

**CLIMATE CHANGE EDUCATION: AN EXPLORATION OF CURRICULUM
ENACTMENTS IN CANADIAN POST-SECONDARY EDUCATIONAL INSTITUTIONS**

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ABSTRACT

Climate change is indisputably one of the most pressing issues of our time. This dissertation is a study of curricula in Canadian Post-Secondary Institutions (PSIs). I conducted a survey of 225 PSIs for climate change courses during the calendar year of 2014-2015 and then focus on four PSIs with climate change programs to explore factors influencing processes of formation and implementation of climate change curricula. This research draws upon elements from literature in climate change policy, cultural studies, and curriculum studies to understand the formation of climate change programs. The study seeks to deepen understanding of institutional change in what I believe is unprecedented times. The first part of this study uses a combination of quantitative and qualitative content analysis of course syllabi. Courses were coded according to their focus into Tiers-of-Concentration and Streams according to their area/discipline of concentration. The second part of this dissertation includes a series of in-depth interviews with climate change program creators, administrators, directors, faculty and faculty committee members in particular PSIs. My selection of four PSIs is based on their programs —these institutions offer undergraduate and graduate climate change programs— as well as their institutional reputations, inclinations and characters. Interviews with curricula innovators reveal some features shaping climate change curricula formation. I focus on four features: (1) The emergence of climate ‘champions’ in bureaucratic procedures; (2) The culture of economics; (3) Disciplinary allegiances; and (4) Climate leanings. My study seeks to better understand climate change curricula innovations and cultures with a commitment to the importance of PSIs as sources of climate change expertise and leadership within democratic societies.

DEDICATION

To my family, Fabricio, Mariana and Alejandro, for their support, patience and love!

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I would like to thank my supervisor, Dr. Steve Alsop. None of this work would have been possible without his guidance, patience and wisdom. He not only gave me the opportunity to explore my interests but also continuously re-directed my compass, when I was going off course or wandering towards uncertain paths. I would like to thank him for his time. My research went from New Schools to citizen science education, to post-secondary education since I started. Not only he dedicated a significant amount of time, sharing with me his thoughts about each one of these fields, but also introduced me to multiple schools of thoughts, concepts and ideas, which have helped shape my way of thinking and my perceptions about education. I want to thank him especially for the opportunity to learn from him while teaching a course in Colombia. This experience has given my life new meanings.

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TABLE OF CONTENTS

| | |
|--|------|
| ABSTRACT | ii |
| DEDICATION | iii |
| ACKNOWLEDGEMENTS | iv |
| LIST OF TABLES..... | viii |
| LIST OF FIGURES..... | ix |
| LIST OF ACRONYMS | xii |
| CHAPTER 1.0 - Introduction..... | 1 |
| 1.1 Overview..... | 1 |
| 1.2 Significance of the Problem..... | 3 |
| 1.3 Research Questions..... | 7 |
| 1.4 Dissertation Outline | 8 |
| CHAPTER 2.0 - Climate Change, National and International Agreements and Post-Secondary Educational Institutions..... | 10 |
| 2.1 Post-Secondary Education and Recent International Climate Change Policies | 10 |
| 2.2 Post-Secondary Educational Institutions’ (PSIs) Responses to Global, Federal, and Provincial Climate Change Policies and Plans | 24 |
| CHAPTER 3.0 – Literature Review and Theoretical Framework | 47 |
| 3. 1 Overview of Climate Change Curriculum in Post-Secondary Educational Institutions (PSIs)..... | 54 |
| CHAPTER 4.0 - Methodology | 65 |
| 4.1.1 Phase One: Census of Canadian Climate Change Curriculum | 66 |
| 4.1.2 Course Analysis | 69 |
| 4.1.3 Quantitative Analysis..... | 71 |
| 4.2 Phase Two: Cultural and Political Study | 72 |
| 4.2.1 Institutional Selection | 72 |
| 4.2.2 Interviews and Data Analysis. | 72 |
| CHAPTER 5.0 - Climate Change Curricula in Canadian Post-Secondary Educational Institutions (PSIs)..... | 74 |
| 5.1 National Sample Overview | 74 |
| 5.2 Provincial Overview | 80 |
| 5.3 Institutional Overview | 117 |
| 5.4 Results Summary | 120 |
| CHAPTER 6.0 - Climate Change Curriculum Formation in Post-Secondary Educational Institutions (PSIs)..... | 123 |
| 6.1 Climate Change Programs in Canadian PSIs..... | 124 |
| 6.1.1 University of Victoria | 124 |
| 6.1.2 University of Waterloo | 129 |
| 6.1.3 University of Toronto | 135 |
| 6.1.4 York University | 139 |

| | |
|---|-----|
| 6.2 Factors that influence the formation of climate change curricula in Canadian PSIs | 143 |
| 6.2.1 Climate ‘Champions’ in Bureaucratic Procedures..... | 144 |
| 6.2.2 Culture of Economics | 149 |
| 6.2.3 Disciplinary Allegiances | 155 |
| 6.2.4 Climate Leanings | 161 |
| CHAPTER 7.0 – Discussion and Conclusions | 164 |
| 7.1 Climate Change Courses and Programs in Canadian PSIs | 165 |
| 7.1.1 What courses exist?..... | 165 |
| 7.1.2 Where are these courses found and what do they contain? | 167 |
| 7.1.3 What are some of the patterns regarding the distribution and content of these courses? | 170 |
| 7.2 Factors that Influence the Formation of Climate Change Curricula..... | 174 |
| 7.2.1 What are factors that selected curriculum leaders identify as significant in curriculum formation in their respective institutions?..... | 174 |
| 7.2.2 How is climate change curriculum influenced by faculty members’ expertise? | 178 |
| 7.2.3 How are climate change courses influenced by broader institutional, provincial or/and international policies? | 179 |
| 7.3 Limitations | 182 |
| 7.4 Recommendations..... | 184 |
| 7.4.1. Recommendations for Policy and Practice | 184 |
| 7.4.2. Recommendations for Future Research | 186 |
| 7.5 Ending | 189 |
| ENDNOTES..... | 191 |
| BIBLIOGRAPHY | 194 |
| Appendix A | 224 |
| Appendix B | 237 |
| Appendix D | 238 |
| Appendix E..... | 239 |
| Appendix F..... | 243 |
| Appendix G | 244 |
| Appendix H..... | 248 |
| Appendix I..... | 255 |
| Appendix J..... | 257 |
| Appendix K | 258 |
| Appendix L..... | 259 |

LIST OF TABLES

| | |
|---|-----|
| Table 1: Timeline of events that have shaped (and continue shaping) CCE. Particular events in Canada have been added to this table | 11 |
| Table 2: Ranking of PSIs large facilities based on 2014 GHG Emissions (kt CO ₂ eq.). Emission rank numbers are in comparison to other large facilities in Canada. Data from Environment and Climate Change Canada (2016g). | 32 |
| Table 3: Canadian PSIs that offered 20+ climate change courses during the calendar year 2014-2015 (Enrolment numbers were extracted from *Universities Canada and **each PSI's website) (Universities Canada, 2016). | 76 |
| Table 4: Total of climate change courses offered by public and private Canadian PSIs during the calendar year of 2014-2015 | 82 |
| Table 5: Climate change courses distribution per level in Canadian PSIs (UG: Undergraduate; GR: Graduate; DE: Continuing Education, Distance Education, Certificate Programs)..... | 83 |
| Table 6: Tiers of concentration of climate change courses per province in Canadian PSIs. Numbers offered by colleges and universities. Streams are displayed in percentages (%).. | 84 |
| Table 7: Canadian, Provincial and Territorial Emissions, Legislation and Status Update. | 224 |
| Table 8: Climate Change Education Streams (Categorized based on the field or discipline and the area or of study) | 238 |
| Table 9: Sample of coding when a climate change course fit in two or more streams..... | 243 |
| Table 10: List of Faculties and Departments that offered climate change courses during the calendar year of 2014-2015. Classified by clusters (A: Arts; B: Business; GS: Graduate Studies; H&SC: Humanities & Social Sciences; L: Law; S&T: Science & Technology; O: Other) | 244 |
| Table 11: List of all Post-Secondary Educational Institutions (PSIs) included in this study (n=225)..... | 248 |
| Table 12: HDCC List of Courses (Core and electives) (University of Victoria, 2016a)..... | 257 |
| Table 13: Master of Environmental Science Program (Climate Change Impact Assessment) and PhD (Climate Change and Environment) (University of Toronto, 2016b, pp. 466-467).. | 258 |
| Table 14: Certificate in Sustainable Energy, Bachelor in Environmental Studies, Honours Degree (FES, 2016, p. 41). | 259 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1: Provincial and Territorial GHG Emissions (1990, 2005 and 2014) in Mt CO ₂ eq. and 2020 Targets. The Territories have not set a 2020 Target, but the Northwest Territories established a 2030 target - shown in the graph. Data from Environment and Climate Change Canada’s ‘Environmental Indicators’ and ‘Ministerial Briefing Book’ (2016f; 2016i). | 37 |
| Figure 2: Climate Change Courses Distribution in Canadian PSIs during the calendar year 2014-2015. A: Range of number of courses offered per PSI; B: College and universities (%) with climate change courses; C: Percentage of climate change courses by college and university. | 75 |
| Figure 3: CCE Streams in Canadian PSIs during the calendar year of 2014-2015 | 77 |
| Figure 4: Distribution of climate change courses offered by faculties and departments in Canadian PSIs (n=104) during the calendar year of 2014-2015..... | 78 |
| Figure 5: Climate change courses offered by departments in Canadian PSIs (n=104) during the calendar year of 2014-2015 | 79 |
| Figure 6: Percentage of Climate Change Courses offered by Canadian PSIs per Province during the calendar year of 2014-2015..... | 80 |
| Figure 7: Percentage of PSIs offering climate change courses per Province during the calendar year 2014-2015 (n=number of courses)..... | 81 |
| Figure 8: Faculties and departments offering climate change courses in Canadian PSIs during the calendar year of 2014-2015 (It is important to note, that in order to represent provinces and territories with a lower occurrence the courses, all pies were left at an equal size). | 86 |
| Figure 9: Climate change education streams per province and territory offered in climate change courses at Canadian PSIs during the calendar year 2014-2015. | 87 |
| Figure 10: CCE Streams in Alberta's PSIs offering climate change courses during the Calendar year 2014-2015 | 88 |
| Figure 11: Tiers of Concentration of Climate Change Courses in Alberta during the calendar year of 2014-2015..... | 89 |
| Figure 12: CCE Streams in British Columbia's PSIs offering climate change courses during the calendar year 2014-2015..... | 91 |
| Figure 13: Tiers of Concentration of Climate Change Courses in British Columbia during the calendar year of 2014-2015 | 92 |
| Figure 14: CCE Streams in Manitoba's PSIs offering climate change courses during the calendar year of 2014-2015 | 94 |

| | |
|---|-----|
| Figure 15: Tiers of Concentration of Climate Change Courses in Manitoba during the calendar year of 2014-2015 | 95 |
| Figure 16: CCE Streams in New Brunswick during the calendar year of 20104-2015 | 96 |
| Figure 17: Tiers of Concentration of Climate Change Courses in New Brunswick during the calendar year of 2014-2015 | 97 |
| Figure 18: CCE Streams in NL's PSIs offering climate change courses during the calendar year of 2014-2015 | 98 |
| Figure 19: Tiers of Concentration of Climate Change Courses in NL during the calendar year of 2014-2015 | 99 |
| Figure 20: CCE Streams in Nova Scotia's PSIs during the calendar year of 2014-2015 | 100 |
| Figure 21: Tiers of Concentration of Climate Change Courses in Nova Scotia during the calendar year of 2014-2015 | 101 |
| Figure 22: CCE Streams in the Northwest Territories' PSIs offering climate change courses during the calendar year of 2014-2015 | 102 |
| Figure 23: Tiers of Concentration of Climate Change Courses in Northwest Territories during the calendar year of 2014-2015 | 103 |
| Figure 24: CCE Streams of Climate Change Courses in Nunavut during the calendar year of 2014-2015 | 104 |
| Figure 25: Tiers of Concentration of Climate Change Courses in Nunavut during the calendar year of 2014-2015 | 105 |
| Figure 26: Tiers of Concentration of Climate Change Courses in Ontario during the calendar year of 2014-2015 | 106 |
| Figure 27: CCE Streams in Ontario's PSIs offering climate change courses during the calendar year of 2014-2015 | 107 |
| Figure 28: CCE Streams in Prince Edward Island's PSIs during the calendar year of 2014-2015 | 109 |
| Figure 29: Tiers of Concentration of Climate Change Courses in Prince Edward Island during the calendar year of 2014-2015 | 110 |
| Figure 30: CCE Streams in Quebec's PSIs during the calendar year of 2014-2015 | 111 |
| Figure 31: Tiers of Concentration of Climate Change Courses offered in Quebec's PSIs during the calendar year of 2014-2015 | 112 |

| | |
|---|-----|
| Figure 32: CCE Streams in Saskatchewan's PSIs offering Climate Change Courses during the calendar year of 2014-2015 | 113 |
| Figure 33: Tiers of Concentration of Climate Change Courses in Saskatchewan's PSIs during the calendar year of 2014-2015 | 114 |
| Figure 34: CCE Streams in Yukon's PSIs offering climate change courses during the calendar year 2014-2015 | 115 |
| Figure 35: Tiers of Concentration of Climate Change Courses in Yukon's PSIs during the calendar year of 2014-2015 | 116 |
| Figure 36: Canadian PSIs with Climate Change Courses who are signatories of UCPCCSAC, have Climate Action Plans (CAP), or policies/strategies addressing sustainability and/or climate change. | 119 |
| Figure 37: Streams, tiers of concentration and level of climate change courses offered by the University of Victoria during the calendar year of 2014-2015..... | 128 |
| Figure 38: Streams, tiers of concentration and level of climate change courses offered by the University of Waterloo during the calendar year of 2014-2015..... | 134 |
| Figure 39: Streams, tiers of concentration and level of climate change courses offered by the University of Toronto during the calendar year of 2014-2015..... | 138 |
| Figure 40: Streams, tiers of concentration and level of climate change courses offered by York University during the calendar year of 2014-2015 | 142 |

LIST OF ACRONYMS

| | |
|-----------------|---|
| AB | Alberta |
| ACUPCC | American College & University President’s Climate Commitment |
| ANT | Actor Network Theory |
| AR5 | Fifth Assessment Report of the Intergovernmental Panel on Climate Change |
| ASSHE | Association for the Advancement of Sustainability in Higher Education |
| BC | British Columbia |
| BAU | Business as usual |
| CO ₂ | Carbon Dioxide |
| CCE | Climate Change Education |
| DE | Courses offered through Distance Education, Continuing Education and Certificate Programs |
| EE | Environmental Education |
| ESD | Education for Sustainable Development |
| FAR | First Assessment Report |
| GHESP | Global Higher Education for Sustainability Partnership |
| GHGs | Greenhouse Gases |
| GR | Graduate Level Courses |
| GUNI | Global University Network for Innovation |
| IARU | International Alliance of Research Universities |
| IPCC | Intergovernmental Panel on Climate Change |
| ISCN | International Sustainable Campus Network |
| NGO | Non-Governmental Organization |
| NRCan | Natural Resources Canada |
| MB | Manitoba |
| NB | New Brunswick |
| NEG-ECP | New England Governors and Eastern Canadian Premiers |
| NL | Newfoundland and Labrador |
| NS | Nova Scotia |
| ON | Ontario |
| PE | Prince Edward Island |
| PSIs | Post-Secondary Educational Institutions |
| QC | Quebec |
| SAR | Second Assessment Report |
| SK | Saskatchewan |
| STARS | Sustainability Tracking, Assessment and Rating System |
| UCPPCSAC | University and College Presidents’ Climate Statement of Action for Canada |
| UG | Undergraduate Level Courses |
| ULSF | Association of University Leaders for a Sustainable Future |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WDI | World Development Indicators |

WG Working Group of the IPCC (I, works on science; II, works on impacts,
adaptation and vulnerability; III, works on mitigation)

YK Yukon

CHAPTER 1.0 - Introduction

One of the perennial problems of studying curriculum is that it is a multifaceted concept constructed, negotiated, and renegotiated at a variety of levels and in a variety of arenas. This elusiveness has no doubt contributed to the rise of theoretical and overarching perspectives — psychological, philosophical, and sociological — as well as more technical or scientific paradigms. But these perspectives and paradigms have been criticized recurrently because they do violence to the practical essentials of curriculum as conceived of and realized (Goodson I. , 1989, p. 1).

Colleges and universities also have an opportunity to lead by example, by taking action to reduce our own contributions to global warming... because actions on our campuses have unique value in society: they have a built-in multiplier effect (Rappaport & Hammond Creighton, 2007, pp. xiv, Foreword by Lawrence S. Bacow, President, Tufts University)

1.1 Overview

This dissertation is a study of climate change curricula in Canadian Post-Secondary Educational Institutions (PSIs). My use of the term PSI refers to colleges, universities, and institutes across Canada, which offer tertiary education, and confer an academic or professional degree or offer non-degree programs (often referred as continuing education programs). My study focuses on climate change “intended curricula” (Porter, 2006), which “reveals the instructional content targets” (Kurz et al., 2010, p. 132). Faculty, departments, and committees develop curriculum predominately in the form of courses and programs with the purpose to further knowledge and expertise about climate change. The first stage of my study is a quantification and textual analysis of 562 curriculum syllabi; these are mostly in the form of course outlines. In the second stage, I then seek explanations for the patterns illuminated in the earlier analysis. This part involves a series of interviews with key curriculum and program instructors and leaders.

I recognise my analysis as political and social. It is political, because there are “political implications [on] every act and fact” (Prindle, 2015, p. 1). It is social, because I believe that “curriculum [should be considered] as a social construct” (Goodson I. , 1989, p. 1). In this regard, this study departs from a traditional representation and analysis of curriculum taken-up as a rational and logical prescription of self-evidently necessary content. In what follows, I acknowledge the sociocultural and political contexts in which curriculum is “constructed, negotiated and renegotiated” (Goodson, *ibid.* p. 1).

My research is a grounded empirical study of curriculum and offers reflections on processes of curriculum formation — the ways that curriculum formation might be conceived as a series of enactments in specific contexts. Enactments are considered here as the “creative process of interpretation and recontextualization ... [as well as] the abstractions of policy [and program] ideas into contextualized practices” (Ball et al., 2012, p. 3). In curriculum building, I am attentive, specifically, to the adoption of climate change policies and other initiatives at the institutional and regional level. My study also pays close attention to those enactments that are produced by means other than more generalised institutional “policy-making”. With the idea to represent and better understand curriculum origins and formations (whether they are founded in local politics or institutional economics), I focused my attention on those places in Canadian PSIs where responses to climate change education (CCE) seem to be greatest. To understand what shapes the adoption of CCE programs and policies in selected PSIs, I conducted and analysed a series of interviews in which selected PSI members were asked to reflect on curriculum formation within their particular institutions. My study wishes to better understand climate change curriculum innovations and obstacles with a commitment to the importance of PSIs as sources of expertise and leadership

within democratic societies. In what follows I focus on curriculum within particular empirical parameters. I also, of course, recognize the complexities of PSIs who are responding to climate change in a multiplicity of diverse and dynamic ways. These include student projects and actions, student organizations, campus services and operations, faculty and research communities, outreach initiatives, administration-led reforms and many other initiatives. This study is focused solely on processes of academic curriculum creation. It therefore presents a partial picture, which nevertheless I think is important for a host of different reasons that I elaborate in the following pages.

1.2 Significance of the Problem

Tipping points, thresholds, points of no return, projections, and future scenarios, are some of the terms frequently associated with the current global climate. Although scientists established the influence of greenhouse gases (GHGs) on the Earth's temperatures in the late 1800s and relationships between the industrialization and changing climate systems in the late 1950s, climate change and climate science remains controversial.ⁱ Indeed it is now labelled and treated as a 'hoax' by some high-profile political leaders.

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as:

a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer (2007, p. 30)

In accordance with the IPCC definition, I accept that “warming of the climate system is unequivocal,” “unprecedented,” and “human” induced (IPCC, 2014c, p. 2). In addition to the warming effects, the input and accumulation of anthropogenically produced GHGs have dire consequences to natural and human systems (such as ocean acidification, sea level rise, and extreme weather events, all of which ultimately affect biodiversity) (IPCC, 2014c). In light of these consequences, tipping points and other epithets become unquestionably important. The latest global resolution (known as the Paris Agreement) made at the 21st Conference of the Parties (COP 21) provoked a tepid reaction. Some climate scientists, high profile individuals, politicians and NGO representatives pronounced their discontent because the efforts proposed by Nation members to keep global temperatures under 1.5° C are not equivalent to the recommended actions (Carbon Brief, 2016; The Nation, 2015; CBC, 2015b; McKibben, 2015).

This dissertation seeks to explore responses of PSIs to climate change, taking into consideration the following factors: (1) the extent in which climate change impacts humans (and non-humans) globally; (2) continuous global political discussions around climate change; and, (3) claims that PSIs make through their mission statementsⁱⁱ in regards to their roles within societies.

Orr (1994) makes an appeal to educational institutions: “We are still educating the young as if there were no planetary emergency...” He continues by persuasively arguing that the crisis that we are presently facing is not a crisis of ecology, but “first and foremost one of mind, perception and values; hence, it is a challenge to those institutions presuming to shape minds, perceptions and values” (pg. 27). In their paper, *Interpretation as Adaptation: Education for Survival in Uncertain Times*, Gough and Stables (2012) argue:

both individuals and (some at least would argue) institutions can learn. They can imitate, reject, experiment and abandon. They can imagine, believe and suppose. In short, and as we have already noted, they can fashion multiple certainties out of uncertainty, though they remain inescapably vulnerable to unforeseen, and unforeseeable, surprises. This can only happen, of course, if institutions are left free to change in such ways (p. 380).

My interest in this dissertation, turning to Gough and Stables (2012) words, is how PSIs learn, grow or evolve in the context of climate change. I am interested in better understanding some of the parameters shaping the processes of curriculum formation and growth — how CCE comes into being and place in PSIs.

At the beginning of this study, I was confronted with Aldo Leopold's idea of the purpose of post-secondary education as "cog[s] in an ecological mechanism" (1966, p. 210). At the onset, it became apparent to me that the number of climate change curriculum initiatives in Canadian PSIs is surprisingly small. Stirred by Leopold and Orr, I was then challenged to consider a series of foundational questions and assumptions: What is higher education for? What roles should PSIs have in Canadian contemporary democratic societies? Furthermore, should PSIs' graduates be expected to make informed decisions (whether personal, societal, or global) in regards to climate change in particular if their pass through PSIs does not provide the basis to inform their choices?

There is little doubt that climate change provokes dynamic and significant societal responses across the globe, both in favour and against. Those strongly in favour include high-profile politiciansⁱⁱⁱ and officials,^{iv} journalists and scientists.^v Some of these individuals' pronouncements

address the ostensible knowledge gaps caused by a continuous state of the debate. Such is the case of The Guardian newspaper's former Editor in Chief, Alan Rusbridger, who, in an unusual fashion, challenged his team of writers to "find a new way to report on climate change" (The Guardian, 2015, Environment Section, para. 1). In response, in March 2015, The Guardian launched a series of podcasts called 'The Biggest Story in the World' and a campaign called 'Keep it in the ground.' The campaign adopted an unquestionably political stance and has gained ample popularity since its launch.

In the introduction to *This Changes Everything*, Naomi Klein (2014) outlines how she suffered for many years from a form of climate denial - a propensity to "look away" (p. 3). As I reflect on her introduction, I wonder if PSIs are guilty of enacting a form of climate denial? Are they looking away? I recognise that climate change has become so heavily politicized, especially over the past decade, and I can imagine that departments and faculties are likely facing some challenges in establishing CCE programs because of the hotly political nature of the topic. Nevertheless, I consider CCE in PSIs as fundamentally important. My hope is that this dissertation offers insight into curriculum formation such that it might assist others in bringing about necessary, essential and lasting curriculum reforms.

This is not a traditional curriculum study. My research draws elements from frameworks of climate change policies, cultural studies, and curriculum studies in order to understand 'what' courses contain as well as 'why' and 'how' they contain this. I do not consider the "effectiveness" (Blauch, 1933, p. 255) of these courses in terms of a series of learning outcomes. My study analyses the content of courses and programs but maintains the idea that the core of these climate change

courses was influenced by both internal and external factors, ranging from the individual/departmental/faculty/institution to broader jurisdictional economic/political factors. In this regards, this study sought to understand PSI's "system of representational practices whereby social meaning is produced and reproduced, communicated and interpreted, asserted and opposed" (Roberts, 2010, p. 171). I also consider the influence that institutional assumptions around climate change issues have on CCE curricula. Finally, taking into consideration prevailing epistemologies in regards to climate change, this research tried to understand what areas of CCE are more predominant and if these have any discernable geographical particulars and particularities.

1.3 Research Questions

My dissertation explores two sets of research questions. The first set of questions might be conceived as a mapping or auditing of Canadian curriculum landscape. This audit includes an Internet search of climate change course offerings, followed by descriptive statistics and a content analysis of available climate change course syllabi. This stage of research was driven by the following questions:

1. What climate change courses are there currently in Canadian PSIs?
 - What courses exist?
 - Where are these courses found and what do they contain?
 - What are some of the patterns regarding the distribution and content of these courses?

The second set of questions concerns curriculum formation. I seek to explore some of the influences and politics associated with the creation of selected climate change programs and courses. The questions that guided this qualitative part of the research are:

2. What are some of the factors influencing climate change curriculum formation in Canadian PSIs?

- What are factors that selected curriculum leaders identify as significant in curriculum formation in their respective institutions?
- How is climate change curriculum influenced by faculty members' expertise?
- How is it influenced by broader institutional, provincial or/and international policies?

1.4 Dissertation Outline

This document comprises seven chapters. Chapter 2.0 focuses on contexts of post-secondary education and the emergence of CCE within recent international, national and provincial policies. This draws from literature on climate science, CCE, IPCC reports, international agreements and actions, and Canadian provincial plans and legislation. The chapter provides an overview of CCE within international and national contexts. Chapter 3.0 is divided into two parts. The first one delineates the theoretical focus of this study, which is the formation of a climate change curriculum. The second part is a review of the literature focusing on climate change curriculum in PSIs. This literature is drawn primarily from the fields of CCE, science education, science and technology studies, environmental and sustainability education, and offers a synopsis of current research and studies on climate change curriculum. Chapter 4 describes the methodology used in

this study. Chapter 5 is an empirical overview of CCE curriculum across Canada and emergent climate change programs. This section maps the current tendencies of climate change curricula at the national, provincial and institutional levels. Chapter 6 is an analysis of a series of interviews concerning the formation and existence of climate change curriculum. In Chapter 7, I conclude with a series of observations and recommendations regarding the implementation of climate change programs and courses in PSIs in Canada and further afield.

CHAPTER 2.0 - Climate Change, National and International Agreements and Post-Secondary Educational Institutions

To better understand how climate change in PSIs is enacted within global, national and provincial policies, this chapter offers a broad review of climate change policies, with a particular focus on Canadian PSIs. The first section examines recent international policies, agreements and documents, and the second section explores institutional initiatives as part of responses to global, national and provincial policies and praxis.

2.1 Post-Secondary Education and Recent International Climate Change Policies

Although education can be overlooked in some of the higher profile climate change gatherings, policies and agreements (see Alsop et al., 2014), there have clearly been developments in climate change in which PSIs have been centrally involved. There are also a series of recent policies and initiatives that directly relate to PSIs.^{vi} I offer a summary of what are widely recognised as some of the key CCE events in Table 1 (p. 11).

Table 1: Timeline of events that have shaped (and continue shaping) CCE. Particular events in Canada have been added to this table

| | | | |
|------|---|--|---|
| 1861 | Tyndall showed how the water vapour and other gases created the greenhouse effect | | |
| 1903 | Arrhenius concluded that industrial-age coal burning would heighten the natural greenhouse effect and formulated the hypothesis that “climatic changes may be related to fluctuations in the carbon dioxide content of the air” (Revelle & Suess, 1957, p. 18) | | |
| 1938 | Callendar “suggested that the increase in atmospheric carbon dioxide may account for the observed slight rise of average temperature in Northern latitudes during recent decades” (Revelle & Suess, 1957, p. 18) | | |
| 1957 | Roger Revelle and Hans Suess published a paper anticipating a potential increase of CO ₂ due to human activities, including fossil fuels burning and agricultural practices: “.human beings are now carrying out a large scale geophysical experiment” (Revelle & Suess, 1957, p. 19). | | |
| 1962 | Rachel Carson published the <i>Silent Spring</i> book suggesting that human agricultural practices would have catastrophic consequences (Carson, 1962/2002). | | |
| 1968 | Paul Ehrlich published the <i>Population Bomb</i> “warning of mass starvation.. due to overpopulation” (Liotta & Miskel, 2012, p. 13). | | |
| 1970 | The first Earth Day was held to raise awareness about environmental issues (Earth Day Network, n.d.). | | |
| 1972 | The United Nations (UN) Conference on the Human Environment was held in Stockholm and largely motivated by the regional pollution and acid rain in Northern Europe. The Principle 19 of the Stockholm Declaration refers to education in environmental matters for all ages and the role of the media. The United Nations Environmental | | |
| | | | Programme (UNEP) was established as a result to this conference (UN, 1972). |
| 1972 | | | The Club of Rome’s <i>Limits to Growth</i> sparked the debate on the notion that resources are finite and population growth would have dire consequences (Bardi, 2011). |
| 1973 | | | There was an oil crisis within OPEC (Organization of the Petroleum Exporting Countries) that fuelled the limits to growth debate. |
| 1974 | | | Molina and Rowland published in Nature magazine on the use CFCs and its relation with the depletion of the ozone layer (Molina & Rowland, 1974). |
| 1977 | | | UN Conference on Desertification adopted a Plan of Action to Combat Desertification (PACD) |
| 1979 | | | Participants to the “First World Climate Conference” organized by the World Meteorological Organization (WMO) expressed concern in regards to human development and global climate (WMO, 2014b). |
| 1985 | | | The Vienna Convention for the Protection of the Ozone Layer was adopted (UNEP, 2012b). |
| 1985 | | | The World Meteorological Society, UNEP and the International Council of Scientific Unions (ICSU) predicted global warming on their report of the build-up of CO ₂ and other greenhouse gases in the atmosphere (WMO, 2014a). |
| 1985 | | | British scientists discovered a hole in the Antarctic ozone layer at the Halley Research Station (British Antarctic Survey, 2014). |
| 1987 | | | The Brundtland Report is published and the term of sustainable development is widely adopted (UN, 1987). |
| 1987 | | | The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted (UNEP, 2012a). |

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| 1988 | Participants to the World Conference on Changing Atmosphere held in Toronto recommended reducing 20% of CO ₂ emissions by 2005 and called on educational institutions and governments to finance and implement educational programmes (WMO, 1988). |
| 1988 | NASA climatologist Dr. James E. Hansen gave testimony to the US Congress in regards to industrially-driven climate change (New York Times, 1988). |
| 1988 | The Intergovernmental Panel on Climate Change is established by UNEP and WMO (IPCC, 2014e). |
| 1990 | The IPCC published the First Assessment Report (FAR), the Chapter 7 proposes goals and recommendations to address CCE (IPCC, 1990b). |
| 1990 | During the “Second World Climate Conference” co-sponsored by WMO, UNEP, United Nations Educational, Scientific and Cultural Organization (UNESCO), the Intergovernmental Oceanographic Commission (IOC), Food and Agriculture Organization of the United Nations (FAO) and ICSU, participants discussed the need for international cooperation, including coordinated activities and policy development (WMO, 2014b). |
| 1992 | The United Nations Framework Convention on Climate Change (UNFCCC) was established at the Rio Convention. The Article 6 of this convention focused on education, awareness and training (UN, 1992). |
| 1995 | At the first Conference of the Parties (COP 1) signatories acknowledged country’s “common but differentiated responsibilities.” A portal (CC:iNet prototype) was launched focused on education and public awareness (UNFCCC, 2014c). |
| 1995 | IPCC published the Second Assessment Report (SAR) asserting the human influence on global climate. Education was considered within the framework of adaptation. It also |

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| | emphasized the need for “collective action and development of institutional and decision-making capacities” (p. 114) which would strengthen educational institutions in general (IPCC, 1995). |
| 1996 | At the COP 2 held in Geneva, the US agrees to targets and proposes a trading scheme (UNFCCC, 2014c). |
| 1997 | Delegates to the UN Framework Convention on Climate Change (COP 3) sign the Kyoto Protocol, establishing goals for reductions, emissions trading for developed countries (38 industrialized countries are included in Annex 1) and clean development mechanisms for developing countries. Canada introduces the concept of ‘carbon sinks.’ The article 10 (e) calls for education and training through international cooperation (UN, 1997). |
| 1998 | UNESCO adopted the ‘World Declaration on Higher Education for the Twenty-First Century: Vision and Action’ and the ‘Framework for Priority Action for Change and Development in Higher Education’ |
| 2001 | The IPCC published the Third Assessment Report (TAR) stating that the evidence that warming was induced by human activities. Public education is centered in adaptation and mitigation efforts (IPCC, 2001). |
| 2001 | US announced the withdrawal from the Kyoto Protocol |
| 2002 | A five-year commitment (called the ‘New Delhi work programme’) to work on the Article 6 of the UNFCCC was adopted at the COP 8 in New Delhi (UN, 2002). |
| 2002 | Canada ratified the Kyoto Protocol |
| 2004 | CC:iNet was further developed in a proposed 4-year project (UNFCCC, 2004). |
| 2007 | The IPCC published the Fourth Assessment Report (AR ₄) stating that the climate change induced by humans was “unequivocal” |

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| 2007 | The New Delhi work programme ended concluding that there were constraints for the implementation of the Article 6 in developing countries and small island developing States (UN, 2008a). Parties adopted the Amended New Delhi work Programme for 5 more years in which the countries' responsibility to implement the Article 6 was emphasized, the scope expanded, and nations were suggested to prepare a Plan of Action to implement the Article 6 (UN, 2008b). |
| 2007 | The Bali Action Plan is adopted at the COP 13 in Bali, Indonesia (UNFCCC, 2008) |
| 2008 | The University and College Presidents' Climate Change Statement of Action for Canada (UCPCCSAC) was signed. |
| 2009 | The Vienna Convention and the Montreal Protocol achieved universal ratification (UNEP, 2012a; UNEP, 2012b). |
| 2009 | The third World Climate Conference (WCC-3) was held in Geneva and the Global Framework for Climate Services was established to strengthen climate predictions, products and information (WMO, 2014b). |
| 2009 | The Copenhagen Accord was adopted by 114 countries at COP 15 (UNFCCC, 2010) |
| 2009 | The Copenhagen Diagnosis was published as an update of AR4 and suggested that climate change was greater than the IPCC predictions. |
| 2009 | UNESCO held an International Seminar on Climate Change Education in July (UNESCO, 2009) |
| 2010 | The Cancun Agreements to limit global warming to 2C relative to pre-industrial levels at COP 16 (UNFCCC, 2011). |
| 2010 | The Global Universities Partnership on Environment and Sustainability (GUPES) was formed. Climate Change is one of the six thematic priority areas (GUPES, 2014; UNEP, 2014) |

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| 2010 | A workshop organized by the Board on Science Education (BOSE) and the National Research Council (NRC) brought experts on education to discuss CCE. The outcomes were published in a paper called " <i>Climate Change Education: Goals, Audiences, and Strategies: A Workshop Summary</i> " (National Research Council, 2011). |
| 2010 | The UNFCCC Secretariat launched the CC:iNet (Climate Change Information Clearing House) to facilitate the implementation of the Article 6 of the amended New Delhi work programme (UNFCCC, 2014a; UN, 2014). |
| 2010 | Climate Literacy & Energy Awareness Network (CLEAN) was launched supported by the National Science Foundation (NSF), the Cooperative Institute Research in Environmental Science (CIRES) at the University of Colorado Boulder, the Science Education Resource Center (SERC) at Carleton College, the United States Department of Energy and the National Oceanic and Atmospheric Administration of the United States (NOAA) (CLEAN, 2014). |
| 2011 | At COP 17, Parties adopted the Durban Platform for Enhanced Action, launched the Green Climate Fund and set the framework for the National Adaptation Plans (UNFCCC, 2012). |
| 2012 | Considering the advances of the amended New Delhi work programme, Parties adopted the Doha work programme on Article 6 at COP 18 (UNFCCC, 2013b). |
| 2012 | GUPES was officially launched by UNEP in advance of Rio+20 (UNEP, 2014). |
| 2012 | The 'UN Alliance on CCE, Training and Public Awareness' was formed as a collaboration between UNESCO, FAO, UNEP, UNFCCC, UNICEF, UNITAR and WMO at the COP 18 in Doha (UNFCCC, 2016c) |
| 2012 | Canada officially withdrew from the Kyoto Protocol (UNFCCC, 2014b). |

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| 2013 | The First Dialogue on Article 6 of the UNFCCC took place in Bonn, Germany. Participants shared experiences and ideas in regards to good practices, lessons and international collaborations (UN, 2013b). Recommendations included that national educational institutions be ‘strengthened to deliver climate change learning action’ (UN, 2013a; UNFCCC, 2016f). |
| 2013 | In response to the mandate to prepare a national strategy, the UN CC:Learn Secretariat published the “ <i>Guidance Note For Developing a National Climate Change Learning Strategy. Handbook</i> (UN CC:Learn, 2013) |
| 2013 | UNESCO’s meeting: “Expert Consultation on Guidelines on Climate Change Education in the context of Education for Sustainable Development (April, Paris) (UNESCO, 2013) |
| 2013 | COP 19 was held in Warsaw, Poland, from 11-22 of November (UNFCCC, 2013a) |
| 2013 | IPCC published the Working Group I Report “Climate Change 2013: The Physical Science Basis” whose statement was more emphatic than ever in terms of changes “warming of the climate is unequivocal, and ... many of the observed changes are unprecedented over decades to millennia” (p. 4) and the anthropocentric causes of it: “human influence on the climate system is clear” (p. 15) (IPCC, 2013) |
| 2014 | The 2 nd Dialogue on Article 6 of the UNFCCC was held in Bonn convention focused on international cooperation (UNFCCC, 2014e). |
| 2014 | The ‘People’s Climate March’ on September 21, was the largest march in history, with 400,000 participants from 162 countries and 2246 events around the world (350.org, 2016) |
| 2014 | China and United States committed to work on reducing GHGs post 2020 (The White House, 2014) . |

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| 2014 | The IPCC published the three remaining reports of the AR5 Climate Change 2014: “Impacts, Adaptation, and Vulnerability,” “Mitigation of Climate Change,” and “Synthesis Report” (IPCC, 2014d) |
| 2014 | At COP 20, held in Lima, Peru (Dec. 1-12), the Lima Ministerial Declaration on Education and Awareness-raising was created (UNFCCC, 2014d) |
| 2015 | The 3 rd Dialogue on Article 6 of the UNFCCC was held in Bonn, Germany on June 2-3, 2015 (UNFCCC, 2015) |
| 2015 | Education Day at COP 21 in Paris. Two side events were dedicated to CCE, one on formal education and one on information education (UN CC:Learn, 2015). |
| 2015 | At COP 21, Nation members signed the Paris Agreement, which seeks to keep global temperatures below 2°C and try to limit it to 1.5°C. As of October 5, 2016, with 74 signatories, the agreement entered into force (UNFCCC, 2016b). |
| 2016 | On March 3, the Canadian Prime Minister met with the Premiers of all Provinces and Territories to work on climate change issues and released the ‘Vancouver Declaration on Clean Growth and Climate Change’ (Canadian Intergovernmental Conference Secretariat, 2016) |
| 2016 | On April, IPCC members met at the 43 rd Session and agreed on finalizing AR6 by 2022. At this time, all the countries will review their progress towards their national targets and goals (IPCC, 2016). |
| 2016 | The 4 th Dialogue on Article 6 of the UNFCCC took place in Bonn, Germany, May 18-19. It focused on ‘empowerment, public participation, access to information and awareness, and international cooperation (UNFCCC, 2016e). |
| 2016 | On October 5, Canada ratified the Paris Agreement and Prime Minister, Justin Trudeau announced a national |

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| | carbon price plan of \$10/tonne, which will take effect in 2018 (CBC, 2016a). |
| 2016 | In late November, Prime Minister Justin Trudeau approved two pipelines, Trans Mountain and Line 3, and rejected the Northern Gateway project. The approved pipelines are estimated to produce between 13.5 to 17 |

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| | additional megatonnes of GHGs per year (CBC, 2016b). |
| 2016 | On December 9, Prime Minister Justin Trudeau and most Canadian Premiers (except for Saskatchewan’s Brad Wall and Manitoba’s Brian Pallister) signed a Pan-Canadian Framework to meet Canada’s 2030 reduction targets (CBC, 2016c). |

In a dissertation that focuses on PSIs, it seems important to note that climate change science emerged out of university-based research. Deliberations amongst scientists took place in the early 20th century since Callendar “revived ...Chamberlain’s (1899) and Arrhenius’ (1903) [hypothesis] that climatic changes may be related to fluctuations in the carbon dioxide [CO₂] content of the air” (Revelle & Suess, 1957, p. 18). But it was through the ground-breaking work of Revelle & Suess (1957) that climate change was underlined as a potential environmental disruptor of natural climatic dynamics. Their scientific paper has become widely renowned for the statement: “Human beings are now carrying out a large-scale geophysical experiment” (p. 19). It highlights how the industrial revolution was altering atmospheric CO₂ levels through the combustion of fossil fuels and changing soil conditions through agricultural practices, both of which have an effect on the ocean’s capacity to absorb the excess of CO₂.

