THE NON-FINANCIAL IMPACTS OF CLIMATE CHANGE

Introduction

The impacts of climate change are largely communicated as direct costs of inaction to create a stronger reaction from government; indirect/non-financial effects are not considered as often. This "bottom line" mindset continues to be an issue within the post-secondary sector as there is no direct financial incentive for reducing greenhouse gases (GHG), though in Canada this will change April 2019.

Looking forward, climate change impacts need to be framed as issues that go beyond financial repercussions to include quality of life. When translating this to higher education this means proactively working to identify changes to the student experience and employee satisfaction and workloads, then adapt as needed.

Outside the home, school is the most influential environment on health and wellbeing[1]. Institutions have key roles to play in creating awareness and education on climate action, as they are partially responsible for preparing students for the uncertainty of life beyond the classroom. Furthermore, the current generation of students will be most impacted by climate change, with consequences playing an ever-increasing role in their life, either directly or indirectly.

This document outlines some of the non-financial related impacts of climate change. It does not represent an inclusive list, but outlines those relevant to higher education.

Mental Health

Until recently mental health effects were not typically associated with climate change impacts. Research connecting the two is becoming stronger, with evidence showing those with pre-existing conditions and individuals living in ecologically sensitive areas as being particularly at risk[2]. Keep in mind that mental health is complex and climate change is not the sole contributing factor though clear links are beginning to emerge[3].

In a post-secondary setting, the risks of climate change related mental health effects may include:

- A poor ability for youth, such as students and recent graduates, to cope with the negative impacts and thoughts surrounding climate change[4]. This reduced coping capacity increases susceptibility to mental illness[5].
- Increased vulnerability of mental illness in low-income individuals[6], such as students and recent graduates. This may be compounded because of limited financial support for treatment.
- The potential for enhanced aggression. A link between temperature and mental health is well established[7]. Warming temperatures activate the part of the brain responsible for emotional regulation[8], discomfort, and irritability; this in turn can (in part) cause increased hostility[9].
- The overarching threat of climate change can create feelings of despair[10] and hopelessness as individual actions seem insignificant compared to the scale of the problem[11]. These feelings increase the risk of self-harm, substance abuse, and suicide[12]. This may culminate in reduced motivation and quality of life, both in youth and adults.

Taken together, the mental health risks associated with climate change may pose an increased risk to students by affecting their attendance, graduation rate, motivation, and overall student experience. Similarly, mental health vulnerabilities can affect all age groups that extend beyond the typical student age demographic, including employees.

Post-Secondary Actions – Mental Health

Work with your Health Centre to understand what services can support climate change related mental health concerns.

Provide training for healthcare providers, such as psychological first aid and heat-related illness response[13].

Continue learning about mental health impacts related to climate change to help understand any capacity changes.

Work to provide green spaces and eco-areas that help improve positive mental health while also fostering a greater sense of community[14].

As an institution, the underlying message of climate change should be one that activates hope and empowers individuals; this helps move actions from thinking to implementing[15] while working to reduce despair and helplessness.

Physical Health

Traditional climate change health impacts focus on the physical health of individuals and communities. Physical health effects will differ between countries and regions, but overall predictions are ones of increased disease, heat-related illness, cardiovascular issues, and reduced nutrition[16], some of which may increase the risk of mental illness.

Below outlines some high-level physical health risks associated with climate change and how post-secondary institutions may be effected.

Increased Rates of Disease

- Vector-borne diseases such as Lyme disease and West Nile virus will increase due to an increase in breeding season length, changing habitats, abundance, activity, bite rate, and faster maturation[17]. In Canada, warming is causing already migration Northward of certain diseases[18]. These diseases cause serious, potentially long-term impacts to infected individuals, significantly reducing their quality of life. Additionally, the risk of vector-borne diseases can impede outdoor classroom learning and recreation.
- Food borne diseases (bacteria) may lead to increased recalls or sickness as warming temperatures may enhance reproduction[19].
- Different countries will experience a range of increases or decreases of disease rates and severity. This is important to keep in mind with the continued representation of international students in Ontario post-secondary institutions and potential travel issues, as was seen with Zika virus[20].
- Incidence of disease does not apply only to humans, but also forests and wildlife that can alter outdoor learning and recreational activities.

