filtration 	<ul style="list-style-type: none"> ▪ Health 	<ul style="list-style-type: none"> ▪ Increased groundwater and surface water quality* ▪ Clean water for consumption and body contact* ▪ Fish safe to consume ▪ Ecosystem health* 	<ul style="list-style-type: none"> ▪ All groups** ▪ Infants/children* ▪ New Canadians ▪ Seniors* ▪ People living off the land* ▪ Low income ▪ Homeless people ▪ First nations communities* ▪ Those who come into contact with water 	<ul style="list-style-type: none"> ▪ Monitoring of water quality ▪ Assessment and remediation (if necessary) of water problems ▪ Increase monitoring stations, ensure health of the watershed, informing the policy decision makers (CVC)** ▪ Prevent outbreaks, issue water advisories (health 	<ul style="list-style-type: none"> ▪ Visually pleasing effect on people ▪ Enhanced experience while being near water bodies ▪ Improved water quality (lower watershed) 	<ul style="list-style-type: none"> ▪ Region of Peel Public Works Department* ▪ sowc.ca ▪ Municipalities ▪ Public health* ▪ Conservation Authorities** ▪ Ducks Unlimited 	<ul style="list-style-type: none"> ▪ How we collect data and what we measure?* ▪ Source of pollution* ▪ Lack of effective communication to the general public* ▪ Lack of adequate number of monitoring stations in the streams* ▪ Lack of compatibility of the data collected by MoE&CC and

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
					authorities, MoE&CC, municipalities, CVC)* <ul style="list-style-type: none"> ▪ Mass communication (CVC, Lake Ontario Waterkeeper, policy makers, community members* ▪ Water treatment (Region of Peel)* 			conservation authorities (type of data, purpose of data, and scales of measurement are different)*

* reported by 3 or fewer respondents

** reported by 4-9 respondents

*** reported by the majority of respondents (10 or more)

h) % People using Natural Space Indicator

Relevance % people using natural space indicator

The mean response for the % people using natural space was 3.58 with a standard deviation of 1.43. For conservation authorities, this indicator is important because they want people to go out to natural spaces through stewardship activities. According to a respondent, TRCA has 44,000 acres of green space in the GTA for the use of people and wildlife. For the MTCS, this indicator is important because want to see people active through outdoor activities.

General benefits of the % people using natural space indicator

Two respondents commented that this is an indicator of public health and has direct connection with human health and well-being. According to two respondents, this indicator can provide baseline information on; "what natural space people are using, why they are using it, how wildlife is using it, and how we can increase it or manage it over time so that there is opportunity for use." According to one respondent, this indicator can provide information if people are giving due recognition to physical activity by being outside and having connections with the community. Another respondent remarked that this indicator can be used for research and policy purposes. According to another respondent, this indicator is important from the standpoint of preservation of culture. Only one person responded that this indicator would not be useful for the general public.

Specific benefits to vulnerable groups of the % people using natural space indicator

According to seven respondents, this indicator will benefit all groups. One respondent commented that benefits could be activity related, partly aesthetics, spiritual and recreational.

Another respondent indicated that this indicator is beneficial if we measure who the people are rather just the % people using natural space to determine diversity of the groups. One respondent remarked that this indicator is useful to understand why particular groups are using natural space and why they are not. According to one respondent, measuring this indicator can only provide information but would not necessarily help people get out to the natural space.

Weaknesses of the % people using natural space indicator

Five respondents remarked that it is hard to measure - one of them commented that it is labor intensive and another stated that it can be measured for conservation areas. One respondent commented that some information about people using parks and conservation areas is available. One of the weaknesses is the understanding of this indicator by the professionals and general public. One of the respondents asked the meaning of this indicator - "is it like are people in it, what are they doing in it, how are they using it, are they just looking at it." One respondent commented that it is better to differentiate between natural space and green space because some people will consider urban parks as natural space. He suggested % time spent in natural spaces as a better indicator. Another respondent commented that this indicator cannot be measured alone because it is connected to many other variables. One of the respondents commented that it is a policy tool and it is more relevant as to how people use natural space instead of the percentage. She posed a number of questions to explain her viewpoint - "Where is the trail instead of number of trails? Which trails take you to a place which is meaningful? If this is a public or private meadow, can I use this space for kite flying or picnicking?" She argued that these questions can then increase the usage of the natural spaces.

Uses and purposes of the % people using natural space indicator

According to five respondents, municipalities can employ this indicator - for the purposes of understanding recreation, transit, people visiting these places and why according to one respondent. Four respondents remarked that conservation authorities can employ this indicator because it is their prime mandate to conserve natural resources within the province. One of the respondents responded that the MNRF and conservation authorities can use this indicator as an educational tool and for the management of natural spaces. One respondent stated that trail groups can use this information. According to another respondent, the MTCS can also use this indicator by hiring the services of the Canadian Fitness and Lifestyle Research Institute (CFLRI) to conduct survey every 5 years asking people about the use of natural space. One respondent indicated its use by the research and policy makers. According to one respondent, MMAH, municipalities and not-for-profit organizations can work on this indicator collaboratively.

Summary

Table 5.9 presents summary of the % people using natural space indicator by updating the table included in the workshop report.

Table 5.9 Summary of the % People using Natural Space Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain of improving the indicator	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Manicured & semi-manicured open green spaces ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/lakes 	<ul style="list-style-type: none"> ▪ Cultural: recreation, education 	<ul style="list-style-type: none"> ▪ Health ▪ Good Social Relations 	<ul style="list-style-type: none"> ▪ Increased human health and well-being* ▪ Better understanding of wants/needs/desires regarding natural space* ▪ Greater social capital* ▪ Not beneficial (because it can only provide information)* 	<ul style="list-style-type: none"> ▪ All groups (except last two)** ▪ Infants/children ▪ Low income and homeless people ▪ Seniors ▪ New Canadians ▪ Those with physical disabilities ▪ Those who lack access to transportation 	<ul style="list-style-type: none"> ▪ Assessment and protection of ecological integrity (CVC)** ▪ Educational tool and management of natural resources (CVC, MNRF)* ▪ Assess design with consideration given to accessibility ▪ Support for funding requests ▪ Understand recreation, transit, people visiting these places and why 	<ul style="list-style-type: none"> ▪ Public participation by sharing stories about their outdoor activities* ▪ Access to information about outdoor activities in natural open spaces 	<ul style="list-style-type: none"> ▪ CVC (for conservation areas only)* ▪ Municipalities ▪ Trail groups (for trails only)* 	<ul style="list-style-type: none"> ▪ Hard to measure** ▪ Lack of effective communication to the general public* ▪ Lack of understanding of the difference between natural and green space* ▪ Not a good indicator (% time spent and how people use natural space can

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain of improving the indicator	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
					(municipalities)* <ul style="list-style-type: none"> ▪ Other uses by trail groups, MTCS, research and policy makers* 			be better options)* <ul style="list-style-type: none"> ▪ Not possible to measure alone (connected to other variables)*
<p>* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)</p>								

i) Proximity to Green Space Indicator

Relevance of the proximity to green space indicator

The mean response for the proximity to green space was 3.68 with a standard deviation of 1.38. According to the responses, this indicator is relevant for reasons such as a requirement of community, getting people into the nature to build appreciation and values for nature, mental and physical health, and lowering levels of stress, anxiety, and cardiovascular illnesses.

General benefits of the proximity to green space indicator

Four respondents indicated that this indicator is good for mental and mainly physical health (due to hiking, gardening, planting trees, physical activity, interaction with family) and also for the environment. One of the respondents mentioned that it is a human health and wildlife indicator and it is vital to note whether humans or wildlife are visiting green spaces. Another respondent remarked that this indicator is easy to measure with the help of GIS.

Specific benefits to vulnerable groups of the proximity to green space indicator

According to five respondents, benefits of measuring this indicator apply to all groups. Four respondents commented that low income people benefit the most. Three respondents commented that this indicator is important for infants and children for their mental growth. According to two respondents, this indicator is good for new immigrants. One respondent referred to its benefits for the first nations people from the cultural standpoint. Another respondent remarked that seniors benefit the most.

Weaknesses of the proximity to green space indicator

Responses about weaknesses of this indicator are quite diverse. Respondents have raised certain questions and comments which are reproduced below.

- How do you define a green space, what makes a green space?;
- What if there is a fee for it and you cannot access it?;
- How does this proximity relate to access?;
- How to gather the data - is it you look at the community and you say that's the green space they get or is it that people from all over can use it? It is not a good measure because it is just you are lucky where you live;
- Perhaps the weakness of it is you can easily measure proximity, but I don't think the measure of the importance of the green space is readily promoted or easily promoted to decision makers.
- Proximity of what - proximity of where they live or is it where they work;
- Proximity to green spaces is like an idea of leading a horse to water but you cannot make him drink, how is measuring and how do you measure - meaning use of the green spaces is more important;
- That one is a pretty good measure because green spaces are fixed and residents are fixed. So that one has actually limited weakness.

Uses and purposes of the proximity to green space indicator

According to seven respondents, municipalities primarily can employ this indicator because they deal with land uses and green spaces within urban areas. Four respondents commented that

conservation authorities are the ones to employ this indicator within rural areas within the watershed. One of these respondents stated that people normally have to drive to conservation areas because they are not in close proximity. One of the respondents stated that this indicator is important for parks people within municipalities and townships to make sure there is proximity to green space (within 450 meters and more depending upon their criteria). Another respondent indicated that the MMAH and MTCS can work in partnership on this indicator to help local economic development. One of the respondents remarked that Natural Resources Canada can employ this indicator due to its parks/trails relationships. Another respondent stated that green NGOs can use this indicator to advocate green spaces are planned within walking distance of visitors and residents.

Summary

Table 5.10 presents summary of the proximity to green space indicator by updating the table included in the workshop report.