By the mid-1970s, publications such as the *Silent Spring* (by Carson in 1962), *The Population Bomb* (by Enrich in 1968), and *Limits to Growth* (by the Club of Rome in 1972), had begun to challenge economic development, population growth and their connections to environmental issues.

After the creation of the United Nations Environment Programme (UNEP), the international community started collaborative work to solve issues such as the depletion of the ozone layer and desertification (Molina & Rowland, 1974). But it was in 1979, at the first World Climate Conference organized by the World Meteorological Organization, when scientists expressed concerns about the implications of human development in the global climate (WMO, 2014b). In the mid-1980s, United Nations' members adopted the Vienna Convention for the Protection of the Ozone Layer (UNEP, 2012b) and increasing numbers of scientists began to predict global warming due to the accumulation of GHGs in the atmosphere (WMO, 2014a).

According to Moser (2010), “anthropogenic climate change first emerged on the public agenda between the mid-to-late 1980s” (p. 32). The term ‘sustainable development’ started to be adopted worldwide by the end of this decade after the publication of the Brundtland Report (UN, 1987). Advances to control substances that deplete the ozone layer were also reached with the adoption of the highly successful Montreal Protocol in 1987 (UNEP, 2012a).

Participants at the World Conference on the Changing Atmosphere in Toronto in June 1988, concluded that “humanity [was] conducting an unintended, uncontrolled, global pervasive experiment... [And that] the Earth’s atmosphere [was] being changed at an unprecedented rate by pollutants resulting from human activities [and] inefficient and wasteful fossil fuel use” (WMO, 1988, p. 1). These participants also called on educational institutions (among others) to act immediately to “counter the ongoing degradation of the atmosphere” (ibid. p. 296). United Nations Member Governments were asked specifically to:

- “*Allocate financial support for environmental education* ¹ in primary and secondary schools and universities. Consideration should be given to establishing special units in university departments for addressing the crucial issues of global climate change” (ibid. p. 299).
- “*Increase funding to non-governmental organizations* to allow the establishment and improvement of environmental education programmes and public awareness campaigns related to the changing atmosphere. Such programmes would aim at sharpening perception of the issues, and changing public values and behaviour with respect to the environment” (ibid. p. 298-299).

In November 1988, the IPCC held its first meeting in Geneva and agreed to assess practical solutions to address climate change. Two years later, the second World Climate Conference was held in Geneva and the IPCC published the First Assessment Report (FAR) concluding that “emissions resulting from human activities [were] substantially increasing the atmospheric concentrations of the greenhouse gases.... [and] that these increases [were] enhanc[ing] the greenhouse effect, resulting on average in an additional warming of the Earth’s surface” (IPCC, 1990a, p. 52).

Education was raised as a concern only after the work of FAR’s Working Group III (WGIII), in their report called “Response Strategies,” when Evans and Luo (1990) (coordinators of Task B: Implementation Mechanisms for Public Education and Information, Working Group III) pointed

¹ Italics from original source

out a widespread level of “ignorance, apprehension, and confusion about climate change” (p. 213). They suggested that the mechanisms to address education would have to be tailored taking into account cultural differences (IPCC, 1990b). To address this gap, universities (and other educational institutions) were asked to quickly develop curriculum and teaching materials, as well as courses that adopted different levels of action (ibid. p. 217). FAR also proposed alternative policies to support developing countries to create mechanisms to study and train locals to adapt to climate change, in addition to “strengthen[ing] existing education and research institutions and the development of new ones at the national and regional level” (IPCC, 1990a, pp. 59-60).

In June 1992, at the Earth Summit (also known as the Rio Convention) the United Nations Framework Convention on Climate Change (UNFCCC) was created and signed by 154 countries. Developed countries committed to stabilize their emissions by the year 2000. Since entering into force^{vii} in 1994, 196 countries—including Canada—have currently ratified it. The Convention’s ultimate aim is “to prevent dangerous anthropogenic interference with the climate systems” (UNFCCC, 2016d, p. 9). The Convention’s sixth article compelled signatory parties to promote educational programs, to create public awareness, participation, and training on topics related to climate change. Since then, the challenges of learning and teaching about climate change were addressed in the “New Delhi Work Programme” in 2002 and in a subsequent amendment in 2007.

The first Conference of the Parties (COP 1) was held in Berlin in 1995. Since then, annual meetings are held to assess the programs’ progress. During these meetings, concepts such as trading schemes, allocation of responsibilities, creation of new programs (such as the New Delhi work programme) are proposed and some are later implemented. Probably, one of the most important

outcomes was the adoption of the Kyoto Protocol in 1997 (during COP 3). The protocol, different to other international treaties, is legally binding for developed countries and has a set of specific emission targets which seek to stabilize national GHG emissions (37 countries are part of Annex I, Canada is one of them). All Annex I countries have ratified the Kyoto Protocol since its adoption, except for the United States. Canada ratified it at the beginning, but subsequently withdrew from it in 2011 (UN, 1997; UNFCCC, 2014b).

There has been a series of international declarations specifically referring to climate change education. For instance, on October 9, 1998, the World Conference on Higher Education adopted the ‘World Declaration on Higher Education for the Twenty-First Century: Vision and Action’, which established the ‘Framework for Priority Action for Change and Development in Higher Education.’ The declaration recognized the knowledge contribution made by higher education to the development of “environmentally sustainable... individuals, communities and nations” (UNESCO, 1998)

After Kyoto, other commitments have been made by the Parties to the Convention, such as the Bali Action Plan of 2007, which required members to quantify emissions and standardize records for comparative purposes (UNFCCC, 2008); the Copenhagen Accord of 2009 and the Cancún Agreements of 2010 set a limit to global warming of 2°C, relative to pre-industrial levels (UNFCCC, 2010; UNFCCC, 2011); and the Durban Platform for Enhanced Action of 2011, which is a legal instrument to force parties to comply with the Convention (UNFCCC, 2012).

In 2009, a seminar on CCE was held in Paris with the goal of integrating CCE into the curriculum, supporting teachers and parents' training, identifying opportunities to encourage local educational projects and the development of appropriate CCE materials (UNESCO, 2009).

In 2012, the Doha work programme was adopted where Parties recognized that to meet the objectives of the Rio Convention, it was necessary for “the implementation of all elements of [its] Article 6... — education, training, public awareness, public participation, public access to information and international cooperation” (UNFCCC, 2013b, p. 20). To accomplish this, Parties were encouraged to “cooperate in, promote, facilitate, develop and implement formal and non-formal education and training programmes focused on climate change” (ibid. p. 21); “to strengthen national education and training/skills development institutions to deliver climate change learning action” (ibid. p. 23); “to promote and enhance the inclusion of climate change in school curricula.... [as well as] to develop materials and promote teacher training” (ibid. p. 23); to “integrate climate change learning into the curricula of institutions that provide formal education and training at all levels” (ibid. p. 23); to “develop tools and methodologies to support climate change training and skills development” (ibid. p. 24); and to “strengthen North-South... in matters of climate change education and training” (ibid. p. 24). In addition to this, intergovernmental organizations were invited to “support countries in developing a long-term, strategic and country-driven approach to climate change education” (ibid. p. 25). COP members will review the progress of the implementation of this programme by 2020 with an interim review held in May 2016 (UNFCCC, 2013b). This review concluded that although Parties have made some progress, there were a “number of remaining barriers to the implementation of Article 6, including the lack of public awareness and knowledge” (UNFCCC, 2016a, p. 14), and recommended to “foster ways of

improving cooperation and cross-sectorial coordination among ministries, especially those dealing with climate change and those responsible for education and training” (UNFCCC, 2016a, p. 15).

The 1st Annual Dialogue on Article 6 took place in Bonn, Germany in 2013. The purpose of this dialogue was to enable participation as well as ideas exchange, international collaboration, best practices and lessons learned. The COP decided to cluster the goals of article 6 into two focal areas: the first one is education and training, and the second one is public awareness, participation and access to information (UNFCCC, 2016f). The 1st Annual Dialogue focused on the education and training, while the 2nd and 3rd Annual Dialogues focused on international cooperation. During the 3rd Dialogue, Christiana Figueres, the UNFCCC Executive Secretary, “highlighted the importance of educating and training students about climate change and the need to incorporate climate change into every subject in the curriculum” (UNFCCC, 2015, p. 4). Finally, at the 4th Dialogue the attention expanded to act for climate empowerment, focus on public participation, public awareness, and public access to information, and on international cooperation (UNFCCC, 2016e).

In September 2013, the IPCC released the first part of Fifth Assessment Report (AR5), called “Climate Change 2013: The Physical Science Basis.” In the document, prepared by the Working Group I, statements were more emphatic and drastic than ever regarding global changes: “warming of the climate is unequivocal, and ... many of the observed changes are unprecedented over decades to millennia” (p. 4), and the anthropocentric causes of it: “human influence on the climate system is clear” (p. 15) (IPCC, 2013).

With this new language, climate change gained an unprecedented momentum. The largest climate action march^{viii} in history took place in 2014. Voices from around the world demanded governments to act to reduce their emissions immediately. Over 500 institutions and foundations either committed to divesting and/or divested from fossil fuels (a portion of which, are colleges and universities in North America, sixteen in the United States, one partially divested in Canada) (350.org, 2016). The world's largest^{ix} emitters of CO₂, China and the United States announced their commitment to establishing measures to work on the reduction of their emissions post-2020 (The White House, 2014). The latest assessment report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) —published in early November 2014— shifted its previous soft tone to describe the causes of climate change as driven by anthropogenic activities from “very likely” to “clear” and “extremely likely.” AR5 clearly stated that to avoid significant long-term risks and higher mitigation costs, an immediate and substantial reduction of CO₂ emissions as well as an urgent adaptation was compulsory before the end of the century (IPCC, 2014a). This language generated a renewed wave of dialogues stirring previous stalled and ambiguous arguments at all levels. PSIs however, have remained motionless.

In the latest report, the AR5, prepared by the IPCC WGIII, the role of education and PSIs has become more ambiguous. Although, PSIs are encouraged to improve areas of research, and technological change, there are few explicit references to actual responsibilities or pathways to action. Education is largely conceived as an instrument for government provisions of public goods and services (including social institutions), for the “reconsideration of policies for managing the risks and uncertainties associated with climate change” (p. 157) and for the increase of capable human capital that works on energy efficient industries. However, it is suggested that the

educational work is done on a voluntary basis within industries such as agriculture, forestry, and other land-use and be provided through partnerships between industry-institutions-governments (IPCC, 2014b).

During the COP 20 in Lima, Peru, the ministers and heads of delegations created the ‘Lima Ministerial Declaration on Education and Awareness-raising,’ which reaffirmed “the importance of Article 6 of the Convention and Article 10(e) of the Kyoto Protocol” (UNFCCC, 2014d, p. 37). One of the recommendations made in the declaration was to “encourage the governments to develop education strategies that incorporate the issue of climate change in the curricula” (UNFCCC, 2014d, p. 38).

In an attempt to unify CCE concepts, several collective efforts have emerged throughout the years. Most of these initiatives focused on teaching the science behind climate change and the tools for mitigation and adaptation. A variety of educational resources have been developed in response to the IPCC reports. These include: classroom educational materials (Deeb, et al., 2011; Selby & Kagawa, 2013; UNITAR, 2013); portals of information, such as the UN Gateway on Climate Change, the CCE Clearinghouse, CC:iNet and the Climate Literacy & Energy Awareness Network (CLEAN) (UN, 2014; UNESCO, 2016; UNFCCC, 2014a; CLEAN, 2014); and books and papers (Anderson A. , 2010; National Research Council, 2011; Chew Hung, 2014).

It is evident that concerted efforts to bring CCE into national and international agendas have produced significant mechanisms to address a global education gap (such Article 6 of the UNFCCC or Article 10 of the Kyoto Protocol). However, the ambiguity in which CCE has shown

in these documents only, perhaps, exacerbates the precarious state of climate educational programs, especially at PSIs.

2.2 Post-Secondary Educational Institutions' (PSIs) Responses to Global, Federal, and Provincial Climate Change Policies and Plans

In general, PSIs' institutional responses to climate change have been framed within larger sustainability initiatives, often taking the form of partnerships, ranking systems, agreements, and declarations. These initiatives all raise questions of entitlement, power, resources, usefulness and transparency. Their appearance and influence over the last decade is undeniable. Some examples of partnerships are:

- The Global Higher Education for Sustainability Partnership (GHESP): Created by the International Association of Universities, the Association of University Leaders for a Sustainable Future (ULSF), the Copernicus Campus and UNESCO
- The United Nations' Higher Education Sustainability Initiative (HESI): Supports the implementation of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals
- The Association for the Advancement of Sustainability in Higher Education (AASHE)
- The Global University Network for Innovation (GUNI)
- The International Sustainable Campus Network (ISCN)
- The International Alliance of Research Universities (IARU)
- The Alianza de Redes Iberoamericanas de Universidades por la Sustentabilidad en el Ambiente (ARIUSA).

Specific declarations on climate change include:

- American College & University President's Climate Commitment (ACUPCC)
- Scottish Universities and Colleges Climate Change Commitment (Osmond, Dave, Prasad, & Li, 2013)
- University and College Presidents' Climate Statement of Action for Canada (Climate Change Action, 2016).

A few examples of popular reporting/ranking systems that include climate change are:

- Sustainability Tracking and Rating System (STARS) developed by the AASHE
- Sustainability Assessment Questionnaire (SAQ) developed by ULSF
- Sustainable Development on Campus: Tools for campus decision-makers developed by the International Institute for Sustainable Development (IISD)
- Platform for Sustainability Performance in Education developed by the Environmental Association for Universities and Colleges (EAUC)

Rappaport and Hammond (2007) state that PSIs “cannot compare their emissions to those of their peers and take comfort in the fact that others are emitting more climate-altering gases” (p. 28). Nevertheless, somewhat ironically, the emergence of metrics and rankings to compare sustainability between universities and colleges has become a market tool for PSIs, where a better score represents market leadership, and is assumed to attract faculty, students (national and international) and additional resources.

According to the ULSF's website, 39 Canadian PSIs have signed the Talloires Declaration, which is the "first official statement made by university presidents, chancellors, and rectors of a commitment to environmental sustainability in higher education" (ULSF, 2016). The declaration, written in 1990, underscores the importance of PSIs in the education of 'responsible citizens' who would respond to environmental problems such as the "depletion of the ozone layer and emission of greenhouse gases [which] threaten the survival of humans and thousands of other living species" (ULSF, 2016). In November 2007, Colleges and Institutes Canada (CICan, previously known as the Association of Canadian Community Colleges —ACCC) held a symposium on sustainability and created the Pan-Canadian Protocol for Sustainability. The protocol's goal was to commit signatories to implement sustainable initiatives in their operations, plan, and policies, through several action items, one of which is to "incorporate ...practices and procedures ... for alternate energy sources, ..and energy efficient transportation" (ACCC, 2016). Also in 2007, the UN Secretary-General Ban Ki-Moon launched an initiative for management-related institutions, including schools of business and university faculties, with the goal to "advance corporate sustainability and social responsibility, [as well as] to incorporate universal values into curricula and research" (UNPRME, 2016). As of September 2016, more than 650 academic institutions (18 institutions in Canada,) from 85 countries have signed this Protocol (UNPRME, 2016). In 2008, the Atlantic Canada Universities and Colleges Sustainability Network (AUCSN) was created to share information on best practices and to enhance cooperation. As of September 2016, the AUCSN counts with 20 members (AUCSN, 2016).

Back in 2009, six of British Columbia's (BC) University Presidents^x decided to follow their American^{xi} counterparts and created the "University and College Presidents' Climate Change

Statement of Action for Canada” (UCPCCSAC). This was the first attempt to tackle the issue of climate change at a high level in Canadian PSIs and was focused on the challenge of climate neutrality and GHGs reduction. It also acknowledged the PSIs’ responsibility regarding leadership to reduce emissions and the idea was to develop targets, plans, and to be accountable for their actions. Out of the 310 PSIs found in this study, 29 have signed this statement (less than 10% of Canadian PSIs) (B.C. Government, 2008; Webster & Moore, 2009; Climate Change Action, 2016).

Even though more than twenty years have passed since the UNFCCC was adopted, and ten years after a working plan was put in place, it is not entirely clear how many educational programs on climate change have been established (or implemented) at a national, regional or provincial levels. Surveys suggest that only a few PSIs across Canada have undertaken or adopted specific plans to address climate change issues (Henderson, Bieler, & McKenzie, 2017); around 9.4% PSIs have committed to address climate change at the institutional level (this number has been estimated in regards to 310 PSIs found in Canada in this study); and the incorporation of climate change into the curriculum is essentially in the preliminary stages (B.C. Government; Webster & Moore, 2009; CMEC, 2012).

A high profile, and controversial, campaign is presently trying to sway Boards of Directors (BOD) to divest their investments from fossil fuels. The fossil fuel divestment model has been compared to the social movements that emerged in North America during the 1960s when social groups challenged institutions whose investments were linked to the South African apartheid. Opponents to the black’s oppression in South Africa used the framework of accountability and information disclosure to contest institutional social responsibility and investment decisions of public pension

funds that profited from an unjust and brutal regime (Arnold & Hammond, 1994). This discontent “surged [across US campuses] after 1984 and the number of colleges and universities at least partially divesting jumped from 53 prior to April 1985 to 155 by August 1988” (Knight, 1990, pp. 68-69).

As one of its many projects, 350’s founder Bill McKibben launched the ‘Fossil Free’ campaign, in November 2012. In a tour throughout the United States to present a movie called “Do The Math,” McKibben sought to build a movement to stop the fossil fuel industry based on scientific and moral grounds (350.org, 2012). The movement has grown both exponentially and globally, and has persuaded —as of June 2017— 732 institutions to divest \$3.4 trillion, 15% of which are colleges, universities, and schools (Fossil Free, 2017).

According to Fossil Free Canada (2017), nearly 25 PSI campaigns have been launched in Canada, and only the University of Ottawa’s BOG approved in April 2016 a motion to shift away from fossil fuels, but without the term ‘divest.’ While some of the most recognized universities have formally refused to divest (Dalhousie University on November 2014; Queen’s University on November 2015; the University of Toronto in March 2016) (University of Toronto, 2016c; Dalhousie University, 2014; Queen's University, 2015). Concordia University, University of British Columbia (UBC) and the University of Ottawa have used a ‘more subtle’ approach. These institutions pledged to create dedicated funds as part of their commitments to a more responsible way to invest. Although the publicity around Concordia’s decision back in November 2014 has been deemed as a partial divestment move, the university created a \$5 million Sustainable Investment Fund — out of its \$90 million endowment (Newswire, 2014). This concept has been

replicated by other PSIs after reviewing divestment campaign's petitions. UBC announced in February 2016 that it would allocate \$10 million to create a Sustainable Future Fund to be invested in low-carbon emissions (University of British Columbia, 2016), while in April 2016, the University of Ottawa pledged a \$10 million transfer for investments in clean technologies, along with \$3 million to create a Clean Innovation Research Fund (half of which will come from donations) (University of Ottawa, 2016). In addition to this, the Chair of the Board of Governors, Robert Giroux's rationale as to why not divest was as superficial as it was unsubstantiated:

We are reducing the carbon footprint of our entire investment portfolio by at least 30 percent by 2030 – in line with Canada's national climate commitment. This will reduce far more greenhouse gases (GHGs) than divesting from fossil fuel companies. Solving this problem will require reducing carbon emissions across the whole economy (University of Ottawa, 2016).

There are global initiatives that have taken roots in Canada, such as the Campus Climate Challenge (C3). Launched by the Energy Action Coalition in May 2005, this campaign seeks to achieve clean energy policies and praxis on thousands of campuses (Energy Action Coalition, 2016). The challenge, for participant institutions, is to develop projects and strategies to promote climate awareness and influence environmental policies within the institutions. Considered as a grassroots scheme, campuses compete within themselves and against other campuses and try to reduce their footprint and quantify the contribution of each particular project. A recent example in Canada was the competition between six maritime universities, who between January 23 to February 6, 2015 raced to “reduce their carbon footprints for honour, glory and bragging rights” (Mount Allison University, 2016). Other C3 examples in BC, ON, QC and SK are highlighted in Helferty, Clarke

and Kouri (2009), who state that although student movement can gain a valuable momentum in PSIs, “they [also] need the support of key stakeholders for the initiative to be successful” (p. 17).

Assuming that PSIs’ responses were fuelled by a combination of both neighbour institutions and the national/provincial political climates, it is important to recall some of the most relevant aspects that influenced Canadian PSIs in the last decade.

Following a newly elected Conservative government in 2006, many Canadian PSIs sought institutional-wide sustainable pathways. This was demonstrated by signing commitments, making declarations, establishing agreements and partnerships, and undertaking institutional changes in order to step up the sustainable ranking ladder. At the election time, the only province that had worked on legislation for Greenhouse Gases (GHGs) was Alberta with the 2003 Climate Change and Emissions Management Act. As of February 2016, all the provinces and territories had a plan to address climate change, except for Saskatchewan, which passed in 2015 the “Management and Reduction of GHGs Act” but it has not yet been proclaimed (David Suzuki Foundation, 2012; CanLII, 2015; Government of Saskatchewan, 2016c).

Harper’s government prioritised developing and exploiting natural resources as his flagship program — and under the auspice of creating jobs and growing the Canadian economy — some provinces decided to ‘publically’ address climate change, even if it meant a challenging position against the federal government. In November 2007, BC passed the GHGs Reduction Targets Act, which set a reduction target of 33% by 2020 below its 2007 levels. This Act also required all public sector organizations, including PSIs to be carbon neutral by 2020 (Webster & Moore, 2009). Public

PSIs must report an annual Carbon Neutral Action Report, where they need to provide their GHG emissions as well as what actions they are taking towards becoming carbon neutral. According to the BC Government, 26 of BC's public PSIs have managed — by 2014 — to reduce 1% of their contribution to the total provincial emissions since 2010 (year considered as the BC baseline) and have paid nearly CAN\$19M in carbon offsets (BC Government, 2016). By 2010, BC became the first and only carbon neutral province in Canada to date. This, according to the 2012 Climate Action Update called 'Progress to Targets,' has contributed to the implementation of several environmental education programs with considerable climate benefits (Province of British Columbia, 2012).

At the federal level, facilities that emit more than 50 kt CO₂ eq. (kilotonnes of carbon dioxide equivalent) per year are required to submit their emission to Environment and Climate Change Canada. Within the 574 institutions in Canada whose facilities emitted more than 50 kt CO₂ eq. in 2014, 9 were universities and colleges. The GHGs contribution of these PSIs to the national annual emissions was 577.43 kt CO₂ eq. (about 0.58 Mt CO₂ eq. out of the 264 Mt CO₂ eq.). The University of Alberta ranked 198 within the 574 facilities and contributed two-fifths to the 0.58 Mt CO₂ eq. emitted by PSIs (See Table 2, p. 32) (Environment and Climate Change Canada, 2016g).

Table 2: Ranking of PSIs large facilities based on 2014 GHG Emissions (kt CO₂ eq.). Emission rank numbers are in comparison to other large facilities in Canada. Data from Environment and Climate Change Canada (2016g).

| Rank | Organization Name | Facility Name | Province | City | 2014 GHG Emissions (kt CO₂ eq.) |
|-------------|--|---|-----------------|-------------------------|---|
| 198 | University of Alberta | Heating Plant | Alberta | Edmonton | 207.51 |
| 347 | The Governing Council of the University of Toronto | St George Campus | Ontario | Toronto | 86.82 |
| 420 | University of Calgary | Central Heating and Cooling Plant | Alberta | Calgary | 66.13 |
| 466 | University of Saskatchewan | University of Saskatchewan - Saskatoon | Saskatchewan | Saskatoon | 54.25 |
| 475 | York University | York University - Keele Campus | Ontario | Toronto | 52.2 |
| 500 | The University of Western Ontario | Main Campus | Ontario | London | 46.2 |
| 521 | Institution royale pour l'avancement des sciences | Université McGill - Campus Centre-Ville | Quebec | Montreal | 30.49 |
| 529 | University of Windsor | University of Windsor | Ontario | Windsor | 26.31 |
| 554 | Institution royale pour l'avancement des sciences | Université McGill - Campus Macdonald | Quebec | Sainte-Anne-de-Bellevue | 4.28 |
| 556 | Fanshawe College of Applied Arts and Technology | Fanshawe College of Applied Arts and Technology | Ontario | London | 3.24 |

In October 2015, the newly elected Liberal government proposed a new — more proactive — approach to tackle climate change issues in comparison to the former government. After announcing in November 2015 at the Commonwealth Heads of Government meeting in Malta a significant financial commitment to support climate change issues in developing countries (\$2.65 billion over the next five years), Canada made a strong appearance at the UNFCCC’s Climate Conference in Paris in December 2015. At the conference, Canada agreed to work with other nations to limit the increase of temperature by 1.5 °C rather than 2 °C. Following Paris, the Prime Minister met with the Premiers of all Canadian Provinces and Territories to plan a “pan-Canadian

framework” to fight climate change. Each province and territory are free to design its carbon pricing policies (Environment and Climate Change Canada, 2016d). A product of this meeting was the ‘Vancouver Declaration’ on clean growth and climate change (of March 3, 2016). Signed by all the premiers, the Declaration committed to increasing the level of ambition (limit global warming to 1.5 °C emissions as it was proposed in Paris), promote clean economic growth, work on mitigation, resilience and adaptation, and enhance cooperation. In Fall 2016, the Pan-Canadian Framework was finalized and the progress of the Canadian Energy Strategy reviewed (Canadian Intergovernmental Conference Secretariat, 2016).

Perhaps one of the most significant accomplishments in BC concerning climate change in higher education was the creation of a \$94.5 million endowment to the Pacific Institute for Climate Solutions (PICS) in January 2008. PICS is currently hosted and led by the University of Victoria in collaboration with three more BC research-intensive PSIs (the University of British Columbia, University of Northern British Columbia and Simon Fraser University).

In 2009, the British Columbia Working Group and Network on Sustainability Education in response to the province’s 2008 Climate Action Plan, conducted a study to assess how this provincial policy has had/would have an effect on BC’s PSIs. According to the report, this plan required “all public sector organizations to be carbon neutral by 2010,” but did not require them to “reduce their gross emissions every year, only to minimize [them and to] offset the remainder” (Webster & Moore, 2009, p. 6). The report highlighted several constraints for PSIs to undertake the province’s mandate ranging from funding issues (such as the cost of conducting baseline GHG inventories to carbon offsetting and prioritizing capital expenditures) to tangible differences

between institutions (such as the state and age of campuses to access, location, and enrolment). Although the study found that most institutions understood the importance of the GHG Reduction Targets Act, it concluded that some of these mechanisms could lead to the ‘least effort/cost’ actions and argued that what was needed was a “cultural shift in which the institution views itself as part of a broader community and acts on its obligations to that community” (p. 4) by “reassessing what [it] value[s]” (Webster & Moore, 2009, p. 23).

On the latest provincial strategy document, the ‘Climate Leadership Plan,’ the BC government celebrated the fact that it has already accomplished the 2012 interim CO₂ reduction target of 6% below the 2007 level. Commitments to reach the 2050 targets continue, but references to the 2020 targets completely disappeared. Education is mentioned as part of the support of the Clean Energy Vehicle program, and PSIs are cited as beneficiaries of the Carbon Neutral Capital Program, but their role or contributions to climate change education are not (Province of British Columbia, 2016).

The rest of the provinces and territories have adopted measures to reduce their emissions, but none — other than BC — have directly mandated their public institutions to report and produce climate reduction plans (See Figure 1 for historical Provincial GHG emissions and targets, p. 37). The following is an overview of climate change legislation on the rest of the provinces and territories. A more comprehensive compilation is found in Table 7 of the Appendix (p. 224).

Even though Alberta had established an early response — with its 2003 Act — the proposed control instruments were lax, with production-favoured initiatives, and neither explicit nor

adjustable goals. This meant in other words that the province would continue conducting its business as usual (BAU) if the oil production increased so would the targets. These conditions supported the development of the tar sands and not other energy industries such as wind power, which by 2006 “had [in Alberta] the highest installed capacity... in the country” (David Suzuki Foundation, 2012, p. 23). By 2007, Alberta was — still is — the largest GHGs Canadian emitter (Environment Canada, 2015; Environment and Climate Change Canada, 2016e).

After the 2015 provincial elections in Alberta, the Progressive Conservative (PC) Party was removed from power (which it had held since 1971), and the New Democratic Party (NDP) was elected for the first time to a majority government. Considering the environmental inclinations of the NDP and the radical position of its membership against the use of fossil fuels — popularized through the Leap Manifesto — it was expected that tar sands extracting industries would encounter a fierce resistance within the new provincial government. However, with the drastic drop in the gas prices since 2015, oil industries cut their budgets, affecting Alberta’s economy and bringing the provincial unemployment rates to their highest registered numbers since the late 1980s (Calgary Herald, 2016). Having inherited economic problems and facing popular criticism, the Alberta Premier, Rachel Notley, during the 2016 NDP convention in Edmonton, called the energy proposals of the Leap Manifesto “thoughtless, naïve and tone deaf” (Edmonton Journal, 2016). Her position demonstrated that even with a new party in government, the province would continue with its BAU in regards to climate change (NDP, 2016). In its 2015 Climate Leadership Plan, specific targets are elusive, but the emissions are expected to be reduced by 20Mt, by phasing out coal-generated electricity, implementing carbon prices, and limiting tar sand and methane

emissions. The need of programs to modify consumer demand and use of energy is the only instance where education is considered (Alberta Government, 2016; Alberta Government, 2015).

Manitoba started a series of public consultations in 2001 by commissioning a ‘Climate Change Task Force.’ Recommendations out of these consultations were the base of the ‘Manitoba Climate Change Action Plan 2002.’ In this plan, the province set an ambitious target for GHG emission reduction of 18% below 1990 by 2010, which would exceed the federal targets of 6%. However, it later lowered its expectations to 6% below 1990 by 2012 (David Suzuki Foundation, 2012; Province of Manitoba, 2002). The province also had a ‘team dedicated to implementing sustainable development policies and practices... [which] include[d] increased energy efficiency for... buildings.’ (Province of Manitoba, 2002, p. 17).

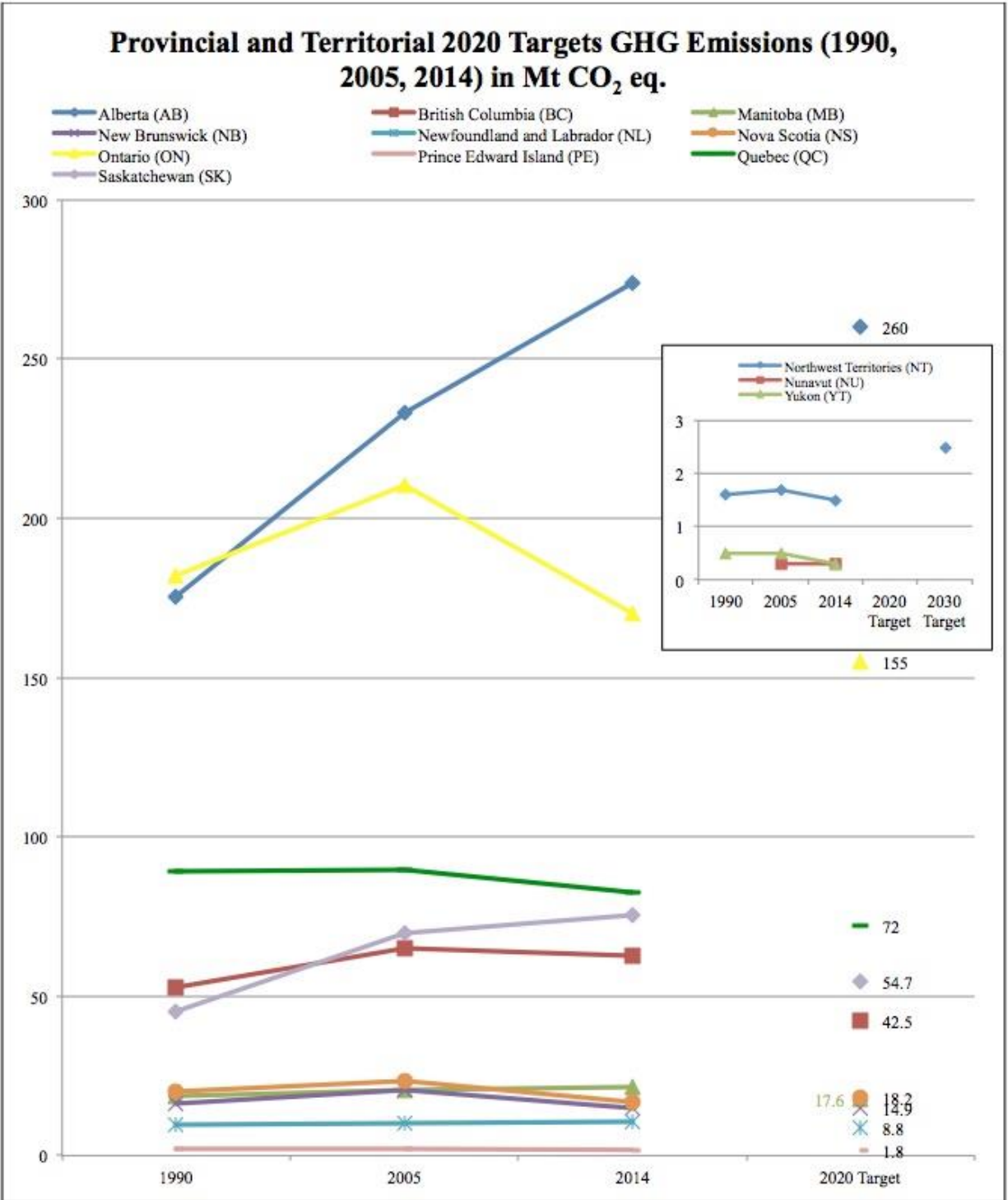


Figure 1: Provincial and Territorial GHG Emissions (1990, 2005 and 2014) in Mt CO₂ eq. and 2020 Targets. The Territories have not set a 2020 Target, but the Northwest Territories established a 2030 target - shown in the graph. Data from Environment and Climate Change Canada's 'Environmental Indicators' and 'Ministerial Briefing Book' (2016f; 2016i).