Heat and Air Pollution

- Overall, Ontario's air quality has significantly improved over the past decade[21]. Interestingly, rising average temperatures from climate change are usually followed by reductions in air quality[22] that can lead to lost work, reduced productivity[23], and added healthcare strain.
- Climate-related heat and air quality health issues include increases in asthma, allergies, respiratory issues, airway disease, cancer, heat illness and deaths, cardiovascular disease, stroke, dizziness, tiredness, lack of concentration, and headaches[24].
- Increased temperatures and therefore reduced air quality may lead to poor employee and student attendance that causes increased stress, reduced quality of life, or decreased outdoor activity for students, ground staff, and related maintenance and construction.
- Heat effects, and therefore air quality impacts, are worse in urban areas because of their ability to trap heat and increase temperatures further, amplifying effects.

Food and Nutrition

The effects of climate change on global food availability, selection, abundance, and price[25] are very concerning. Fortunately, Canada is relatively food secure. In the short term, small temperature increases may increase certain crop yields, including those grown in Ontario[26], due to longer growing seasons. Conversely, overall long-term predictions show instability in many crops globally due to extreme weather. Additionally, nutrient deficiencies are observed as CO2 levels increase[27].

With the critical role food and proper nutrition play in our overall health small shifts in food supply or price can have global impacts. Poor nutrition can play a role in worsening other climate change related impacts, such as increased vulnerability for disease, and mental and physical illness[28].

In the context of post-secondary institutions, particularly students, the possibility for reduced nutritional content and increases in food prices may lead poorer diets and sacrificing nutritious food for necessities such as housing, education-related costs etc. In turn, this increases the chances of poverty, which feeds directly to risks of physical and mental illness, and reduced productivity in the office and classroom[29].

Physical Activity

The majority of physical activity occurs outdoors[30], this ensures a warming world will alter our ability to participate in recreational activities. Modifications in outdoor activities may include; reduced winter sports due to warmer and shorter winters, earlier spring-related activities, longer periods for summer activities, which may be balanced by periods of reduced activity due to heat extremes, and reduced water activities because of increased water-borne bacteria and algae[31].

Interestingly, climate change may increase physical activity up to a certain temperature, though extreme hot and cold days are predicted to reduce physical activity levels[32]. Furthermore, other mental health-related effects of climate change, such as increased stress and anxiety[33] may also offset physical activity increases.

Physical activity is an important factor in student success, and a lack of regular activity can lead to reduced academic performance in students[34] and potentially staff performance, which could continue on a downward trend with continual warming.

Post-Secondary Actions – Physical Health

Offer relevant vaccination clinics to make disease protection convenient and accessible.

Work to incorporate and promote local, nutritious food both on campus and at home.

Create and promote, in conjunction with the health team, communications around extreme heat and air quality risks.

Offer promotions for students and employees for indoor physical activity in spring and summer months.

Service Disruption

Taken together, the effects of climate change in Ontario will interrupt business as usual operations. This may lead to unanticipated spending, budget changes, and increased staffing needs and expertise. From a post-secondary view, changes could include:

- Issues with road quality and upkeep due to more freeze-thaw cycles, added salting, or temperatures that delay maintenance and construction.
- Delays or stoppages in public transit because of more frequent extreme weather or worse road conditions that may influence student attendance.
- Strain on water and wastewater infrastructure due to extreme precipitation events causing added maintenance and expense at unpredictable times, in addition to increases in staff stress and workload.
- An added need for air conditioning to cope with warmer average weather and longer periods of heat. Moreover, increased electricity demand for cooling may result in power outages that reduce productivity, services, and learning.
- Erratic seasonal temperatures will make predicting heating and cooling schedules difficult and may require further staff to support, in addition to added and unstable costs.
- Reduced natural gas use for space heating due to warmer winters. Warmer winters may also reduce the amount of snow required for plowing, though snow is projected to be replaced with freezing rain and more extreme snowstorms. These transitions and extremes have the potential to reduce the total days institutions are open for students, and this can influence funding.
- Changes in national and international transportation may cause issues with time-sensitive deliveries and project implementation.
- Overall increases in deferred maintenance can be anticipated, as strain on equipment and infrastructure are closely tied to weather.
- In general, proactive planning will be more difficult, creating an even greater case for adaptation.

Post-Secondary Actions – Service Disruption

Adopt newer engineering codes, practices, and standards for new builds to avoid future upkeep and renovations.