Table 5.10 Summary of the Proximity to Green Space Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Manicured & semi-manicured open green spaces ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/ lakes 	<ul style="list-style-type: none"> ▪ Cultural: recreation 	<ul style="list-style-type: none"> ▪ Health ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Increased market values ▪ Greater social capital ▪ Improved physical and mental health** 	<ul style="list-style-type: none"> ▪ All groups (except last one)** ▪ Infants/children* ▪ Low income** ▪ Homeless people ▪ Seniors* ▪ New Canadians* ▪ First nations communities* ▪ Those with physical disabilities or lack of access to transportation 	<ul style="list-style-type: none"> ▪ Land use planning (municipalities)** ▪ Within rural areas (CVC)** ▪ Local economic development (MMAH and MTCS)* ▪ Parks/trails relationships (Natural Resources Canada)* 	<ul style="list-style-type: none"> ▪ Share information about green spaces within walking distance 	<ul style="list-style-type: none"> ▪ York University ▪ Municipalities** ▪ CVC** 	<ul style="list-style-type: none"> ▪ What makes a green space?* ▪ Proximity of what - place of living or work* ▪ How does proximity relate to access?* ▪ Hard to access to green space with fee (especially for low income people)* ▪ How to gather the data (not a good measure)?* ▪ Importance of the green space not readily promoted or

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
								<p>easily promoted to decision makers*</p> <ul style="list-style-type: none"> ▪ Use of the green spaces more important* ▪ Limited weakness (pretty good measure because green spaces and places of residences are fixed)*

* reported by 3 or fewer respondents

** reported by 4-9 respondents

*** reported by the majority of respondents (10 or more)

j) Connectivity of Green Spaces Indicator

Relevance of the connectivity of green spaces indicator

The mean response for the connectivity of green spaces was 3.74 with a standard deviation of 1.56. For municipalities, it is quite important e.g. City of Brampton gives due recognition to this indicator in its sustainability metrics for new development. For conservation authorities, it is important because it is part of their mandate which is shared with the MNR and municipalities. One of the respondents from a conservation authority explained the importance of connectivity in that it is vital for biodiversity and genetic exchange - animals and plants use corridors to move north due to climate change. According to other responses, this indicator is relevant for a number of reasons such as: "species migration, feeding, resting; benefits to humanity in the form of seeds dispersal and nectar pollination; climate change adaptation; enhanced capacity of connected forests to absorb air emissions and pollutants; greater trail connections; and accessibility of green spaces through active modes of transportation within neighborhoods." One of the respondents indicated that this indicator can be measured on a provincial scale.

General benefits of the connectivity of green spaces indicator

Mostly there is a mixed response on the benefits of this indicator. According to two respondents, measurement of this indicator will have greater benefit to human health and well-being especially the well-being. Other benefits shared by respondents included: "creation of balance between human access to green space and wildlife use of corridors for movement, improved air and water quality, more shaded areas, it is integral to ecological integrity, species sustainability, genetic exchange, ability to migrate and response to climate change." One respondent

commented that it can be used for research and policy. Another respondent raised a question that as a measurement tool, how can it benefit human health and well-being?

Specific benefits to vulnerable groups of the connectivity of green spaces indicator

According to four respondents, specific benefits apply to first nations and people living off the land in terms of their livelihood and nutrition. One of the respondents indicated that specific benefits would be better air quality, better water quality, better adaptation for climate change for all these groups. According to one respondent, measurement of this indicator would not be applicable to any of the groups.

Weaknesses of the connectivity of green spaces indicator

According to two respondents, it is a good and strong measure. One of the respondents commented that it can be easily measured at a local level but would be difficult at a higher level. One of the respondents commented that it is an easy measure because a lot of GIS models are available to measure this indicator. Another respondent remarked that the weakness is how to define the green space because the definitions of green space are not consistent. Another respondent stated that connectivity is not legislated by anything. According to one respondent, the challenges with this indicator are; "how you monitor it and how do you communicate it to the general public." Three respondents raised the following questions and comments about this indicator:

- Who is measuring it? How do you measure it? How do you get the accurate number?
Who is using it?

- How do you define what kind of connectivity you are speaking to? Are you talking about trail connections or you are just talking about the connections that allow space to flow together?
- How do you measure that? I guess you could say if the place is connected (yes or no), how many of those are connected then you can look at the percentage of the entire green environment? It is tough to measure.

Uses and purposes of the connectivity of green spaces indicator

Six respondents commented that this indicator can be employed by municipalities. One of these respondents stated that it is important for municipalities because they have to design neighborhoods. Another of these respondents remarked that municipalities manage trails system. According to five respondents, this indicator can be employed by conservation authorities. One of these respondents stated that it is useful because it is part of their mandate to protect connected areas although the MNRF provides some guidance on it and the municipalities are close partners in this regard. Another of these respondents explained that conservation authorities are the ones who ponder over these questions; "do we have healthy ecosystems, do we have species diversity and if we are lacking connectivity, we are lacking habitat." He added that this vital piece of information can help them change the way the public lands are acquired, change the way we are zoning in the urban environment. One respondent remarked that Forests Ontario and municipalities can work together in using this indicator. Another respondent commented that this indicator can be used by research and policy makers. One respondent commented that it is a strong indicator. Another respondent explained that by measuring this indicator, we would get to know which areas are less connected so that we can put more budget money in expanding on our trails through some of the areas.

Summary

Table 5.11 presents summary of the connectivity of green spaces indicator by updating the table included in the workshop report.

Table 5.11 Summary of the Connectivity of Green Spaces Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/ lakes ▪ Manicured & semi-manicured open green spaces ▪ Trails 	<ul style="list-style-type: none"> ▪ Cultural ▪ Regulating ▪ Supporting 	<ul style="list-style-type: none"> ▪ Health ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Increased accessibility* ▪ Improved physical and mental health* ▪ Increased opportunities for recreation through access facilitation ▪ Increased system resiliency* ▪ Biodiversity & habitats; opportunities for wildlife viewing ▪ Improved air and water quality* ▪ More shaded areas* ▪ Ecological integrity, species 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income & homeless people ▪ Seniors ▪ People living off the land** ▪ New Canadians ▪ First nation communities** ▪ Those with physical disabilities ▪ Those with respiratory disease ▪ Not applicable to any of the groups* 	<ul style="list-style-type: none"> ▪ Set targets to increase connectivity ▪ Establish baseline data to facilitate measurement of program progress ▪ Design neighborhoods and manage trails (municipalities)* ▪ Protect connected areas (CVC)* ▪ Can be used by research and policy makers, Forests Ontario in partnership with municipalities* 	<ul style="list-style-type: none"> ▪ Improved access to continuous green areas* ▪ Improved passive and active recreational opportunities ▪ Improved physical and mental health* 	<ul style="list-style-type: none"> ▪ CVC** ▪ Municipalities** 	<ul style="list-style-type: none"> ▪ Hard to measure at the higher level (easy at the local level)* ▪ No weakness (due to having GIS models)* ▪ How to define green space and connectivity?* ▪ Connectivity not legislated by anything* ▪ How you monitor and how you communicate to the public?*

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
			sustainability, genetic exchange, ability to migrate* ▪ No benefit as a measurement tool*					
* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)								

k) Access to Green Spaces Indicator

Relevance of the access to green spaces indicator

The mean response for the access to green space was 3.84 with a standard deviation of 1.30. According to the responses, it is relevant for a number of reasons such as high quality of life, interest or mandate to provide ready access to park land and natural areas through programs, grants (to municipalities, first nations communities, conservation authorities not-for-profit organizations), policy influence, and stewardship programs.

General benefits of the access to green spaces indicator

Understanding and measuring this indicator over time would be beneficial for municipalities and conservation authorities. One respondent from a municipality mentioned that we plan all these natural or green spaces and it is good for us to know through this indicator if people are using those spaces or not and, if not, why so that we can revisit our design strategy. Another respondent raised the same concern for wildlife. According to one respondent, this indicator is important because it will help them meet their mandate of making sure that the sport and recreation infrastructure including recreation buildings, community centers, pools, public swimming areas, fishing areas is accessible. According to four respondents, this indicator is directly related to human health and well-being. One of the respondents stated that it will be helpful in chronic disease prevention. Another respondent commented that it is difficult to figure out how this indicator will be helpful as a measurement tool because providing information about accessibility of green spaces is fine but it is up to the people if they want to use green spaces or not.

Specific benefits to vulnerable groups of the access to green spaces indicator

According to two respondents, it would be more beneficial if we can measure who is using and accessing these green spaces for the purpose of identifying the gaps. One of the respondents mentioned that engaging different groups in the recognition of the importance of these spaces is also important. Two respondents remarked that this indicator will have a greater impact on the health of infants/children if we can get them outside to benefit the nature. Two respondents commented that it would be beneficial for new immigrants because green spaces like parks can be an important place for social gatherings. One respondent stated that it may be culturally important for many first nation communities. Another respondent remarked that it would be beneficial for seniors. According to one respondent, green spaces are vital for sustainable community development. One respondent argued that measuring this indicator can provide information as to which group is having access to green spaces and this information can be important to identify and bridge the gaps. Only one respondent remarked that this indicator can only provide information and cannot change anything.

Weaknesses of the access to green spaces indicator

According to two respondents, it is a good measure but hard to measure. Different people raise the following questions and comments concerning measurement of this indicator:

- How do you measure that? Is it postal code thing? How do you measure access and ask people who is measuring it?
- I can walk to a park that takes 20 minutes and I can drive to an area that takes 20 minutes, are they equally accessible? You can measure like the number of people come to the area,

if lot of people come to it, it must be accessible. You can measure by distance to drive and distance to walk.

- How do we make accessibility to seniors easier? How do we make that connection? How do we help them to journey from their homes and sit under the tree?

One respondent commented that use of green spaces is more important than having them. She added that without measuring who is using these spaces and who is not and why, diversity of opinions from different groups cannot be achieved. She further explained, there may be people (e.g. low income) who may not be using such spaces because they don't have money or don't feel comfortable and included. She continued that there may not be enough resources in different languages for people to understand and participate. One of the respondents in the City of Brampton explained that: "For the Sustainable Community Development Guidelines (SCDGs), a lot of people are mentioning that we are using 400 meters and 800 meters radius from an area as opposed to direct walking routes. So like in 800 meters walk on a road will be significantly less and larger than the circle. Within the circle, walking route is shorter but the reality is we have to figure that the walking path is going to be outside that. So that's the weakness of monitoring or trying to do assessments." Two respondents held the view that communication to the general public is important - people should know what this indicator is all about and what do they need to do with this indicator.

Uses and purposes of the access to green spaces indicator

According to six respondents, this indicator is useful for municipalities (parks people in particular) to be considered in new developments and also find out who is accessing these spaces. One of these respondents explained that we can increase our natural heritage system

through the areas identified in the natural heritage studies. Three respondents commented that this indicator can be employed by the conservation authorities within rural areas throughout the watersheds. One of the respondents commented that the MMAH, MTCS and probably Ministry of Transportation would be interested in this indicator because accessibility links to active transportation, and street ways for the purposes of providing greater access to green spaces. She explained that they are keen in issuing a new set of guidelines to assist municipalities to determine how much parkland is required, what type of parkland is required, where is it required, and how to access parkland? One of the respondents stated the accessibility should come from provincial standards and monitoring should be done on municipal basis to meet those standards. Another respondent remarked that this can be used by community organizations to ensure that vulnerable groups are having access to green spaces. According to two other responses, this indicator can also be used by developers, individuals, and public health organizations. One respondent remarked that it can be used at the provincial and federal levels too.