A fund was also in place (the Manitoba Climate Action Fund, MCCAF) with an annual budget of \$250,000 to support climate research, and public education and outreach projects. To accomplish these educational and outreach projects, MB established the *Manitoba Climate Change Connection*, “to distribute information on climate change mitigation and adaptation” (Province of Manitoba, 2002, p. 22). A call was made to incorporate climate change across the science curriculum, to purchase and distribute copies of “Inuit Perspectives on Climate Change” in schools, and to develop a teacher’s guide as new curriculum (Province of Manitoba, 2002, p. 24).

In 2004, Dr. Lloyd Axworthy was appointed the president and vice-chancellor of the University of Winnipeg. By 2005, the Board of Regents made the same Kyoto commitments as the federal government, but by 2011 the university had surpassed by 37% the 1990 GHG emissions. Dr. Axworthy had also led Manitoba’s Climate Change Task Force in 2001 (Province of Manitoba, 2002; University of Winnipeg, 2014).

In the latest proposal called the ‘Manitoba Climate Change and Green Economy Action Plan’ of 2015, education and PSIs are emphasized as a fundamental part of reaching a “secure long-term sustainable development” (Province of Manitoba, 2015, p. 15). Within the proposed ideas are: boosting investments in education and outreach programs; partnerships with PSIs for green jobs training; and developing research with academics and educational institutions to “promote applied science education and increased understanding of climate change” (Province of Manitoba, 2015, p. 39). This plan indicates that to reduce GHG emissions and to adapt to climate change, education for sustainable development (ESD) must be incorporated into the educational system at the primary, secondary and tertiary levels. Manitoba considers itself as “a leader in ESD, working [to

develop] a culture of sustainability in schools, school divisions and PSIs across the province, [including the incorporation of] ESD in teacher training and in training of all educators” (Province of Manitoba, 2015, p. 40). An important part of the plan is the proposal to include traditional knowledge and Indigenous perspectives in the curriculum to strengthen the climate change education. Finally, as an indicator of social well-being, the plan proposed to chart the number of schools that incorporate ESD as part of their plans (Province of Manitoba, 2015).

At the 2001 New England Governors and Eastern Canadian Premiers' Annual Conference (NEG/ECP), Atlantic region's Premiers adopted the Resolution 25-9 on global warming where they committed to reduce “regional” GHG emissions:

- “Short-term goal: to 1990 levels by 2010
- Mid-term goal: 10% below 1990 levels by 2020
- Long-term goal: 75-85% below 2001 levels by 2050” (NEG/ECP, 2001, pp. 6-7).

To this date, all the Atlantic Canada Provinces continued to subscribe to the NEG/ECP's established GHG emissions reduction targets (Government of New Brunswick, 2014; Government of Prince Edward Island, 2015; NEG/ECP, 2015).

New Brunswick's Climate Change Action Plan (2014-2020) published in April 2014 underlined the importance of working with academia to strengthen climate research. It also stated that the development of educational tools and measures were critical “to help communities to assess their risks and opportunities and prioritize their actions to adapt to climate change” (2014, p. 6), and to reduce energy consumption (Government of New Brunswick, 2014).

Since 2002, Conservation Corps has hosted the Climate Change Education Centre, which is funded by the Province of Newfoundland and Labrador (NL). According to the 2011 ‘Charting Our Course. Climate Change Action Plan,’ the centre has helped to raise the climate change profile in the province, as well as worked with schools, teacher training, the general public, and has collaborated in decision-making processes with the government (Government of Newfoundland and Labrador, 2011a). A year after the plan, the Province launched an online campaign called ‘Turn Back the Tide’ to “increase awareness and understanding of climate change and energy efficiency” (Government of Newfoundland and Labrador, 2016, p. About us). The website contains climate change educational materials and tools targeting different stakeholders and groups.

On its 2015 “Greening Government” Action Plan, the Government of NL proposed to “improve the environmental sustainability of new and existing government buildings,” which include college campuses (Government of Newfoundland and Labrador, 2015b, p. 7). The Plan highlighted that the Department of Education is in the process of implementing a pilot project to retrofit schools across the province (Government of Newfoundland and Labrador, 2015a).

Nova Scotia’s 2009 Climate Change Action Plan called ‘Toward a Greener Future’ placed education as a primary focus of the plan and proposed eight concrete actions at the municipal, provincial and stakeholder levels to address it. Within the actions are public awareness, education programs, and the integration of climate change into the school curriculum (Province of Nova Scotia, 2009, pp. 28-29).

The Northwest Territories are working on a ‘Climate Change Strategic Framework’ which will address the “commitments to reduce greenhouse gas emissions, explore carbon pricing systems and how to capture local alternatives such as hydro, biomass, wind and solar” (Northwest Territories, 2016). In the 2011-2015 ‘Greenhouse Gas Strategy for the Northwest Territories’ only mention of education was in energy conservation awareness for consumers (Northwest Territories, 2011).

Nunavut, in its 2003 plan acknowledges the economic and chronological challenges of climate change awareness due to “the immediacy of other significant issues such as health care, education, and employment” (Government of Nunavut, 2003, p. 11), and appealed to the leadership of the government to make climate change a priority. To move forward, five specific actions were recommended, with ‘enhance[d] awareness and understanding’ through education and ‘investing in knowledge’ being two of the actions (Government of Nunavut, 2003).

Since 2006, the Government of Nunavut along with Natural Resources Canada (NRCan), the Indian and Northern Affairs Canada and the Canadian Institute of Planners started the ‘Atuliqtuq Project’ (which means ‘coming into force’), to build local knowledge and community adaptation. In 2011, the Nunavut Department of the Environment published an assessment of the experience of working on climate change adaptation with different groups, agencies and departments in Nunavut. The results show that whereas formal education is important to adapt to climate change, informal education in the North is essential, since “the transmission of land-based knowledge and *Inuit Qaujimagajatuqangit*, has historically enabled Inuit to pass on the wisdom of generations to

younger Inuit... [which] has enabled Inuit to adapt.. [learning about] personal experiences and history” (Government of Nunavut, 2011, p. 16).

Although Ontario’s goal is to reduce its emissions by 15% by 2020 below its 1990 levels (David Suzuki Foundation, 2012) and the province has been part of the Western Climate Initiative^{xii} since 2007, it was not until 2009 with the Green Energy Act that Ontario started to transition to clean energy and to substantially reduce its GHGs emissions. In its 2014 report, the Environmental Commissioner of Ontario captured the public’s attention by stating that since “Ontario does not publish its own GHG emissions inventory” (ECO, 2014, p. 23) and the data is processed and produced by Environment Canada through the National Inventory Report (NIR), this made it more difficult for Ontario’s policy-makers to set specific targets and track emissions per sector (ECO, 2014). Additionally, there are no specific guidelines for public sector organizations and PSIs reporting GHGs have done so voluntarily.

With the goal of generating zero GHG emissions by 2050, on May 18, 2016, the province created the Bill 172 (Climate Change Mitigation and Low-carbon Economy Act), which will support the cap-and-trade program; and on May 19, 2016, a regulation called the ‘Quantification, Reporting and Verification of GHG Emissions.’ This regulation took effect on January 1, 2017. In June 2016, the latest plan was released, the ‘Ontario’s Five Year Climate Change Action Plan 2016-2020,’ which contains eight action areas (transportation, buildings and homes, land-use planning, industry and businesses, collaboration with indigenous communities, research and development, government, and agriculture, forests and lands). The plan details investments and budgets for each one of the action areas. Starting in 2017, the Province will allocate between CAN\$1,750,000 to

CAN\$2,000,000 to establish a facility to showcase the benefits of the use of electric vehicles (EV). EV and energy consumption awareness campaigns are the only two instances where education emerges in the plan. PSIs are projected to play a role in new and expanded training programs focused on a low-carbon economy. The plan allocated between CAN\$100 to \$400 million to create a ‘Global Centre for Low Carbon Mobility’ at a PSI located in Ontario, whose function will be to advise the Government on transportation, development and manufacturing issues (Government of Ontario, 2016a).

In November 2009, led by the Council of Ontario Universities, the Executive Heads of 21 PSIs in ON pledged to work together on issues around sustainability and climate change. All the commitments were around improving operational practices and sharing information (COU, 2009).

Around 2008-2009, there was a similar proposal to the province of ON to fund a climate modelling centre (similar to PICS). The Vice-President of Research and Innovation (VPRI) at York University in conjunction with faculty members and students from the Faculty of Environmental Studies began a series of roundtables and managed to get the Toronto and Region Conservation Authority (TRCA) involved. In 2010, after a workshop at the Black Creek Pioneer Village in Toronto, a report on the state of climate science and potential events was submitted to the province along with a proposal to create the centre. The province rejected the proposal but asked to try and engage other groups and universities. In 2010, invitations to partake in an ad-hoc working committee were sent by the VPRI’s office at York University and the TRCA to universities and municipalities across the province. Out of this process, the Climate Consortium for Research Action and Integration (CC-RAI) was created and later the Ontario Regional Climate Consortium

(ORCCC). As of September 2016, the ORCCC's members are the initial founders, plus the Region of Peel, the University of McMaster's Centre for Climate Change, the University of Guelph, and Western University (CC-RAI, 2010; ORCCC, 2016).

Quebec's 2012 plan proposed 30 priorities to fight climate change, one of which recommended the support of community and civil society initiatives. The aim of this priority was to link young people with the battle against climate change through the incorporation of this issue into existing courses and through teacher's training (Gouvernement du Québec, 2012).

The Prince Edward Island (PE, 2008) Strategy document — although not in a comprehensive manner — contemplated the idea of developing public education and awareness campaigns to influence individual behaviours, which included the inclusion of climate change into the science curriculum of public schools (K-12). This initiative and the development of a provincial website with climate change education tools and information available to the public, practically disappear in the 2015 and subsequent 2016 Strategy documents (Government of Prince Edward Island, 2008; Government of Prince Edward Island, 2015; Government of Prince Edward Island, 2016b).

To date, Saskatchewan has neither plan nor legislation to address climate change. In 2009, the province introduced an act to manage and reduce GHGs and to adapt to climate change, but the act has not yet been proclaimed (Government of Saskatchewan, 2009; Boothe & Boudreault, 2016). Saskatchewan's initiative so far (pending the outcome of the 2016 Fall's meeting with the Premiers^{xiii}) has been to propose to reduce 40% of GHGs emitted by SaskPower — the largest provincial emitter — below the 2005 levels by 2030 (Government of Saskatchewan, 2016b). This plan is based on the premise that carbon capture and storage (CCS)'s technologies will help to

accomplish this goal. It is important to consider that in 2015, 42% of the energy produced in Saskatchewan came from coal-fired plants and only 4% from plants whose technology use CCS. This provincial response also fails to consider the emissions generated by the oil and gas industries, which account for the 28% of the provincial GHGs, while the power generation industry accounts for the 22% (SaskPower, 2016; Government of Saskatchewan, 2016a).

In 2002, the Saskatchewan Government in partnership with the University of Regina, the Canadian Government, SaskEnergy, and SaskPower, created a fund for a CCE project, whose goal was to develop educational materials for students and teacher training. Unfortunately, there is no evidence of the implementation or development of the project by any of the aforementioned partners (Government of Saskatchewan, 2002a).

Yukon does not yet have a target for the territory, but on its latest plan of 2015, it stated its intention to set a target within the next two years. The plan describes the progress as well as sets specific sector targets, such as the government's internal operations to become carbon neutral by 2020. The plan has four goals, one of which is the climate change 'enhancing [of] knowledge and understanding' through educational outreach programs. Also, the Climate Change Secretariat of the Government of Yukon is developing a certificate focused on Northern climate change policy at the Yukon College (Yukon Government, 2015).

Summary

This introductory chapter provides an overview of multiple efforts made by high-level international, provincial and institutional factions and their underlined desires for change. My

focus has been drawn to policy. As I reflect on climate policies, I am reminded of Sauv   et al.'s (2007) analysis of over thirty years of international environmental education policies. Their study suggests that within these policies environmental issues are rebranded but tend to remain (fundamentally) unchanged. Although the policy language changes, the underpinning assumptions and values remain static, policies persistently promote:

- “sociocultural mega trends which characterize our contemporary Western civilization” (p. 36), and,
- “perspectives on education, environment, and development” (p. 36) in which:
 - education is an instrument to support a political and economic agenda,
 - environment is reduced to problems of resources, and
 - development is mainly associated with sustained economic growth (p. 36).

Many PSIs have publically made climate declarations and developed institutional-wide policies. I leave this chapter contemplating the underpinning assumptions and values of such policies and also the actions that these promote and foreclose. I am also conscious of key differences between policy and practices. Rather than repeating a policy analysis along the lines of Sauv   et al., I focus my growing attention on how PSIs *do* climate change education at the institutional level, taking into consideration policy and contextualised factors that influence emergent curricula actions. My point is that policy is seeking to bring about change and my assertion is that it is better to focus on contexts of change in educational practices (and connect these to policy where appropriate). The influences of policy on particular educational practices warrant extended exploration. In the next chapter I make a case for the complex nature of educational institutional change.

CHAPTER 3.0 – Literature Review and Theoretical Framework

Those who are looking ahead to a new movement in education, adapted to the existing need for a new social order, should think in terms of Education itself rather than in terms of some ‘ism about education (Dewey, 1938, p. 6)

Part of the complex conundrum of schooling is to be understood by capturing the internal process of stability and change in the curriculum (Goodson I. , 1992, p. 79)

The previous chapter offers a detailed overview of climate change policies, declarations and associated PSI curriculum directives. In broad terms, this highlights significant numbers of policy statements, many of which call for a reorientation of education in schools and universities in response to pressing environmental challenges. In this chapter, I turn my attention to PSIs as complex institutions. My research is sensitive to the contexts of PSI climate change curriculum formations. Climate change curriculum in this sense is not to be conceived as a ‘given’ – a logical, incontestable ordering of knowledge - but as a dynamic social situated process of curriculum formation. I take the relationships between international, national and institutional policies and curriculum as an open question for exploration.

National and international policies are complexly encoded into textual statements, often following “declarations”. But it is also important to recognise that these policies are further encoded/translated (or not) into particular actions, including curriculum guidelines and pedagogical activities within specific educational settings and contexts. My focus is on curriculum formations — I am interested in getting a sense of what curriculum formations have occurred in PSIs, as well as how and why.

In other words, notions of curriculum as dynamic, changing, epistemic, social, institutional formations are the focus of my research. I turn to theories grappling with ideas of curricula as social and political constructs/ assemblages/ enactments (there are a number of different words here). My research is supported by studies that frame curriculum as social, political and cultural repeaters (Bernstein, 1975) and praxis (Goodson I. , 2005); and, as enactments, interpretations and recontextualizations (Ball, et al., 2012).

Bernstein (1975) argues that the selection, classification, distribution, transmission and evaluation of knowledge “reflect the distribution of power and principles of social control” (p. 77) in societies. My study is particularly interested in the ‘selection’ of climate change knowledge, which according to Bernstein underlines a struggle “between different conceptions of social order [which are] fundamentally moral” (p. 73). Furthermore, my study seeks to explore links between institutional climate change policies and formations of climate change curriculum, without the presumption that one is a precondition for the other, but rather to understand whether and in what forms are these links present in PSIs.

The framework of analysis developed by Bernstein (1990) to explain the social construction of pedagogic discourse (pedagogic device) was based on the distribution of power (at the macro and micro levels) between social groups and the production and reproduction of forms of knowledge (consciousness). This pedagogic device, Bernstein argues, is organized by a set of rules, which in turn transform the device into “a symbolic ruler of consciousness” (p. 172). He asks then, “whose ruler, what consciousness?” (p. 172). He goes further:

Pedagogic discourse is a recontextualizing principle, which transforms the actual into the virtual or imaginary, then any recontextualized discourse becomes a signifier for *something other than* itself. What this ‘other’ is, the *principle of the principles* of the recontextualizing is selected — or, perhaps more accurately, the principle which regulates the range of principles available for selection — varies according to the dominant principles of a given society. In this sense regulative discourse is itself a precondition for any pedagogic discourse (1990, pp. 175-176)

Hence, Bernstein’s suggestion is that dominant principles within societies have an implication for the selection of pedagogic discourses is particularly relevant for PSIs, which has been systematically incorporated in the business^{xiv} of higher education. What Stephen J. Ball (2012) calls the “rough neoliberal beast” (p. 17), suggests that the nature of economics and how PSIs are currently operating have the effect of “subordinat[ing the] moral obligations to economic ones,” (p. 20) therefore, members of a PSI are constantly “produced rather than oppressed, animated rather than constrained” (p. 19). Consequently, PSIs operate under double standards, where it is acceptable to invest funds in polluting or socially ‘questionable’ capital, as long as the profits are promising. In addition to this, popular subjects, research and educational programs are funded whether they are in line with what the job markets dictate or whether these are considered as “a tool for economic stimulus and social engineering” (The Guardian, 2009).

In an analysis of history curriculum formation in South Africa, Suellen Shay (2011) writes:

While universities have greater autonomy over curricula than schools, these ‘choices’ are always constrained. The pedagogic device models the conditions for constraint. Firstly, the selection, sequencing and evaluation of educational knowledge – what Bernstein

refers to as ‘instructional discourse’ – is always embedded in a regulative discourse: that is, a particular moral, social and political order of meaning. This suggests that the formation of a history curriculum in South Africa is embedded in, and thus regulated by, the norms of the given society. Secondly, the field of recontextualization is itself regulated by the field of knowledge production, in this case, the investigations, analyses, interpretations and arguments of historical scholars. The pedagogic device explains how curriculum ‘choices’ are shaped by, among other things, the norms of the prevailing socio-political order, as well as the contestations for legitimacy in the field of knowledge (p. 317).

My study was also built in line with Goodson’s (1989) proposition that “we must embrace fully the notion of curriculum as social construction first at the level of prescription itself, but also at the levels of process and practice” (p. 1). My research seeks to understand those ‘dominant principles’ behind the process of curriculum formation, which according to Goodson are typically “left unexplained” (2005, p. 55), and according to Ball et al. “are marginalized or go unrecognized” (2012, p. 2).

Ball et al. also challenge the notion that “teaching is de-politicised” (Ball, et al., 2012, p. 6) and argue that educators are presented with a set of institutional guidelines, norms, policies, but in the process of ‘enacting’ them, subjects (faculty, curriculum committees, administrators) transform, adapt and interpret these set of guiding principles rather than just implementing them:

Thus, we want to ‘make’ policy into a process, as diversely and repeatedly contested and/or subject to different ‘interpretations’ as it is enacted (rather than implemented) in

original and creative ways within institutions and classrooms (see also Ball 1997, 2008) but in ways that are limited by the possibilities of discourse.... policy enactment involves creative processes of interpretation and recontextualization — that is, the translation of texts into action and the abstraction of policy ideas into contextualized practices — and this process involves ‘interpretations of interpretations’ (Rizvi and Kemmis 1987), although the degree of play or freedom from ‘interpretation’ varies from policy to policy in relation to the apparatuses of power within which they are set and within the possibilities of context (pp. 2-3).

Curriculum, in my study, is understood as those climate change courses and programs (including activities, materials, resources, and discussions) developed by professors, departments, committees, whose intentions are “an attempt to generate valuable [knowledge and] experiences” (Pierce, 1971, p. 278). My research is also based on assumptions that knowledge, values, ideologies, power and identities shape the nature of climate change courses and programs.

Acknowledging “the limitations of humanist notions of truth, bias, reality and representation” (Berbary & Boles, 2014, p. 402), my study parts from the assumption that PSI curriculum is “far from being timeless statements of intrinsically worthwhile content, subject and disciplines [but rather] are in constant flux” (Goodson I. , 2005, p. 56) with current social, economic, cultural and environmental ideas and ideals. The first stages of my research examined questions concerned with the nature of CCE in PSIs and the types of knowledge that constitute the Canadian climate change curricula (Creswell, 2013, pp. 20-22). This consisted of an extensive survey of all the climate change course offerings and programs in Canadian PSIs and a grounded analysis of the intended

CCE curriculum, with the assumption that the generation of courses and their content were based on ‘ideas’ and ‘truths’ presented by professors, faculties or departments, and that these ‘ideas’ were explicitly and implicitly expressed in the course/program titles, descriptions, and syllabi.

The existence of climate change courses at PSIs constitutes “signifying practices” which “share a set of social and cultural codes” (Roberts, 2010, p. 173). It is possible then, that PSIs define their identity based on the representation of climate change ideas or ideologies, which suggest that dynamics of representation within PSIs where courses are chosen, discarded, or arranged into programs could be both an ideological demonstration as well as a form to resistance of the *status quo*:

The power to determine the horizons of what counts as meaningful can be achieved by controlling the images, symbols, and social codes that make up cultural life, and this power is equivalent to the power to legitimate and naturalize a particular worldview as common sense, thereby determining the horizons within which self-definition and social meaning are achieved (Roberts, 2010, p. 173)

As professors design a course, they construct a story line. The inclusion and omission of content are revealing, as this content becomes an instrument for professors to lead students through each session towards the proposed objectives. As Arthur W. Frank writes “Stories work with people, for people, and always stories work *on* people, affecting what people are able to see as real, as possible, and as worth doing or best avoided... human life depends on the stories we tell” (2010, p. 3). But this study is not about the stories themselves or how not only are humans affected by the way in which climate change stories have been portrayed in recent decades. This study attempts

to understand how and why particular professors or departments within PSIs chose these stories as part of their curriculum.

My point is that curriculum is a climate change performance, and as such it performs climate change in some ways rather than other ways. Curriculum outlines cover somethings and not others — to use Thomas Gieryn's words these processes create boundaries. Drawing from the aforementioned works of Bernstein, Goodson, Ball et al., Roberts and Frank, I return to the general questions of my study:

1. What climate change courses are there currently in Canadian PSIs?
2. What are some of the factors influencing climate change curriculum formation in Canadian PSIs?

3. 1 Overview of Climate Change Curriculum in Post-Secondary Educational Institutions (PSIs)

PSI studies on sustainability and climate change policy, research and curriculum are scarce (Henderson et al., 2017; Leal Filho, 2010; Vaughter et al., 2013; Vaughter et al., 2016). Anderson argues that since CCE is a relatively new area of study, “the majority of evidence that exists is anecdotal, often in case-study format, without monitoring and evaluation processes in place that could lead to quantitative as well as qualitative data” (2012, p. 200). According to Henderson et al. (2017) PSIs predominately focus climate change curriculum on “changing energy consumption behaviours” (p. 20). Vaughter et al. (2016) found that in the majority of sustainability policies, education focuses on co-curricular activities, with a few exceptions:

Although the development of curricula on sustainability was often encouraged in the policies, it was not mandated and the operationalization was typically vague. Where sustainability curricula were discussed, they were often linked to interdisciplinarity. The majority of the content that was coded in relation to education was focused on co-curricular activity, or in other words, campus activities not part of the regular curriculum. To a lesser extent, public awareness campaigns seeking to change behavior were also discussed in the policies (p. 27).

It is possible that in Canada — as it has been suggested by Ng-A-Fook (2014) — the lack of publications on climate change curriculum was influenced by the federal political landscape of the last decade, where climate change was deliberately diffused from the national scene:

As we well know, under the current governmental regime, even scientists themselves must now offer Socratic apologies, protesting on parliament's front steps, to secure funding for projects that do not comply with the utilitarian dream of economic prosperity — like the science that supports our concerns about the future intergenerational impacts due to climate change. Therefore very few international and national curriculum scholars have been able to secure these competitive grants and/or Canadian Research Chairs in order to ask more of Canadian curriculum studies in relation to “crazy ideas” (p. 40).

Inventories of climate change courses in PSIs are to be found within sustainability frameworks of institutional assessments (such as STARS). Only one report, to my knowledge, has been published in Canada of climate change courses located in British Columbia during the 2010-2011 calendar year (PICS, 2011). The GHG Management Institute claims to have built a database of climate change courses for the United States but the results are neither public nor easily accessible (Gillenwater, 2011).

In preparation for my research I conducted an extensive review of publications focusing on climate change education and curriculum in PSIs. Here, I organize this literature in the following groups: (1) national responses to climate change curriculum; (2) individual influences in climate change curriculum; (3) expansion of the climate change knowledge base — including CCE in general education courses at the undergraduate level, post-graduate certifications and courses, vocational and technical training, development of graduate program — and bridging disciplinary boundaries; (4) and reforming the curriculum to include contemporary topics such as climate change.

- **National Responses to Climate Change Curriculum**

At the national level, some of the climate change curriculum responses seem to be linked to major climate incidents. For instance, by 2010 the African continent had already experienced significant changes in the weather patterns, including heavy rainfall events, which triggered the worst flooding incidents in the last decade in Kenya (NOAA, 2011). This prompted responses from the Southern African Regional Universities Association (SARUA) and the Kenya's National Climate Action Plan both of which clearly recognized the urgency and importance of integrating CCE into their tertiary education:

Climate change permeates all sectors of the economy. Because of that, climate change should be infused into the various professions taught at universities in Kenya. Civil engineers, for example need learn how to design and develop structures that can withstand climate shocks; doctors need to be aware of the effects of climate change on human health, while architects should have the skills and training to design houses that need minimal energy to run and maintain. Teachers ought to be equipped with knowledge about climate change in order for them to be suited to teach a curriculum that integrates climate change across all subjects taught at schools in Kenya. Whereas it is already the case that climate change as a subject is now being taught at some Kenyan universities there will be a need for institutions of higher learning to develop policies to ensure that all students trained there are familiar with climate change and its impact (Republic of Kenya, 2012, pp. 8-9).

There is a need for graduating university students to be well versed with the challenges posed by climate change if they are going to advise the communities they will be working with appropriately. They also need to understand the implications of climate change on

economic development. Educating learners, currently at school about climate change, will help to shape and sustain future policy-making. Studies on climate change have so far been limited to adaptation and mitigation intervention strategies. The faculty and students should be able to contribute to the development of the body of knowledge as regards climate change. Students should be aware of the various International Conventions and Protocols surrounding climate change. These include UN Framework convention on climate change (UNFCCC), Kyoto protocol, and a range of other informal partnerships and dialogues that provide both a framework that supports co-operation and a foundation on which to build further collective action. The challenge now is; how to develop good curricula, produce relevant learning resources and capacitate educators. This is where efforts should be put to ensure such needed knowledge is offered in the region (SARUA, 2010, pp. 28-29).

- **Individual Influences on Climate Change Curriculum**

Individuals can have direct influence on the existence (or not) of certain topics within the curriculum or and whether these topics are continuously taught. This effect is experienced both at the institutional and national levels. In an interview with Sims & Falkenberg (2013), Dr. Don Dippo of the Faculty of Education at York University acknowledged an individual who shaped a particular course at the institutional level:

One of our faculty members working on the course was a very committed environmental educator. So now, this course has an explicit social justice agenda and it's where climate change and environmental education are taken up. That was a pretty remarkable achievement where the course had to be redesigned and approved at all levels. In the pre-

service curriculum, it's a core required course. However in practice, that course is sometimes team taught but more often it's taught by an individual and the extent to which that person has knowledge in those areas, that's the extent of which EE/ESD gets taken up. But it's there, and that's significant. (Sims & Falkenberg, 2013, p. 5).

An example of an individual exerting power at the national level in regards to a curriculum reform is highlighted in the Introduction of the book “*Sustainability Education. Perspectives and Practice Across Higher Education*” edited by Jones, Selby & Sterling (2010). In 2005, the Higher Education Funding Council of England (HEFCE) proposed that since many students who graduated from PSIs were unable to make sustainable-conscious decisions, the inclusion of sustainability in the “curricula, pedagogy and extra-curricular activities [could] enable students to develop values, skills and knowledge [and therefore] contribute to SD” (Jones, Selby, & Sterling, 2010, p. 4). Peter Knight, a former Vice-Chancellor of the University of Central England, responded in a letter to The Guardian that “it is not the job of the universities to promote particular orthodoxy; it is the role to educate students to examine critically policies, ideas, concepts and systems, then make up their own minds... it is about basic rights and responsibilities of universities, and the need to safeguard academic freedom” (Jones, Selby, & Sterling, 2010, p. 4). According to Jones, et al. (2010), Knight’s letter seemed to have had a profound effect on the HEFCE’s work in curriculum development in the UK (Jones, Selby, & Sterling, 2010, pp. 5-6).

- **Expanding the Climate Change Knowledge Base and Bridging Disciplinary Boundaries**

Between January and July 2009, the Hamburg University developed a study called the “World Climate Change Survey,” in which Leal Filho (2010) found that students learn more about climate change through the media and the Internet than through university courses. He also found that the actual course offerings were generally restricted to the area of natural sciences. Rappaport & Hammond (2007) affirmed that although “climate change can play a role in virtually any classroom” (p. 272), the number of climate change course offerings is highly localized and virtually insignificant. These authors also suggest that the limited exploration of climate change issues within other disciplines lies in the fact that climate change has been understood and “marginalized as environmental problem[s and not]... as an enormous societal challenge” (p. 273). This view is also shared by the GHG Management Institute, who in a 2009 report on the need for a workforce better prepared on climate change, stated that even though “climate change stretche[d] across academic disciplines,” the majority of PSIs limit the offerings to the field of atmospheric sciences, which makes it a challenge when developing new climate change programs (2009, p. 29). This report said also that 84.1% of PSI respondents considered that their institutions were not providing enough climate change management skills and preparation “to work within the industry” (2009, p. 29).

The disconnection between climate change and disciplines outside the natural sciences has started to emerge in the literature — although scarcely — in recent years. Brulle and Dunlap have recently suggested that the reason for this separation is that “from the very beginning of the climate change research effort, the social sciences have been and continue to be marginalized” (2015, p. 3).

According to UNESCO (2010), bridging across disciplines can be done in a “transdisciplinary manner into existing subject areas,” which would help to reduce the “already overstretched programmes” (p. 7). In 2011, the ACUPCC’s report on the “Higher Education’s Role in Adapting to a Changing Climate” maintained that although “many planning departments [were] routinely including lessons in some required courses on weighing climate impact risks when undertaking community master plans, zoning ordinances, and the like.... Climate adaptation education [should] not be limited to the STEM disciplines (science, technology, engineering, and math)” (p. 12). It also indicated the importance to “increase [PSIs] curricular offerings on climate adaptation, both through mainstreaming the information in core courses and ..electives” (p. 4), as well as “evaluate research activities and pursue opportunities ...to help society to adapt to climate disruption” (p. 22).

This segregation of subjects to a few disciplines, for some is, therefore, problematic and can constrain the ability of students to respond to climate change issues as professionals or individuals. Gough & Stables (2012) argued that ‘learners’ engage with issues such as climate change, not as following simple prescriptions of facts and processes, but as an “ongoing deliberative review and refinement of their own interpretative structures [and] through consideration of the interpretative structures of others” (p. 381), therefore the climate change curriculum would potentially lead them ‘to respond’ rather than only ‘to know.’ Fadeeva et al (2014) chose a whole-university approach as an example of the previous premise. First-year students at the Leuphana University take the same courses regardless of their program, which has integrated sustainable development issues into the curriculum. In 2014, the focus was on climate change and justice. The authors argued that

for the students this experience is transformational in the sense that it “combines research, education and institutional activities and, as such, seeks to transform itself as well as the region it serves” (p. 74). Bokhoree et al. (2012), who conducted a study on the understanding of climate change impacts on water resources in Mauritius, found that those who have not only access to higher education but also where climate change was part of their curriculum, were able to discuss climate change issues more comprehensively.

Gillenwater (2011) argued that since PSIs “struggle to integrate learning across disciplinary boundaries” — a problem not only limited to CCE — their challenge is to create resources to bridge and innovate within specialties (p. 14). He also called for the establishment of a specialty programme (GHG Measurement and Management, GHGMM), as a new field and discipline, which would standardize techniques and technologies, by arguing that climate change experts were working “in isolation.... [and] develop[ing] techniques for addressing similar problems without knowledge of previous or parallel work... [in addition to using] varying and imprecise terminology” (p. 13)

UNESCO also suggested that the integration of climate change into the curriculum should follow the successful approaches of Education for Sustainable Development (ESD) (2010, p. 12). Paradoxically, the isolation of CCE in PSIs from a number of disciplines mirrors the challenges faced by the Education for Sustainable Development (ESD), in terms of curriculum integration regarding content, pedagogy and the reorientation of teachers’ education (Sims & Falkenberg, 2013). Furthermore, discussions around CCE (addressed in Section 2.1) and the few papers on CCE in PSIs that touch upon curriculum have been framed within sustainable development,

environmental education, and science and technology studies (Ubelis, Abolins, Berzina, Blahins, & Bajars, 2010; Eagan, et al., 2008; ACUPCC, 2011). Gillenwater's (2011) argued that having climate change embedded into the sustainability curriculum was problematic because sustainability was "very broad-based... and often lack[ed the necessary] technical focus, foundational of concrete metrics and management techniques" (pp. 11-12), and also that climate change issues needed a certain level of professionalization.

The importance of CCE as the basis for technical and vocational training has been addressed by UNESCO (2010), who highlighted the significance of 'green jobs' to reduce both the consumption of energy and GHGs emissions (within other benefits). Although UNESCO acknowledged the limitation of these types of jobs to fields such as recycling, agriculture, construction and transportation, it stated that within the framework of technical and vocational education and training (TVTET) for sustainable development, 'greening' the curriculum would make it possible for "all jobs [to] have the potential to become greener" (p. 13). ACUPCC (2011) has also suggested that community colleges had the opportunity "to teach members of the local community ...the specific skills needed to implement adaptation solutions" (ACUPCC, 2011, p. 13).

- **Climate Change and the Curriculum Reform**

UNESCO (2009) demanded the incorporation of CCE within ESD at all levels, not as a "new "adjectival" education" (p. 18), in other words by "reforming [the] educational systems towards sustainability: curriculum change, structural change and reorienta[tion of] teacher education" (p. 18).

Using the curriculum reform of a master's program (the Master of Climate Change Adaptation), offered by an Australian university, Fahey (2012) argued that although it took a degree of personal interest in undertaking a "renewal process" of an academic program in climate change, this process not only helped those involved in their professional development as researchers, but also in the quality of their teaching practices. In addition to this, the revision, redesign and subsequent selection of relevant courses helped (1) students to "achieve specific programme-level learning outcomes" (p. 717), and (2) teachers as active researchers to "embed social issues.... [and] to prepare [students] to resolve multi-dimensional, international issues and problems such as those associated with climate change" (p. 718).

Desha & Hargroves (2014) argue that by leaving the curriculum as it currently stands, postgraduates and professionals would have to confront challenging climate change issues. Therefore, a curriculum renewal process that would "prepare undergraduates to contribute to society achieving gradual sustained reductions" (p. 18) was necessary. The authors proposed two ways to stabilize (referred to as 'peaking' by the authors^{xv}) GHG emissions, first by developing post-graduate certificates, diplomas or Master's programs; and second, by "focusing on undergraduate programs to develop the required knowledge and skills" (p. 18).

SARUA (2010) recalled the work of Temu et al. (2003) and Chakeredza et al. (2008) in recognizing the disconnection between curriculum objectives and local needs:

The shortfalls in tertiary agricultural education have been further described by Temu et al. (2003) and Chakeredza et al. (2008) as: the poor staffing of institutions to meet the desired curriculum coverage; the training is predominantly based on curricula adopted

from countries that had colonies in Africa, the curricula were founded on an agricultural philosophy that aimed at the production of cash crops for consumption by the colonising countries; the teaching mode is not learner-centred; and there is very little integration of theoretical training with field level experience. While agricultural sector and land use are the chief economic sector in the region, in contrast, most of the universities are located in towns where there are no farming communities nearby to work with. In most cases [n]either the farming community nor the private sector is involved in the design and delivery of the agricultural curricula. (p. 28).

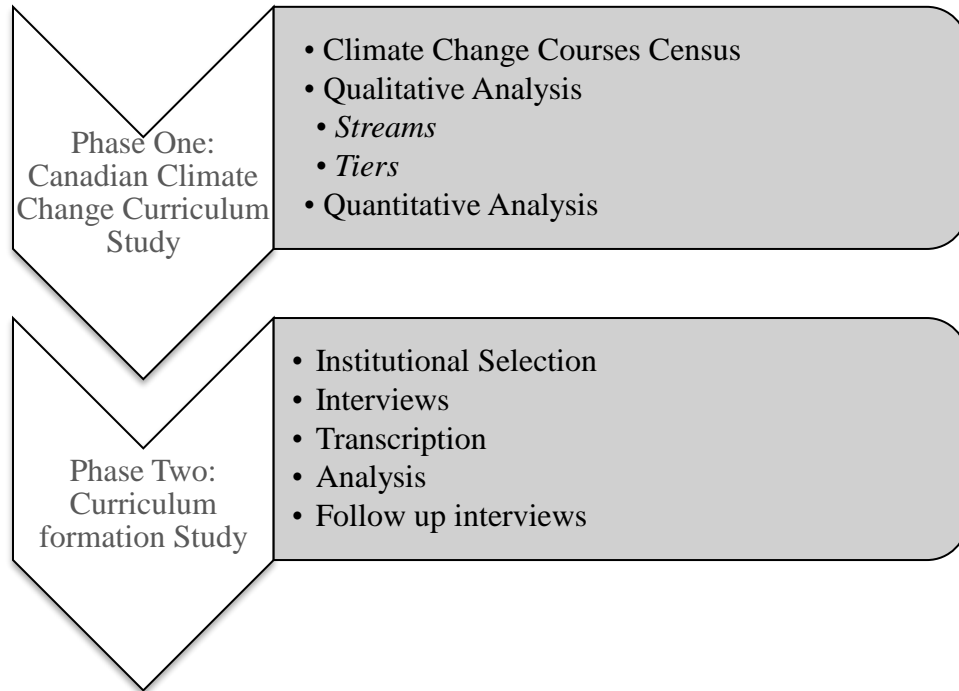
This chapter highlighted how climate change curriculum can be shaped by selected and selective discourses (whether individual, local, regional, national, or international), which are clearly influenced by a multitude of powers applied in the production and reproduction of knowledge. It is important to emphasize that studies on climate change curriculum-in-action are scarce and that research focusing on the process of formation and selection of climate change programs and courses is practically nonexistent.