Learn from failures and adapt/plan to avoid future occurrences.

Take a look at the upcoming seasons weather predictions to plan for supplies such as salt, plowing requirements etc.

Use energy software, such as RETScreen Expert, for energy projects to help predict utility consumption.

Employment Opportunities

Graduate employment is a high priority in the post-secondary sector. Forecasting the effects of climate change on future jobs is difficult due to the number of factors involved, but in general transitioning to a low-carbon economy and adapting to climate change will create new jobs in certain areas and reductions in others[35]. Most studies indicate that transitioning to a low carbon economy will result in a net increase in employment, but the number of jobs created throughout this evolution depends on investments into low carbon products and services[36]. Furthermore, anticipated changes to established jobs (scope, responsibility) are not well known. Fortunately, Canada's service sector is expected to be less sensitive to changes in climate, though significant changes in natural resource based jobs are likely[37]. Furthermore, stronger economies will have more options for adaptation, and this may reduce negative job-related impacts.

Due to limited planning and adaptation, there is a high vulnerability in areas including:

- Natural resources
- Insurance
- Tourism
- Construction
- Manufacturing
- Trade

Climate change impacts are anticipated to lead to additional jobs in the following areas:

- Infrastructure improvements
- Building codes
- Adaptation and resilience
- Energy management
- Renewable energy

Post-Secondary Actions – Employment Opportunities

Understand what program offerings are expected to lead to jobs in areas identified above as being vulnerable or created because of climate change.

Communicate to students potential job related impacts as the effects of climate change continue to manifest.

Depending on the severity of impacts, alterations to curriculum may be necessary.

Inequality

Inequality refers to status, rights, and opportunities not being equal in society[38]. Climate change is a compounding factor in inequality and is often an extension of discussions on climate change and poverty[39]. In this context, a cycle is created where initial inequality causes a disadvantaged group to suffer climate change effects disproportionately, resulting in greater inequality[40] that can be increased further due to limited coping and adaptation resources. A widening inequality gap may not refer solely to the gap itself, but also the number of people who experience inequality due to climate change.

Climate change inequality is occurring globally as countries that are responsible for extremely small fractions of emissions are not only faced with the most severe effects, but are the least equipped to properly respond and adapt.

Canada is not immune from climate-induced inequality, as Ontario's (particularly Toronto and the surrounding area) income-inequality is well understood[41]. Climate change has the ability to make this (and other types of inequality) worse as increases in inequality have direct impacts on education enrollment[42] and graduation rates. Additionally, amplified levels of inequality in part due to climate change may worsen the student experience by increasing physical and metal health issues because of financial strain or personal effects. This can result in reduced motivation, participation, retention, graduation, and employment[43] that widens the divide further to create a cycle of increasing inequality.

Post-Secondary Actions – Inequality

Simply understanding that there is a link between climate change and inequality is a great first step. This article does a good job of communicating global climate change related inequalities.

Consider a conversation with inclusivity and/or equality employees on campus. These employees will have a different perspective, network, and ideas for actions and goals to work toward to improve climate-related inequality proactively.

Potential Challenges

- Non-financial issues of climate change, though compelling, may not resonate with key institution stakeholders.
- Climate change will lead to added inconveniences, disruptions, and reactive responses to ensure fully functioning services; this can lead to climate change as a lower priority due to time sensitive, unanticipated events that need immediate action.
- Capacity to offer climate-related resources may be limited due to barriers such as funding.

Conclusion

The effects of climate change extend beyond financial impacts to alter overall quality of life and basic human needs. These impacts will be widespread, profound, and cumulative[44] and the post-secondary sector is not immune. Current student and employee stressors may be compounded or new ones created through disruption of basic operations, services, educational quality, and overall health and wellbeing. Singularly, climate change impacts may not have significant effects, but the connectedness of impacts can create severe and unanticipated negative effects. These issues create an opportunity to increase resilience and supports in preparation for incoming changes that may already be lacking, and to take responsibility for the future of our graduates.