Summary

Table 5.12 presents summary of the access to green spaces indicator by updating the table included in the workshop report.

Table 5.12 Summary of the Access to Green Spaces Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Manicured & semi-manicured open green spaces ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/Lakes ▪ Trails 	<ul style="list-style-type: none"> ▪ Cultural: recreation 	<ul style="list-style-type: none"> ▪ Health ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Increased revenue (through tourism etc.) ▪ Increased property value ▪ Health (physical and mental)** ▪ Improved social ties/cohesion ▪ Prevention of chronic disease* ▪ No benefit as a measurement tool * 	<ul style="list-style-type: none"> ▪ Infants/children* ▪ Low income ▪ Homeless people ▪ Seniors* ▪ People living off the land ▪ New Canadians* ▪ First nation communities* ▪ Those with physical disabilities ▪ Those with respiratory disease 	<ul style="list-style-type: none"> ▪ Land use planning (municipalities)** ▪ Quantification of walkability ▪ Greater access to green spaces (MMAH, MTCS, probably Ministry of Transportation)* 	<ul style="list-style-type: none"> ▪ Access to information about availability of green spaces within and outside of neighborhoods 	<ul style="list-style-type: none"> ▪ York University ▪ CVC* ▪ Municipalities** 	<ul style="list-style-type: none"> ▪ Hard to measure?* ▪ How to measure?* ▪ How to enable seniors to have access?* ▪ Having green spaces not important but use* ▪ Monitoring in terms of measuring distance* ▪ Lack of effective communication to the public *
<p>* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)</p>								

1) Wildlife [Habitat] Indicator

Relevance of the wildlife (habitat) indicator

The mean response for the wildlife [habitat] indicator was 3.74 with a standard deviation of 1.41. It is mainly relevant for conservation authorities and then municipalities. One of the respondents from a conservation authority emphasized on defining wildlife habitat. He explained that wildlife habitat is not just a forest but includes plants and animals. He added that this term is quite often underestimated and undervalued. He argued that the whole Credit River Watershed is a wildlife habitat. Then he introduced the term urban wildlife which is not well-defined. He had this understanding that wildlife habitat includes those areas (under natural heritage systems) which cannot be developed. For municipalities, it is relevant because they provide funding to TRCA and CVC to conduct surveys (ecological land classification) of all landscapes. For Forests Ontario, it is important because they create habitats through tree plantations and forest restoration. One of the respondents commented that this indicator is relevant due to emerging infectious diseases of concern.

General benefits of the wildlife (habitat) indicator

According to three respondents, this is a good indicator of ecosystem health, biodiversity, ecological integrity, functioning ecosystems, which support human health and well-being. One of the respondents commented that it is a stress relieving indicator and feel good measure e.g. if there is Pileated woodpecker in the woodlot or salamanders, people would like to go and see them so through measurement of this indicator, we can determine the wildlife that is actually there. Another respondent explained that this indicator is good for them because it can help them

communicate the effectiveness of their naturalization programs - whether they are planting the right species and maintaining them properly.

Specific benefits to vulnerable groups of the wildlife (habitat) indicator

According to three respondents, this indicator would benefit all groups. Two respondents commented that this indicator relates to biodiversity (a measure of ecosystem health). She explained that wildlife provides us a number of benefits such as pollination, seed dispersal and measurement of this indicator would help us understand "what we are losing and what vulnerable groups are missing" - e.g. this indicator can be very useful for farmers who depend on pollination. Another respondent explained that this information is important for children to understand connections to nature. Two respondents commented that the benefits would apply to people living off the land (due to cultural values, access to wild spaces and natural spaces) and first nations (due to their dependence on wildlife for a variety of needs).

Weaknesses of the wildlife (habitat) indicator

There is a lot of variation in the responses on weaknesses of this indicator. One respondent highlighted two weaknesses - one is the definition of this indicator and second is the measurement of this indicator at the landscape and ground (in the field) scales. He explained that one of the weaknesses related to ground scale is lack of measurement of abundance of most of the species (except fish and frogs) because we quite often get stuck on a small number of species. Another respondent commented that ecological field studies are expensive. One of the respondents stated that we have not done a good job in integrating and developing an integrated measure of wildlife habitat or integrated ecosystem - we have separate data on forest lands, wetlands, riparian zones and rivers. Another respondent explained that communication of this

indicator to the general public is very important because people should know what types of animals and birds are out there for watching. She suggested that it would be nice to encourage people to share their sightings in writing and through pictures. She added that the both scientific people (biologists) and the public can play their roles collectively - a biologist can tell what kind of animals and birds are out there and the public can share their stories. One respondent remarked that people's perception about wildlife is a huge weakness - some people don't like coyotes in their backyards thinking they are not good but in fact they are.

Uses and purposes of the wildlife (habitat) indicator

According to five respondents, this indicator can be employed by municipalities. One of these respondents stated that municipalities can better use this indicator because they have master municipal plans which control the details of the greenspace access. Four respondents commented that it can be used by conservation authorities. One of these respondents remarked that conservation authorities can address this indicator holistically because they have more expertise available with them, unlike municipalities which depend on natural area surveys and the information from conservation authorities. Another respondent commented that conservation authorities can employ this indicator at a local level and the MNRF can use it at a provincial level for the purpose of creating green spaces, parks, and protected areas (through the Greenbelt and Oak Ridges Moraine) for wildlife habitat, protecting wildlife habitat and understanding wildlife habitat over time. According to four other responses, this indicator can be also used by other organizations such as agriculture departments (because of the disease risk), research and policy makers, wildlife federations, and environmental non-government organizations.

Summary

Table 5.13 presents summary of the wildlife [habitat] indicator by updating the table included in the workshop report.

Table 5.13 Summary of the Wildlife [habitat] Indicator

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/Lakes ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Cultural ▪ Provisioning 	<ul style="list-style-type: none"> ▪ Good social relations ▪ Basic materials for good life 	<ul style="list-style-type: none"> ▪ Recreation (fishing, bird watching)* ▪ Aesthetics ▪ Food ▪ Communicate effectiveness of naturalization programs* 	<ul style="list-style-type: none"> ▪ All groups* ▪ Children* ▪ People living off the land* ▪ First nation communities* ▪ New Canadians ▪ Seniors 	<ul style="list-style-type: none"> ▪ Track relative health over time and success of programs ▪ Management of green space access (municipalities)* ▪ Creating green spaces, parks, and protected areas (CVC, MNRF)* ▪ Control of disease risks (agriculture departments)* ▪ Other uses by research and policy makers and wildlife 	<ul style="list-style-type: none"> ▪ Public can relate to animals 	<ul style="list-style-type: none"> ▪ CVC** ▪ Municipalities* 	<ul style="list-style-type: none"> ▪ How to define?* ▪ How to measure at the landscape and ground scales* ▪ Lack of integrated ecosystem* ▪ Expensive ecological field studies* ▪ Lack of people's perception* ▪ Lack of effective communication

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Weakness of the indicator
					federations*			-ion to the general public*
* reported by 3 or fewer respondents ** reported by 4-9 respondents *** reported by the majority of respondents (10 or more)								

Summary

This chapter presented responses of key stakeholders involved in measuring different indicators and also those which can employ indicators. Each indicator has benefits and shortcomings in terms of its measurement. The importance of partnerships among different stakeholders is also discussed in this chapter. This chapter also discusses inter-relationships of different indicators. For example, urban heat island indicator is linked to % canopy cover, % imperviousness and air quality index indicators. Similarly, % imperviousness, % canopy cover and water quality index indicators are inter-related. This chapter also highlights that some of the indicators are ecosystem health related and some human health and well-being related. The next chapter presents conclusions and recommendations.

6 Conclusions and Recommendations

6.1 Conclusions

This research project illustrates that role of watershed planning and governance is vital to the implementation of the ecohealth and human health and well-being indicators. Although CVC is the primary governing body in the Credit River Watershed, the role of other partners and stakeholders is indispensable. The discussions with different governance stakeholders indicate the importance of relationships of different indicators and partnerships in the implementation of the indicators. Although some partnerships already exist (e.g. CVC working in collaboration with municipalities, the Peel health units working with municipalities), the stakeholders have put forth some suggestions on who can be involved in partnerships and for what purpose. For example, it is one of the suggestions that the MoE&CC and Ontario Ministry of Health and Long-term Care can work with planners to reduce urban heat island effects.

It is evident from discussions that indicators can be employed mainly at both the local and provincial levels by different authorities such as conservation authorities, municipalities and ministries. These indicators include air quality index, traffic patterns and modes of transportation, water quality index, connectivity of green spaces, urban heat islands, and wildlife [habitat].

Based on the information from the governance stakeholders, some of the indicators seem to be quantitative which cannot be easily translated to the general public and are more appropriately used for research and policy e.g. % imperviousness, % people using natural space, % canopy cover, water quality index, air quality index and connectivity of green spaces.

Some indicators are reported to be hard to define and measure. These indicators include % imperviousness, % people using natural space, and access to green spaces.

It is also discussed that the definitions of natural and green spaces should be articulated. Without having consistent definitions of these spaces, these indicators cannot be consistently applied.

Some indicators are reported to be master variables and currently used as coarse measures. These include land cover change and % imperviousness. These indicators cannot be measured alone because they are correlated with other attributes.

6.2 Recommendations

For the purposes of this research project, the governance stakeholders have unearthed a variety of information on all the indicators. Some of the information overlaps but most of the information is different. The information also leads to identification of new stakeholders which were not considered for this research project and can be useful for future research projects of this kind. These new stakeholders include; MoE&CC, Environment Canada, Natural Resources Canada. For this project, I have conducted 19 interviews. Any student, who is interested in this kind of project, can conduct 19 or more interviews and do the combined content analysis of my transcripts and his or her transcripts. A sample of 40 or more can give statistical power to use some software (e.g. NVivo) for content analysis and lots of significant differences among respondents.

This research project focuses on the information within the Region of Peel; therefore, the stakeholders working within the region were contacted for the purpose of soliciting information on the indicators. Another suggestion could be to broaden out the research in terms of the area (e.g. by adding Conservation Halton, City of Toronto) so there is a larger region to produce a

larger sample. Conservation Halton is currently doing a similar kind of project on assessing human health and well-being indicators. The sustainability plan coordinator is the main lead on this project. He can be a potential stakeholder to participate in the research project in the future.