CHAPTER 4.0 - Methodology

Considering the extent to which climate change impacts humans (and non-humans) globally, this study (as previously mentioned) seeks to explore the following questions:

1. What climate change courses are there currently in Canadian PSIs?
2. What are some of the key factors influencing climate change curriculum formation in Canadian PSIs?

In response, my research comprises two distinctive chronological phases with distinctive methodologies. The first phase (a Canadian Climate Change Curriculum census during the calendar year 2014-2015) provides foundations for the following phase (a social and political study of climate change curricula formations in selected Canadian PSIs). These are represented chronologically in the following flow chart. The first phase informs the second.



4.1.1 Phase One: Census of Canadian Climate Change Curriculum

The first phase of the research involved a “quantitative census analysis” (Dal, 2011) through an online data collection of PSIs climate change course names, descriptions, and syllabi. This methodology has been defined by Dal (2011) as a “quantitative nonexperimental research that can be conducted in a descriptive, predictive, and explanatory manner and carried through as cross-sectional, longitudinal, or retrospective research” (p. 276). According to Dal, there are two types of online data collection. The first is where data is directly obtained from websites, and the second is where data is requested by email. This study used both approaches. Course data was obtained directly from PSIs’ websites through a Boolean search using the most popular North American crawler-based^{xvi} search engine, Google. The dataset was completed by accessing university data through direct request from either course directors or department administrators.

In order to compile a comprehensive list of PSIs for Canada, the following lists were consulted: the '*Canadian Education Directory*' of the Canadian Education Association; the accredited member's lists from Universities Canada and the Association of Canadian Community Colleges; and the lists from each provincial and territorial Ministry/Department of Education. I consulted these lists because I was trying to make an exhaustive list of all PSIs in Canada that were registered with provincial ministries or were part of organizations that accredited PSIs.

A total of 310 PSIs were found and then organized by province and territory. My study focused only on English and Bilingual PSIs, criteria after which resulted in a total of 225 institutions. Climate change courses offered by these institutions were identified during the calendar year of 2014-2015.

To locate the climate change course curriculum, I performed an online Boolean search of the 225 PSIs' published online course program materials. These materials include the academic calendar, the list courses of every faculty/department, and the central database of the registrar's systems. All available program materials were examined in order to locate climate change course offerings. Three keywords were used to identify climate change courses: a) 'climate change', b) 'global warming' and c) 'greenhouse gases/GHGs'. These keywords were used as compound words. In some cases, the searches returned courses containing part of the compound word, in which case the course was further assessed (e.g. by identifying variations to the keyword, for example 'climatic change'; and by requesting and evaluating the course syllabus). This was done to verify that 'climate change' was in fact considered (or not) as a topic in the proposed syllabus.

Limiting the search to the three selected keywords was done deliberately. It is likely that some courses that focus on sustainability, energy, or ecological systems will touch upon climate change. However, the study sought a manageable sample and use of these terms in both the titles and descriptions was read as an expression of purpose and commitment to ‘climate change’.

The data collected from the PSIs’ websites, Statistics Canada, the UCPCCSAC’s website and Universities Canada was compiled in a pre-set excel spreadsheet. A title and description for each one of the courses were downloaded. In the cases where the syllabus was not available online, the course material was requested by email from the professor or the contact person in the department where the course was being offered.

Contacting each professor and department was decided after trying to acquire the data through the registrar’s office in a few institutions. Universities Canada was also contacted to determine if they collect course content information. Both approaches demonstrated that the best way to acquire the data was through direct contact with the department that offered the course or the professor who taught/currently teaches the course. The requests were made primarily through email correspondence (n = 702). The enrolment numbers per calendar year were to be the most difficult data to acquire. In many cases, both professors and departments returned estimates of enrolments rather than actual numbers. Within the reasons offered by departments/faculties as to why these records were not provided were the lack of access to historical enrolment records or the inability to allocate someone’s time to gather these data, since it is was not usually collected for analytical purposes. Enrolment data was subsequently eliminated from the analysis due to the incomplete number of registered students per course per year.

A few of the contacted professors pointed to courses that were not found through the Internet searches (n=9). These courses were examined and those that met the criteria were included in the study database (n=4). Faculties and departments were condensed into clusters according to the area of study/discipline, in order to facilitate the final analysis (See Appendix, Table 10, p. 244).

4.1.2 Course Analysis

A grounded content analysis (Creswell, 2013) was performed on the sample of course syllabi and descriptions. Grounded theory, first described by Glasser and Strauss (1967) allows for the “discovery of theory from data [which] is faithful to the everyday realities of the substantive area [and] is one that has been carefully induced from the data” (1967, p. 239). My research sought resonance with data, but also recognises the ways in which it is shaped by curriculum theory. The analytical approach adopted might best be described as “abductive inferencing” - a dynamic blend of induction and deduction as a means to “reach to the sphere of deep insight and [with the idea to generate] new knowledge” (Reichertz, 2007, p. 216). In the first phase, each course was coded according to its: a) ‘focus’ on climate change (into tiers) and b) according to the areas of knowledge or disciplines (into what I am referring to as ‘streams’).

(a) Focus (Tiers): The descriptions and syllabi focus were assigned to different tiers. The classification into tiers was adopted from the 2011 Pacific Institute for Climate Solutions’ (PICS) paper and modified for this study. PICS (2011) included in their Tier 3 listings courses that mentioned “current environmental issues.” In this study only those courses that contained any of the keywords or a variation of the keywords were included. This analysis was a two-pass

examination, which sought to initially sort the descriptions and syllabi into a series of concentration levels. Then a further analysis was developed employing the criteria described below. In case of ambiguities, course directors and/or departments were contacted to determine the Tier category. To establish the level of attention on climate change and following the criteria established by PICS (2011), each course was classified as either:

- **Tier 1.** Climate change is the main focus of the course: This includes courses where climate change is in the title, or where it is clear in the description and/or syllabus that climate change is the central topic for the entire semester.
- **Tier 2.** Climate change is a core topic: This includes courses where climate change is a module or an important section of the course.
- **Tier 3.** Climate change is included to a lesser extent: This includes courses where climate change is mentioned in the description [or syllabus], but not listed as a core module (pp. 5-6).

Course extracts and examples of how they were coded are provided in the appendix (Tiers of Concentration, coding sample, p. 237).

(b) Area of Knowledge (Streams): The classification into ‘streams’ was generated after a grounded content analysis (Creswell, 2013) of the course descriptions and syllabi. The data was uploaded into NVivo (for Mac, ver 11.3.2). Coding of the course content helped to identify the categories and to group them “in[to] a systematic order.. “in order to consolidate meaning and explanation”” (Grbich, 2007, p.21, in Saldaña, 2009, p. 19). I refer to the categories in which the climate change courses are classified as ‘streams.’ Fields of study and disciplines were identified from the courses, and common terms (in what Saldaña (2009) calls “coding for patterns: similarity, difference, frequency” (p. 16)) were selected and compiled into a table to assist classifications.

Coding in this project was done individually, recognizing that “all coding is a judgment call” since we bring “our subjectivities, our personalities, our predispositions, [and] our quirks” to the process” (Sipe & Ghiso, 2004, pp. 482-3, in Saldaña, 2009, p. 18). As suggested by Saldaña (2009), after the first individual coding cycle, the categories were analyzed and discussed with my supervisor and peers to “articulate [my] internal thinking process [and to] clarify [my] ideas” (p. 37). Five streams were identified: Technical, Managerial, Environmental/Sociological, Economics, and Politics and Governance (Table 8, p. 238). Each course was further examined and classified into a particular stream. Further details of these streams and the associated coding processes are available in appendix (Climate Change Education Streams, Coding Sample, p.239).

4.1.3 Quantitative Analysis

All the data was processed using Microsoft Excel. Simple statistical analyses were performed on the numeric weighting of the streams to explore trends at the institutional, provincial and national levels. Data charts and maps were created with Microsoft Excel (For Mac, ver. 2011).

4.2 Phase Two: Cultural and Political Study

4.2.1 Institutional Selection

After completing the analysis of collected data on climate change courses, PSIs with existing undergraduate and graduate programs on climate change were selected as interview sites. After careful consideration (and discussions with my supervisor), the decision to limit the sample to PSIs with climate change programs was based on the fact that Canadian PSIs with existing climate change programs are also in this study the ones that offer the most climate change courses in Canada. Therefore, the likelihood of finding faculty who have experience in the process of creating, proposing, and/or updating climate change courses was high. Also, considering that all of the climate change programs in Canada had been set up within the last decade, the chance of finding committee members, program creators and administrators who actively participated in the process was also high.

4.2.2 Interviews and Data Analysis.

Members of each program, including directors, professors, and curriculum committee members were contacted, and interviews were made either on the phone, in person and through Skype.

The interviews were conducted as informal conversations (Creswell, 2013). A questionnaire was prepared to guide the interviews (See Appendix for a list of sample questions, p. 255). 13 interviews were conducted in 6 PSIs located in three provinces. Notes were taken during the

interviews and the conversations were electronically recorded. Each interviewee was provided with an Informed Consent Form in accordance with the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. Recorded interviews were then transcribed with a focus on the interview content.

Some of the interviewees were contacted via email with further questions. The interview data was uploaded and individually coded (as explained in section 4.1.2 b) using NVivo (For Mac, ver. 11.3.2). Creswell (2013) and Saldaña (2009) inform the coding methodology. After finding “patterns: similarities, difference, [and] frequency in the interviews” (Saldaña, 2009), responses were coded into the following categories: Culture (Ideas; ideologies; philosophy; power; language — in administration, power; values; agendas); Place (Administration — bureaucracy, invisibility, processes, siloes and access; economics — budget, growth model, job markets, marketing; disciplinary boundaries; micropolitics, program — enrolment, educational model); Politics (global; macropolitics; policies — national, institutional, provincial, global; affiliation); Power (corporate; federal; institutional; provincial; within individual; within stories).

Selected parts of the interviews are omitted in the analysis to protect the confidentiality of the interviewees. This involved the removal of institutional affiliation, positions, name of programs, and geographical location. Each interviewee was assigned a code: Interviewee 1 is I1, Interviewee 2 is I2, and so on.

I now turn my attention to Canadian climate change curricula.

CHAPTER 5.0 - Climate Change Curricula in Canadian Post-Secondary

Educational Institutions (PSIs)

In this chapter, I map the climate change courses in Canadian PSIs. The purpose of this is to provide an overview of climate change curriculum in PSIs at the national, provincial and institutional level, and to identify types of courses, their content, as well as what units within PSIs offer these courses.

5.1 National Sample Overview

225 PSIs were examined for climate change courses, 80 universities and 145 colleges for the calendar year of 2014-2015. Of the 225 PSIs sampled, 121 (54%) did not offer any identifiable climate change course (based on my selection criteria), while 104 (46%) PSIs offered a total of 849 climate change courses. Of the 104 PSIs with climate change courses, 43 (41%) were colleges and 61 (59%) were universities. Of the 849 climate change courses identified, universities offered over four-fifths (83%) of the climate change courses, while colleges offered under a fifth (17%) (See Figure 2, p. 75).

34% of the PSIs offered between 1 and 10 courses, 10% PSIs offered between 11 and 20, and 2% PSIs offered 21 or more courses.

About three quarters (73%) of the courses were offered at the undergraduate level (UG), around one sixth (17%) at the graduate level (GR) and 10% as part of continuing education programs,

distance education, diplomas or certificates (DE). At the national level, 5.5% of the UG courses were also offered through DE programs (see Figure 7, 81).

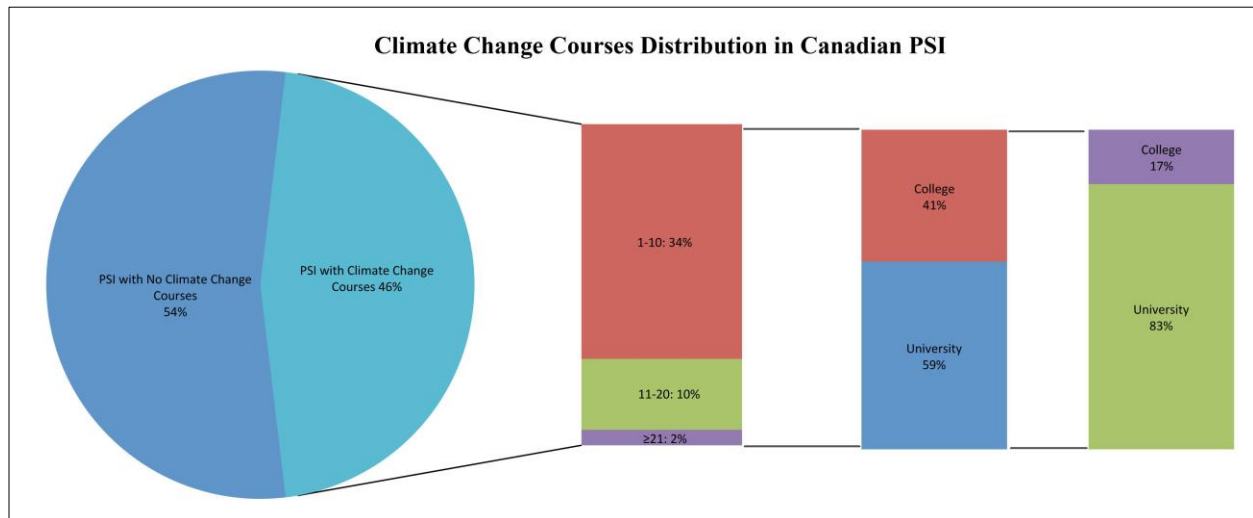


Figure 2: Climate Change Courses Distribution in Canadian PSIs during the calendar year 2014-2015. A: Range of number of courses offered per PSI; B: College and universities (%) with climate change courses; C: Percentage of climate change courses by college and university.

A linear regression analysis was performed to determine the relation between the number of PSI and the number of courses, which resulted in a positive correlation ($r=0.88$). This suggests that the more PSIs, the larger the number of courses offered.

From the total of courses found, 23% are focused exclusively on climate change (Tier 1), 20% have climate change as a main topic (Tier 2), and 57% touch upon climate change for at least on one lecture during the semester (Tier 3).

In terms of orientation: 54% of the courses are focused on the scientific/technical aspects of climate change, 16% on the environmental/sociological, 12% on the managerial, 11% on the policy/governance and 7% on the economic elements of this issue (See Figure 3, p. 77).

Eleven out of the 225 PSIs included in this study, offer more than 20 climate change courses, 5 of these PSIs are located in Ontario (ON), 5 in British Columbia (BC), and 1 in Nova Scotia (NS). During the calendar year 2014-2015, these eleven publicly funded PSIs offered 35% of the total climate change courses found in this study (See Table 3). An analysis per-capita of these eleven PSIs suggests that although the size of the institution affects the availability of climate change courses per student, it is not a single determinant factor. It is important to highlight that courses were found in a limited number of faculties within institution or programs. This will be discussed further in the Chapter 7.

Table 3: Canadian PSIs that offered 20+ climate change courses during the calendar year 2014-2015 (Enrolment numbers were extracted from *Universities Canada and **each PSI's website) (Universities Canada, 2016).

| | PSI Name | Province | Total Climate Change Courses | Student Enrolment | Climate Change Courses Per Capita (1,000) |
|----|---|-----------------|-------------------------------------|--------------------------|--|
| 1 | University of Waterloo | ON | 51 | 35,900* | 1.4206 |
| 2 | York University | ON | 45 | 53,900* | 0.8348 |
| 3 | University of Toronto | ON | 35 | 84,400* | 0.4146 |
| 4 | Dalhousie University | NS | 29 | 18,560** | 1.5625 |
| 5 | Lakehead University | ON | 22 | 8,510* | 2.5851 |
| 6 | Douglas College | BC | 20 | 10,464** | 1.9113 |
| 7 | University of British Columbia | BC | 20 | 58,030* | 0.3446 |
| 8 | University of Northern British Columbia | BC | 20 | 3,420* | 5.8479 |
| 9 | University of Ottawa | ON | 20 | 43,100* | 0.4640 |
| 10 | University of the Fraser Valley | BC | 20 | 8,190* | 2.4420 |
| 11 | University of Victoria | BC | 20 | 20,910* | 0.9564 |

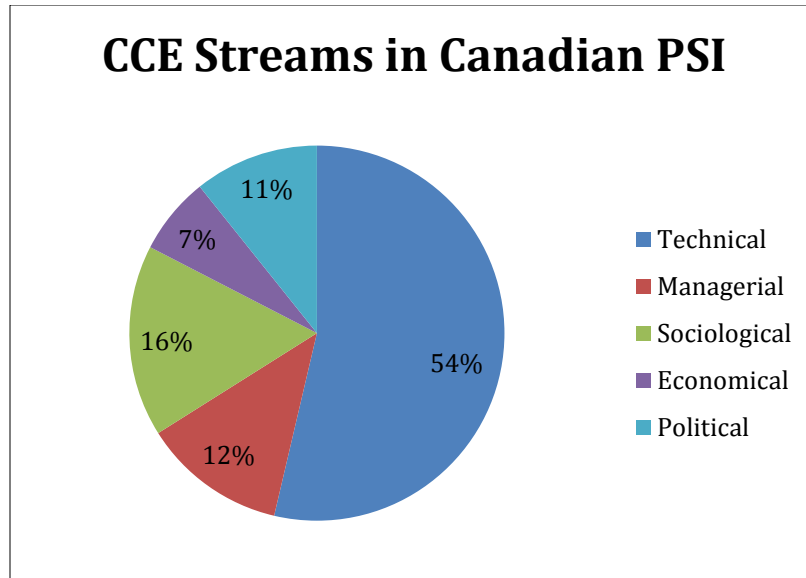


Figure 3: CCE Streams in Canadian PSIs during the calendar year of 2014-2015

Climate change courses were offered by a total of 179 Faculties and 169 Departments across Canada. The Faculties that offered the most climate change courses are those of Science & Technology (37%), followed by Arts with (28%, See Figure 4, p. 78). Faculties of Art ranked second due to the fact that many Geography Departments are located within these faculties.

The majority of courses are found within the departments of Humanities & Social Sciences (45%) and Science & Technology (44%). Geography Departments offered 22% of the total of climate change courses at the national level, followed by Biological and Applied Sciences (11%), Atmospheric & Oceanic Sciences (9%) and Environmental Sciences (9%). Other departments that offered a significant number of courses are Business, Economic and Development Departments, Environmental Studies, and Continuing Education (see Figure 5, p. 79).

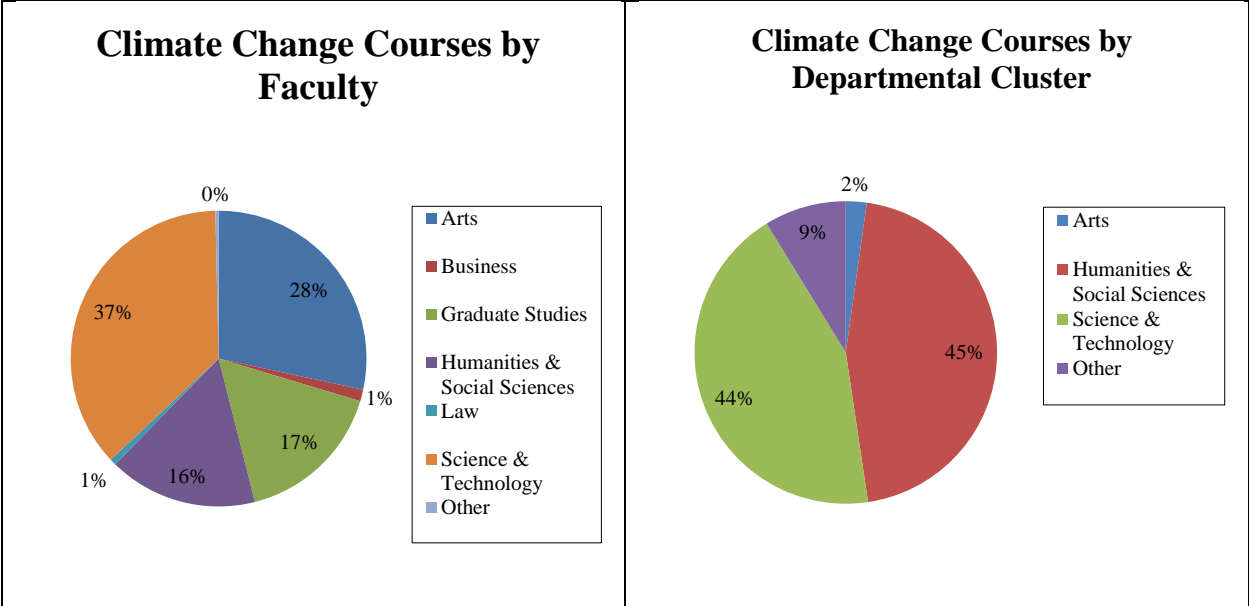


Figure 4: Distribution of climate change courses offered by faculties and departments in Canadian PSIs (n=104) during the calendar year of 2014-2015.

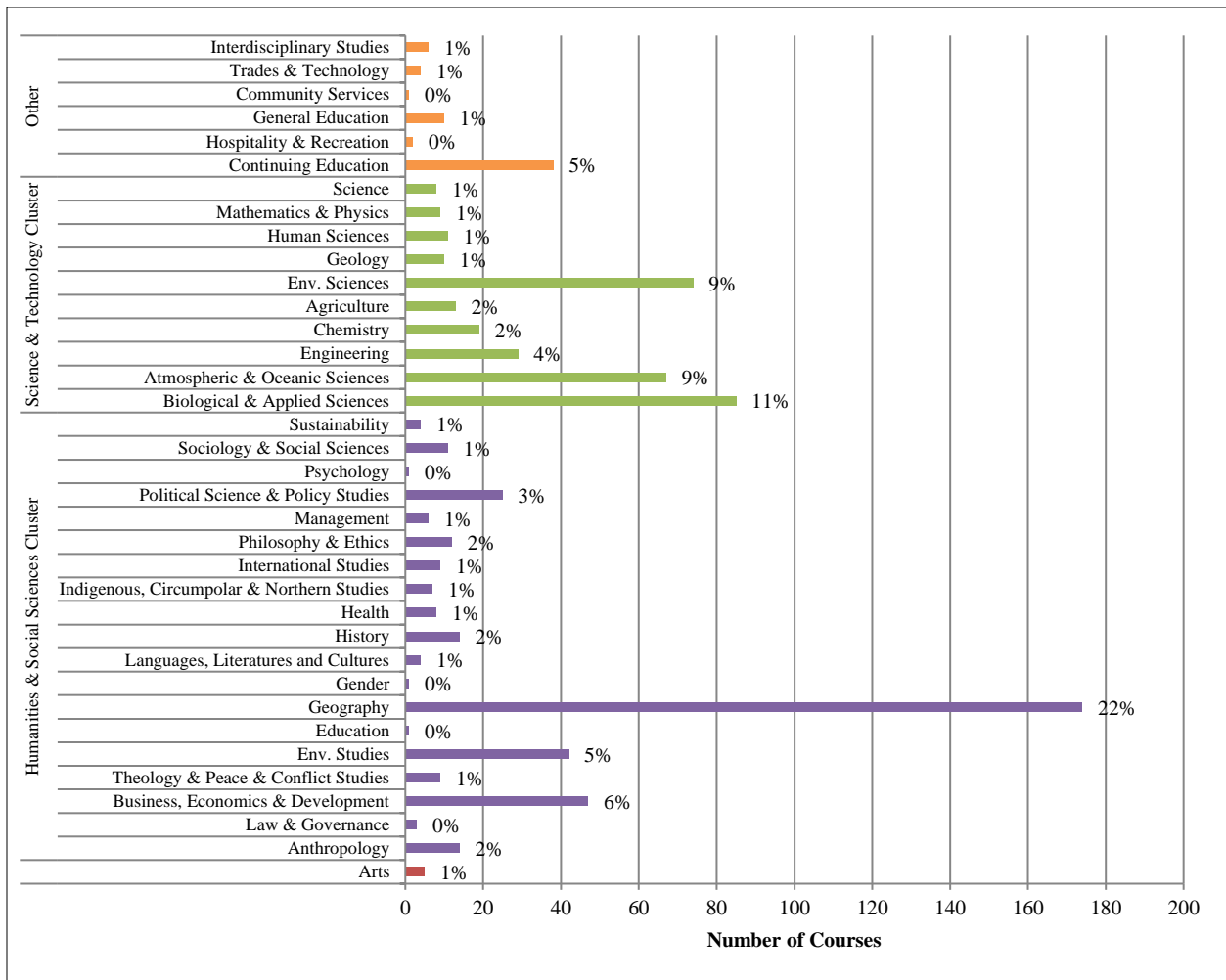


Figure 5: Climate change courses offered by departments in Canadian PSIs (n=104) during the calendar year of 2014-2015

5.2 Provincial Overview

Ontario (ON) is the province with the largest percentage of climate change courses (48%) in 2014-2015, followed by British Columbia (BC, 21%). The rest of the provinces and territories comprise the remaining 31%. Combined, Prince Edward Island (PE), Saskatchewan (SK), Yukon (YK), Newfoundland and Labrador (NL), Northwest Territories (NT), New Brunswick (NB) and Nunavut (NU) account for less than 10% of the total number of courses (See Figure 6).

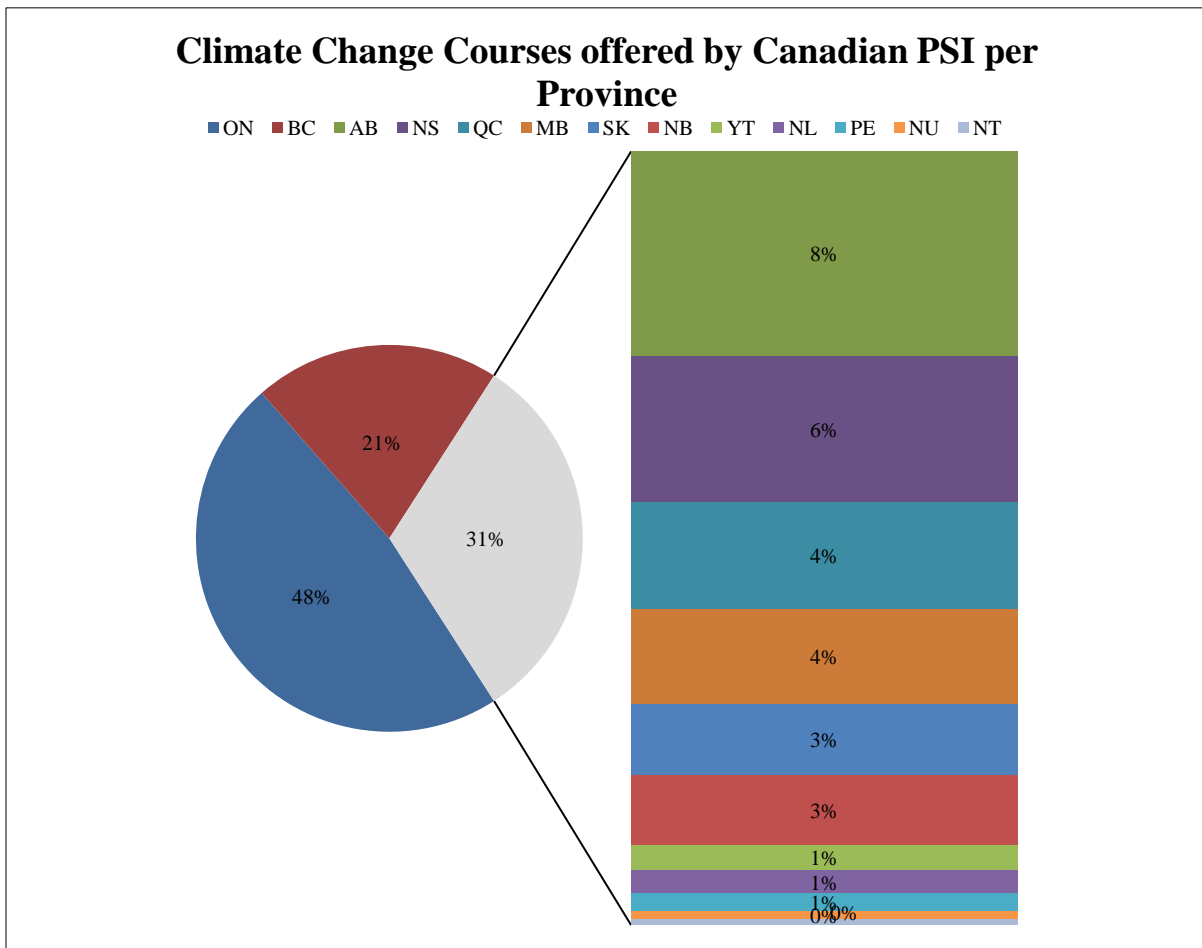


Figure 6: Percentage of Climate Change Courses offered by Canadian PSIs per Province during the calendar year of 2014-2015.

Out of the 61 universities and 43 colleges offering climate change courses, only 6 universities and 5 colleges are private and these are located in the provinces of Alberta (AB), BC, Manitoba (MB), ON, and SK (See Figure 7).

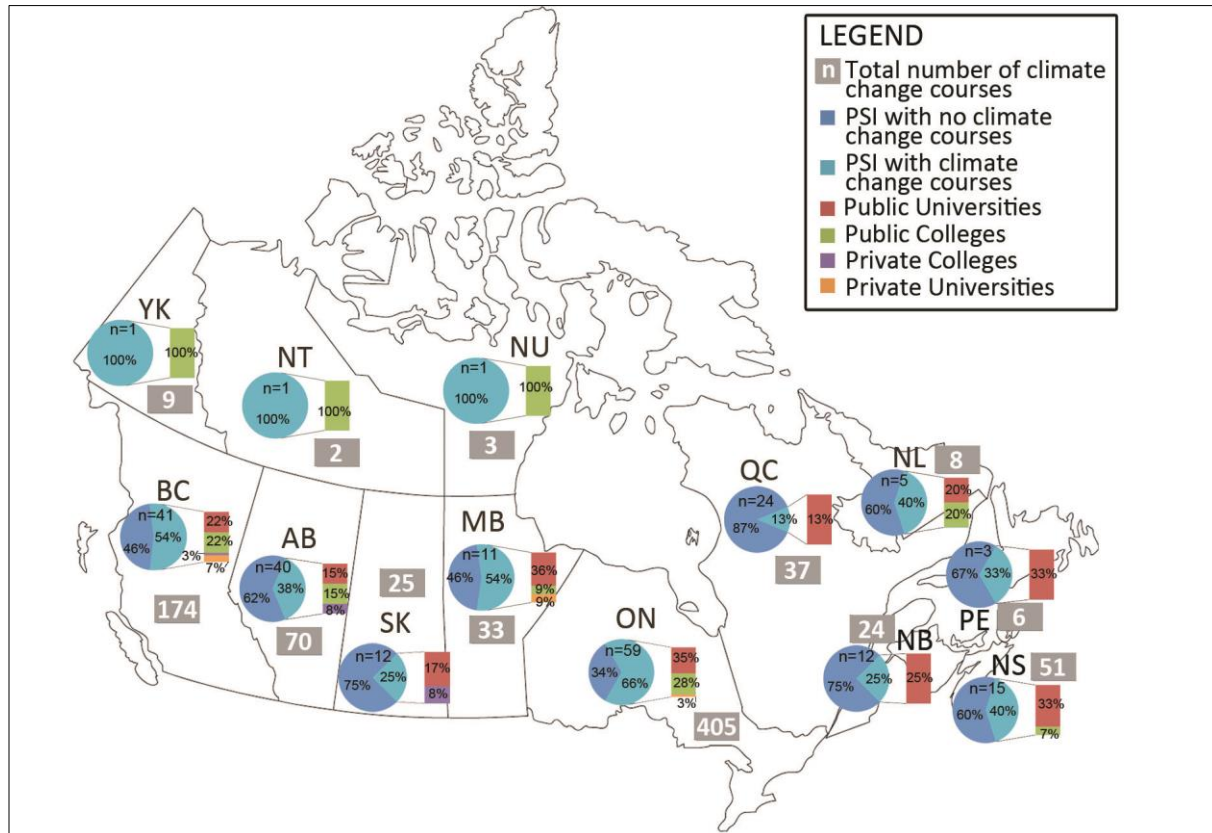


Figure 7: Percentage of PSIs offering climate change courses per Province during the calendar year 2014-2015 (n=number of courses).

In AB, NL, Quebec (QC), and PE, all the universities offered climate change courses, as well as all the colleges in the NT, NU and YK.

Relative to the total number of universities in each province, NB is the province with the lowest number of universities offering climate change courses, followed by Nova Scotia (NS). While colleges in NB, QC and PE offered no discernable climate change courses (Table 4, p. 82).

Table 4: Total of climate change courses offered by public and private Canadian PSIs during the calendar year of 2014-2015

| Province/Territory | Total PSIs | English | French | Total of PSIs with climate change courses | Universities | Univ. with climate change courses | # Climate change courses in Univ. | Public Univ. | Private Univ. | Colleges | Colleges with climate change courses | # Climate change courses in Colleges | Public College | Private College | Total Courses |
|--------------------|------------|------------|-----------|---|--------------|-----------------------------------|-----------------------------------|--------------|---------------|------------|--------------------------------------|--------------------------------------|----------------|-----------------|---------------|
| AB | 40 | 40 | 0 | 15 | 6 | 6 | 49 | 6 | 0 | 34 | 9 | 23 | 6 | 3 | 72 |
| BC | 42 | 41 | 1 | 22 | 15 | 12 | 129 | 9 | 3 | 26 | 10 | 45 | 9 | 1 | 174 |
| MB | 12 | 11 | 1 | 6 | 6 | 5 | 32 | 4 | 1 | 5 | 1 | 1 | 1 | 0 | 33 |
| NB | 13 | 12 | 1 | 3 | 8 | 3 | 24 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 24 |
| NL | 5 | 5 | 0 | 2 | 1 | 1 | 5 | 1 | 0 | 4 | 1 | 3 | 1 | 0 | 8 |
| NS | 16 | 15 | 1 | 6 | 9 | 5 | 50 | 5 | 0 | 6 | 1 | 1 | 1 | 0 | 51 |
| NT | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 2 |
| NU | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 1 | 0 | 3 |
| ON | 61 | 59 | 2 | 40 | 28 | 23 | 351 | 21 | 2 | 31 | 17 | 54 | 17 | 0 | 405 |
| QC | 91 | 24 | 67 | 3 | 3 | 3 | 37 | 3 | 0 | 12 | 0 | 0 | 0 | 0 | 37 |
| PE | 4 | 3 | 1 | 1 | 1 | 1 | 6 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 6 |
| SK | 22 | 12 | 10 | 3 | 3 | 2 | 23 | 2 | 0 | 18 | 1 | 2 | 0 | 1 | 25 |
| YK | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 9 | 1 | 0 | 9 |
| Total | 310 | 225 | 85 | 104 | 80 | 61 | 706 | 55 | 6 | 145 | 43 | 143 | 38 | 5 | 849 |

In all the provinces and territories, except for NU, over 40% of the offered climate change courses are at the undergraduate (UG) level. The provinces with the largest percentage of UG courses are NB (89%) and NS (88%), while in NU only 33% are UG. The province with the largest percentage of graduate (GR) courses is NL (38%), while in NT, NU and YK there are no GR courses. MN, NB, NL, NS and SK did not offer any distance education, diploma or certificate (DE) courses during the calendar year of 2014-2015, whereas NU offered all its courses through DE programs (Table 5, p. 83).

Table 5: Climate change courses distribution per level in Canadian PSIs (UG: Undergraduate; GR: Graduate; DE: Continuing Education, Distance Education, Certificate Programs)

| Province | UG | GR | DE |
|-----------------|-----------|-----------|-----------|
| AB | 61 | 7 | 12 |
| BC | 147 | 17 | 16 |
| MB | 27 | 6 | 0 |
| NB | 22 | 2 | 0 |
| NL | 5 | 3 | 0 |
| NS | 45 | 6 | 0 |
| NT | 1 | 0 | 1 |
| NU | 1 | 0 | 3 |
| ON | 276 | 93 | 44 |
| QC | 27 | 9 | 2 |
| PE | 5 | 1 | 6 |
| SK | 19 | 7 | 0 |
| YK | 7 | 0 | 3 |

Nearly all the provinces and territories, with the exception of NL, NU and NT offered Tier 1 courses. While PE and YK (33% for both) offered the most Tier 1 courses in regards to the other provinces and territories. The PSI with the largest number of Tier 1 courses offered in Canada are located in Ontario (53%), followed by British Columbia (16%) and Alberta (9%). NL (38%), NU (33%) and QC (36%) offered the largest number of Tier 2 courses, while NT and PE offered none. AB (45%), QC (44%) and YK (44%) offered the lowest number of Tier 3 courses, while in the NT all the courses were Tier 3 (See Table 6, p. 84).