[1] Sheffield, PE et al. (2017). Climate Change and Schools: Environmental Hazards and Resilience. International Journal of Environmental Research and Public Health. 14:1387. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5708036/#!po=0.434783
[2] Bourque, F. (2014). Climate Change: the next challenge for public mental health? International Review of Psychology. 26: 415-422. Accessed from https://www.ncbi.nlm.nih.gov/pubmed/25137107
[3] Intergovernmental Panel on Climate Change. (2014). Climate change 2014: Impacts, adaptations, and Vulnerability, Part B: Regional Impacts. Accessed from https://www.ipcc.ch/report/ar5/wg2/
[4] The Lancet Planetary Health. (2017). The impact of climate change on youth depression and mental health. 1: e94-e95. Accessed from https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196(17)30045-1.pdf
[5] The Lancet Planetary Health. (2017). The impact of climate change on youth depression and mental health. 1: e94-e95. Accessed from https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196(17)30045-1.pdf
[6] Gamble, JL et al. (2016). The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, Ch. 9: Populations of Concern. U.S. Global Change Research Program. Accessed from https://health2016.globalchange.gov/populations-concern
[7] Anderson, CA & DeLisi M. (2011). Implications of global climate change for violence in developed and developing countries. The psychology of social conflict and aggression (pp. 249–265).
[8] Plante, C et al. (2017). Effect of Rapid Climate Change on Violence and Conflict. Oxford Research Encyclopedias. Accessed from http://oxfordre.com/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-344#acrefore-9780190228620-e-344-bibItem-0012
[9] Anderson, CA & Bushman, BJ. (2002). Human aggression. Annual Review of Psychology. 53: 27–51.
[10] Kefford, R. (2006). Medical heat for climate change. Medical Journal of Australia. 184: 582. Accessed from https://www.mja.com.au/system/files/issues/184_11_050606/kef10410_fm.pdf
[11] Hayes, K et al. (2018). Climate change and mental health: risks, impacts and priority actions. International Journal of Mental Health Systems. 12: 28. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5984805/#CR29
[12] Burke, M et al. (2018). Higher temperatures increase suicide rates in the United States and Mexico. Nature Climate Change. 8: 723-729. Accessed from https://www.nature.com/articles/s41558-018-0222-x
[13] Hayes, K et al. (2018). Climate change and mental health: risks, impacts and priority actions. International Journal of Mental Health Systems. 12: 28. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5984805/
[14] Ebi, KL an d Semenza, JC. (2008). Community-Based Adaptation to the health Impacts of Climate Change. American Journal of Preventative Medicine. 35: 501-507. Accessed from https://www.ajpmonline.org/article/S0749-3797(08)00684-3/pdf
[15] Hayes, K et al. (2018). Climate change and mental health: risks, impacts and priority actions. International Journal of Mental Health Systems. 12: 28. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5984805/
[16] Public Health Agency of Canada. (2017). Science Narrative: Climate Change Impacts on the Health of Canadians. Government of Canada. Accessed from http://publications.gc.ca/collections/collection_2017/aspc-phac/HP5-122-2017-eng.pdf
[17] Public Health Agency of Canada. (2017). Science Narrative: Climate Change Impacts on the Health of Canadians. Government of Canada. Accessed from http://publications.gc.ca/collections/collection_2017/aspc-phac/HP5-122-2017-eng.pdf
[18] Habegger, S. (2014). Lyme Disease in Canada: An Update on the Epidemiology. National Collaborating Centre for Infectious Diseases. Accessed from https://nccid.ca/publications/lyme-disease-in-canada-an-update-on-the-epidemiology/
[19] Public Health Agency of Canada. (2017). Science Narrative: Climate Change Impacts on the Health of Canadians. Government of Canada. Accessed from http://publications.gc.ca/collections/collection_2017/aspc-phac/HP5-122-2017-eng.pdf
[20] Government of Canada. (2018). Travelling and Zika virus. Accessed from https://www.canada.ca/en/public-health/services/diseases/zika-virus/travelling-zika-virus.html
[21] Ministry of the Environmental and Climate Change. 92016). Air Quality in Ontario. Government of Canada. Accessed from http://www.airqualityontario.com/downloads/AirQualityInOntarioReportAndAppendix2016.pdf
[22] Orru, H et al. (2017). The Interplay of Climate Change and Air Pollution on Health. Current Environmental Health Reports. 4:504-513. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5676805/