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Appendix 1 Governance Stakeholders' Workshop Report

HEALTH AND WELL-BEING INDICATORS FOR THE CREDIT RIVER WATERSHED

(Workshop Report)

Prepared By:

Iftexhar Ahmad
MES (planning) 2nd Year/Graduate Assistant
Faculty of Environmental Studies
York University

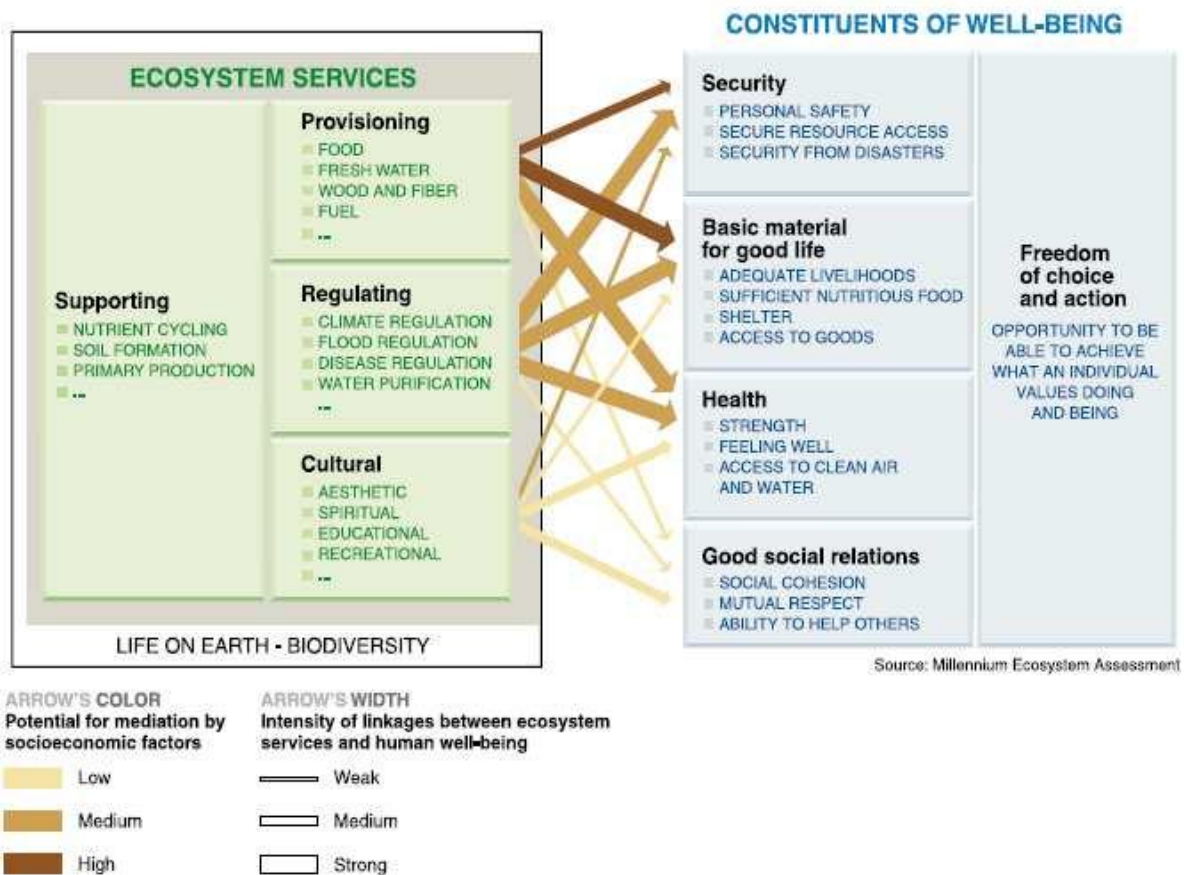
Reviewed By:

Dr. Martin Bunch and Dr. Karen Morrison
Faculty of Environmental Studies
York University
&
Tatiana Kovesnikova and Mike Puddister
Credit Valley Conservation (CVC) Authority

March 12, 2015

1 Overview of the Workshop

The governance stakeholders’ one day workshop on “Human Health and Well-being Indicators for the Credit River Watershed” was held on November 6, 2014 from 9 am to 3:30 pm (workshop agenda provided in Appendix A). The workshop is a component of a larger project¹ that has as its primary goal the exploration and reporting about the status and relationships between watershed ecosystem health and human health and well-being in the Credit River watershed. This workshop adapted the framework of ecosystem services and constituents of human well-being defined in the Millennium Ecosystem Assessment (MEA). The figure below, taken from the MEA’s report on Ecosystems and Human Well-being,² provides an overview of this framework.



Source: Corvalan, C., Hales, S., & McMichael, A. (2005). *Ecosystems and Human Well-being: Health Synthesis*. Geneva: WHO.

Watershed management organizations are aware of the importance of healthy ecosystems and ecosystem services to human health and well-being but they very rarely track and report

¹Human well-being, ecosystem services and watershed management in the Credit River Valley: Web-distributed mechanisms and indicators for communication and awareness, funded by the Canadian Water Network via a SSHRC Partnership project sub grant from the “Water, Economics, Policy and Governance Network” (CWN and Brock University).

²Corvalan, C., Hales, S., & McMichael, A. (2005). *Ecosystems and Human Well-being: Health Synthesis*. Geneva: WHO.

measures of human well-being to demonstrate the efficacy of their work. The main objective of the workshop, which is a joint venture between CVC and a research group from York University, was to engage a broader internal and external group of experts and opinion leaders to assist in developing and refining the list of well-being indicators that relate to the watershed's environmental conditions. Prior to the workshop, a suite of indicators of human well-being had been reviewed and selected by the project partners³. The list was later refined based on the discussions with the project team. While developing indicators, input was also solicited from local residents through the administration of a survey in two neighborhoods in Mississauga and Brampton. This list of indicators was used in the workshop for further refinement through the expert input of the governance stakeholders.

2 Role and Approach of the Workshop

Input from the stakeholders was necessary to achieve a key project objective: "to identify indicators of human well-being that connect to ecosystem services such as drinkable, swimmable, fishable water, flood protection, etc., for the purpose of communication of ecosystem-well-being relationships, and to support governance and management activities in the Credit River watershed." This input is critical for achieving the ultimate outcome of the larger project: developing an online communications and mapping tool to engage and support the watershed community as well as help guide future watershed management and restoration strategies.

The workshop was conducted using an Appreciative Inquiry (AI) approach. It is a four-pronged approach comprising Discovery (what is/what has been), Dream (what could be), Design (what should be), and Destiny (what will be) stages. A total of 17 stakeholders from different organizations participated in the workshop. All the participants were divided into four groups (representing five domains of well-being) with four or five members at each table as follows.

Group 1 – Health (indirect benefits through ecosystem services)

Group 2 – Health (direct benefits through ecosystem services)

Group 3 – Good Social Relations and Freedom of Choice and Action

Group 4 – Security and Basic Materials for a Good Life

The workshop organizers selected participants in each group based on similar professional backgrounds and/or common interests. Participants at each table were assigned a similar set of activities related to the AI process. Each group had a facilitator and a recorder (Appendix B for the list of these people). An instructions manual (Appendix C) was prepared for the participants to accomplish the required tasks of the workshop.

³Potential Indicators were brain-stormed at the Ecohealth & Watersheds: Indicators Meeting (Prince George, BC) in June 2013. The meeting was hosted by UNBC and involved local, provincial, national and international organizations that gathered to collaborate on the use of indicators and integrated frameworks to address the connections between health, environment and communities.

The workshop started with a brief introduction of the participants. The participants were asked to self-identify themselves as to which type of organization they belonged to and what professional background they were from. Most answered government organization and had an assortment of professional backgrounds such as Environmental Planning, Forestry, Natural Heritage, Public Health, Ecology and Landscape, Biology, Sustainability. A list of participants is provided in Appendix D.

The workshop process was formally initiated with a “what is/what has been” activity, developed through a PowerPoint presentation given by Mike Puddister, Tatiana Koveshnikova and Dr. Martin Bunch. In this presentation, the presenters gave an overview of the project, shared the basic problem to be addressed (identifying and communicating environment-health relationships with examples), presented the goals of the workshop, and provided a snapshot of the workshop activities.

The presentation was followed by the “what could be” activity in which the participants identified gaps, suggested additional ecosystem/components that are connected to human health and well-being and/or removed already identified ecosystem components. They also were asked to recommend additional indicators to represent these relationships. The output was a short list of ecosystem components and a long list of indicators⁴.

The third activity was “what should be” in which the participants sifted through the long list of indicators and selected the ones matching the usefulness and practicality criteria. This was a “Dotmocracy” exercise in which the participants used red and blue dot stickers to indicate relevant and practical indicators respectively. The indicators that ranked highest in number of dots were selected for further analysis. The final indicators were displayed on a matrix that mapped them against human health and well-being benefits on x-axis and well-being domains on y-axis (Appendix E).

The last activity was “what will be” in which the participants expanded on the final indicators in terms of describing final benefits, potential uses by managers, data availability, data type, data accessibility, and links to vulnerable groups.

Appendix F provides pictorial presentation of the workshop activities.

3 Summary of the Workshop's Results

The workshop resulted in the selection of 12 indicators, each of which has an ecological and human well-being significance. The indicators identified were the following:

No	Indicator	No	Indicator
1	Air Quality	7	Water Quality Index
2	Traffic Patterns/Mode of Transportation	8	% People using Natural Space
3	Land Cover Change	9	Proximity to Green Space
4	Urban Heat Island	10	Connectivity of Green Spaces
5	% Imperviousness	11	Access to Green Spaces
6	% Canopy Cover	12	Wildlife (habitat)

⁴initially provided by workshop organizers and to which participants added additional indicators and more information.

A summary of each indicator is given in the tables below. These tables are a compilation of information/outcomes of various activities of the workshop. In some cases, information obtained from the workshop participants was supplemented by input from the project team.