Table 6: Tiers of concentration of climate change courses per province in Canadian PSIs. Numbers offered by colleges and universities. Streams are displayed in percentages (%).

| | Tier 1 | | Colleges | Universities | Technical | Managerial | Env./Sociological | Economical | Policy | Tier 2 | | Colleges | Universities | Technical | Managerial | Env./Sociological | Economical | Policy | Tier 3 | | Colleges | Universities | Technical | Managerial | Env./Sociological | Economical | Policy |
|-------|---------------|----|-----------------|---------------------|------------------|-------------------|--------------------------|-------------------|---------------|---------------|-----|-----------------|---------------------|------------------|-------------------|--------------------------|-------------------|---------------|---------------|-----|-----------------|---------------------|------------------|-------------------|--------------------------|-------------------|---------------|
| AB | 18 | 6 | 12 | 52 | 25 | 18 | 0 | 5 | 21 | 6 | 15 | 78 | 2 | 19 | 0 | 0 | 32 | 10 | 22 | 60 | 9 | 15 | 5 | 11 | | | |
| BC | 32 | 3 | 29 | 38 | 23 | 18 | 10 | 11 | 39 | 12 | 28 | 57 | 27 | 4 | 6 | 6 | 102 | 30 | 72 | 53 | 13 | 16 | 11 | 7 | | | |
| MB | 8 | 0 | 8 | 67 | 17 | 12 | 0 | 4 | 3 | 1 | 2 | 67 | 16 | 17 | 0 | 0 | 22 | 0 | 22 | 63 | 8 | 14 | 4 | 11 | | | |
| NB | 4 | 0 | 4 | 51 | 15 | 4 | 14 | 16 | 6 | 0 | 6 | 67 | 0 | 17 | 8 | 8 | 14 | 0 | 14 | 65 | 3 | 24 | 1 | 7 | | | |
| NL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 83 | 17 | 0 | 0 | 0 | 5 | 3 | 2 | 60 | 20 | 0 | 20 | 0 | | | |
| NS | 13 | 1 | 12 | 39 | 11 | 9 | 12 | 29 | 8 | 0 | 8 | 62 | 5 | 0 | 28 | 5 | 30 | 0 | 30 | 53 | 10 | 13 | 11 | 13 | | | |
| NT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 37 | 0 | 37 | 13 | 13 | | | |
| NU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 34 | 0 | 33 | 0 | 33 | 2 | 2 | 0 | 47 | 11 | 31 | 0 | 11 | | | |
| ON | 105 | 12 | 93 | 42 | 22 | 15 | 5 | 16 | 65 | 5 | 61 | 59 | 13 | 11 | 3 | 14 | 237 | 37 | 200 | 37 | 16 | 32 | 6 | 9 | | | |
| PE | 2 | 0 | 2 | 12 | 37 | 38 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 100 | 0 | 0 | 0 | 0 | | | |
| QC | 8 | 0 | 8 | 47 | 22 | 14 | 11 | 6 | 13 | 0 | 13 | 83 | 4 | 10 | 3 | 0 | 16 | 0 | 16 | 63 | 14 | 13 | 0 | 10 | | | |
| SK | 5 | 0 | 5 | 43 | 26 | 10 | 13 | 8 | 6 | 1 | 5 | 92 | 8 | 0 | 0 | 0 | 14 | 1 | 13 | 54 | 4 | 8 | 8 | 26 | | | |
| YK | 3 | 3 | 0 | 50 | 13 | 6 | 6 | 25 | 2 | 2 | 0 | 100 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 75 | 25 | 0 | 0 | 0 | | | |
| Total | 198 | 25 | 173 | | | | | | 167 | 28 | 139 | | | | | | 484 | 89 | 395 | | | | | | | | |

Faculties of Science & Technology offered over 30% of the climate change courses in all the provinces, except in Ontario (28%). In MB, NT, PE and SK, the Faculties of Arts offered between 45% and 52% of the courses. In all the provinces and territories, the Science and Technology department offered between 36% and 88% of the courses, except for the NT, where all the courses are offered within the Humanities and Social Sciences clusters (See Figure 8, p. 86).

The technical and managerial streams represent 62% or more of the courses offered in most provinces, except for the NT, NU, ON and QC. QC is the only province where the political and managerial streams are over 20% of the courses, while in NL not a single course touches upon political issues and in NT there are no managerial courses. In the NT, NU, and ON the sociological stream is over 20%, while NL, NS and NT are the ones that offered the most courses in the economic stream (See Figure 9, p. 87).

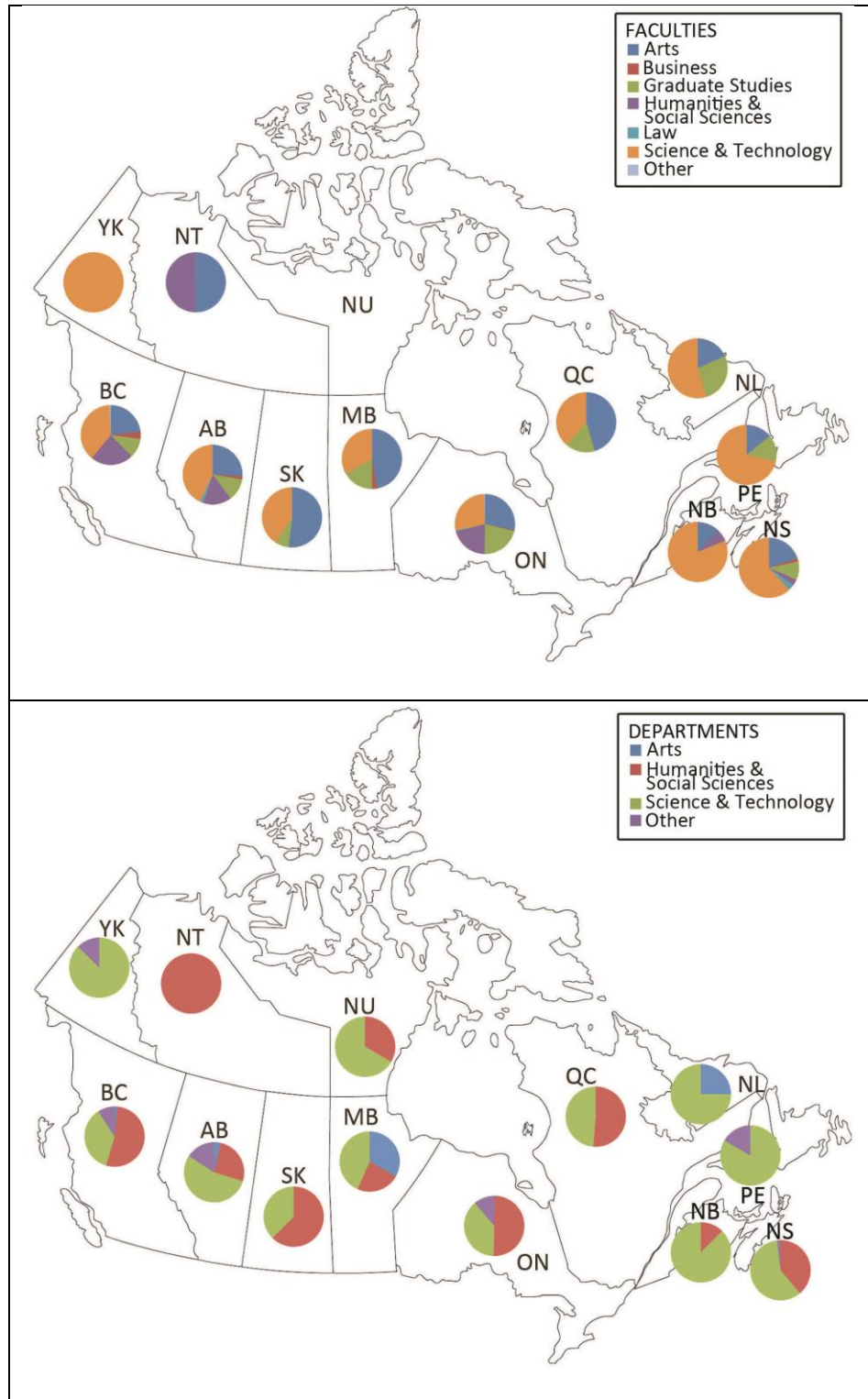


Figure 8: Faculties and departments offering climate change courses in Canadian PSIs during the calendar year of 2014-2015 (It is important to note, that in order to represent provinces and territories with a lower occurrence the courses, all pies were left at an equal size).

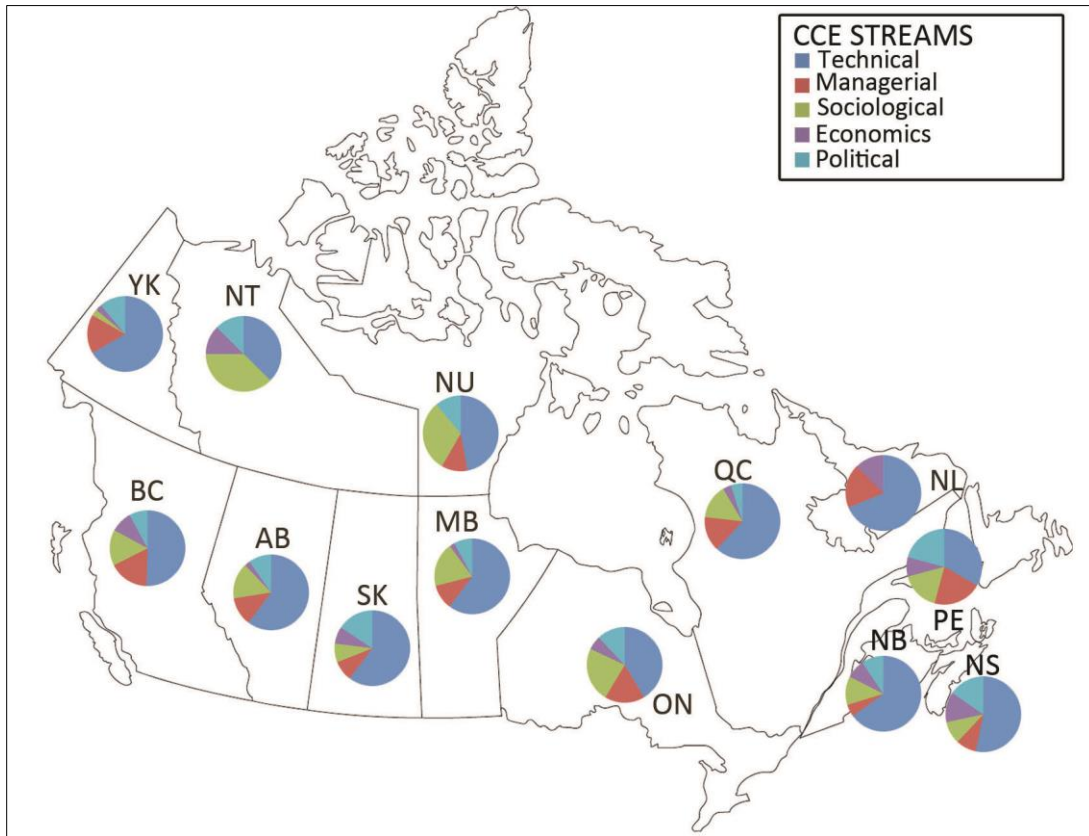


Figure 9: Climate change education streams per province and territory offered in climate change courses at Canadian PSIs during the calendar year 2014-2015.

ALBERTA

In Alberta, all the universities included in this study (n=6) offered climate change courses. The University of Alberta (n=15) and the University of Calgary (n=14) offered the most number of courses. 9 out of 34 colleges offered at least one climate change courses, the King's University College of Edmonton and Lakeland College being the ones that offered the most number of courses (each n=4) (See Appendix, Table 11 for a complete list of all the PSIs offering climate change courses in Canada, p. 248).

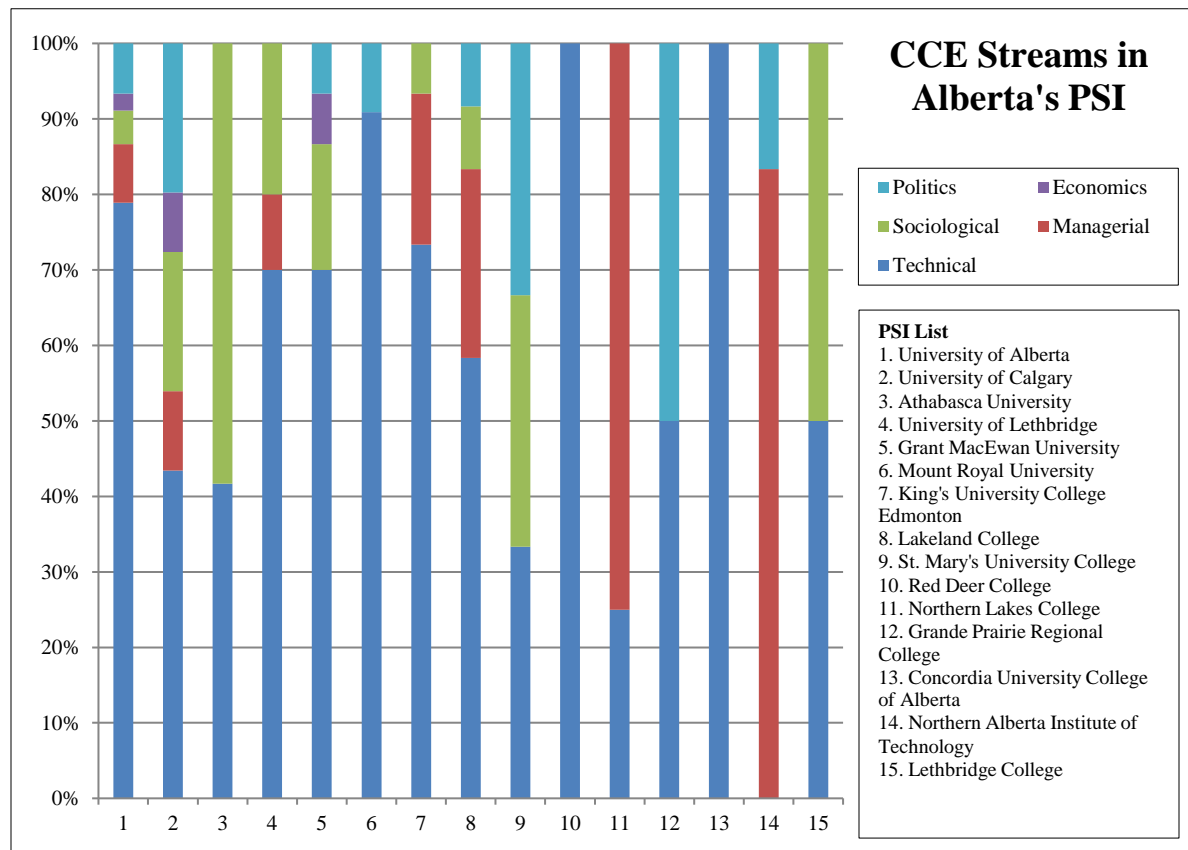


Figure 10: CCE Streams in Alberta's PSIs offering climate change courses during the Calendar year 2014-2015

Over three quarters of the climate change courses are at the undergraduate level (77%), less than one tenth are at the graduate level (8%), and less than one fifth are offered through distance or continuing education (15%).

79% of the PSIs offering climate change courses were publicly funded and 21% were private PSIs (Refer to Figure 7 for a detailed overview, p. 81).

60% of the courses were oriented to the technical stream, 15% on the sociological, 12% on the managerial, 10% on the political, and 3% on the economic (See Figure 10, p. 88).

26% of the courses are Tier 1, 30% are Tier 2 and 44% are Tier 3 (See Figure 11). The University with more Tier 1 courses was the University of Alberta (n=3).

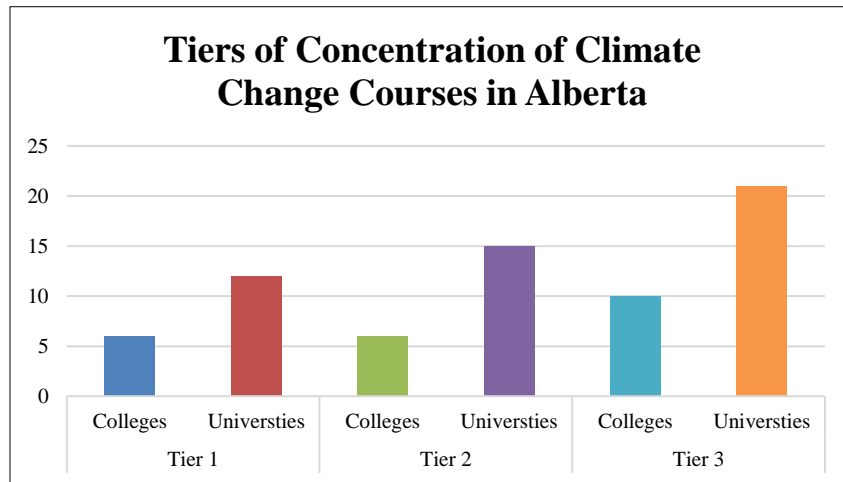


Figure 11: Tiers of Concentration of Climate Change Courses in Alberta during the calendar year of 2014-2015

In AB, 43% of the faculties offering climate change courses are those within the disciplines of Science & Technology, followed by Faculties of Art (26%). Less than one third of the courses were offered by the combined faculties of Business (2%), Law (2%), Graduate Studies (12%) and Humanities and Social Studies (16%). Departments of Science & Technology offered 54% of the courses, followed by Humanities & Social Sciences with 26%, Other with 16% and Arts with 4%.

BRITISH COLUMBIA

In British Columbia 12 out of the 15 universities included in this study offered climate change courses. The University of British Columbia, University of Victoria, University of Northern British Columbia, and University of the Fraser Valley offered the most number of courses (each n=20). 10 out of 27 colleges offered climate change courses and the ones that offered the most number of courses are Douglas College (n=20), Okanagan College (n=7) and Camosun College (n=5). Douglas College is the college with the most number of climate change courses in the Canadian PSIs included in this study.

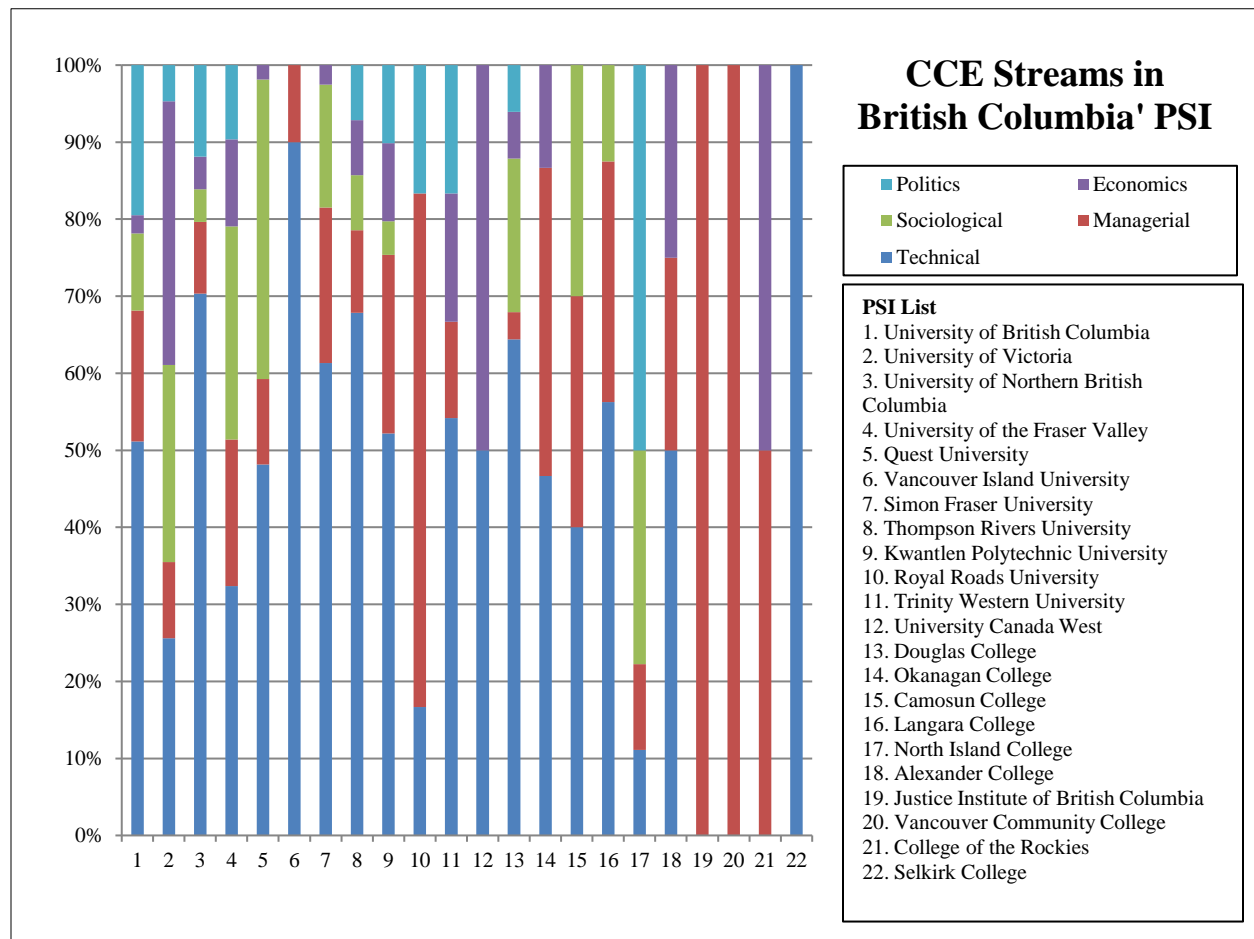


Figure 12: CCE Streams in British Columbia's PSIs offering climate change courses during the calendar year 2014-2015

Over four fifths of the courses were at the undergraduate level (82%) and less than a tenth were graduate and distance or continuing education courses (9% each).

82% of the PSIs offering climate change courses were publicly funded and 18% were private PSIs (Refer to Figure 7 for a detailed overview, p. 81).

Technical courses comprised 51%, while managerial and sociological courses were 17% and 15% respectively. Economic and political courses were 9% and 8% respectively (See Figure 12, p. 91).

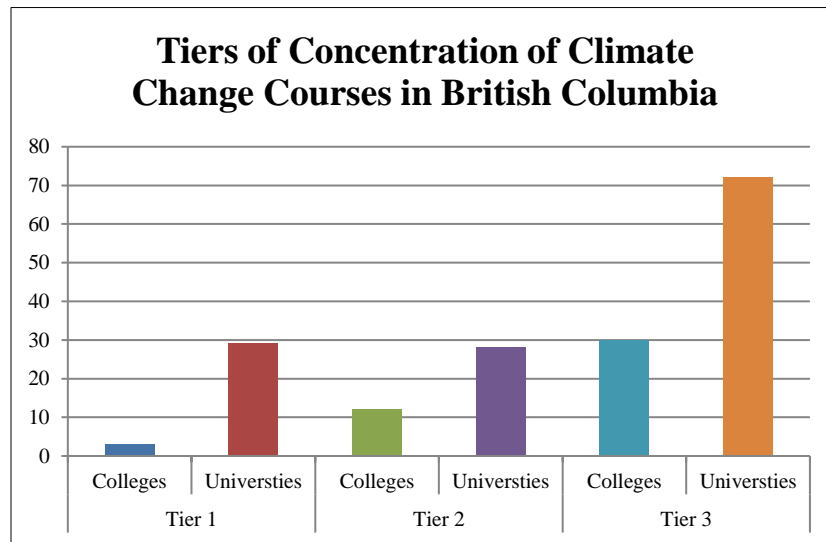


Figure 13: Tiers of Concentration of Climate Change Courses in British Columbia during the calendar year of 2014-2015

18% of the courses are Tier 1, 23% are Tier 2 and 59% are Tier 3 (See Figure 13). The universities with more Tier 1 courses were the University of British Columbia (n=9) and the University of Victoria (n=6).

Under two fifths of the courses are offered by faculties of Science & Technology (38%), and one fifth (each) are offered by the Faculties of Arts (23%) and Humanities & Social Sciences (23%). Clusters of Faculties of Business, Graduate Studies and Other, comprise the remaining 16%. Departments of Humanities & Social Sciences offered over half of the courses (53%), followed by Science & Technology (36%), Other (9%) and Arts (1%).

MANITOBA

In Manitoba, 5 out of the 6 universities included in this study offered climate change courses. The University of Winnipeg (n=15) and the University of Manitoba (n=8) are the ones that offered the most number of courses in Manitoba. One out of the five colleges, the Red River College, offered one climate change course.

Four fifths of the courses were at the undergraduate level (82%) and less than one fifth at the graduate level (18%). There were no offered continuing or distance education courses.

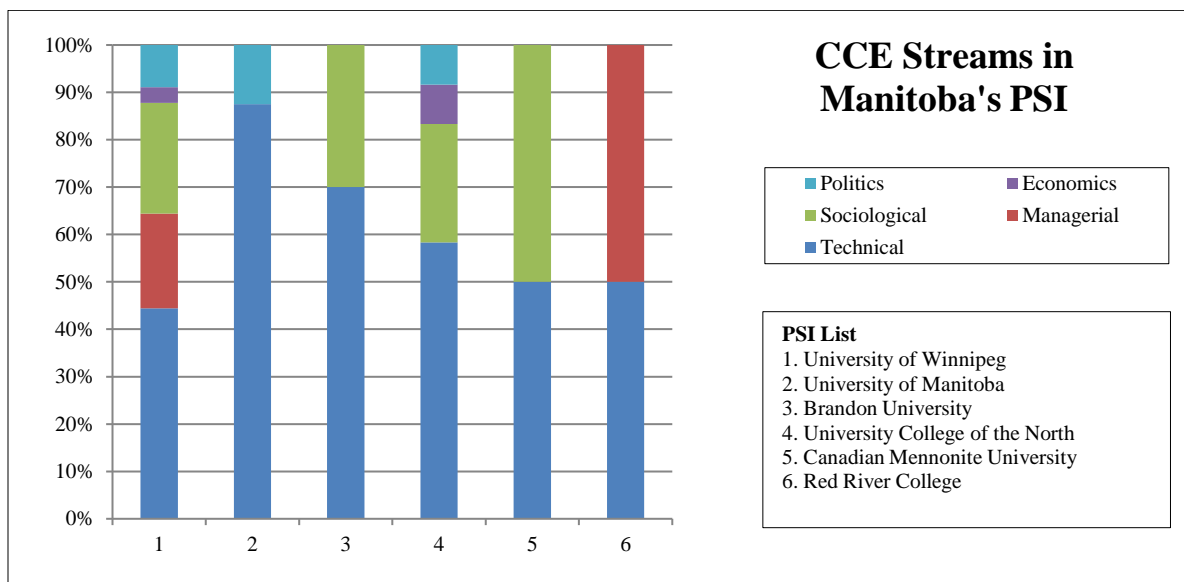


Figure 14: CCE Streams in Manitoba's PSIs offering climate change courses during the calendar year of 2014-2015

83% of the PSIs offering climate change courses were publicly funded and 17% were private PSIs (Refer to Figure 7 for a detailed overview, p. 81).

60% of the courses were technical, 19% sociological, 11% managerial, 8% political and 2% economic (See Figure 14, p. 94).

24% of the courses were Tier 1, 9% Tier 2 and 67% Tier 3 (See Figure 15). The universities with more Tier 1 courses were the University of Winnipeg (n=4) and the University of Manitoba (n=3).

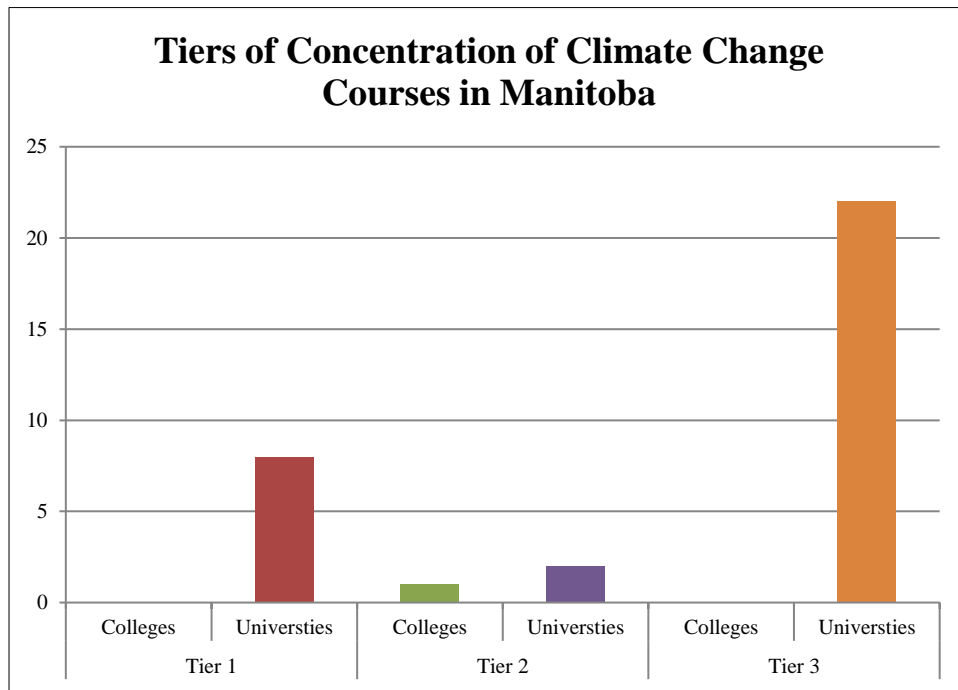


Figure 15: Tiers of Concentration of Climate Change Courses in Manitoba during the calendar year of 2014-2015

47% of the courses were offered by faculties of Arts, followed by Science & technology (33%), Graduate Studies (17%) and Business (3%). Departments of Science & Technology offered 43% of the courses, while Arts offered 33% and Humanities & Social Sciences offered 23%.

NEW BRUNSWICK

In New Brunswick, 3 out of 8 PSIs included in this study offered climate change courses. The University of New Brunswick (n=14), Mount Allison University (n=3), and St. Thomas University (n=1). No college offered climate change courses.

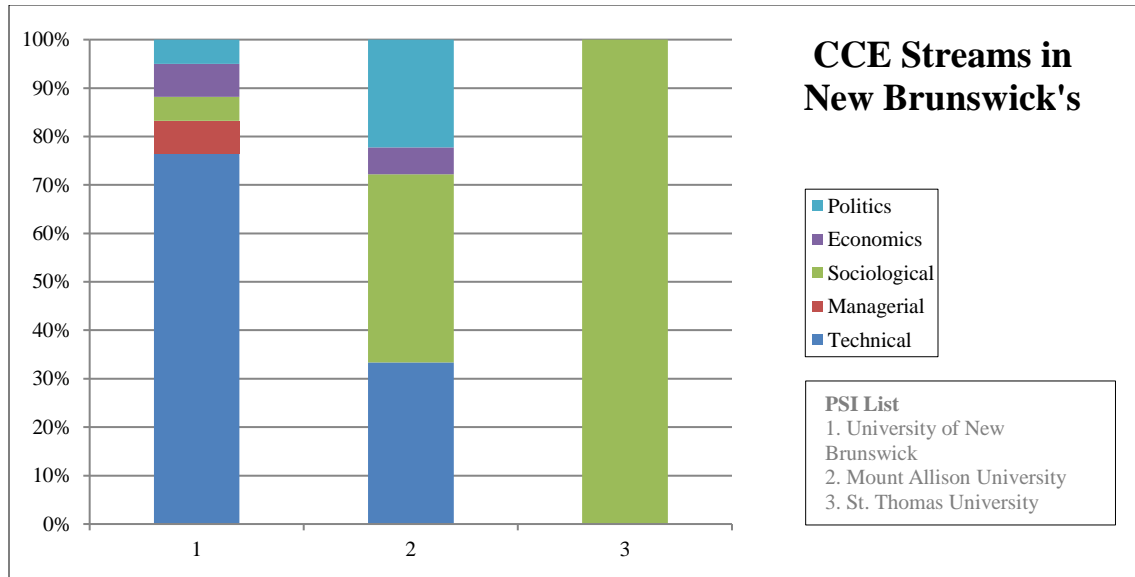


Figure 16: CCE Streams in New Brunswick during the calendar year of 2010-2015

Over nine tenths of the offered courses were at the undergraduate level (92%) and less than one tenth (8%) at the graduate level. There were no offered continuing or distance education courses.

100% of the PSIs offering climate change courses were publicly funded (Refer to Figure 7 for a detailed overview, p. 81).

57% of the courses were focused on the technical stream, 22% on the sociological stream, 11% on the political stream, 6% on the economic stream and 4% on the managerial stream (See Figure 16, p. 96).

17% of the courses were Tier 1, 25% were Tier 2 and 58% Tier 3 (See Figure 17). The only university with Tier 1 courses was the University of New Brunswick (n=4).

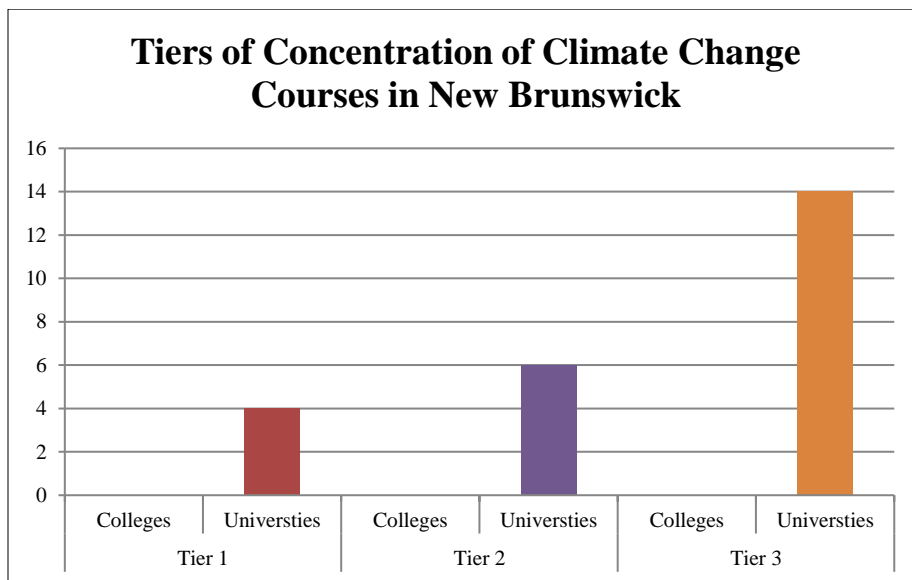


Figure 17: Tiers of Concentration of Climate Change Courses in New Brunswick during the calendar year of 2014-2015

Faculties of Science & Technology offered 59% of the climate change courses, followed by Humanities & Social Sciences with 36% and Arts 5%. Nearly three quarters of the courses were offered by departments of Science & Technology (74%), and over one quarter by departments of Humanities & Social Sciences (26%).

NEWFOUNDLAND AND LABRADOR (NL)

In NL, two out of 5 PSIs included in this study offered climate change courses. These are the Memorial University of Newfoundland (n=5) and the Marine Institute (n=3).

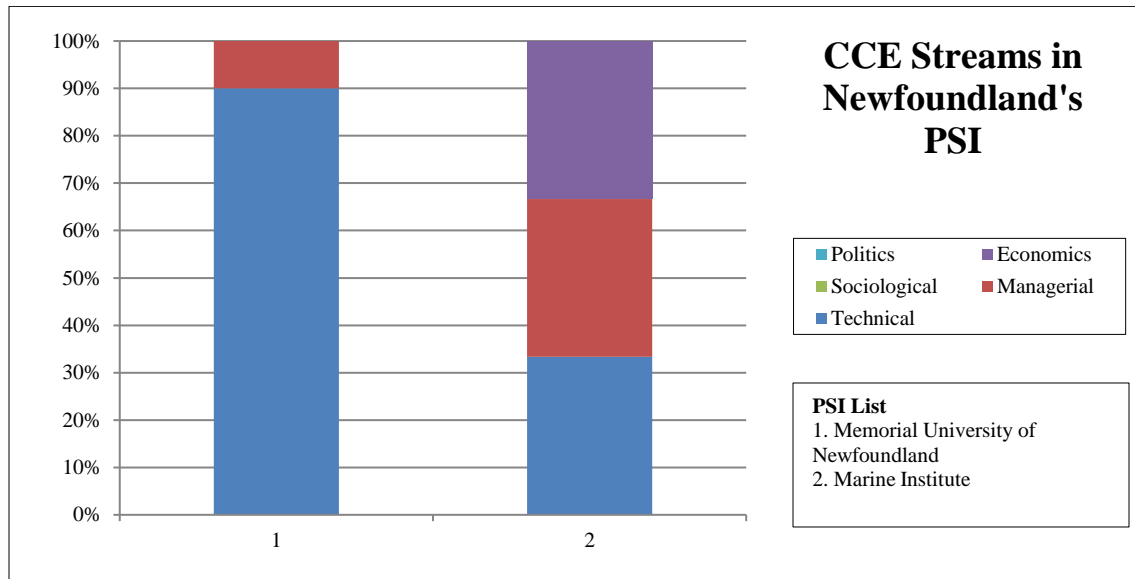


Figure 18: CCE Streams in NL's PSIs offering climate change courses during the calendar year of 2014-2015

Over three-fifths of the courses were at the undergraduate level (63%) and under two-fifths at the graduate level (38%). There were no offered continuing or distance education courses.

69% of the courses are focused on the technical aspects of climate change, 19% on the managerial and 12% on the economics. There were no courses focused on the sociological or political streams (See Figure 18, p. 98).

100% of the PSIs offering climate change courses were publicly funded (Refer to Figure 7 for a detailed overview, p. 81).

None of the two PSIs included in this study offered Tier 1 courses. 37% were Tier 2 and 63% Tier 3 (See Figure 19).