[23] Health Effects Institute. (2018). State of Global Air 2018, Special Report. Accessed from https://www.stateofglobalair.org/sites/default/files/soga-2018-report.pdf
[24] Sheffield, PE et al. (2017). Climate Change and Schools: Environmental Hazards and Resilience. International Journal of Environmental Research and Public Health. 14:1387. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5708036/#!po=0.434783
[25] Dalhousie University. (2018). Canada's Food Pricing Report 2019. Accessed from https://cdn.dal.ca/content/dam/dalhousie/pdf/management/News/News%20&%20Events/Canada%20Food%20Price%20Report%20ENG%202019.pdf
[26] Cabas, J et al. (2010). Crop yield response to economic site and climatic variables. Climate Change. 101:599-616. Accessed from https://www.researchgate.net/profile/Alfons_Weersink/publication/225339783_Crop_yield_response_to_economic_sit_and_climatic_variables/links/09e415109d8e30fb25000000.pdf
[27] Myers, SS et al. (2017). Climate Change and Global Food Systems: Potential Impacts on Food Security and Undernutrition. Annual Review of Public Health. 38:259-277. Accessed from https://www.annualreviews.org/doi/full/10.1146/annurev-publhealth-031816-044356
[28] Gundersen, C and Ziliak, JP. (2015). Food Insecurity and Health Outcomes. Health Affairs. Accessed from https://www.healthaffairs.org/doi/10.1377/hlthaff.2015.0645
[29] Florence, MD et al. (2008). Diet Quality and Academic Performance. Journal of School Health. 78:209-215. Accessed from https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1746-1561.2008.00288.x
[30] Dannenberg, AL et al. (1989). Leisure time physical activity in the Framingham Offspring Study description, seasonal variation, and risk factor correlates. American Journal of Epidemiology 129: 76– 88.
[31] Public Health Agency of Canada. (2017). Science Narrative: Climate Change Impacts on the Health of Canadians. Government of Canada. Accessed from http://publications.gc.ca/collections/collection_2017/aspc-phac/HP5-122-2017-eng.pdf
[32] Obradovich, N et al. (2017) Climate change may alter human physical activity patterns. Nature Human Behaviour. Accessed from https://dash.harvard.edu/bitstream/handle/1/36874928/climate_exercise_nature_human_behaviour_revisions_round_3.pdf?sequence=4
[33] Doherty, TJ and Clayton, S. (2011). The psychological impacts of global climate change. American Psychologist. 66: 265- 276. Accessed from https://www.apa.org/pubs/journals/releases/amp-66-4-265.pdf
[34] Hillman, CH et al. (2008). Be smart, exercise your heart: Exercise effects on brain and cognition. Nature Reviews Neuroscience. 9: 58– 65. Accessed from https://www.ncbi.nlm.nih.gov/pubmed/18094706
[35] International Labour Organization. (2018). Climate change and jobs. Accessed from https://www.ilo.org/global/topics/green-jobs/areas-of-work/climate-change/lang--en/index.htm
[36] International Labour Organization. (2018). Climate change and jobs. Accessed from https://www.ilo.org/global/topics/green-jobs/areas-of-work/climate-change/lang--en/index.htm
[37] Natural Resources Canada. (2015). Overview of Climate Change in Canada. Government of Canada. Accessed from https://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/ch2/10321
[38] Department of Economic ad Social Affairs. (2015). Concepts of Inequality. United Nations. Accessed from http://www.un.org/en/development/desa/policy/wess/wess_dev_issues/dsp_policy_01.pdf
[39] Islam, SN and Winkel, J. (2017). Climate change and Social Inequality. Department of Economic and Social Affairs. Accessed from https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf
[40] Islam, SN and Winkel, J. (2017). Climate change and Social Inequality. Department of Economic and Social Affairs. Accessed from https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf
[41] The Conference Board of Canada. (2017). Income Inequality. Accessed from https://www.conferenceboard.ca/hcp/provincial/society/income-inequality.aspx
[42] Frenette, M. (2017). Post-Secondary Enrolment by Parental Income: Recent National and Provincial Trend. Economic Insights, Statistics Canada. Accessed from https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2017070-eng.htm
[43] Statistics Canada. (2015). Employment rates, by educational achievement. Government of Canada. Accessed from https://www150.statcan.gc.ca/n1/pub/71-222-x/2008001/sectionf/f-education-eng.htm
[44] Bourque, F and Willox, AC. (2014). Climate change; the next challenge for public mental health? International Review of Psychiatry. 26: 415-422. Accessed from https://www.ncbi.nlm.nih.gov/pubmed/25137107