Indicator #1: AIR QUALITY INDEX

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating: air filtration 	<ul style="list-style-type: none"> ▪ Health 	<ul style="list-style-type: none"> ▪ Clean air through pollutant removal ▪ Healthy lungs and bodies ▪ Healthier plants and animals ▪ Healthier water and soil ▪ Ability to exercise outdoors ▪ Improved cardiovascular and respiratory health 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Seniors ▪ Low income & homeless people ▪ People living off the land ▪ New Canadians ▪ First nation communities ▪ Those suffering from respiratory disease 	<ul style="list-style-type: none"> ▪ By health units, MOE&CC* ▪ Regulate air pollutants ▪ Smog day announcements ▪ Controls on car exhaust 	<ul style="list-style-type: none"> ▪ Direct effect on physical health ▪ Effect on lifestyle ▪ Ability to spend time outdoors 	<ul style="list-style-type: none"> ▪ Region of Peel ▪ Environment Canada 	<ul style="list-style-type: none"> ▪ Ozone, particulate matter, greenhouse gases

*Ministry of the Environment & Climate Change

Indicator #2: TRAFFIC PATTERNS/MODE OF TRANSPORTATION

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Manicured & semi-manicured open green spaces ▪ Trails* 	<ul style="list-style-type: none"> ▪ Regulating: air filtration ▪ Cultural: recreation (active lifestyle) 	<ul style="list-style-type: none"> ▪ Health 	<ul style="list-style-type: none"> ▪ Mobility and interconnectivity (including bike/walk, public transit, car pool) ▪ Improved physical health by promoting walkability ▪ Improved air quality by reducing traffic 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Seniors ▪ Low income & homeless people ▪ People living off the land ▪ New Canadians ▪ Those suffering from respiratory disease 	<ul style="list-style-type: none"> ▪ By municipalities and the Region ▪ Promotion of walkable neighborhoods ▪ Understanding of impacts of traffic on wildlife 	<ul style="list-style-type: none"> ▪ Livable and walkable cities ▪ Improved health resulting from active lifestyle 	<ul style="list-style-type: none"> ▪ CVC ▪ Region of Peel ▪ Municipalities 	<ul style="list-style-type: none"> ▪ Number of transit options ▪ Number of collisions and accidents ▪ Wildlife mortalities ▪ Proximity to major roads ▪ Number of trails/ Multi-use pathways

*Trails are important since they add access to natural surroundings

Indicator #3: LAND COVER CHANGE

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/Lakes ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating: all ▪ Provisioning: all ▪ Cultural: all ▪ Supporting: all 	<ul style="list-style-type: none"> ▪ Basic materials ▪ Security ▪ Health ▪ Good social relations ▪ Freedom of choice and action 	<ul style="list-style-type: none"> ▪ Less risk to humans and more resilience) ▪ Better land use planning ▪ Helps maintain natural habitats for wildlife ▪ Maintains a healthy ecosystem and provision of services ▪ Food security (from new development) 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Seniors ▪ Low income & homeless people ▪ People living off the land ▪ New Canadians ▪ First nation communities 	<ul style="list-style-type: none"> ▪ By Region, municipalities, CVC ▪ Land use planning (evidence based) 	<ul style="list-style-type: none"> ▪ Pictorial depiction of change over time 	<ul style="list-style-type: none"> ▪ CVC 	<ul style="list-style-type: none"> ▪ Aerial photos, mapping etc.

Indicator #4: URBAN HEAT ISLAND

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating: micro-climate regulation 	<ul style="list-style-type: none"> ▪ Health ▪ Security 	<ul style="list-style-type: none"> ▪ Improved air quality ▪ Decreased illnesses and mortalities due to high temperatures 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income & homeless people ▪ Seniors 	<ul style="list-style-type: none"> ▪ By municipalities ▪ Monitoring and mitigating urban heat island and its effects 	<ul style="list-style-type: none"> ▪ Imagery of heat island spots in order to illustrate potential effects/causes/re-mediation of heat 	<ul style="list-style-type: none"> ▪ Region of Peel 	<ul style="list-style-type: none"> ▪ Satellite imageries

Indicator #5: % IMPERVIOUSNESS

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Forests (urban & natural) ▪ Wetlands ▪ Manicured & semi-manicured open green spaces ▪ Green Infrastructure* 	<ul style="list-style-type: none"> ▪ Regulating: water storage and regulation ▪ Regulating: water filtration 	<ul style="list-style-type: none"> ▪ Security ▪ Health 	<ul style="list-style-type: none"> ▪ More permeable less stress ▪ Improved water quality and quantity ▪ Mitigated flooding potential 	<ul style="list-style-type: none"> ▪ Those living in flood and erosion vulnerable areas ▪ Those dependant on sensitive groundwater systems ▪ Low income & homeless people ▪ People living off the land 	<ul style="list-style-type: none"> ▪ By Region, municipalities, CVC ▪ Land use planning ▪ Monitoring and mitigating impacts of floods 	<ul style="list-style-type: none"> ▪ Show changes over time in order to illustrate potential effects / causes / remediation 	<ul style="list-style-type: none"> ▪ CVC ▪ Municipalities 	<ul style="list-style-type: none"> ▪ % impervious-ness ▪ Runoff coefficient ▪ Changes in land use

*Green Infrastructure/Low Impact Development components are included because they imitate the natural hydrology of the site. Using these techniques helps to protect local ecosystems and to create more livable communities.

Indicator #6: % CANOPY COVER

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Regulating ▪ Cultural ▪ Supporting 	<ul style="list-style-type: none"> ▪ Health ▪ Security ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Decreased air temperature ▪ Improved air quality ▪ Energy cost savings ▪ Improved physical, social and mental health and well-being ▪ Reduced peak flows 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income and homeless people ▪ Seniors ▪ People living off the land ▪ First nation communities ▪ New Canadians ▪ Those living in flood vulnerable areas ▪ Those with respiratory disease ▪ Heat sensitive individuals 	<ul style="list-style-type: none"> ▪ By Region, municipalities ▪ Monitoring and mitigating ▪ Prioritize areas for protection and restoration 	<ul style="list-style-type: none"> ▪ Promotes walkability ▪ Increases property value ▪ Directly and indirectly affects physical, mental, and social health and well-being ▪ Saves \$ on energy ▪ Improves air quality and decreases temperature ▪ Reduces potential of flooding 	<ul style="list-style-type: none"> ▪ Municipalities ▪ Region of Peel 	<ul style="list-style-type: none"> ▪ Aerial photos ▪ % by dissemination area

Indicator #7: WATER QUALITY INDEX

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows 	<ul style="list-style-type: none"> ▪ Regulating: water filtration 	<ul style="list-style-type: none"> ▪ Health 	<ul style="list-style-type: none"> ▪ Increased groundwater and surface water quality ▪ Clean water for consumption and body contact ▪ Fish safe to consume 	<ul style="list-style-type: none"> ▪ Infants/children ▪ New Canadians ▪ Seniors ▪ People living off the land ▪ Low income & homeless people ▪ First nations communities ▪ Those who come into contact with water 	<ul style="list-style-type: none"> ▪ By Region, municipalities, CVC ▪ Monitoring of water quality ▪ Assessment and remediation (if necessary) of water problems 	<ul style="list-style-type: none"> ▪ Visually pleasing effect on people ▪ Enhanced experience while being near water bodies ▪ Improved water quality (lower watershed) 	<ul style="list-style-type: none"> ▪ Region of Peel Public Works Department ▪ sowc.ca ▪ Municipalities ▪ Public health ▪ Conservation Authorities ▪ Ducks Unlimited 	<ul style="list-style-type: none"> ▪ Reports ▪ Water quality data (chemical, physical and biological)

Indicator #8: % PEOPLE USING NATURAL SPACE

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain of improving the indicator	Well-being benefit	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Manicured & semi-manicured open green spaces ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/lakes 	<ul style="list-style-type: none"> ▪ Cultural: recreation, education 	<ul style="list-style-type: none"> ▪ Health ▪ Good Social Relations 	<ul style="list-style-type: none"> ▪ Increased human health and well-being ▪ Better understanding of wants/needs/desires regarding natural space ▪ Greater social capital 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income and homeless people ▪ Seniors ▪ New Canadians ▪ Those with physical disabilities ▪ Those who lack access to transportation 	<ul style="list-style-type: none"> ▪ By municipalities, CVC ▪ Assessment and protection of ecological integrity ▪ Assess design with consideration given to accessibility ▪ Support for funding requests 	<ul style="list-style-type: none"> ▪ Public participation by sharing stories about their outdoor activities ▪ Access to information about outdoor activities in natural open spaces 	<ul style="list-style-type: none"> ▪ CVC ▪ Municipality 	<ul style="list-style-type: none"> ▪ Visitor surveys ▪ Permits ▪ Counts ▪ Reports ▪ Database

Indicator #9: PROXIMITY TO GREEN SPACE

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Manicured & semi-manicured open green spaces ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/ lakes 	<ul style="list-style-type: none"> ▪ Cultural: recreation 	<ul style="list-style-type: none"> ▪ Health ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Increased market values ▪ Greater social capital ▪ Improved physical and mental health 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income and homeless people ▪ Seniors ▪ New Canadians ▪ Those with physical disabilities or lack of access to transportation 	<ul style="list-style-type: none"> ▪ By municipalities ▪ Land use planning 	<ul style="list-style-type: none"> ▪ Share information about green spaces within walking distance 	<ul style="list-style-type: none"> ▪ York University ▪ Municipalities, CVC 	<ul style="list-style-type: none"> ▪ Database (land cover, demographics)

Indicator #10: CONNECTIVITY OF GREEN SPACES

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/ lakes ▪ Manicured & semi-manicured open green spaces ▪ Trails* 	<ul style="list-style-type: none"> ▪ Cultural ▪ Regulating ▪ Supporting 	<ul style="list-style-type: none"> ▪ Health ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Increased accessibility ▪ Improved physical and mental health ▪ Increased opportunities for recreation through access facilitation ▪ Increased system resiliency ▪ Biodiversity & habitats; opportunities for wildlife viewing 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income & homeless people ▪ Seniors ▪ People living off the land ▪ New Canadians ▪ First nation communities ▪ Those with physical disabilities ▪ Those with respiratory disease 	<ul style="list-style-type: none"> ▪ Set targets to increase connectivity ▪ Establish baseline data to facilitate measurement of program progress ▪ Regions, municipalities, CVC 	<ul style="list-style-type: none"> ▪ Improved access to continuous green areas ▪ Improved passive and active recreational opportunities ▪ Improved physical and mental health 	<ul style="list-style-type: none"> ▪ Land cover 	<ul style="list-style-type: none"> ▪ Trail counts (optimum versus actual route) ▪ Quantification of connections (amount, acreage, gaps) ▪ Corridor spatial data

*Trails are important since they add access to natural surroundings.