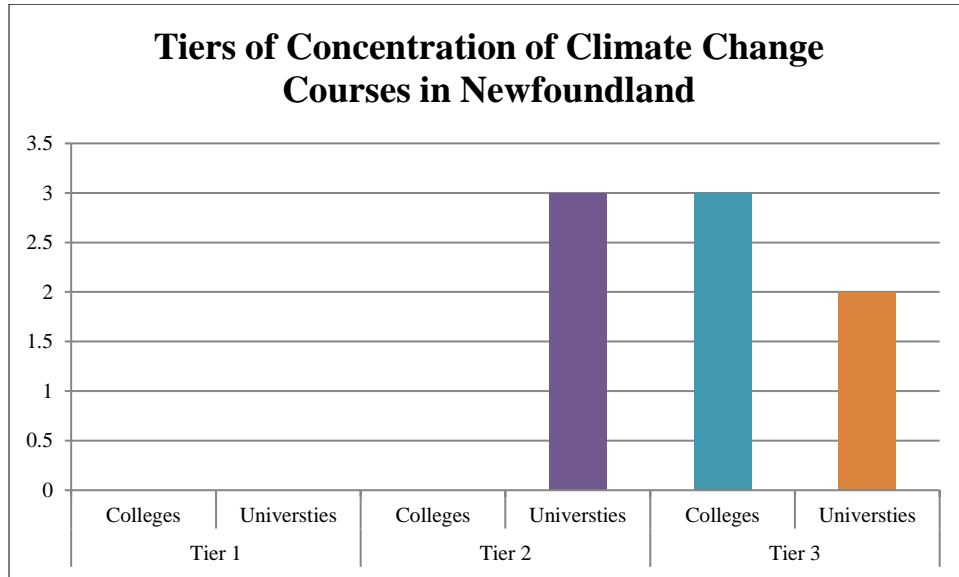


Figure 19: Tiers of Concentration of Climate Change Courses in NL during the calendar year of 2014-2015

Faculties of Science & Technology offered 55% of the climate change courses, followed by Graduate Studies with 27% and Arts 18%. Three quarters of the courses were offered by Science & Technology departments (75%), while one quarter by Arts departments (25%).

NOVA SCOTIA

In Nova Scotia, 5 out of 9 universities included in this study offered climate change courses. The universities that offered the most number of courses are Dalhousie University (n=29) and Acadia University (n=11). Only one college out of six, the Nova Scotia Community College offered one course.

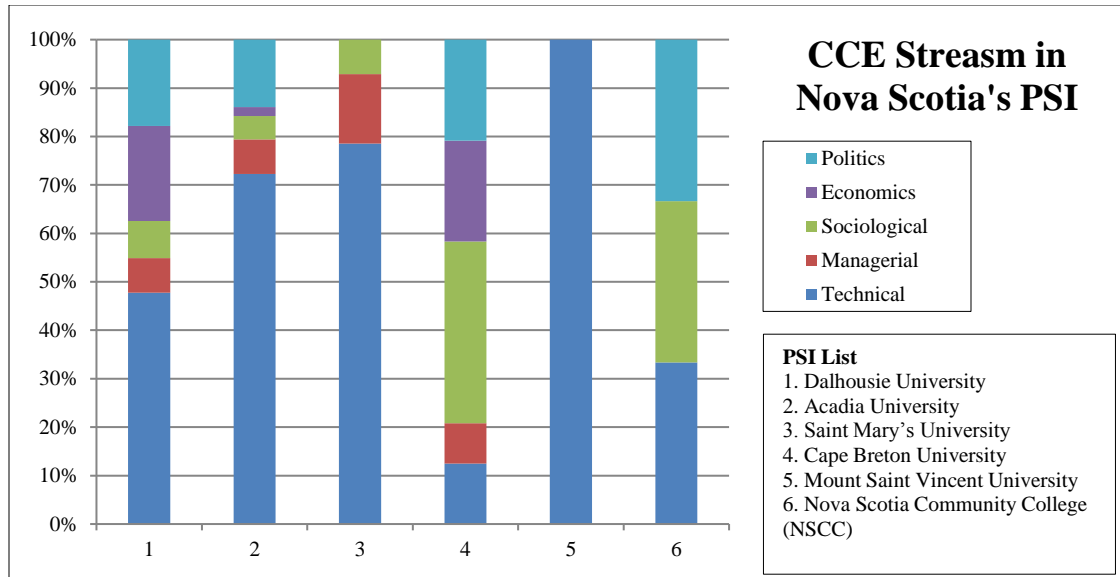


Figure 20: CCE Streams in Nova Scotia's PSIs during the calendar year of 2014-2015

A little under nine tenths of courses were offered at the undergraduate level (88%) and over one tenth at the graduate level (12%). There were no offered continuing or distance education courses.

100% of the PSIs offering climate change courses were publicly funded (Refer to Figure 7 for a detailed overview, p. 81).

53% of the courses were focused on the technical aspects of climate change, 15% on the politics, 13% on the economics, 10% on the sociological and 9% on the managerial (See Figure 20, p. 100).

25% comprised Tier 1 courses, 16% were Tier 2 and 59% were Tier 3 (See Figure 21). The university with more Tier 1 courses was Dalhousie University (n=9).

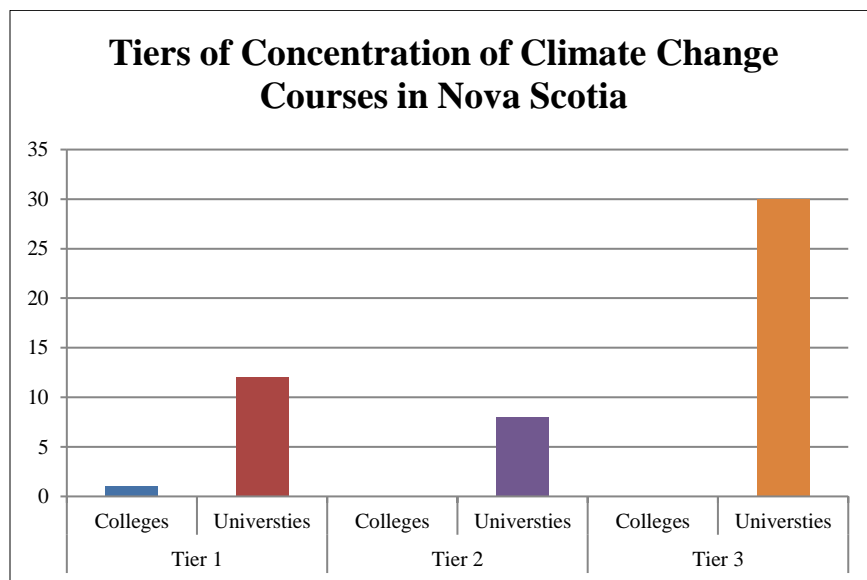


Figure 21: Tiers of Concentration of Climate Change Courses in Nova Scotia during the calendar year of 2014-2015

Faculties of Science & Technology offered 62% of the climate change courses, followed by Arts with 20%, Graduate Studies with 10%, Humanities & Social Sciences and Law with 3% each, and Business with 2%. A little under three fifths of the courses were offered by Science & Technology departments (59%), while under two fifths were offered by Humanities & Social Sciences departments (39%). The remaining 2% were offered by Other departments.

NORTHWEST TERRITORIES

In the Northwest Territories, the only college included in this study, the Aurora College, offered two climate change courses.

The technical and sociological streams comprised 37% each. And Politics and Economics comprised 13% each. There were no courses focused on the managerial aspects of climate change (See Figure 22).

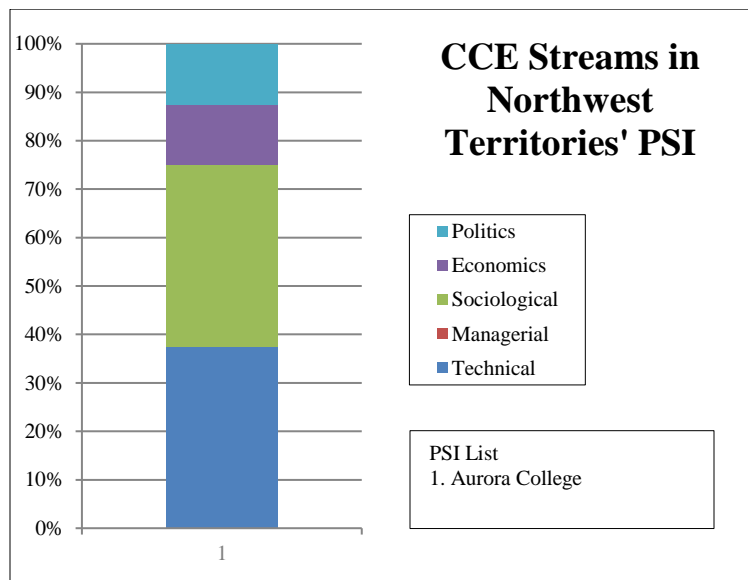


Figure 22: CCE Streams in the Northwest Territories' PSIs offering climate change courses during the calendar year of 2014-2015

100% of the PSIs offering climate change courses were publicly funded (Refer to Figure 7 for a detailed overview, p. 81).

50% of the courses were offered at the undergraduate level and 50% were offered as part of continuing or distance education programs.

There were no Tier 1 or 2 courses. The two courses offered were Tier 3 (See Figure 23).

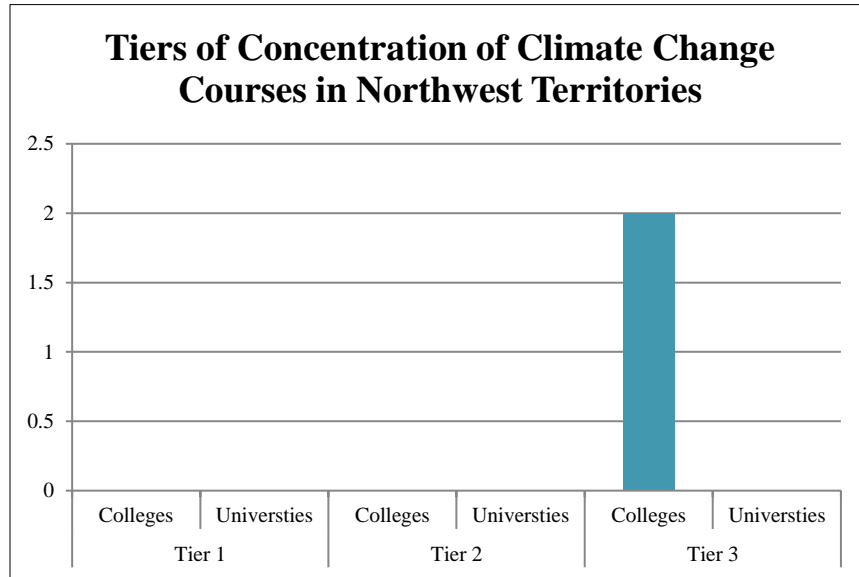


Figure 23: Tiers of Concentration of Climate Change Courses in Northwest Territories during the calendar year of 2014-2015

All the courses are part of continuing or distance education program and one of the courses is also part of an undergraduate program.

All the courses were offered by the department of Humanities & Social Sciences.

NUNAVUT

In Nunavut, the only college included in this study, the Nunavut Arctic College, offered three climate change courses.

Technical stream courses comprised 47% and sociological 31%. Politics and managerial courses comprised 11% each. There were no courses focused on the economics aspects of climate change (See Figure 24).

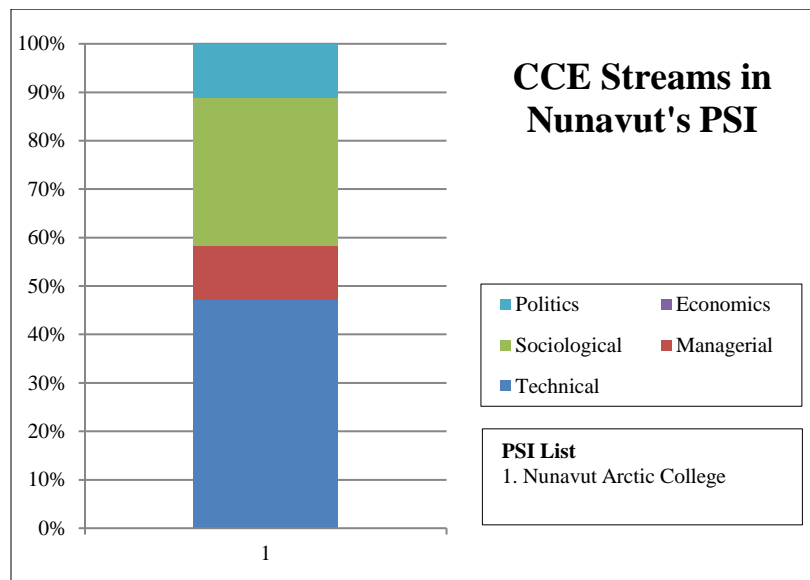


Figure 24: CCE Streams of Climate Change Courses in Nunavut during the calendar year of 2014-2015

100% of the PSIs offering climate change courses were publicly funded (Refer to Figure 7 for a detailed overview, p. 81).

33% of the courses were Tier 2 and 67% were Tier 3. There were no Tier 1 courses (See Figure 25, p. 105).

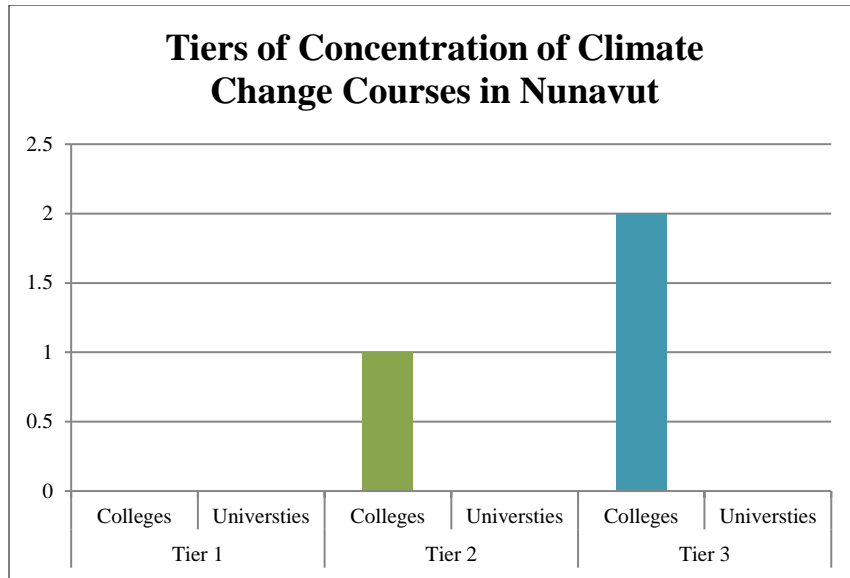


Figure 25: Tiers of Concentration of Climate Change Courses in Nunavut during the calendar year of 2014-2015

67% of the courses were offered by Science & Technology departments, and the remaining 33% were offered by Humanities & Social Sciences departments.

ONTARIO

In Ontario, 23 out of the 28 universities included in this study offered climate change courses. Four universities ranked within the top 5 PSIs that offered the most number of climate change courses in Canada. These are University of Waterloo (n=51), York University (n=45), University of Toronto (n=37) and Lakehead University (n=22). 17 out of 31 colleges included in this study offered from 1 to 8 courses. The colleges with the largest number of courses are Algonquin College of Applied Arts and Technology (n=8), Seneca College of Applied Arts and Technology (n=6), Niagara College of Applied Arts, and Technology and Durham College of Applied Arts and Technology (n=5).

95% of the PSIs offering climate change courses were publicly funded and 5% were private PSIs (Refer to Figure 7 for a detailed overview, p. 81).

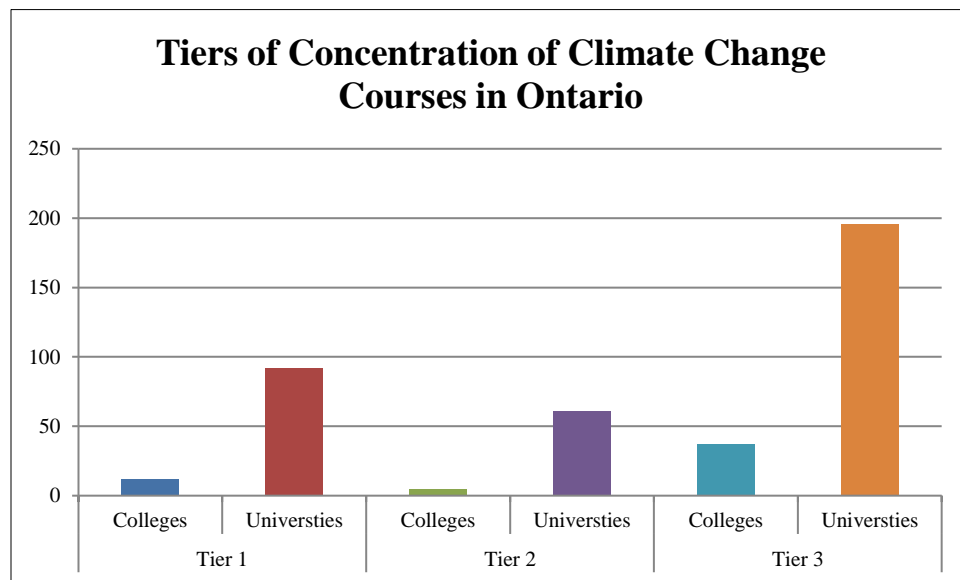


Figure 26: Tiers of Concentration of Climate Change Courses in Ontario during the calendar year of 2014-2015

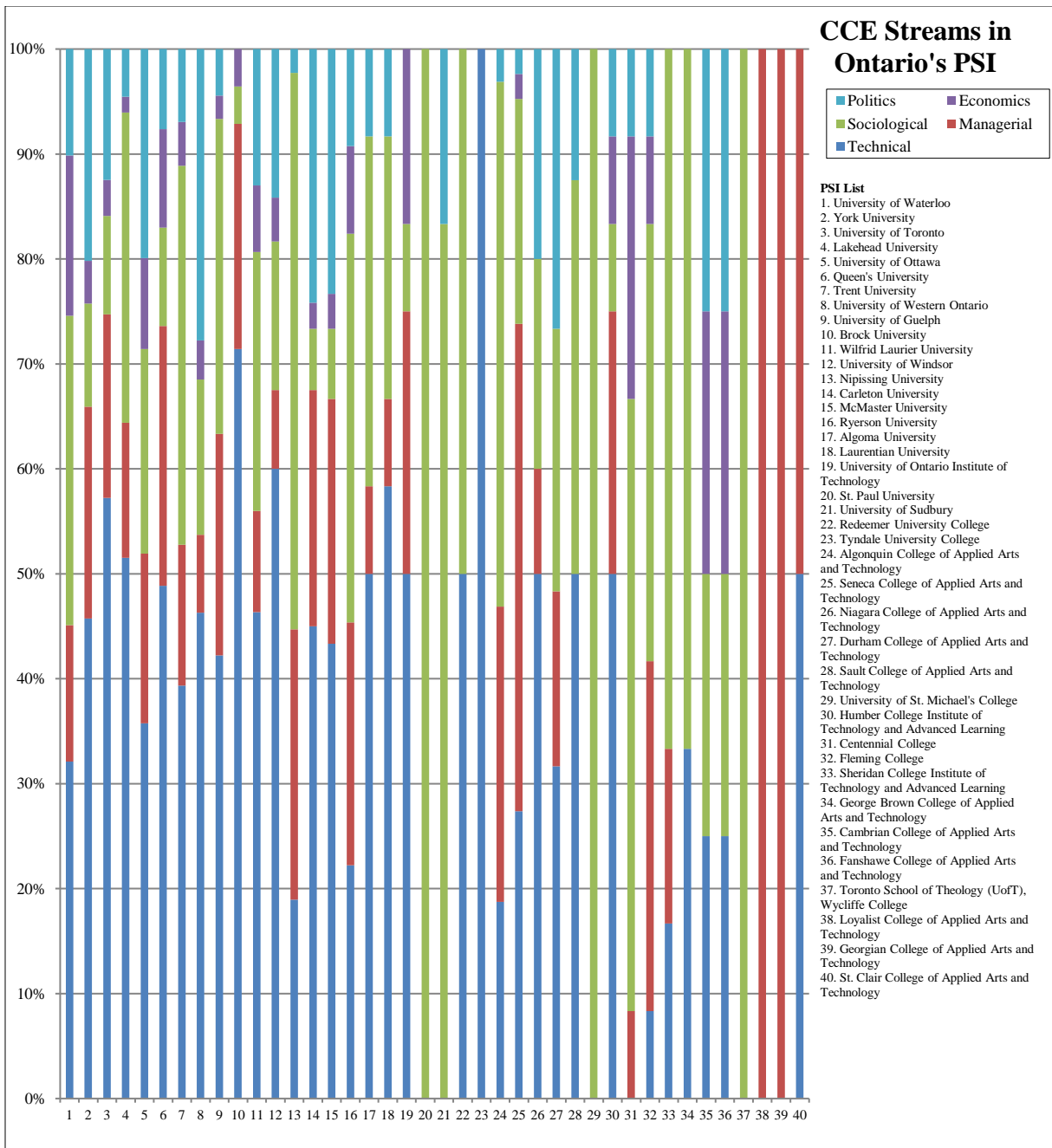


Figure 27: CCE Streams in Ontario's PSIs offering climate change courses during the calendar year of 2014-2015

26% of the courses were Tier 1, 16% Tier 2 and 58% Tier 3 (See Figure 26, p. 106). The universities with more Tier 1 courses in Ontario and Canada were York University (n=16), University of Waterloo (n=15) and the University of Toronto (n=15).

42% of the courses are focused on the technical stream, 24% on the sociological, 17% on the managerial, 12% on the politics, and 5% on the economics (See Figure 27, p. 107).

67% of the courses are offered at the undergraduate level, 22% at the graduate level and 11% are part of continuing or distance education programs.

29% of the courses were offered by Faculties of Art, followed by Science & Technology (28%), Graduate Studies (21%), Humanities & Social Sciences (21%), and Law (1%). The Humanities & Social Sciences departments offered 51% of the courses, while Science & Technology offered 38% and Other 11%.

PRINCE EDWARD ISLAND

In Prince Edward Island, one of three PSIs included in this study offered climate change courses. Publicly funded, the University of Prince Edward Island offered six climate change courses during the calendar year of 2014-2015. None of the colleges offered climate change courses.

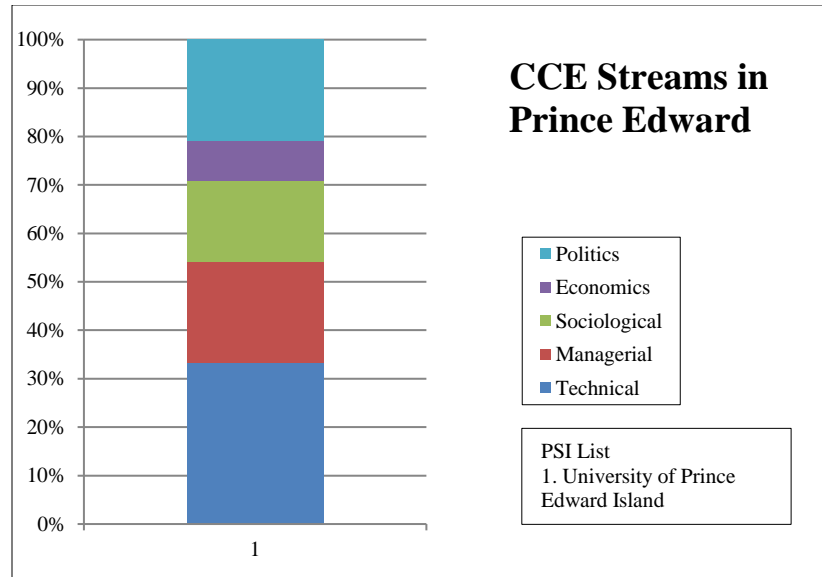


Figure 28: CCE Streams in Prince Edward Island's PSIs during the calendar year of 2014-2015

33% of the courses were focused on the technical stream, 17% on the sociological, and 8% on the economics. Politics and managerial courses comprised 21% each (See Figure 28).

Five sixths of the courses were offered at the undergraduate level (83%) and one sixth at the graduate level (17%). All of the courses were also offered through distance or continuing education programs.

33% of the courses were Tier 1 and 67% Tier 3. There were no Tier 2 courses (See Figure 29).

Prince Edward Island University offered 2 Tier 1 courses.

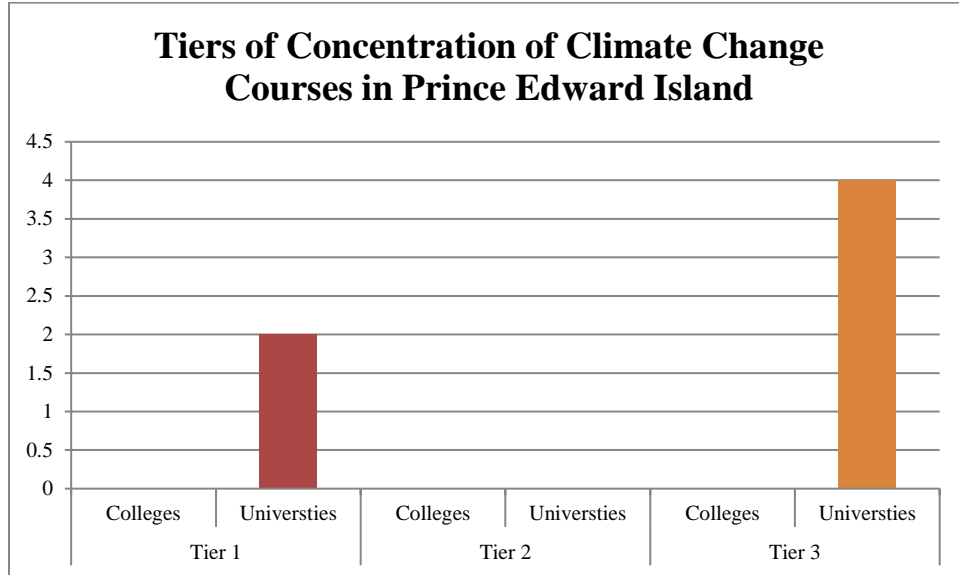


Figure 29: Tiers of Concentration of Climate Change Courses in Prince Edward Island during the calendar year of 2014-2015

Faculties of Science & Technology offered 71% of the climate change courses in PEI, followed by the faculties of Art (14%) and Graduate Studies (14%). Over four fifths of the courses were offered by the departments of Science & Technology (83%) and less than one fifth were offered by Other departments (17%).

QUEBEC

In Quebec, the three universities included in this study offered climate change courses, McGill University (n=19), Concordia University (n=14) and Bishop's University (n=4). None of the 12 colleges offered any course.

Almost three quarters of the courses were offered at the undergraduate level (73%), over one fifth at the graduate level (22%), and less than one tenth were offered through continuing or distance education programs (4%).

62% of the courses were focused on the technical stream, 5% on the politics, and 3% on the economics. Sociological and managerial courses comprised 15% each (See Figure 30).

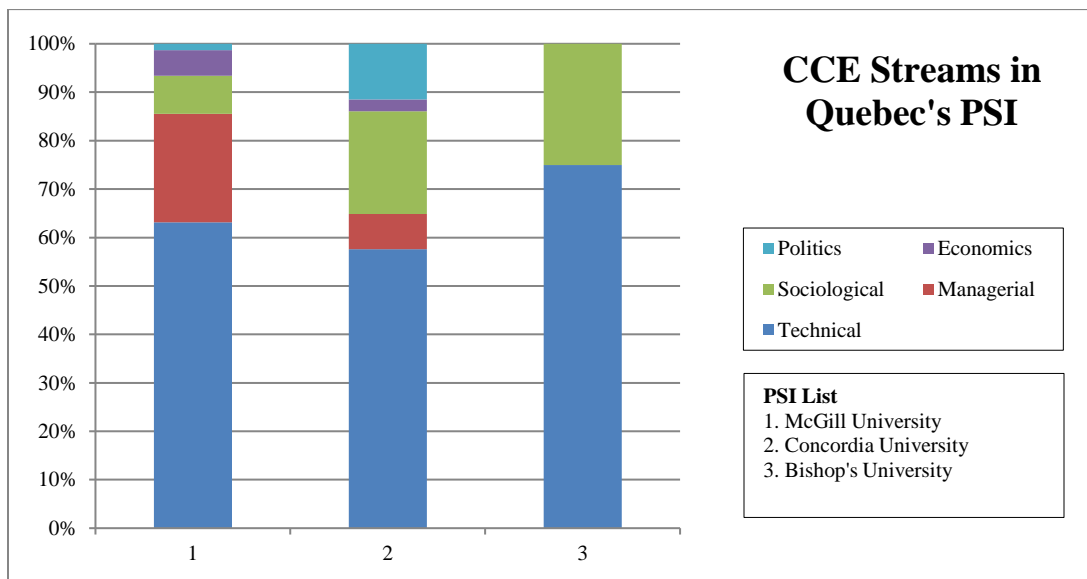


Figure 30: CCE Streams in Quebec's PSIs during the calendar year of 2014-2015

100% of the PSIs offering climate change courses were publicly funded (Refer to Figure 7 for a detailed overview, p. 81).

22% of the courses offered were Tier 1, 35% were Tier 2 and 43% were Tier 3 (See Figure 31).

The university with more Tier 1 courses was McGill University (n=5).

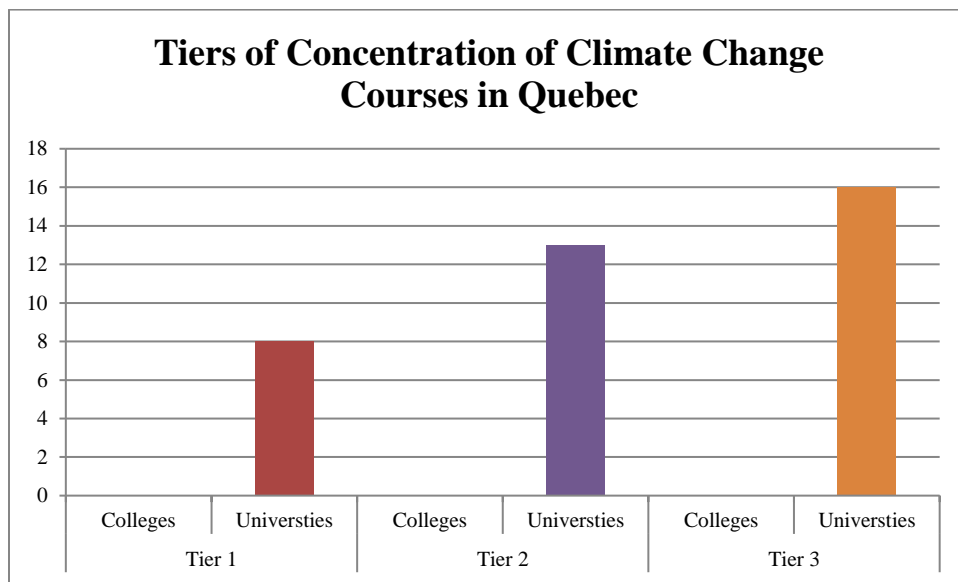


Figure 31: Tiers of Concentration of Climate Change Courses offered in Quebec's PSIs during the calendar year of 2014-2015

Faculties of Arts offered 45% of the climate change courses in Quebec, followed by the Faculties of Science & Technology (39%) and Graduate Studies (16%). Over half of the courses were offered by the departments of Humanities & Social Sciences (51%), and then other half by the Science & Technology departments (49%).

SASKATCHEWAN

In Saskatchewan, 2 out of 3 universities offered climate change courses, the University of Regina (n=13) and the University of Saskatchewan (n=10). Only 1 out of 18 colleges offered 2 courses, the Briercrest College and Seminary.

60% of the courses focused on the technical stream, 16% on the politics, 9% on the managerial, 8% on the sociological and 7% on the economics (See Figure 32).

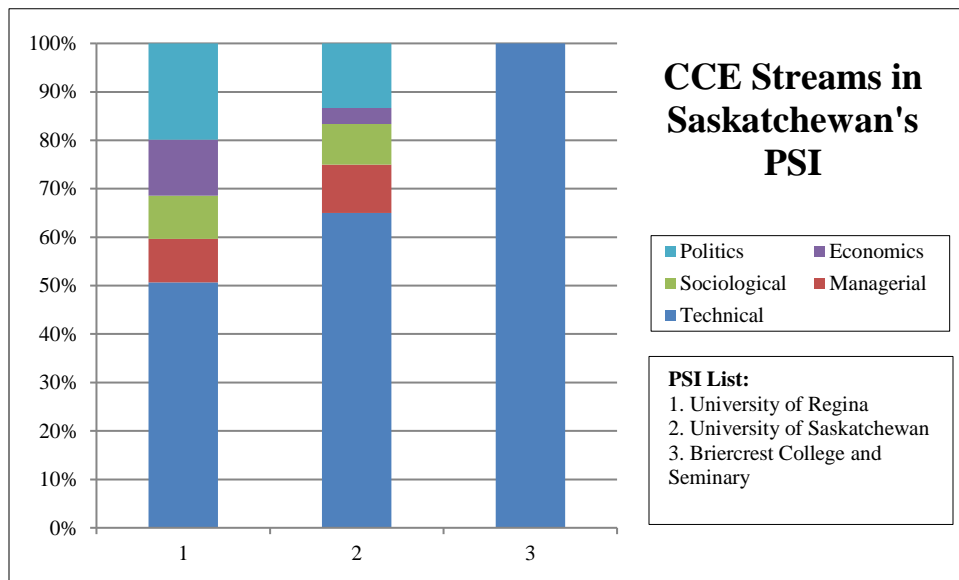


Figure 32: CCE Streams in Saskatchewan's PSIs offering Climate Change Courses during the calendar year of 2014-2015

67% of the PSIs offering climate change courses were publicly funded and 33% were private institutions (Refer to Figure 7 for a detailed overview, p. 81).

20% of the courses were Tier 1, 24% were Tier 2 and 56% were Tier 3 (See Figure 33). The university with more Tier 1 courses was the University of Regina (n=4).

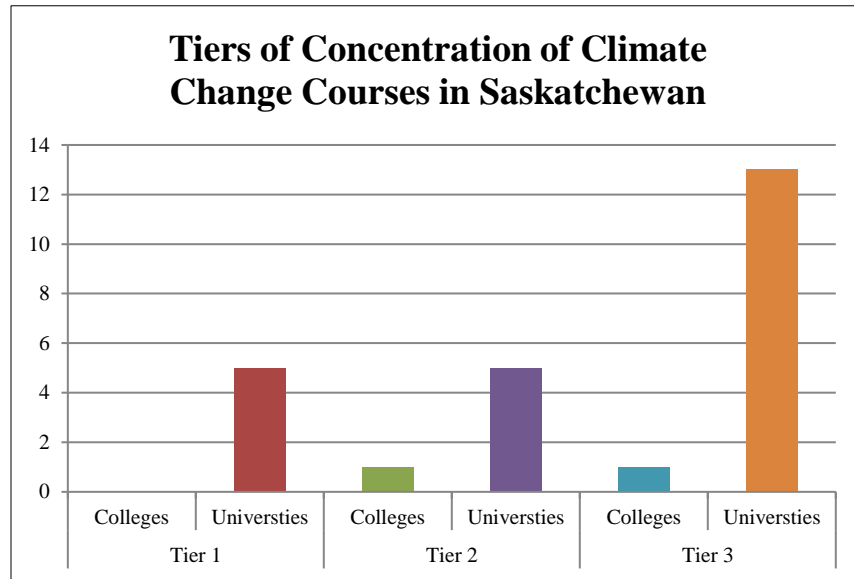


Figure 33: Tiers of Concentration of Climate Change Courses in Saskatchewan's PSIs during the calendar year of 2014-2015

Faculties of Arts offered 52% of the climate change courses in Saskatchewan, followed by the Faculties of Science & Technology (41%) and Graduate Studies (7%). Over three fifths of the courses were offered by the departments of Humanities & Social Sciences (63%), and the other two fifths by the Science & Technology departments (38%).

YUKON

The publicly funded Yukon College is the only one of Yukon's PSIs included in this study and offered 9 courses.

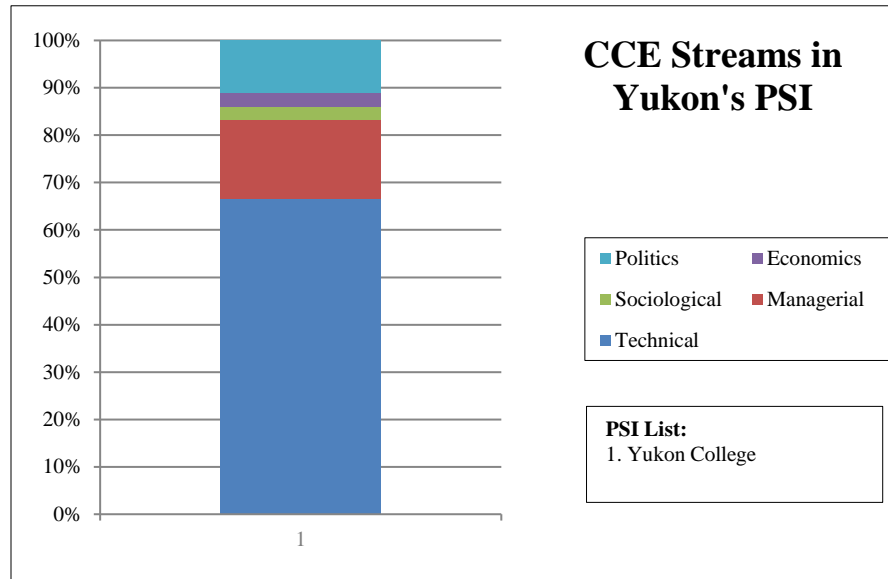


Figure 34: CCE Streams in Yukon's PSIs offering climate change courses during the calendar year 2014-2015

67% of the courses were focused on the technical stream, 16% on the managerial and 11% on the political. Sociological and managerial courses comprised 3% each (See Figure 34).