Indicator #11: ACCESS TO GREEN SPACES*

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well- being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Manicured & semi-manicured open green spaces ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/Lakes ▪ Trails* 	<ul style="list-style-type: none"> ▪ Cultural: recreation 	<ul style="list-style-type: none"> ▪ Health ▪ Good social relations 	<ul style="list-style-type: none"> ▪ Increased revenue (through tourism etc.) ▪ Increased property value ▪ Health (physical and mental) ▪ Improved social ties/cohesion 	<ul style="list-style-type: none"> ▪ Infants/children ▪ Low income & homeless people ▪ Seniors ▪ People living off the land ▪ New Canadians ▪ First nation communities ▪ Those with physical disabilities ▪ Those with respiratory disease 	<ul style="list-style-type: none"> ▪ Land use planning ▪ Quantification of walkability 	<ul style="list-style-type: none"> ▪ Access to information about availability of green spaces within and outside of neighborhoods 	<ul style="list-style-type: none"> ▪ York University ▪ CVC 	<ul style="list-style-type: none"> ▪ Point of access (canoeing, kayaking, trail, barriers (continuity along the river)) ▪ Frequency of access (daily, seasonal, etc.) ▪ Type of access (on foot, bicycle, vehicle) ▪ Satellite imagery ▪ Settlement patterns ▪ Locations of bridges

*Accessibility of green space (geographic, financial and disability); some natural areas should not be accessed by humans.

Indicator #12: WILDLIFE (HABITAT)

Landcover/ ecosystem components related to the indicator	Ecosystem service	Well-being domain	Well-being benefit of improving the indicator	Vulnerable group	Potential use of the indicator by managers	Potential for communication of the indicator to stakeholders	Data availability on the indicator	Data type for the indicator
<ul style="list-style-type: none"> ▪ Trees (urban) ▪ Forests (urban & natural) ▪ Wetlands ▪ Meadows ▪ Streams/Lakes ▪ Manicured & semi-manicured open green spaces 	<ul style="list-style-type: none"> ▪ Cultural ▪ Provisioning 	<ul style="list-style-type: none"> ▪ Good social relations ▪ Basic materials for good life 	<ul style="list-style-type: none"> ▪ Recreation (fishing, bird watching) ▪ Aesthetics ▪ Food 	<ul style="list-style-type: none"> ▪ Children ▪ People living off the land ▪ First nation communities ▪ New Canadians ▪ Seniors 	<ul style="list-style-type: none"> ▪ Track relative health over time and success of programs ▪ By CVC 	<ul style="list-style-type: none"> ▪ Public can relate to animals 	<ul style="list-style-type: none"> ▪ CVC 	<ul style="list-style-type: none"> ▪ *NHS mapping ▪ Land cover ▪ Angler survey data ▪ Number of licenses and permits ▪ Wildlife monitoring data
*NHS - Natural Heritage System								

4 Closing Remarks

The completion of the workshop by active involvement of all the participants is a stepping stone towards the development of a GIS based interactive tool to explore relationships among ecosystem services/landscape components and human health and well-being. It is expected that this tool will be rolled out by the end of March 2015 for some of the identified indicators (such as % canopy cover, % imperviousness, proximity to green space, and surface water quality) for which data are readily available. In parallel to this, one-on-one interviews will be organized with key stakeholders (those who participated in the workshop and those who could not) using semi-structured questionnaires to fill up the gaps and flesh out all 12 indicators selected by participants during the workshop.

Appendix A

WORKSHOP AGENDA

WORKSHOP AGENDA

Time	Activity	Facilitators
8:45 am – 9:15 am	Welcome/registration/ morning snacks/coffee	Iftekhar+Alexandra
Session 1		
9:15 am – 09:30 am	Participants introduction	Martin
9:30 am – 10:20 am	Project Introduction	Mike+Tatiana+Martin
10:20 am – 10:30 am	Q&A session	Mike+Tatiana+Martin
Session 2		
10:30 am – 11:30 am	Land Cover/Ecosystem Components and Community Benefits Links	Mike+Tatiana+Martin+Karen
11:30 am – 12:30 pm	Indicators Identification	Martin+Mike+Tatiana+Karen
12:30 pm – 1:15 pm	Lunch Break	
Session 3		
1:15 pm – 2:15 pm	Indicators Evaluation	Martin+Mike+Tatiana+Alvaro /Iftekhar
Session 4		
2:15 pm – 2:45 pm	Indicator Information Sheet/Health Domain Matrix	Martin+Mike+Tatiana+Alvaro /Iftekhar
2:45 pm – 3:30 pm	Q&A and Wrap Up	Martin+Mike+Tatiana+Alvaro /Iftekhar

Workshop Venue:

German Canadian Club Hansa
6650 Hurontario Street
Mississauga, ON
L5W 1N3
Telephone: 905-564-0060
Web: www.hansahaus.ca

Appendix B

LIST OF RESEARCHERS

(including facilitators and recorders)

1. Mike Puddister, CVC
2. Tatiana Koveshnikova, CVC
3. Dr. Martin Bunch, York University
4. Karen Morrison, York University
5. Mitch Harrow, York University
6. Alexandra Belaskie, York University
7. Iftekhar Ahmad, York University
8. Alvaro Palazuelos, York University
9. Elizabeth Paudel, York University
10. John Choy, York University
11. Julie Mallette, York University

Appendix C

WORKSHOP INSTRUCTIONS MANUAL

FOR PARTICIPANTS

Session 2

ACTIVITY 1 - Land Cover/Ecosystem Components and Community Benefits

Time: 10:30 am – 11:30 am

Group 1: Health (Indirect Benefits through Ecosystem Services)

Facilitator: Martin

Recorder: Alexandra

Description:

Q1. How do watershed's ecosystems contribute to the health of local residents? Please identify an environmental benefit (e.g., Clean Air) rather than a health outcome (e.g., reduced mortality rate).

Q2. (For each benefit identified) what landcover/ecosystem components provide this benefit?(Refer to Table 2 for the list of landcover/ecosystems). Is there any other landcover/component that provides this benefit but is not listed here?

Q3. In one sentence describe the mechanism or process by which landcover/ecosystem component realizes this benefit.

Session 2

ACTIVITY 1 - Land Cover/Ecosystem Components and Community Benefits

Time: 10:30 am – 11:30 am

Group 2: Health

Facilitator: Tatiana

Recorder: Elizabeth

Description:

Q1. What health benefits people derive through direct contact with nature, both active and passive? Try to think of the experiences (e.g., opportunities for exercising outdoors or meditation) rather than the health outcomes (e.g., reduced blood pressure).

Q2. (For each benefit identified) What landcover/ecosystem components provide this benefit/opportunity? (Refer to Table 2 for the list of landcover/ecosystems). Is there any other landcover/component that provides this benefit but is not listed here?

Q3. In one sentence, describe the mechanism or process by which landcover/ecosystem component realizes this benefit.

Session 2

ACTIVITY 1 - Land Cover/Ecosystem Components and Community Benefits

Time: 10:30 am – 11:30 am

Group 3: Social Relations and Freedom of Choice and Action

Facilitator: Mike

Recorder: Mitch

Description:

Social Relations

Q1. How watershed's ecosystems and their components contribute to good social relations in a community? Do they help to build stronger families, friendships and communities and how?

Q2. What are the particular types of ecosystems/components that contribute to improved social relations? (Refer to Table 2 for the list of landcover/ecosystems). Is there any other landcover/ecosystem component that contributes to the improved social relations that is not listed here?

Q3. In one sentence, describe the mechanism or process by which particular landcover/ecosystem component contributes to the improved social relations.

Freedom of Choice and Action

Q1. How can CVC contribute to empowering communities to make a positive change in their health and well-being?

Session 2

ACTIVITY 1 - Land Cover/Ecosystem Components and Community Benefits

Time: 10:30 am – 11:30 am

Group 4: Security + Basic Materials

Facilitator: Karen

Recorder: Alvaro/Iftekhhar

Description:

Security

Q1. *How do watershed's ecosystems and their components contribute to environmental security of local residents?*

Q2. *What are the particular types of ecosystems/components that address this aspect of security (e.g., secure water supply, protection from floods)? Is there any other landcover/ ecosystem component that provides that benefit but is not listed here?*

Q3. *In one sentence, describe the mechanism or process by which landcover/ecosystem component realizes this benefit/security aspect.*

Basic Materials

Q1. *What basic materials are provided by the watershed's ecosystems and their components?*

Q2. *Which particular types of ecosystems/components provide this basic material? Is there any other landcover/ecosystem component that provides this benefit but is not listed here?*

Q3. *In one sentence, describe the mechanism or process by which landcover/ecosystem component provides this benefit (basic material).*

Session 2

ACTIVITY 2 - Links and Indicators

Time: 11:30 am – 12:30 pm

ALL GROUPS

Description:

- Go through the table (provided by the facilitator) and the flipchart records to identify and record benefits/landcover types or linkages that are missing from the table.
- Identify relevant indicators for each benefit. A list of draft indicators is provided to you for your reference. You are expected to identify additional indicators for each benefit.

The guiding question is: What environmental variables can be used as proxy to measure this final benefit (connection/ecosystem component)?

Flip charts will be provided for jotting down your ideas

Session 3

ACTIVITY – Screening Criteria for Indicators

Time: 1:15pm – 2:15 pm

ALL GROUPS

All indicators identified in previous activity are displayed on flipcharts on the walls. A list of criteria (Relevant and Practicality) for evaluating indicators is provided to you. This activity will be completed using Dotmocracy. Each group is provided with 20 dot stickers in two different colors to be used for each criterion respectively. Half stickers in one color will be placed against any indicators of your choice under one criterion and the remaining half under the other criterion. Final indicators will be selected on the basis of total number of dot stickers against each indicator.

Below template is for illustrative purposes of Dotmocracy exercise only.

Indicator	Criteria		Total Score
	Relevance	Practicality	
Indicator A	● ●	○	3
Indicator B	● ●	○ ○	4 (selected)
Indicator C	●	○	2

Session 4

ACTIVITY – Indicator Report Card

Time: 2:15 am – 2:45 pm

ALL GROUPS

Description:

A report card for each final indicator will be prepared by respective group members. This card consists of a set of questions which have to be answered for each indicator on the given template.