Tier 1 comprised 33% of the courses, Tier 2 were 22% and Tier 3 were 45% (See Figure 35, p. 116).

88% of the courses were offered by the department of Science & Technology and the remaining 12% by Other departments.

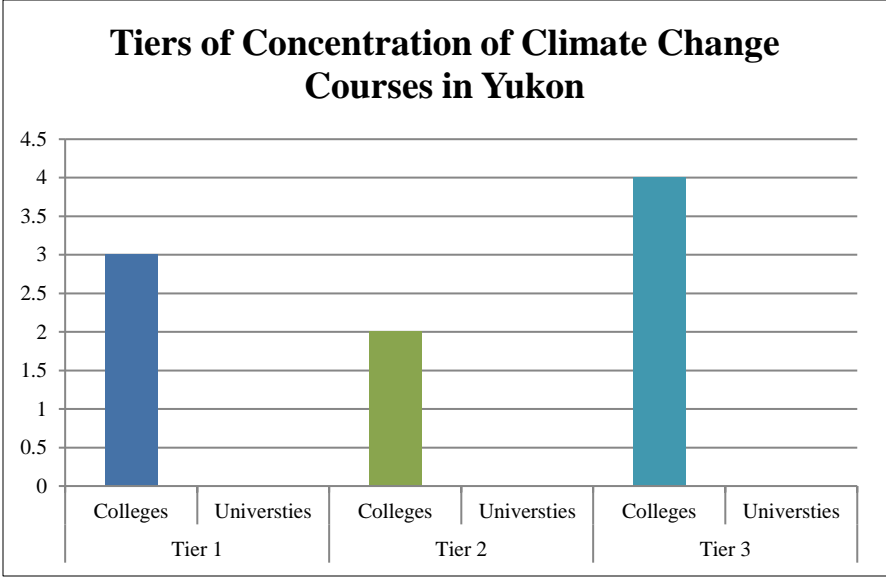


Figure 35: Tiers of Concentration of Climate Change Courses in Yukon's PSIs during the calendar year of 2014-2015

5.3 Institutional Overview

The PSIs with the largest number of Tier 1 courses are York University (n=16) followed by the University of Toronto and University of Waterloo (n=15 each). Tier 2 courses were offered the most at the University of Waterloo and York University (n=9 each), followed by Lakehead University and Concordia University (n=7). Tier 3 courses were offered the most at the University of Waterloo (n=25), York University (n=20) and University of Toronto (n=18).

The PSIs with the largest number of technical stream courses are York University (n=21), University of Toronto (n=20), and University of Waterloo, University of Northern British Columbia and Dalhousie (n=14). PSIs with the largest number of managerial stream courses are York University (n=9), University of Waterloo (n=7), University of Toronto (n=6) and Queen's University (n=5). Sociological stream courses were offered the most at the University of Waterloo (n=12), Trent University (n=7), Lakehead University and Nipissing University (n=6), and Algonquin College of Applied Technology, University of the Fraser Valley and University of Victoria (n=5). The PSIs with the largest number of economic stream courses are University of Waterloo (n=9), University of Victoria (n=7), and Dalhousie University (n=6). Policy/Governance stream courses were taught the most at York University (n=9), University of Toronto (n=6), Dalhousie University, University of Western Ontario and University of Waterloo (n=5).

Section 2.3 discussed how the majority of PSIs have committed to address climate change at the institutional level in two ways: i) through national or international agreements; and ii) by establishing policies or university-wide strategies. The last one is the most informal, yet the most

common approach used by Canadian PSIs, typically done through the PSIs' sustainability office. A list of institutions was created to address the research question of how institutional, provincial, national policies affect the establishment of climate change courses. This list includes only the PSIs who have more than 15 courses, or have signed the UCPCCSAC, or have a Climate Action Plan (CAP), or have established policies or strategies related to sustainability. Although some of these policies do not mention climate change *per se*, they do address some of its factors indirectly.

A total 42 PSIs, located in 7 provinces, were found to meet these criteria and offered 65% of the climate change courses at the national level. BC and AB are the provinces with the majority of UCPCCSAC's signatories (n=9 and n=11 respectively), while ON is the province with the largest number of CAPs (n=4) and policies/strategies (n=10) (Figure 36, p. 119).

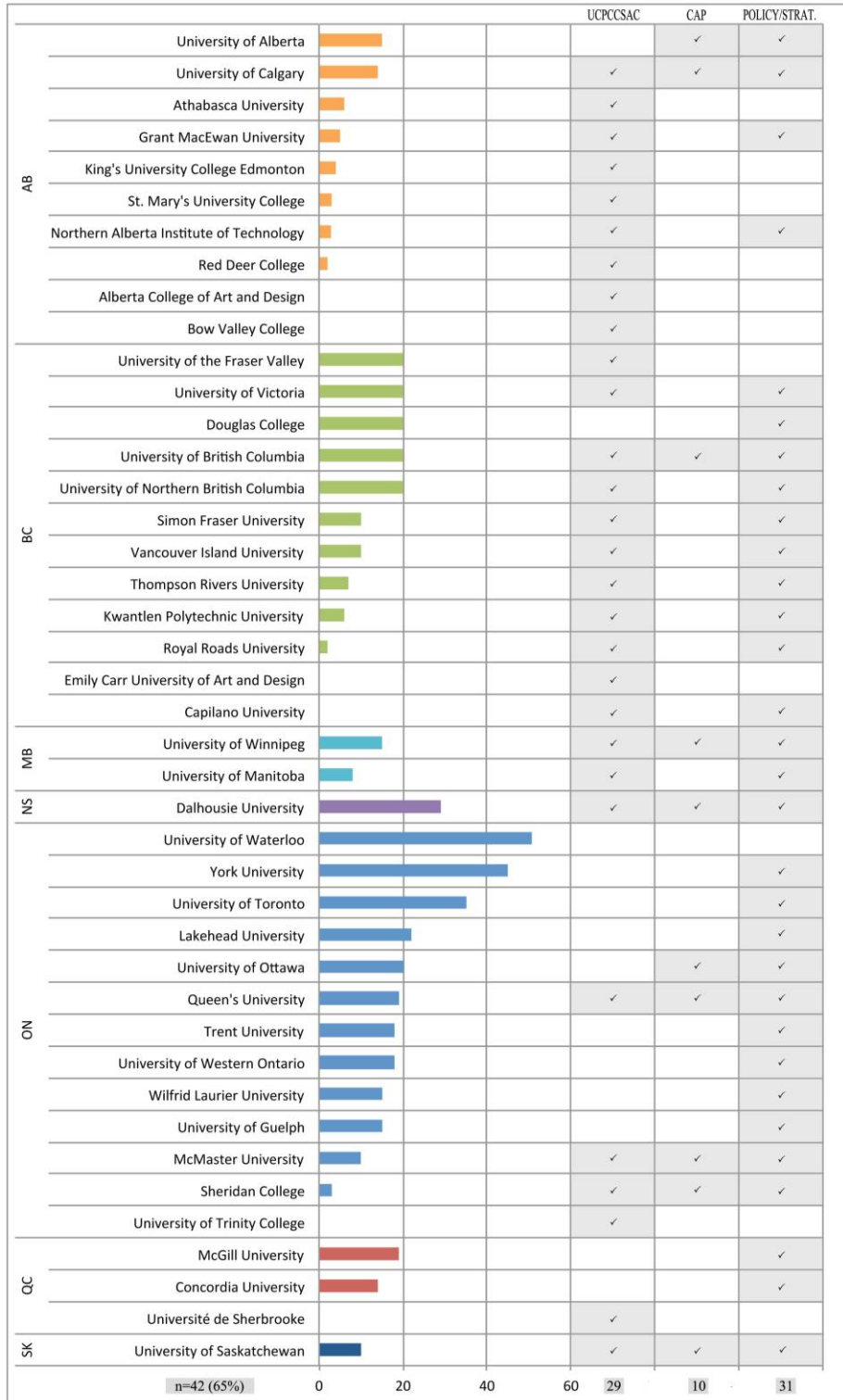


Figure 36: Canadian PSIs with Climate Change Courses who are signatories of UCPCCSAC, have Climate Action Plans (CAP), or policies/strategies addressing sustainability and/or climate change.

5.4 Results Summary

Of the 225 PSIs examined in the calendar year of 2014-2015 some patterns emerge:

- 46% offered a total of 849 climate change courses. Of this 46% (104 PSIs), 59% were universities and 41% were colleges.
- Universities offered over four-fifths of the climate change courses (83%), while colleges offered under a fifth (17%). Nearly three fourths of the 104 PSIs with climate change courses offered between 1 and 10 courses. The majority of the courses (73%) were offered at the UG level.
- 89% of the climate change courses were offered by publicly funded PSIs.
- Eleven publicly funded PSIs offered more than 20 climate change courses each and these are located in ON (n=5), BC (n=5), and NS (n=1).
- 48% of the climate change courses were offered in ON, followed by BC (21%). The rest of provinces and territories comprise the remaining 31%.
- 23% are Tier 1, 20% are Tier 2, and 57% Tier 3. The largest number of Tier 1 courses were offered in ON (53%), BC (16%) and AB (9%). NL (38%), NU (33%) and QC (36%) offered the largest number of Tier 2 courses. AB (45%), QC (44%) and YK (44%) offered the lowest number of Tier 3 courses, while in the NT all the courses were Tier 3.
- In regards to the Climate Change Education (CCE) Streams, 54% were scientific/technical, 16% environmental/sociological, 12% managerial, 11% politics/governance, and 7% economic.

- 179 Faculties and 169 Departments across Canada offered climate change courses. The faculties that offered the most climate change courses are Science & Technology (37%) and Arts (28%).
- Geography Departments offered two-fifth (22%) of the total of climate change courses at the national level, followed by Biological and Applied Sciences (11%), Atmospheric & Oceanic Sciences (9%) and Environmental Sciences (9%).
- UG courses are predominant in NB (89%) and NS (88%). The largest percentage of GR courses was found in NL (38%), while non-existent in NT, NU and YK.
- MN, NB, NL, NS and SK did not offer any DE courses whereas NU offered all its courses through DE programs.
- The technical and managerial streams represent 62% or more of the courses offered in most provinces, except for the NT, NU, ON and QC.
- QC is the only province where the political and managerial streams are over 20% of the courses, while in NL not a single course touches upon political issues and in NT there are no managerial courses.
- In the NT, NU, and ON the sociological stream is over 20%, while NL, NS and NT are the ones that offered the most courses in the economic stream.
- Four out of the top five PSIs that offered the largest number of climate change courses are located in ON, these are the University of Waterloo (n=51), York University (n=45), University of Toronto (n=35), and Lakehead University (n=22). Dalhousie University ranks in four place at the national level (n=29).
- There are 2 UG (undergraduate) and 3 GR (graduate) programs in climate change in Canada, which are offered in BC and ON. Two of these programs, which grant degrees

specifically on climate change, are the UG minor program called ‘Human Dimensions of Climate Change’ (HDCC) at the University of Victoria (BC) and the GR program called ‘Master of Climate Change’ at the University of Waterloo. The University of Toronto and the University of Waterloo offer specializations at the UG level, while the University of Toronto offers a Master’s and a PhD with a general degree but with a focus on climate change. York University offers an UG Certificate in Sustainable Energy and starting in Winter 2017, the University of Victoria offers a Certificate in HDCC.

- Enrolment numbers data could not be analyzed for lack of consistency on the data provided by PSIs.

This chapter provided an overview of climate change courses (during the calendar year 2014-2015) and programs offered in Canada. Building on this analysis, the following chapter seeks to understand some of the social processes underpinning curriculum course formation. I seek to better understand why and how some of these patterns emerge within particular institutions and programs.

CHAPTER 6.0 - Climate Change Curriculum Formation in Post-Secondary

Educational Institutions (PSIs)

Universities have become central institutions within our society... [however] our understanding of [their] contributions and relationships has surprisingly little depth. Our discussion of the relationship between the university and society is seldom nuanced or detailed. If universities can take credit for the enormous benefits of an educated population, then they should also share some blame for social failings. (Jones G. , 2008, p. 432)

If there is anything worth celebrating in the Paris Agreement signed in April – and sadly, there isn't enough – it has come about because of this kind of principled action: climate sumud^{xvii} (Klein, 2016, pp. 11-14).

As I mentioned at the beginning of this dissertation, my study was built with the goal to better understand how PSIs curricula are responding to climate change, particularly in regards to the establishment of climate change courses and programs. The following chapter is an attempt to advance (at least partially) knowledge around climate change curriculum formation in specific universities. It also points to the need for more systematic and in-depth analysis of the internal workings of contemporary post-secondary educational institutions.

This chapter starts with an analysis of four PSIs that not only offer climate change programs, but also that are known by their ecological inclination and character. The chapter then continues with an examination of the factors that influence climate change curriculum formation based on a series of interviews with those involved in formulating these programs. Two main research questions guided this study, what climate change courses/programs exist in these Canadian PSIs, and what are the main factors motivating formation of these courses/programs?

6.1 Climate Change Programs in Canadian PSIs

6.1.1 University of Victoria

UVic is located in Southern Vancouver Island in the city of Victoria. It is a publicly funded research institution with an annual enrolment of around 20,000+ students (Universities Canada, 2016). Situated between two bays (Saanich and Oak), UVic is not only known for its green spaces, architecture, style, and mild Canadian weather, but also for its environmental courses. UVic ranked 8th on Maclean's 2017 Ranking of the Best Environmental Science Programs in Canadian Universities. Maclean's affirms that this particular "location influences UVic's identity," (Maclean's, 2016a, p. 8/22) which subsequently has an impact in the strength and types of conducted research, including "climate change, oceans science and alternative energy" (ibid, p. 8/22).

UVic has a history of high profile environmental actions – for example in 2010 it "performed the first comprehensive institution-wide greenhouse gas inventory consistent with the provincial government's standardized methodology and emissions factors" (University of Victoria, 2014, p. 7). The same year, UVic became carbon neutral by reducing its energy consumption and purchasing carbon offsets. 2010 also became the baseline year to compare its energy and climate performance. By 2015, UVic had reduced its GHGs by 31% below 2010 levels (University of Victoria, 2016c).

In 2008, UVic developed a five-year Sustainability Action Plan to guide its campus operations. The plan highlighted eight thematic areas and 46 goals to manage them, including energy and

climate strategies. This plan was renewed in 2014, the same year in which UVic was awarded Gold by AASHE's STAR certification.

In 2007 the then Dean of the Faculty of Social Sciences, Peter Keller, came forth with the idea of creating a program on the Human Dimensions of Climate Change (HDCC). Keller approached psychology professor, Dr. Robert Gifford, known for his work on environmental psychology to initiate the process. Although the program originated in Social Sciences, the goal was to bring into the program expertise from across campus. At the time, the University of Victoria (UVic) had a number of scientists collecting climate data mainly to generate climate models. Keller's argument, in Dr. Gifford's words was that:

I think that there is more to this problem than just counting the rise in temperature that is going to have social implications, etc., so let's do something in social sciences about mitigation of climate change and adaptation to climate change (Dr. Gifford, Professor, Faculty of Social Sciences, UVic).

Around the same time, after a trip to China, British Columbia (BC) Premier Gordon Campbell, asked UVic to write a proposal to create a centre to tackle climate change. In January 2008, the Pacific Institute for Climate Solutions (PICS) was founded, hosted and led by UVic, in collaboration with three other research BC universities (See Section 2.2). UVic administrators and faculty members (including faculty from the HDCC program) have been part of PICS executive and program committees since the beginning. Dr. Gifford, who participated simultaneously in the proposal writing committees for PICS and HDCC, pointed out in an interview that although

undergraduate students have no direct access to fellowships nor grants through PICS, they are affected by the work of faculty members who are involved in both the HDCC and PICS.

The process, similar to all Canadian PSIs, started with the creation of a committee (in this case all from Social Sciences), which submitted a proposal to the University Senate and presented the idea to the Senate's subcommittees. Once approved by the Senate, the proposal was presented to the Province of BC for approval. The application process was led by Dr. Robert Gifford, who became the first HDCC program director. The program started in 2009.

As of December 2016, the HDCC is the only undergraduate interdisciplinary minor program in Canada. The program introduces students to the physical aspects of climate change, but its intended focus is on the human aspects, which is emphasized in their online introduction, including knowledge and market-driven considerations:

HDCC focuses on climate change from the perspectives of all the major disciplines that emphasize the human element, including psychology, economics, geography, anthropology, law, philosophy, political science, sociology, business, environmental studies and others. Climate change is not only an environmental event. Effective policy dealing with climate change will require understanding of its human dimensions. Employers will value graduates who know something about all the human aspects of climate change (University of Victoria, 2016a).

Students must complete 12 credits, 3 of which are core courses (1.5 credits each) and 5 are electives (7.5 credits selected from a list of 33 elective courses). From these electives courses, some are

recommended, and all need to be approved by the program's director (University of Victoria, 2016a) (See Table 12, p. 257).

Starting in January 2017, UVic offers a Certificate in HDCC, which is accessible concurrently to students completing an honours, major, general or independent programs. Students must complete 10.5 credits, 6 of which are core courses (1.5 credits each) and 4.5 are electives (with approval from the director). The core courses are the same as for the minor program, with the addition of HDCC490, an Experiential Learning course, which includes "at least 150 hours of work or volunteer activities" (University of Victoria, 2016b).

During the calendar year 2014-2015, UVic offered 20 climate change courses, around a third of which focused on the technical and managerial aspects of climate change, while the remaining 64% focused on sociological/environmental, economic and policy. In respect to my previous analysis of concentration, 50% I judge as Tier 3 courses, 30% Tier 1 and 20% Tier 2. 95% of the courses were offered at the UG level. Faculties of Humanities and Social Sciences offered 67% of the courses, followed by Science and Technology (19%) and Business (9%) (See Figure 37, p. 128).

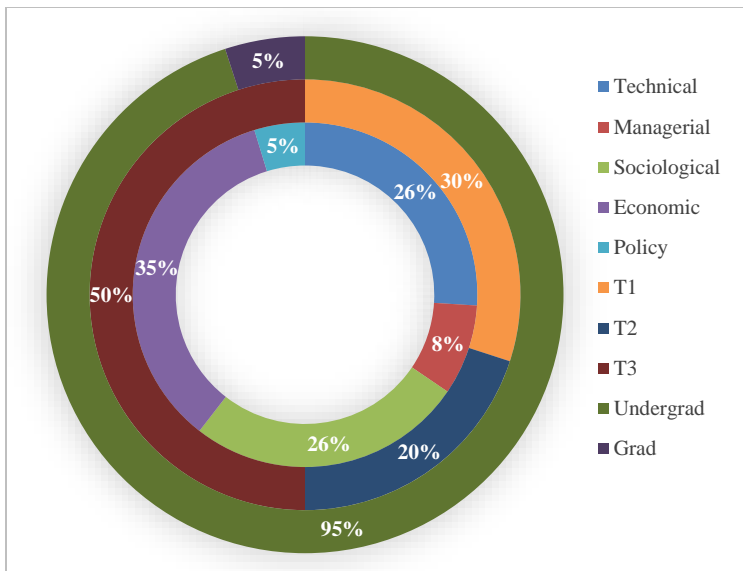


Figure 37: Streams, tiers of concentration and level of climate change courses offered by the University of Victoria during the calendar year of 2014-2015.

6.1.2 University of Waterloo

University of Waterloo (henceforth referred to as Waterloo) is located on 1,000 acres of land — adjacent to Waterloo Park — in Waterloo, Ontario (University of Waterloo, 2016d). Waterloo is a publicly funded research institution and member of the Canadian U15^{xviii}. Waterloo’s annual enrolment is 35,000+ students (Universities Canada, 2016) and is known for its large co-op program, which according to its website is the “largest in the world” (University of Waterloo, 2016c). According to Maclean’s 2017 Ranking of the Best Environmental Science Universities in Canada “Waterloo is a research mecca” ranked in 3rd place, with the Mike and Ophelia Lazaridis Quantum-Nano Centre, the Balsillie School of International Affairs, and proximity to the Perimeter Institute for Theoretical Physics (Maclean's, 2016a, p. 3/22).

In 2009, Waterloo signed the Council of ON Sustainability Pledge in which the university accepted its responsibility to respond to environmental challenges, including climate change. In 2011, the first sustainability report was produced and by 2013 rebranded as the Sustainable Campus Initiative (University of Waterloo, 2015).

Acknowledging the need for a more effective environmental action and considering the momentum gained in Paris, in 2015 Waterloo formed the President’s Advisory Committee on Environmental Sustainability, which started to work on an Environmental Sustainability Policy. The Committee was scheduled to meet in Fall 2016 to finalize and adopt the strategy (University of Waterloo, 2016e, pp. 3, 22). Waterloo tracks its GHG emissions in all campuses and uses 2010

levels as benchmark year. According to the latest report, the total emissions increased by 2.7% in regards to 2010 levels (University of Waterloo, 2016e, p. 11).

In 2004, shortly after being named University Research Chair at Waterloo, Dr. Daniel Scott approached his Dean in the Faculty of Environment at the time and expressed his interest in a climate change program. In 2010, after finding support from the newly appointed Dean of the Faculty of the Environment, Dr. Scott started the process, including all the assessments before submitting the proposal for a broader climate change program to the Province of Ontario. The process was similar to UVic in the sense that a proposal was developed — led by Dr. Scott with the support of the Associated Dean for Graduate Studies — presented to the University Senate, external reviewers were brought in, and finally submitted to the Province for approval. The Master of Climate Change (MCC) was the first of its kind in Canada and started in 2013. Dr. Scott stated that with Waterloo’s pioneering program “We have taken a bit of a risk, but in a way, Waterloo is known for things like that” (Dr. Scott, Professor, Executive Director of the Interdisciplinary Centre on Climate Change-IC3, University Research Chair, Waterloo).

The MCC program offers students the possibility to explore how climate change is interconnected to society, and appeals to the role that future graduates will play having an edge on climate change as an emergent ‘career path’ and a new global reality:

The MCC program provides a unique educational experience to students interested in the rapidly evolving fields of climate change research and diverse career paths in climate change science, policy and management. The program is designed with the flexibility to meet the needs of recent graduates who endeavour to become part of the first generation

of climate change professionals by building on their undergraduate degree with advanced training and experience specific to climate change. The program will also be of interest to mid-career professionals looking to upgrade their current knowledge and skills to take on the challenges climate change poses to their field (University of Waterloo, 2016a).

Some of Waterloo's faculty members have been involved with the IPCC since SAR. In addition to this, a node of Environment Canada's working group dedicated to climate change impacts and adaptation was located in Waterloo. When the Harper government disintegrated this node, some of its officers remained in Waterloo and their work continued through the university. Waterloo had the expertise to run the MCC program and according to Dr. Scott "we had a real core of people to launch the MCC even without hiring some new people" (Dr. Scott, Professor, Executive Director of the Interdisciplinary Centre on Climate Change-IC3, University Research Chair, Waterloo).

The legacy and experience that these faculty members brought to Waterloo are highlighted in Dr. Scott's remarks on the MCC's website:

Universities play a critical role in addressing the challenges posed by climate change, both through innovative research and specialized training required to respond to complex and rapidly evolving professional demands. The MCC provides students the opportunity to learn from and mentor with several scientists that have served with the Nobel Peace Prize winning Intergovernmental Panel on Climate Change (IPCC) in various capacities over the last 15 years (University of Waterloo, 2016a).

Offered since 2013 by the Department of Geography and Environmental Management (GEM) in the Faculty of Environment, the MCC is the only master's degree in climate change in Canada to date. The MCC is a 12-month (3 semesters), full-time course-based interdisciplinary program. It requires a major paper research or a 4-month professional internship. It offers 19 graduate courses ranging from the technical to the socio-political streams (58% are focused on the technical stream; 16% in the managerial stream, 10.5% in the economic stream, 10.5% in the sociological stream, and 5% in the political stream). To complete the program, eight courses are required, 3 of which are core courses. Each one of the three core courses follows the IPCC working groups' areas of work:

- GEMCC 601: Climate Change: Physical Science Basis
- GEMCC602: Climate Change, Vulnerability and Adaptation
- GEMCC603: Climate Change Mitigation

The GEM department offers the majority of the courses, only 4 courses are offered by other departments within the Faculty of Environment (University of Waterloo, 2016a):

School of the Environmental, Enterprise and Development:

- ENBUS 621: Enterprise Carbon Management
- INDEV 603: Global Health
- SUSM 650: Environmental Finance

School of Planning:

- PLAN 674: Site Planning and Design Studio

In 2015, GEM started to offer an undergraduate specialization program in climate change for students completing a Bachelor in Environmental Studies and majoring in Honours Geography and Environmental Management, Geography and Aviation or Geomatics. The program requires

students to take 4 courses. Of these courses, one must be selected from a list of 8 physical geography courses and one from a list of 8 human geography courses. To complete the specialization, 4.0 units must be completed. Two of the required courses focus on the physical aspects of climate change – energy flow and water cycles; one is focused on the sociological aspects, including the scientific history, impacts and adaptation measures. Political issues are also introduced through a course on the human dimensions of climate change; and a course focused on the management and economic aspects of energy, including renewable and non-renewable systems (University of Waterloo, 2016b).

The required courses are:

- GEOG 209: Hydroclimatology
- GEOG 308: Human Dimensions of Global Climate Change
- GEOG 309: Physical Climatology
- GEOG 459: Energy and Sustainability

During the calendar year 2014-2015, Waterloo offered 51 climate change courses, 44% of which focused on the technical and managerial aspects of climate change, while the remaining 56% focused on sociological/environmental, economic and policy. Regarding tiers of concentration, 53% were Tier 3 courses, 29% Tier 1 and 18% Tier 2. 57% of the courses were offered at the UG level and 43% at the graduate level. Faculties of Humanities and Social Sciences offered 41% of the courses, followed by Graduate Studies (35%) and Science and Technology (11%) (See Figure 38).

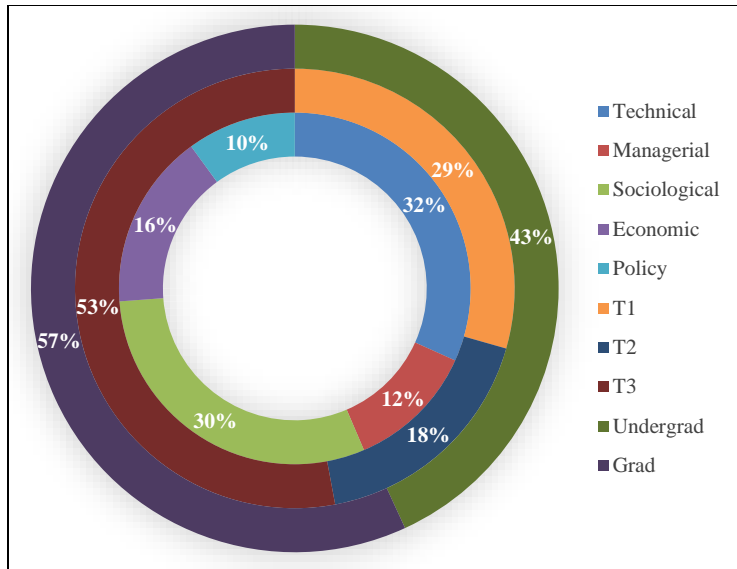


Figure 38: Streams, tiers of concentration and level of climate change courses offered by the University of Waterloo during the calendar year of 2014-2015

6.1.3 University of Toronto

UT is located North of the financial district in Downtown Toronto and is the largest university in Canada. It is a publicly funded research institution with an annual enrolment of over 82,000 students. In 2016-2017, UT ranked second in research performance in the world according to the University Ranking by Academic Performance (URAP, 2016). Maclean's '2017 Ranking of the Best Environmental Science Universities in Canada,' placed UT in 4th place and denominated it as "in a class of its own" (Maclean's, 2016a, p. 4/22).

In 2004, the University's Environmental Protection Advisory Committee created the Sustainability Office, and in 2009, President Naylor signed the Council of ON Sustainability Pledge (University of Toronto, 2011a). By 2011, UT developed a master plan for each campus (Mississauga-UTM, St. George and Scarborough-UTSC), which are administered by a decentralized system. St. George's Campus Master Plan doesn't address climate change directly but through the management of sustainability (University of Toronto, 2011a). UTM's plan claimed to be working on a Climate Action Plan at the time in which the master plan was written, but there is no evidence of such plan in any of the university's resources (University of Toronto, 2011c).

Different to the other two campuses, UTSC's plan detailed in one of its four sections (called 'achieving sustainable systems') its academic vision to tackle climate change: "Ongoing teaching and research will further UTSC's contributions to understanding and addressing climate change" (University of Toronto, 2011b, p. 80). Within its planning recommendations are to develop a climate change plan (as of December 2016 it has not been published), to design and develop

campus operations to minimize GHGs, to seek opportunities to generate alternative energy, and to develop risk assessments and mitigation strategies (University of Toronto, 2011b, pp. 104-105).

St. George and UTSC are members of AASHE but as of December 2016 they have not reported to STARS. The latest university sustainability report (2015-2016) is not detailed in regards to institutional initiatives to address climate change and is very vague in regards to reduction targets at the institutional level.

The Master's Program in Environmental Science started in 2006 as a broad program at UTSC. Three years later, Dr. William Gough (who was then the Vice Dean of Graduate Education and Program Development of UTSC, and founder and director of the Climate Lab in UTSC), developed a PhD program, with one of its six fields of concentration dedicated to climate change and the environment (CC&E) (University of Toronto, 2016b). This was the first PhD program for UTSC.

In 2014, UTSC started to offer three different fields of concentration within the existing master's program in environmental science, one of which is called 'Climate Change Impact Assessment-CCIA.' Both the masters and doctorate programs with climate change concentrations are offered by the Department of Physical and Environmental Sciences, Division of Physical Science at the UTSC. While the PhD program on CC&E is very flexible in the sense that students build their interests with support from their supervisors, the CCIA master's program is structured around a particular area.

Undergraduate students seeking a degree in Biological Sciences with a Specialist Program in Integrative Biology have the route option to focus on “the impacts of environment and climate change on the biology of ecosystems.” This specialization requires 14.5 credits. To follow this route, the following courses are required (University of Toronto, 2016a):

- BIOB52H3: Ecology and Evolutionary Biology Lab
- BIOC52H3: Ecology Field Course
- BIOC58H3: Biological Consequences of Global Change
- BIOC59H3: Advanced Population Ecology
- BIOC60H3: Winter Ecology
- BIOC61H3: Community Ecology and Environmental Biology
- BIOC67H3: Inter-University Biology Field Course

The master program is a full-time 12-month (3 terms), 5.5 full-course equivalents with the option of a research paper or an internship. Students must complete six required courses and one course from the elective list (if doing the internship), or two courses from the elective list (if doing the research paper, one of which is the ‘EES 1114H Directed Readings in Environmental Science I’ course). There are 33 electives, in addition to two direct reading courses (See Table 13, p. 258). From the elective list of courses, 61% are focused on the technical stream, 10% on the managerial stream, 9% on the political stream and 1% on the sociological stream. There are no courses focused on the economic stream.

The PhD program requires 2 full-course equivalents, including a 0.5 FCE mandatory seminar (EES 2200H Advanced Seminar in Environmental Science), and 1.5 FCEs for the elective courses (See Table 13, p. 258), which need approval from supervisor’s and Graduate Chair.

During the calendar year 2014-2015, UT offered 35 climate change courses, 75% of which focused on the technical and managerial aspects of climate change, while the remaining 25% focused on sociological/environmental, economic and policy. Regarding tiers of concentration, 51% were Tier 3 courses, 43% Tier 1 and 6% Tier 2. 86% of the courses were offered at the UG level and 14% at the graduate level. Faculties of Arts & Science offered 81% of the courses, followed by Graduate Studies (13%) and Science and Technology (3%) (See Figure 39).

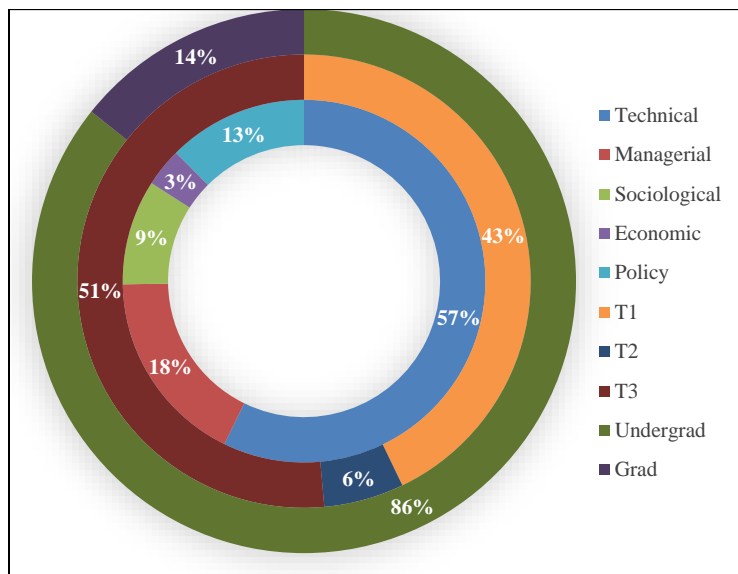


Figure 39: Streams, tiers of concentration and level of climate change courses offered by the University of Toronto during the calendar year of 2014-2015

6.1.4 York University

York University's (henceforth York) has two campuses (Keele and Glendon) and a third one is currently under construction. York is a publicly funded research institution with an annual enrolment of around 53,000 students. Due to its location, York's access requires commuting to or limited lines of public transportation. This situation is expected to change with the opening of an extension of Toronto's subway sometime in 2017. Maclean's 2017 University Comprehensive Ranking, placed York in 7th place for "its renowned programs in business, law, science and fine arts" (Maclean's, 2016b).

In 2008, York completed an energy audit of all campus buildings and in 2012 set a reduction target of 25% from 2006-2007 levels by retrofitting and replacing lighting, heating and cooling, and water systems across campus. Approved in 2011, the Sustainability Policy's goal was to incorporate sustainability into the university's decision making. Finally, after a few years of being an AASHE's member, in April 2016 York submitted its data to STARS, which awarded it a Silver rating.

The Faculty of Environmental Studies (FES) offers an undergraduate certificate in Sustainable Energy (SE) which offers students pursuing an Honours degree with foundations, strategies and applied skills to "prevent dangerous climate change" (FES, 2016, p. 41) and appealing to the job prospects in the field:

By completing the certificate as part of your Honours BES degree, you will enhance the theoretical foundation provided by your Area of Concentration with expertise in

sustainable energy policy, economics, law, technology, management, communications and evaluation and hands-on applied training. These skills are in high demand in the growing sustainable energy sector. Students completing the certificate program can pursue career paths with government agencies, local energy distribution companies, renewable energy developers and energy service companies (York University, 2016a).

The SE was approved by the York Senate in 2011, but was part of a concerted effort by FES professors Dr. Mark Winfield and Dr. Jose Etcheverry. Both professors were hired by FES in 2007 as part of a faculty complement. Since hired, both professors had the idea to integrate climate change in a formal way within the curriculum. According to Dr. Winfield, the process was done progressively until the implementation of the certificate:

We did it in several rounds. We did the courses first. And moved them through the system. And then, the certificate after that. We built the building blocks first and we built the certificate after that. It was more like an incremental strategy (Dr. Mark Winfield, Associate Professor, Coordinator of the MES/JD Joint Program, Sustainable Energy Initiative Co-Chair, York University).

Both, Dr. Winfield and Dr. Etcheverry made a wording choice for the certificate to differentiate from other emerging programs:

And we made a conscious decision at the undergraduate level to frame the certificate around sustainable energy. It fundamentally is about climate change mitigation. But we made the conscious decision that climate change programs are becoming a dime a dozen, everybody seems to be having a certificate, master's degree or something on climate

change, and so, we made a conscious decision to call it sustainable energy (Dr. Mark Winfield, Associate Professor, Coordinator of the MES/JD Joint Program, Sustainable Energy Initiative Co-Chair, York University).

Students who are enrolled in the Environmental Management Stream in FES, must complete 48 to 60 credits before they are allowed to register in the certificate. To obtain the certificate, students are required to take a total of 24 credits, 18 credits from six core courses, and 6 credits from 17 elective courses (See Table 14, p. 259) (FES, 2016, p. 41).

During the calendar year 2014-2015, York offered 45 climate change courses, 66% of which focused on the technical and managerial aspects of climate change, while the remaining 34% focused on sociological/environmental, economic and policy. Regarding tiers of concentration, 44% were Tier 3 courses, 36% Tier 1 and 20% Tier 2. 73% of the courses were offered at the UG level and 27% at the graduate level. Faculties of Humanities & Social Sciences offered 34% of the courses, followed by Science and Technology (28%) and Graduate Studies (22%) and (See Figure 40, p. 142).