Appendix D

LIST OF WORKSHOP PARTICIPANTS

(highlighted in green color)

	First Name	Last Name	Title/Department	Organization	Email	Y/N	Table
1	Alexandra	Belaski	MES II Student, Faculty of Environmental Studies	York University	a.belaskie@gmail.com	Y	F/R
2	Alvaro	Palazuelos	MES I Student, Faculty of Environmental Studies	York University	palazuelos.alv@gmail.com	Y	F/R
3	Anand	Balram	Planning and Infrastructure Services	City of Brampton	Anand.Balram@brampton.ca	Y	2
4	Anna	Martin	Founder and Executive Director	Gumption Inc.	anna@gumptioninc.org	Y	3
5	Bob	Morris	Manager, Lands and Natural Heritage, Natural Heritage Department	Credit Valley Conservation (CVC)	BMorris@creditvalleyca.ca	Y	4
6	Chaya	Chengappa	Manager, Programs and Operations, Community Environment Alliance	Community Environment Alliance	cchengappa@communityenvironment.org	Y	2
7	Janet	Wong	Integrated Planning (EG&S contact)	Region of Peel	Janet.Wong@peelregion.ca	Y	2
8	Jessica	McEachren	Ecologist, UFMP Project Lead Supervisor of Woodlands and Natural Areas	City of Mississauga	Jessica.McEachren@mississauga.ca	Y	4
9	Julie	Malette	Social/Community Health MES	York University	sabinejulie@gmail.com	Y	3
10	Karen	Hutchinson	MES II Student, York University	Caledon Countryside Alliance	karen@caledoncountryside.org	N	4
11	Karen	Morrison	Adjunct Professor, Faculty of Environmental Studies	York University	kmorriso@yorku.ca	N	F/R
12	Leesa	Fawcett	Associate Dean, Acting GPD, Associate Professor, Faculty of Environmental Studies	Headwaters Community in Action (HCIA)/York University	lfawcett@yorku.ca	N	3

	First Name	Last Name	Title/Department	Organization	Email	Y/N	Table
13	Les	Stanfield	Senior Research Biologist	MNR	les.stanfield@ontario.ca	Y	1
14	Lisa	Brusse	Manager, Landowner Outreach	CVC	lbrusse@creditvalleyca.ca	Y	3
15	Louise	Aubin	Manager, Environmental Health, Public Health, Health Services	Region of Peel	louise.aubin@peelregion.ca	Y	1
16	Mark	Howard	Team Leader, Long-term Planning (acting), Park Planning/Project Lead, Credit River Parks Strategy	City of Mississauga	Mark.Howard@mississauga.ca	Y	2
17	Martin	Bunch	Professor, Faculty of Environmental Studies	York University	bunchmj@yorku.ca	Y	F/R
18	Mary	Bracken	Environmental Specialist, Community Services Department, Environment Division	City of Mississauga	Mary.Bracken@mississauga.ca	Y	1
19	Michael	Hoy	Environmental Planner (Planning & Infrastructure Services)	City of Brampton	Michael.Hoy@brampton.ca	N	4
20	Mike	Puddister	Director, Restoration and Stewardship	Credit Valley Conservation (CVC)	MPuddister@creditvalleyca.ca	Y	F/R
21	Mitch	Harrow	MES II Student, Faculty of Environmental Studies	York University	m-harrow@rogers.com	Y	F/R
22	Neelam	Gupta	Manager, Hydrology and Hydraulics	Credit Valley Conservation (CVC)	ngupta@creditvalleyca.ca	N	4
23	Olav	Sibille	Planner, Long-term Planning Project Lead, Mississauga's Natural Heritage and Urban Forestry Strategy	City of Mississauga	Olav.Sibille@mississauga.ca	Y	2

	First Name	Last Name	Title/Department	Organization	Email	Y/N	Table
24	Paivi	Abernethy	Environment and Resource Studies	University of Waterloo	pkaberne@uwaterloo.ca	Y	1
25	Sara	Peckford	Environmental Progress Officer	Town of Caledon	Sara.Peckford@caledon.ca	N	3
26	Shelly	McKay	Direction, Communications and Development	Trees/Forest Ontario	smckay@treesontario.ca	Y	1
27	Susan	Jorgenson	Manager, Environmental Planning	City of Brampton	Susan.Jorgenson@brampton.ca	Y	3
28	Tatiana	Koveshnikova	Ecological Goods and Services Project Coordinator	Credit Valley Conservation (CVC)	tkoveshnikova@creditvalleyca.ca	Y	F/R
29	Vicky	McGrath	Humber Watershed Specialist (ecohealth)	Toronto Region Conservation Authority	VMcGrath@trca.on.ca	Y	3

Appendix E

FINAL INDICATORS MATRIX

Benefits to People	Security	Basic Materials for a good life	Health	Good Social Relations	Freedom of Choice & Action
Clean air			TRAFFIC PATTERNS/ MODES OF TRAFFIC		
Comfortable temperature			Air Quality		
Mitigation of adverse CC effects (long-term protection of people & property)			TRAFFIC PATTERNS		
Comfortable noise Level			TRAFFIC PATTERN		
Protection of people, property and soil from landslides and erosion hazards					
Protection of people and property from floods					
Clean water (Quality)					
Water Supply for drinking and other household, industrial and agricultural use (Quantity)					
Opportunities for active and passive recreation					
Opportunities for nature appreciation, relaxation and spiritual experience					
Educational opportunities and opportunities for taking action					
Opportunities for socializing; strong family, friendship and communities					
Food, including: a) agricultural products b) garden produce c) fish d) bushmeat e) Other "wild" food		BIRDS/ FISH			
Materials, including: a) fuel wood b) timber c) aggregate					
FINANCIAL WELL-BEING					
MENTAL HEALTH					
LEISURE TIME					
			TRAFFIC PATTERNS		

Appendix F

**PICTORIAL PRESENTATION OF THE
WORKSHOP ACTIVITIES**



Mike explaining the "what is/what has been" activity of the workshop



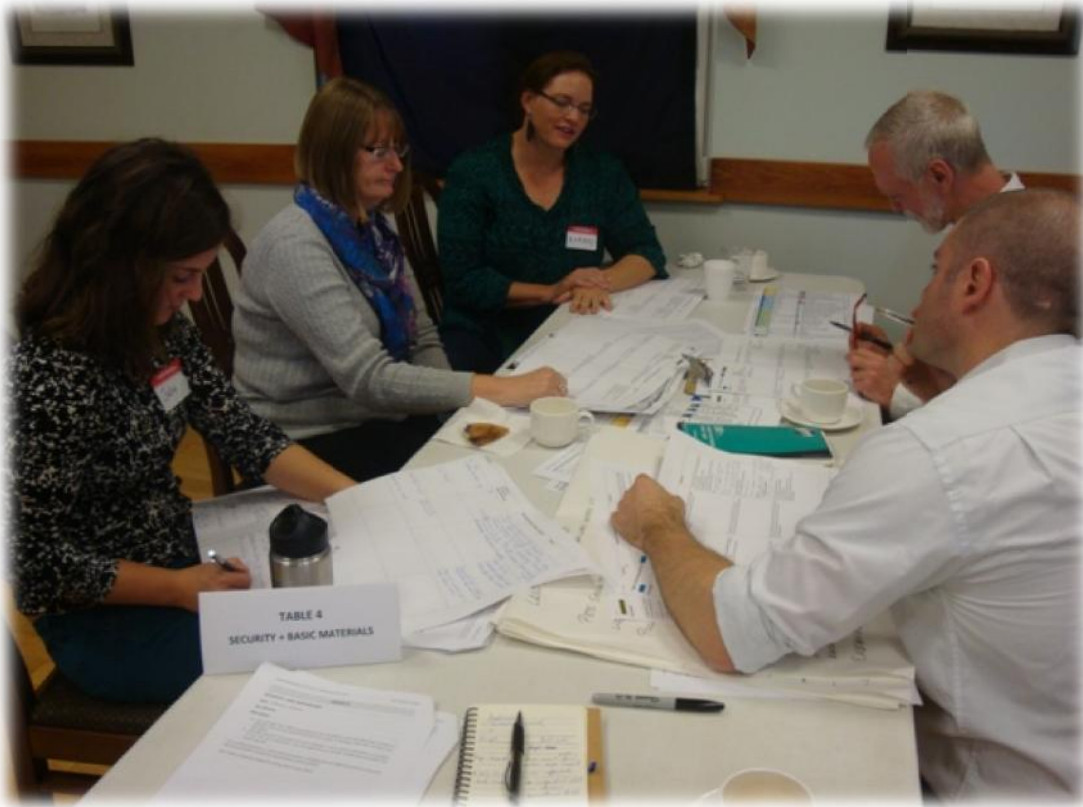
Tatiana continuing with the "what is/what has been" activity of the workshop



Martin also contributing to the "what is/what has been" activity of the workshop



Participants working in respective groups - "what could be" activity



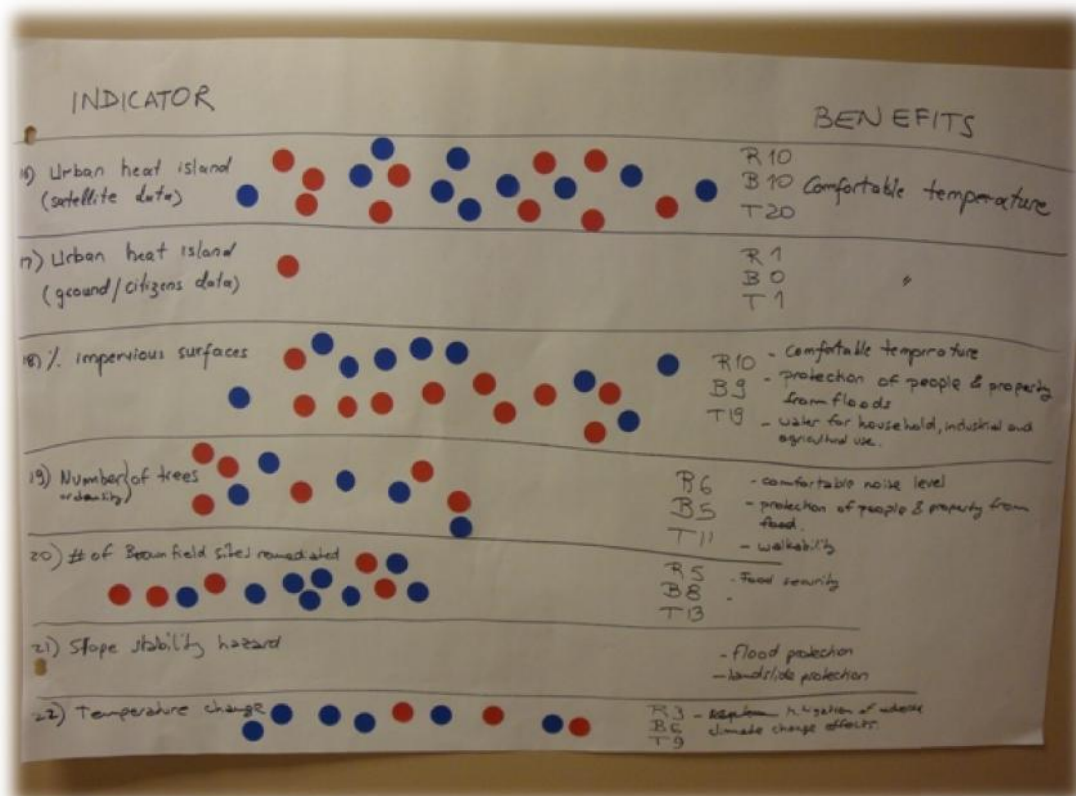
Another view of group discussions - "what could be" activity



Mike contributing to "what could be" activity discussions



Dotmocracy exercise - "what should be" activity



Some results of the Dotmocracy exercise

Appendix 2 List of Interviewees

Date	Method	Name	Position	Organization	Contact Details
01-May-15	In-person	Louise Aubin	Manager, Environmental Health	Region of Peel	7120 Hurontario Street, PO Box 669 Streetsville, Mississauga 905-791-7800 x 2479 louise.aubin@peelregion.ca
11-May-15	In-person	Michael Hoy	Environmental Policy Planner	City of Brampton	2 Wellington Street W, Brampton 905.874.2608 Michael.Hoy@brampton.ca
11-May-15	In-person	Mary Bracken	Environmental Specialist	City of Mississauga	201 City Centre Drive, Mississauga 905-615-3200 ext.4918 mary.bracken@mississauga.ca
14-May-15	In-person	Bob Morris	Manager, Natural Heritage	Credit Valley Conservation (CVC)	1255 Old Derry Road, Mississauga (905) 670-1615 BMorris@creditvalleyca.ca
14-May-15	In-person	Lisa Brusse	Manager, Landowner Outreach	Credit Valley Conservation (CVC)	1255 Old Derry Road, Mississauga 905.670.1615 ext 444 lbrusse@creditvalleyca.ca
15-May-15	In-person	Vicky McGrath	Humber Watershed Specialist	Toronto & Region Conservation Authority (TRCA)	101 Exchange Avenue, Vaughan VMcGrath@trca.on.ca

Date	Method	Name	Position	Organization	Contact Details
22-May-15	On phone	Donald Cole	Professor, Dalla Lana School of Public Health	University of Toronto	155 College St. Toronto 416-946-7870 donald.cole@utoronto.ca
26-May-15	In-person	Les Stanfield	Former, Senior Research Biologist/currently visiting professor	Ministry of Natural Resources and Forestry (MNRF)/Seneca College (King Campus)	13990 Dufferin St, King City les.stanfield@outlook.com
27-May-15	In-person	Carol Oitment	Policy Advisor	Ministry of Tourism, Culture and Sport	777 Bay Street, Suite 2302, Toronto (416) 314-7205 Carol.Oitment@ontario.ca
28-May-15	On phone	Shelley McKay	Director, Communications and Development	Forests Ontario	144 Front St. West, Suite 700, Toronto 416-646-1193 x. 232 smckay@forestsontario.ca
28-May-15	On phone	Gary Nielsen	Climate Change Coordinator	Ministry of Natural Resources and Forestry (MNRF)	300 Water Street, Peterborough 705 755 3286 gary.nielsen@ontario.ca
29-May-15	On phone	Jane Parmley	Epidemiologist	Public Health Agency of Canada	160 Research Lane, Suite 103, Guelph 519 400 8217 jane.parmley@phac-aspc.gc.ca

Date	Method	Name	Position	Organization	Contact Details
01-June-15	Email/In-person	David Culham	Former Councillor	Brueckner Rhododendron Gardens Stewardship Committee (BRGSC) - a stewardship group	905-608-2886 davidculham@rogers.com
03-June-15	In-person	Susan Jorgenson/ Anand Balram	Manager, Environmental Planning/Internee	City of Brampton	2 Wellington Street downtown Brampton 905-874-2054 Susan.Jorgenson@brampton.ca Anand.Balram@brampton.ca
10-June-15	On phone	Paivi Abernathy	Professor, Environment and Resource Studies	University of Waterloo	200 University Ave W, Waterloo 705-342-7474 pkaberne@uwaterloo.ca
10-June-15	In-person	Carolyn Bailey	Acting Executive Director (Associate Director)	EcoSource	6600 Falconer Drive, Mississauga 905-274-6222 cbailey@ecosource.ca
18-June-15	In-person	Brian Baird	Manager, Parks	Town of Caledon	6215 Old Church Road, Caledon 905-584-2272 Ext. 4209 brian.baird@caledon.ca
25-June-15	In-person	Eric Lucic	Team Leader, Park Planning - Park Assets	City of Mississauga	201 City Centre Drive, Mississauga 905-615-3200 ext.5372 Eric.Lucic@mississauga.ca

Date	Method	Name	Position	Organization	Contact Details
30-June-15	On Phone	Sylvia Cheuy	Volunteer	Headwaters Communities in Action	416-988-6887 (Direct Line) sylvia@tamarackcommunity.ca

Appendix 3 Informed Consent Form

INFORMED CONSENT FORM

Contacts:

If you have any questions about this research in general or your role in this study, please contact any of the following:

Martin Bunch Professor, Faculty of Environmental Studies York University bunchmj@yorku.ca	Tatiana Koveshnikova Ecological Goods and Services Project Coordinator Credit Valley Conservation (CVC) tkoveshnikova@creditvalleyca.ca
Iftekhar Ahmad MES candidate, Faculty of Environmental Studies York University eplanner@yorku.ca	Mike Puddister Director of Restoration and Stewardship Credit Valley Conservation (CVC) mpuddister@creditvalleyca.ca

Purpose of the Research

This research is a part of the York University and CVC's larger project on "Human Health and Well-being in the Credit River Watershed" and also a part of my MES major project. The overall intent of our research is to identify and communicate the relationships between watershed ecosystem health and human health and well-being in the Credit River Watershed. Semi-structured interviews will be conducted with stakeholders in different organizations such as the municipalities, the Region of Peel, the Ministry of Natural Resources etc. to further explore the indicators selected in the governance stakeholders' workshop held on November 6, 2014.

Role of the Research Participants

Your expert opinion in this survey is important to the successful completion of the research. We request you to please answer our questions to the best of your knowledge. The survey will take about 45 minutes. Your participation in the survey is entirely voluntary. You have the right to withdraw your participation anytime or not to answer any questions during the survey. This will not affect your relationship with York University and CVC. Should you wish to withdraw during the survey, the information obtained thus far will be discarded.

Confidentiality

All the answers will be recorded through digital audio device with your permission. Names of the interviewee will be kept in strictest confidence. The information obtained from you will be used solely for the York University and CVC's project and my research purposes. It will not be shared with other parties without your prior written consent. Transcripts of interviews may be retained or used in further related research.

This research has been carefully reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics Review Board and complies with the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, you may contact the Senior Manager and Policy Advisor for the Office of Research Ethics, 5th Floor, York Research Tower, York University, telephone 416-736-5914 or e-mail ore@yorku.ca.

I _____, consent to participate in the survey conducted by Iftekhar Ahmad (graduate researcher) using a semi-structured questionnaire. I permit/don't permit to use audio device. By signing this form, I will not waive any of my legal rights.

Signature: _____
(Participant)

Date: _____

Signature: _____
(Graduate Researcher)

Date: _____

Appendix 4 Semi-structured Questionnaire

INTERVIEW QUESTIONNAIRE

Interview No: _____

Date: _____

Name of the Interviewer:

Name of the Interviewee:

Name of the Organization:
York University

Name of the Organization:

Introduction of the Researcher

Hi. My name is Iftekhar Ahmad. I am a student of Master in Environmental Studies (MES) at York University. I am a graduate researcher on this project. I am conducting face to face interviews to collect additional information about the indicators identified through a governance stakeholders' workshop organized by CVC and York University on November 6, 2014. The purpose of the interview is solicit your expert opinion to help flesh out each indicator.

Selected Indicators

Air Quality	Traffic Patterns/Mode of Transportation	Land Cover Change	Urban Heat Island
% Imperviousness	% Canopy Cover	Water Quality Index	% People using Natural Space
Proximity to Green Space	Connectivity of Green Spaces	Access to Green Spaces	Wildlife (habitat)

QUESTIONS

Q.1) Can you tell me in your own words what is the strategic mandate of your organization?

Q.2) With respect to measuring progress toward this mandate, how relevant are the following indicators on a scale of 1-5, where 1 is not relevant and 5 is very relevant? Please also state the reasons for your responses.

Indicators	Relevance (1-5)	Why
Air Quality		
Traffic Patterns/Mode of Transportation		
Land Cover Change		
Urban Heat Island		
% Imperviousness		
% Canopy Cover		
Water Quality Index		
% People using Natural Space		
Proximity to Green Space		
Connectivity of Green Spaces		
Access to Green Spaces		
Wildlife (habitat)		

Q.3) Can you describe benefits of measuring an indicator to human health and well-being?

Indicators	General Benefits
Air Quality	
Traffic Patterns/Mode of Transportation	
Land Cover Change	
Urban Heat Island	
% Imperviousness	
% Canopy Cover	
Water Quality Index	
% People using Natural Space	
Proximity to Green Space	
Connectivity of Green Spaces	
Access to Green Spaces	
Wildlife (habitat)	

Q.4) Can you think of the specific benefits of measuring an indicator to vulnerable groups, such as infants/children, low income & homeless, seniors, people living off the land, new immigrants, first nations?

Indicators	Benefits to Vulnerable Groups
Air Quality	
Traffic Patterns/Mode of Transportation	
Land Cover Change	
Urban Heat Island	
% Imperviousness	
% Canopy Cover	
Water Quality Index	
% People using Natural Space	
Proximity to Green Space	
Connectivity of Green Spaces	
Access to Green Spaces	
Wildlife (habitat)	

Q.5) How would you describe weaknesses of each indicator?

Indicators	Weaknesses
Air Quality	
Traffic Patterns/Mode of Transportation	
Land Cover Change	
Urban Heat Island	
% Imperviousness	
% Canopy Cover	
Water Quality Index	
% People using Natural Space	
Proximity to Green Space	
Connectivity of Green Spaces	
Access to Green Spaces	
Wildlife (habitat)	

Q.6) How can each indicator be employed to improve human well-being?

Indicators	Use for Human Well-being	
	<i>By whom</i>	<i>For what purpose</i>
Air Quality		
Traffic Patterns/Mode of Transportation		
Land Cover Change		
Urban Heat Island		
% Imperviousness		
% Canopy Cover		
Water Quality Index		
% People using Natural Space		
Proximity to Green Space		
Connectivity of Green Spaces		
Access to Green Spaces		
Wildlife (habitat)		