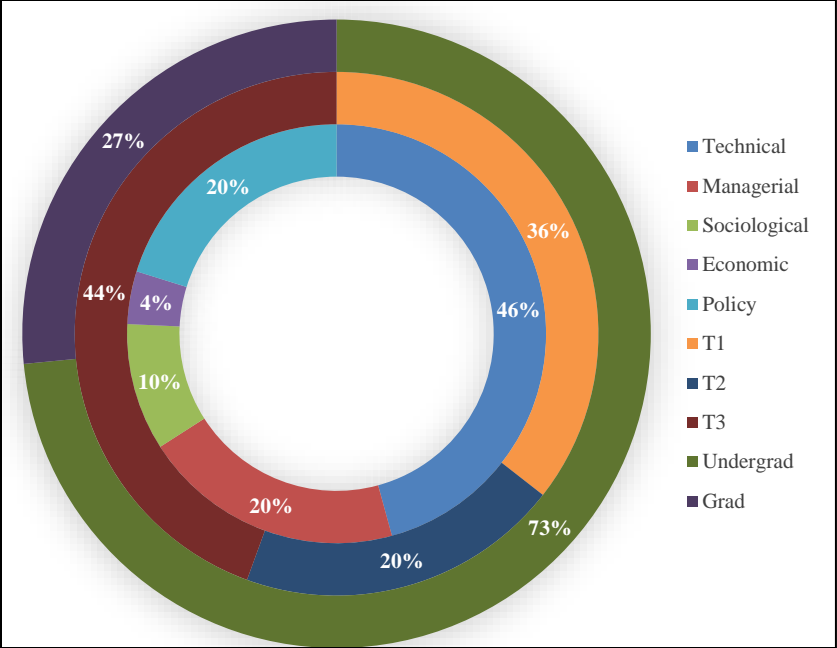


Figure 40: Streams, tiers of concentration and level of climate change courses offered by York University during the calendar year of 2014-2015

6.2 Factors that influence the formation of climate change curricula in Canadian PSIs

The preceding discussions offer an overview of different institutions that were selected because during the last decade these PSIs supported the creation and implementation of a significant number of climate change courses and programs. It is important to recognise that these institutions are similar and different. They are exceedingly complex with multidimensional connections and histories. Nevertheless, in the tradition of grounded empirical research, I sought in my 13 interviews to gather together some common themes that seem significant in climate change curriculum. I remain conscious of not flattening the ideologies and particularities of institutions, but at the same time recognise some commonalities between academic institutions (whose cultural practices are clearly far from mutually exclusive). I started this research project seeking to explore the impact of institutional, provincial policies, however, as the following discussion illustrates, policy [in a formal sense] did not emerge as an influential factor in curricula formation within my interviews. I return to discuss this more fully in the conclusion.

The following sections describe some of the personal and institutional factors that interviewees highlight as affecting the creation and development of climate change curriculum. These represent some aspects of the complexity of institutional change, but also stress how particular places attract certain individuals as well as enable these individuals to pursue change. Curriculum changes undertaken by individuals/departments seem to be affected by cultural bureaucratic struggles, the emergence of climate curriculum champions, disciplinary allegiances, cultural identities and

economics. I focus on four factors: (1) The emergence of climate ‘champions’ in bureaucratic procedures; (2) culture of economics; (3) disciplinary allegiances; (4) climate leanings.

6.2.1 Climate ‘Champions’ in Bureaucratic Procedures

Bureaucratic struggles refer to institutional practices and traditions within PSIs that are related to the organization, structure and function of curriculum and not particularly linked to personal agencies, philosophies nor preferences. These practices — described in similar ways in the four institutions I studied — make processes within PSIs operate in a distinctive way. These institutional structures are affected by bureaucratic struggles that influence procedures and timing, and are constrained by hierarchal arrangements, which vary subtly from place-to-place (whether they are individual departments/Faculties/ pan-university committees/councils). More recently in Canada there have been discussions of standardized course structures and forms, involving objectives and learning outcomes.

In response to my interview questions, the most recurrent difficulty highlighted by interviewees is the taxing amount of time and layers of steps required to propose, submit, establish, revise or reform either a course or a program. These bureaucratic struggles are related to lengthy and somewhat discouraging institutional practices that are similar in structure and function between the four PSIs, and which can have a direct influence in the motivation of climate change courses/programs creators/proponents:

The problem is, in my mind, more bureaucratic. To create a new course or to change the course title or to change the course description that you see online turns out to be a remarkably complicated bureaucratic process. I can't just change the name of my course. It actually has to go through the grad courses specialist and then has to go to the university Senate. So it has to go through 4 or 5 layers of governance process to make a relatively simple change... You tend to do that when you do a whole bunch of courses at once kind of thing. Because it's such a performance to go through the system. So, don't discount a really quite mundane explanation. This place is a huge bureaucracy. And I find that some things you can change very easily and others things are like you bring this mountain down on your head. It's not anything to do with the subject matter. It's just that any kind of change of that nature seems to invoke all this process, which provides a disincentive to make changes in formal parts of the curriculum (IN9, professor/program creator/ program coordinator).

There is a little bit of bureaucratic work to bring in a new program and it takes quite a lot of time (IN4, professor/program coordinator).

You have to establish the proposal, then you have to go through governance process, it's mind boggling (IN10, professor/program coordinator/creator).

Our Dean at the time who was from [province A] was pleasantly amazed that we could have done the proposal and the review process in six months for a new program. He/she said it would take him/her six years to do it in [province A] (IN3, professor/program coordinator/creator).

What stands out in these interviews is that curriculum change is slow, regardless of the topic, place, proponent's position or location. PSIs emerge as having a curriculum culture of complex governance processes with multiple layers and committees, which involve a level of scrutiny and

underlying work. These bureaucratic structures appear unresponsive to the urgency of climate change. In all four institutions presented in this study, the success of climate change programs resided in the arrival/emergence of ‘champions’ or climate curriculum advocates within departments/faculties — whose work, persistence and due diligence played a key role on the creation and final implementation of the programs — and not on high level administrators nor institutional/provincial climate policies. To the question ‘would the program have been approved had he/she been in a different position within the institution at the time,’ a climate curriculum proponent (champion) responded:

No, it wouldn’t have happened. I mean, it was a combination of me being in the right position and this was my personal piece of interest (IN13 professor/administrator/program coordinator/creator).

Perhaps it is important to note that the ‘right position’ does not refer to a senior rank within the PSI (President or Vice-President), but to a curriculum leadership position at the Associate/Assistant Dean level.

During the interviews individual faculty members or “champions” — often times with the support of selected administrators — not only encouraged the creation of climate change courses and programs, but also become lead participants through the entire process. The creation of climate change courses appears to be connected to the interest of particular faculty members, who undertake the course/program development from conception to creation, including administrative required stages:

And there is not any underlying reason, other than an individual faculty member thinking that's very interesting and we should have a course on it, or, it would be really bad if we don't have a course on that (IN9 professor/program creator/ program coordinator).

We don't do that collegially. New courses are often developed by professors who see a sense of need, a gap, a hole (IN8 professor).

Basically fell to me. So, I developed the proposal and our associate Dean was a strong proponent, he/she helped along the way (IN3 professor/program coordinator/creator).

Along with my colleague, professor [A], basically we invented these courses and the program. And we moved them through the university governance process (IN9 professor/program creator/ program coordinator).

I went to the dean at the time and asked about his/her interest in a climate change program (IN3 professor/program coordinator/creator).

Course development is a very individualistic thing. They allow you to make those decisions. You would think that it would be a collegial decision, but no (IN8 professor).

That changed when Professor [A] took over the administration. [He/She] has been incredibly active, engaged and championed climate change studies in here. [He/She] is the one who wrote the [program] curriculum and then we worked together on some grants when we felt the need to look at [Topic A] for a comprehensive climate change education (IN6 professor/administrator).

In my interviews, individual faculty members identify gaps in climate change content, and what is normally done is rather than proposing new courses and going through such a complex and lengthy process, professors tend to reform or modify existing courses making use of their relative academic freedom at this level:

It is an enormous undertaking to create new courses, bureaucratically, in terms of the hoops that you have to go through. So what a lot of people have done is to morph existing courses, you know, the content of them, there's more climate change content that there might have been in the past and that's part of what's going on. And then also, at least on our case, we have a suite of [subject A] courses as well, the sub-text of which is very strongly climate change oriented, but again, it might not be obvious, unless you actually take the course, how much climate change content there is in the course (IN9 professor/program creator/ program coordinator).

I can change the course outline anyway I want (IN9 professor/program creator/ program coordinator).

Faculty sort of does what they want really... So, I can change the content of my course all the time (IN2 professor).

There was no approval process, I just went ahead and did it. It was my course and no one cared (IN2 professor).

It was also evident in my interviews that these climate change curriculum 'champions' face and confront situations in which new course proposal or ideas are contested either because of what the name entails or because of the politicized nature of climate change:

I wrote, I challenged them, a rebuttal, so I said ‘it is a good name.’ I wouldn’t take no for an answer. I went to the Chair of my Department and asked [his/her] thoughts... who came back to me saying ‘we stand by this name, we think that is a good name’ (IN8 professor).

I was a bit shocked when I got pushback. I don’t think that we have done anything too radical (IN9 professor/program creator/ program coordinator).

The emergence of climate champions in PSI seems vital to the development of climate change programs and courses. In addition to navigating institutional bureaucracies, these champions carry the weight of bureaucratic struggles (long multi-level practices, hierarchical provisions, time-consuming processes), and are ultimately responsible for the success of climate change programs/courses.

6.2.2 Culture of Economics

This refers to budgets and cost considerations of curriculum changes in an era of declining state funding and competition. The prominence of this factor in my interviews, might suggest a prominent window on influences of neoliberal market-driven decision making on curriculum formation at multiple institutional levels. My interviewees made it clear that climate change curriculum initiatives have to create a competitive edge in reference to job markets and promising prospects for students. In this regards, ideological commitments to climate change are being considered in parallel with economic viability - climate change programs are being shaped at multiple levels of formation by economic considerations, such as viability of climate change

courses, market driven considerations, gathering economic support for research, and enrolment numbers.

In my interviews, program coordinators/creators made it clear how climate change programs are created with job markets in mind. This instrumental/ vocation goal seemed significant in the successful formation of these curricula, marking an emerging contemporary theme in higher education of employability. This is related to competitiveness between climate programs and the capacity to attract as many students as it can and dissuade them from enrolling into similar programs at other PSIs. This macro-economic influence is specially felt within departments/faculties, which need to clearly explain how knowledge in these programs will turn into jobs:

It's very much tied to job markets rather than having a well-rounded education (IN7 professor/ administrator/ committee member).

We are not tools - or techniques- oriented, which is why we are moving away from [a particular] course. It was much more theoretical, to replace it with things like carbon accounting, which is much more applied, we are aiming to develop climate change professionals. A lot of our students are looking into those fields and they need job ready skills (IN6 professor/administrator).

There is demand for students who have very applied skills in climate change (IN10 professor/program coordinator/creator).

You have to have prove that this is going to sustain, otherwise the Dean's office won't let you do it. So, I asked myself, what does the job market want? (IN10 professor/program coordinator/creator).

One of the most notorious hindrances in the creation and/or continuation of climate change programs and courses is the accessible pool of resources within individual departments and faculties. Allocation of resources can potentially lead to uncertainty and/or disagreements between faculty members:

The total resources available for offering courses are shrinking. And inevitably that's going to lead to conflict. Because everybody has courses that they would like to see offered (IN9 professor/program creator/ program coordinator).

And I guess that there was some fear that the more we do these courses that takes resources away from other things, that was sort of undefined kind of boundary (IN9 professor/program creator/ program coordinator).

Because one of the major strengths of the program is that we weren't demanding anything from the university. We just said whatever we had, we have the faculty, we have the courses in place, we just want to offer the [program] (IN10 professor/program coordinator/creator).

And then, who is going to pay for it. That's a huge question, what Dean is going to pay for it? Universities are organized around the collegiate; the funding is organized around student bodies that are taking courses and how many bodies are in different programs. So, issues like climate change even though is a very important issue becomes subordinate to the workings of the institution and is tied to how the institution works. And of course, climate change is something that's 'disrupting' (IN4 professor/program coordinator).

The concerns raised by some faculty members, less so outside of the program, but within the faculty were that we would end up cannibalizing other programs (IN3 professor/program coordinator/creator).

Hiring climate change faculty is connected to the expansion of climate programs and occasionally to collegiate strategies within individual departments and faculties:

Often comes out of retreats we have. We are brainstorming, we are thinking about important things that we should do, important people we should have to deal with this. So I'm pretty sure that that's where it came from (IN7 professor/ administrator/ committee member).

Allocating faculty time to teach a course or to be released from courses to run programs is another constraint. This becomes evident, when professors develop an interest in climate change but teach another subject matter in other units:

With climate change and [Topic A], as I mentioned before, we have two faculty who would love to do that for us, but they are not given the time from their hosts or their departments (IN3 professor/program coordinator/creator).

It just adds into your work load, there is a bit of a course release, one gets a course release every three years for being a [program administrator] (IN4 professor/program coordinator).

We rely on the good will of our department [A] to allow some of the other faculty members to teach some of the courses (IN3 professor/program coordinator/creator).

It's maybe hard to attract resources and in the current fiscal climate, no university can simply throw ten faculty lives into one program (IN6 professor/administrator).

Another issue regarding fiscal resources is maintaining existing courses or programs when enrolment numbers are low:

They would allocate more resources if the enrolments were higher... I'm told that if enrolment goes up the resources will increase (IN4 professor/program coordinator).

I am certain that we would be offering other climate change related courses, except for the fact that we are now in this major financial strap for money... And we have to hire for these courses (IN7 professor/administrator/committee member).

You offer it to see if it's popular. If it is, it stays. If it's not, it goes (IN10 professor/program coordinator/creator).

[Faculty member A] has been interested in [Topic A] and climate change and [he/she] has proposed a course, which we have on the books and that's not required for anything. It's been offered [a number of] years in a row, but is not going to be offered this year. There was a discussion about retiring it because [he/she] is part-time. We are hiring [him/her] to teach that course. And we are really trying to offer courses that full-time faculty can teach (IN7 professor/administrator/committee member).

In the university there is some competition for students across different departments, so I think there was a little bit of worry in some of the smaller departments about 'well, if the students take this [program], maybe that will reduce the enrolment in our department' (IN5 professor/program creator).

Another issue with 'the potentially available funds' for departments and faculties is that in order to access these resources, enrolment numbers must be maintained. In other words, students are 'persuaded' to take only the courses offered within their departments. These unwritten directives,

create a problem of access for students who want to take a climate change course outside their own departments, but are unknowingly advised to stay put:

Budgetary systems actually provide very strong incentives to discourage your students from taking courses in other faculties. Because in fact, your faculty ends up having to pay for the course to someone else. So again, in the context of budgetary constraints, that's bad. You probably want to maximize. Pedagogically it's not good.... The reality is that way that budgetary systems have been set up, so they have very powerful and strong incentives to discourage our students from taking courses in other Faculties and other Faculties have the same disincentives from taking courses with us (IN9 professor/program creator/ program coordinator).

Macro economic paradigms seem to also influence the culture in which faculty understand how their PSIs internally function and how their academic decisions can have an effect on their personal advancement and careers:

So, I really outed specific industries and there was pushback.... Both regulators wrote rebuttals to the journal and we were essentially having this dialogue with the [newspaper A] and I'm up for tenure, my file was about to sit on the president's desk. I was thinking I sure hope that he doesn't have friends in the oil and gas industry (IN7 professor/administrator/committee member).

There's a big struggle in the world right now, virtually, people who want to maintain the oil industry, ten of thousands of millions of dollars of capital on the energy industry. So, there's very powerful vested interests that are trying to put the brakes on and I think that's a major factor trying to explain, not just why the university hasn't rushed to embrace what scientists have been telling us for the last 20 years, why institutions are slow to change. So there is a struggle right now with the direction of this university... (IN8 professor).

Contemporary PSI curricula creators and coordinators must then successfully navigate a culture of economic constraints, in which formations are constituted as economic entities at all stages of curriculum formation. In other words, curricula plans are no longer at the hands of a curriculum group, who propose and design a curriculum based on particular subject interests and regardless of economic considerations and fiscal viability to implement such curriculum. This process has shifted into a co-constitutive nature of budget and curriculum formation, in which creators/proponents must navigate the competitive disposition of global markets and prospects of employability.

6.2.3 Disciplinary Allegiances

Studies on climate change have been traditionally led by natural scientists. In other words, distinctive disciplinary areas seem historically and culturally better positioned with respect to climate change within Canadian PSIs. Science clearly has a dominant voice in climate discussions (it provides a language of the global, that has become globalized). It is linked to historic and cultural traditions of speaking for “nature”, in contrast to those who speak for “culture” (Latour, 1983). The point is that the IPCC is fundamental to climate change, and other curriculum areas have traditionally focused on different areas, with different cultural traditions. The diversity of disciplinary cultural traditions in academia has been a topic of sustained reflection (Snow, 1959). In my study, almost two thirds of the courses at the national level focused on the technical (science) and managerial (adaptation and mitigation) aspects of climate change. This selection of courses is broadly in line with the IPCC reports where usually one volume is dedicated to science, one to mitigation, and one to adaptation. In my interviews, it brings to the forefront the assumption

that to ‘know about’ and to ‘teach’ climate change is also necessary to be ‘proficient’ in at least at one of the three technical aspects climate science:

We tried to cover the full basis on the core courses we have, so they get the breath of that science, adaptation, mitigation. We want them at least know all of what’s out there in the climate change space (IN3 professor/program coordinator/creator).

We decided to go more into the quantitative, scientific route. So, we knew that they need to understand the science of climate change, they need to understand how models work (IN13 professor/administrator/program coordinator/creator).

During the last years, numerous efforts to address climate change from an interdisciplinary perspective have multiplied, but turf issues around climate change ownership are evident as not all subject areas were equal. Hence, the emergence of climate curriculum champions, who are identified within particular structures (Faculties/Departments) rather than cross-disciplinary alliances. In other words, climate curriculum innovation and work remain heavily disciplinary and co-dependant on climate leaders. In this study, Faculties of Science and Technology offered around a third of climate change courses, yet subject’s ownership is manifest during the process of creating courses outside of science:

We want to try to make this [program] transdisciplinary, so no discipline owns this. It is an advantage to be interdisciplinary, but it’s a disadvantage, because the university is organized along disciplinary lines (IN4 professor/program coordinator).

This is natural in universities, that there’s some discussions about who “owns” the topic, and I think that there was probably some worry on their part that a topic that they thought they owned might be dispersed across the campus (IN5 professor/program creator).

I think they have changed their mind now, but at that time I think there was some hesitation, I do not know if I want to call it opposition, questioning from the part of physical scientists, who in some sense, I think, thought that the topic of climate change belonged to them completely (IN5 professor/program creator).

Sometimes there is the sense that ownership, some departments may feel like they are more knowledgeable or that they have more expertise in certain areas than others. With climate change you can imagine that Geography might think that this is more their area, so there can be kind of turf issues (IN4 professor/program coordinator).

Although it could be assumed that Faculties/Departments with existing interdisciplinary/transdisciplinary programs would offer an advantage to the development of climate change programs, my interviews indicated both support and resistance to idea of incorporating climate change into existing curriculum:

We are in the Faculty/Department [A], which means that we have the luxury, of not being either natural scientists or social scientists; we are what we choose to be. And we have strengths in both areas and we collaborate well with each other. Because we are the Faculty/Department [A], we are not even bound by disciplinary roles, so we are in a great position, I think, to really be the leader on climate change in Canada, and we are actively pursuing that right now (IN6 professor/administrator).

When Professor [A] instructed the committee to the importance of climate change and how we deal with it, there was a push back from faculty members saying that it's not all about climate change. That the focus of the Faculty is not about climate change, that's one piece of many... So there was a bit of resistance from individuals about climate change dominating the lens of our faculty (IN7 professor/administrator/committee member).

I personally think that Faculty/Department [A] could host [climate change] very well, for its innate interdisciplinarity, whether is going to rise to the occasion and embrace it in a way that is effective, is another question (IN13 professor/ administrator/ program coordinator/creator).

A common practice within PSIs — highlighted during my interviews — is that units tend to develop their programs within a set of parameters, which are not necessarily equal to units from other disciplines. This contributes to the frequently voiced critique that departments and faculties work as siloes, where practices differ from other units within the same PSI:

We have experienced the silos, especially with the [discipline A]. I don't know if it's because of the way we are organized but we don't seem to interact so much and we need to (IN4 professor/program coordinator).

The university is relatively siloed (IN9 professor/program creator/ program coordinator).

Some of the existing climate change programs were designed with the idea of taking advantage of existing courses with climate content, which would count towards the completion of these programs. This, in theory is a logical idea, since there would not be a need to create new courses, to go through the governance process, or potentially hire new professors to teach these courses. Instead, making use of existing courses and professors would expand the range of programs. However, in some cases, this proved to be counterproductive for students and ultimately discouraged program enrolments. Program creators did not expect inflexible (and somewhat justified) course pre-requisites, where students are not able to finish their programs because elective courses require them to take additional courses in order to take the one with climate content:

What we didn't really anticipate was that students had to take many pre-requisites in order to get to the courses that were for the [program] and it made it very difficult, it turned almost impossible for students to complete the [program]. And this was something that we really didn't foresee in the beginning (IN4 professor/program coordinator).

I really don't want somebody who never had any [Topic A] in my 3rd year [Topic A] class. But from the [program's] point of view, we wanted the students to get the climate change portion of that course, which was not in the introductory courses, but on the 3rd year course. So, these poor students are running around the campus saying 'Can I get in this 3rd year course?' And the profs saying 'Well, not really, because you haven't really taken the intro course in our department.' And I understand that, I'm not against it. So, this is the kind of difficult problem from an institutional and political curriculum point of view (IN5 professor/program creator).

We had continually over time, material has been added, but nothing has really been removed, until the curriculum was completely out of state, but it was too big for them to get through in two years. So, the problem with that was in teaching in third or fourth year, you couldn't assume anything (IN2 professor).

At a personal/professional level, it is possible that some faculty members develop some forms of resistance to particular ideas, possibly to safeguard the integrity of their own disciplines, possibly to protect their autonomy. This was identified by Jones, Selby and Sterling (2010) as 'principal inhibitors' to sustainability curriculum formation in PSIs. Two of these inhibitors present similarities with the formation of climate change curriculum found in my study. The first one is the impression imposing one topic over the other, described by Jones et al. as "academic staff jealousy guarding their academic freedom.... Steeped in their specialism, they are uncomfortable

about the interdisciplinary teaching for which the multi-dimensional concept of sustainability calls” (p. 9). This situation, shared by the broad nature of climate change, may make some faculty members resistant to the idea of having to teach about climate change in their subject areas:

Several people asked me to be a part of it and I said no, I don't do climate change. It's not what I do (IN7 professor/administrator/committee member).

The second inhibitor is the notion of lacking the required expertise and depth to teach about climate change issues. The assumption that some of the interpretations of climate science are considered too technical makes it challenging for faculty to consider it in their own teaching:

Climate change science is huge, enormous and complicated and there's all kinds of angles... The other challenge is that climate change is very quantitative, no matter how you look at it. I guess that even in mitigation you have a lot of planning, a lot of modeling, just predicting is a lot of math and chemistry. And it ends up being a sticking point for how to kind of deliver it (IN7 professor/administrator/committee member).

To teach climate change, you really do need a background in climatology (IN13 professor/administrator/program coordinator/creator).

Although the majority of the programs offered in Canadian PSIs in this study have been constituted within interdisciplinary Faculties/Departments, the emergence of climate change curricula remains deeply connected to disciplinary structures and more importantly to individual histories of climate champions.

6.2.4 Climate Leanings

This refers to the relationship between the emergence of climate change programs and PSI's histories and cultures — how some climate curriculum stories seem easier to assemble in some institutions than others. My suggestion is that different institutions have different climate change macro-identities, associated with the types of expertise that certain PSI's identities attract over others, and how this expertise becomes crucial in the development and success of climate change programs. It is very likely that the proximity to climate research centers and their experts have an impact on the types of curricula/program, funding and work placements/internships for students (especially graduate) in PSIs. For example, it is possible that the PSI's reputation attracts certain types of faculty, not only because of its climate leanings but also because changes are known to be possible in these places. The notion of institutional identity was evident in multiple interviews; it is captured in the following three interview segments:

And sometimes things are generated because of critical ideas ... and maybe someone says 'your ideas won't happen in here, go to PSI [A]' (IN8 Professor).

PSI [A] has fairly autonomous Faculties, our Faculties are very strong, very decentralized. So it's under the leadership of past and current Deans, that climate change really became what it is, as one of our thrusts. The university has a number of research thrusts including water, those overlap nicely with climate change, so many of us work in both areas, but the climate change thrusts came out of the Faculty/Department [A]. That being said, Faculty/Department [B] has also been close to climate change. Whereas we have been able to do it, slowly and strategically, and we are lucky to have the leadership that it also fits with our vision. And that's the PSI [A] brand and that's probably why it happened here. We've already been co-located with [a climate change research group] ... we had those relationships all along, we had that history and we got to do strategic hires in the areas where we weren't so strong (IN6 professor/administrator).

I heard that there's a lot of stuff happening out there, someone said 'if it's happening in PSI [A] there's a market out there' (IN8 Professor).

In my interviews, it became apparent that faculty members within these programs assume their roles and those of their programs as “vehicles of influence,” idea generators, or shapers of culture for both their institutions and societies:

We like to think that we are on the cutting edge and we like to think that we help to bring society forward, but this university also reflects the priorities and values and culture of society. And I think that climate change and notions of sustainability and limited growth are new ideas, revolutionary ideas in some sense... in the sense that they challenge the new order (IN8 Professor).

And so that Faculty/Department [A] has turned more of the vehicle of influence but in some ways is taking ways and expertise that we have developed within our own program [A] and applying them in the context of the university. So we are influential that way. We had some mild influence with allied Faculties.... I think quietly, subtly, diplomatically, we kind of worked ideas into the system that otherwise wouldn't be there. We are very conscious of dealing with Faculty [B] because they hire so many people, it's really essential what you get in there. We are trying to influence that as much as possible, in terms of what type of positions they advertise and the types of people they hire (IN9 professor/program creator/ program coordinator).

It is an area that we have strengths, it's an area that's socially relevant, that's the PSI [A] approach to the world, which is to be very applied, very policy relevant (IN6 professor/administrator).

I am arguing here, that local histories and identities are influential. The combination of PSI's location, landscape, faculty, infrastructure, surrounding populations, etc., is significant and

defines these local histories. Each PSI has distinctive identities with a particular allegiance/or less so with ecological thinking (hence the reference by Maclean's of UVic, see section 6.1.1).

It should be recognized that the outward identities of institutions is often different to their internal cultures. In other words, while certain PSIs are perceived with a marked pro-ecological identity, this does not mean that curriculum formation within these places occurs without the tensions and contradictions experienced in PSIs seen as not environmentally responsive.

It is also important to recognize that faculty expertise contribute in great part to the construction of PSI's identity. These faculty members, who ultimately become climate champions, are attracted to places where their curriculum ideas are more likely to assemble, because the institutional culture already has a particular public identity.

This chapter described four institutions with programs dedicated to climate change in Canada. An overview of their history and content was provided focusing on selected institutional particularities and characteristics for each program. Interviews with selected PSI members afforded an exploration into the process of formation of climate change programs, as well as the factors that constrained or enabled their emergence in PSIs. It is important to emphasize that institutional/provincial/international climate policies did not appear as a strongly influential factor in the formation of climate change curriculum. I offer four factors that seem significant in the processes of creation of climate change programs: (1) The emergence of climate 'champions' in bureaucratic procedures; (2) culture of economics; (3) disciplinary allegiances; (4) climate leanings.

CHAPTER 7.0 – Discussion and Conclusions

Education's role is to ensure that variety is productive, with regard to both the biological fact of survival, and what it means to survive. It cannot fruitfully be reduced to either "learning" or "doing the right thing." However, for the necessarily unpredictable to emerge in such forms as permit the future, when it comes, to be judged a success, both information and invitation to critique and respond are prerequisites. In short, curricular practices are for the long term, and have an importance at least equal to, and usually greater than, the environmental priority of the moment (Gough & Stables, 2012, p. 384).

The student leaders of the civil rights movement had shown by their example that is not enough merely to believe in justice and equality. They had shown that one must struggle and sacrifice to achieve these things as well. They have proved that is necessary to enter the fray and become a participant in the great contest of life or risk not having a life of any consequence at all (Kronman, 2007, p. 2).

This has been a study of climate change curriculum formation in Canadian PSIs. It was driven by my commitments to climate change and democratic education. When I started to explore issues around CCE, I observed a considerable volume of literature dedicated to CCE as an instrument for institutional adaptation or mitigation but a relative absence of studies of CCE curricula. In response, my research offers a census of CCE courses (demarcated in specific ways) and explores the formation of climate change curriculum in selected institutions with the intention to better understand institutional change. It is evident that all the programs analyzed in this study are evolving, as well as re-inventing themselves. Whether these changes are driven by personal or institutional ideals, neoliberal paradigms or other factors, these programs are pioneering what is widely recognised as a sensitive and high profile topic. I am inspired by these innovations.

7.1 Climate Change Courses and Programs in Canadian PSIs

My research has two main questions. In the following sections I revisit these questions and offer some responses, supported by the preceding discussions. The first set of questions concern the number of climate change courses and programs in Canadian PSIs. Throughout I use emboldened text to accentuate some key themes.

7.1.1 What courses exist?

- **In 2014-15 there were 849 climate change courses in Canada and the majority of these were at undergraduate level.**

I conducted a census of 225 PSIs during the calendar year of 2014-2015, which included educational institutions from all Canadian Provinces and Territories. From this sample, 104 PSIs (43 colleges and 61 universities) offered (based on my selection criteria) a total of 849 climate change courses, of which universities offered four-fifths and colleges one-fifth. Almost three quarters of these courses were offered at the undergraduate level; eleven out of the 104 PSIs offered 20+ courses.

- **There are a significant number of innovative courses and programs but the number remains very small in comparison with the total number of courses.**

Reflecting on these figures, it is important to acknowledge the number of courses and the associated student enrolment.^{xix} I consider the presence of these courses as fundamentally

important, as they offer potential opportunities for reflection, alongside the prospect of building supportive networks. They offer a firm platform for change. However, it is also important to recognise that this number of courses is small when compared with the total number of university course offerings in general, or in a given institution. For instance, according to this study's data, the average of climate change courses per PSI during the 2014-2015 calendar year in Canada was four. That is, if all 225 PSIs examined in this study had offered climate change courses. However, only 46% of PSIs offered climate change courses (See Section 5.1, p. 74). As an example at the institutional level, out of the 5,000 courses York claims to offer every calendar year (York University, 2016d), 45 climate change courses were found in this study during the 2014-2015 calendar year. This is less than 1% of the courses for the entire university.

As the data suggests, access to this 1% of climate change courses at York is limited not only to certain Faculties but also to students enrolled in particular programs. The majority of the courses (35 out of the 45 courses) were offered by two out of the eleven existing Faculties at York (Environmental Studies and Science). According to interview data (See Section 6.2.2, p. 149), this suggests two associated issues. First, that since Departments and Faculties tend to operate separately, students from one faculty are often not aware of courses offered by other units within the PSI; and/or students might be dissuaded or discouraged from taking courses in other Departments and Faculties. Both these issues highlight some structural barriers to access climate change courses.

For example, to continue this argument, according to data from Common University Data Ontario (CUDO, York University, 2016b), enrolment in these two Faculties at York was around 10% of

the total university enrolment in the calendar year 2014-2015. Assuming that only a small fraction of students who are enrolled in particular programs are required or have an interest in climate change, the ability to take available courses will depend on their programs. In other words, just a portion of those 10% students with access to climate change courses will choose or be able to take them.

In conclusion, innovative climate change courses do exist and, I believe, these need to be more widely publicised. But access to these courses remains limited, patchy and isolated. Climate change courses rarely stretch outside of particular Faculty/Departments and are likely to attract (interested) students from disciplinary backgrounds more strongly associated with climate change (such as science). Again, it is important throughout these discussions to recognize that curricula development is one piece of PSI's climate change responses and more progress has been made in other areas, such as energy and waste conservation education (Henderson et al., 2017). Also it is important to acknowledge that climate change issues likely featured in other courses that I am not aware of, because they are subsumed within broader terms of reference (such as sustainability).

7.1.2 Where are these courses found and what do they contain?

- **Climate change courses predominately occur in public education institutions.**

Publicly funded PSIs offered nine tenths of the climate change courses at the national level (see Section 5.1, p. 74). Of the 104 PSIs that offered climate change courses, only 11 were private

(6 universities and 5 colleges) and are located in Alberta (AB), British Columbia (BC), Manitoba (MB), Ontario (ON) and Saskatchewan (SK) (Section 5.2, p. 80). This is relevant, because it implies that public funds not only enable the emergence of climate change curricula, but most importantly that publicly funded PSIs support curriculum proponents to transform, improve and shape knowledge in PSIs.

In Alberta (AB), Newfoundland and Labrador (NL), Quebec (QC), and Prince Edward Island (PE), all the universities offered climate change courses, as well as all the colleges in the Northwest Territories (NT), Nunavut (NU) and Yukon (YK) (Section 5.2, p. 80).

- **There are 6 programs specifically focused on climate change**

Presently, there are 3 UG (undergraduate) and 3 GR (graduate) programs in climate change in Canada, which are offered in BC and ON. Two of these programs, which grant degrees specifically on climate change, are the UG minor program called ‘Human Dimensions of Climate Change’ (HDCC) at the University of Victoria (BC) (Section 6.1.1, p. 124) and the GR program called ‘Master of Climate Change’ at the University of Waterloo (Section 6.1.2, p. 129). The University of Toronto (Section 6.1.3, p. 135) and the University of Waterloo (Section 6.1.2, p. 129) offer specializations at the UG level, while the University of Toronto offers a Master’s and a PhD with a general degree but with a focus on climate change (Section 6.1.3, p. 135). York University offers an UG Certificate in Sustainable Energy closely connected with climate change and the University of Victoria offers a Certificate in HDCC (Section 6.1.4, p. 139).

- **The province of Ontario has the greatest number (and concentration) of climate change courses.**

ON offered almost half of the courses at the national level, followed by BC, which offered almost one fifth. Combined, PE, SK, YK, NL, NT, NB and NU account for less than one tenth of the total number of courses (Section 5.2, p. 80). In other words, ON (48%) and BC (21%) offered almost seven tenths of the courses at the national level. This means, that the numbers in other provinces and territories are masked by the magnitude of courses offered in just two provinces. Total numbers, I suggest, should be considered as an instrument to understand larger trends, but not as the only points of reference.

Eleven out of the 104 PSIs offered more than 20 climate change courses, of which five are located in ON, five in BC, and one in NS. These eleven PSIs are publicly funded and offered almost two fifths of the courses at the national level (Section 5.1, p. 74).

- **Departments/faculties of science and technology offer the majority of courses**

Climate change courses were offered by a total of 179 Faculties and 169 Departments in the 104 PSIs examined in this study. The Science & Technology Faculties offered almost two fifths of the courses, followed by Faculties of Arts. Geography Departments offered over one fifth of the total of climate change courses at the national level, followed by Biological and Applied Sciences, which offered one tenth (Section 5.1, p. 74).

Faculties of Science & Technology offered over one third of climate change courses in all the provinces, except in ON. In MB, NT, PE and SK, the Faculties of Arts offered around half of the courses. In all the provinces and territories, the Science and Technology department offered between two fifths to four fifths of the courses, except for the NT, where all the courses are offered within the Humanities and Social Sciences clusters (Section 5.2, p. 80).

7.1.3 What are some of the patterns regarding the distribution and content of these courses?

- **The majority of the courses are at the undergraduate level.**

Nationwide, UG level comprise 73% of the total climate change courses found in this study. In all provinces and territories, except for NU, over two fifths of the offered climate change courses are at the undergraduate (UG) level. The provinces with the largest percentage of UG courses are NB and NS, while in NU UG courses are over one fifth. The province with the largest percentage of graduate (GR) courses is NL, while in NT, NU and YK there are no GR courses. MN, NB, NL, NS and SK did not offer any distance education, diploma or certificate (DE) courses during the calendar year of 2014-2015, whereas NU offered all its courses through DE programs (Section 5.2, p. 80).

- **The majority of the courses are Tier 3, which means that climate change is taught to a lesser extent during the course.**

Three fifths of the total of courses are Tier 3, which means that climate change is discussed at least once during the semester. Tier 1 and Tier 2 courses were one fifth each (Section 5.1, p.74).

Nearly all the provinces and territories, with the exception of NL, NU and NT offered Tier 1 courses. The PSIs with the largest number of Tier 1 courses offered in Canada are located in ON (over half), followed by BC and AB. NL, NU and QC offered the largest number of Tier 2 courses, while NT and PE offered none. AB, QC and YK offered the lowest number of Tier 3 courses, while in the NT all the courses were Tier 3 (Section 5.2, p. 80).

Ontario is the province with the largest Tier 1 number of courses (n=104), which is probably related to the fact that 3 PSIs in this province offer climate change programs (See Table 6, p.84). An aspect to emphasize in this analysis, is that the technical aspects of climate change dominate Tier 1 courses in all three provinces with the larger number of Tier 1 courses (AB, BC and ON). However, a closer look shows a significant difference between them. Each province has rather distinctive curricular focus, which has to do, I think, with the prospects of future employability and the capacity to make courses and programs attractive to prospective students (See Section 6.2.2, p. 149). For instance, in AB most of the technical Tier 1 courses were focused on carbon management and technologies associated to site remediation and bio-solutions. While in BC and ON, technical courses were mostly focused on physics, models, and broad aspects of science behind climate change. For the latter province, topics such as renewable energy and energy

efficiency were also evident (See Table 6, p. 84). While this could suggest provincial trends, it is necessary to keep in mind that individual PSIs are significantly shaping provincial curricula development. To be more concrete, three fourths of Tier 1 courses offered in Ontario are found in the three PSIs with climate change programs.

The PSIs with the largest Tier 1 courses are York University (n=16) followed by the University of Toronto and University of Waterloo (n=15 each). Tier 2 courses were offered the most at the University of Waterloo and York University (n=9 each), followed by Lakehead University and Concordia University (n=7). Tier 3 courses were offered the most at the University of Waterloo (n=25), York University (n=20) and University of Toronto (n=18) (Section 5.3, p. 117).

- **The content of courses was mapped on five streams, the majority of courses were classified in the scientific/technical stream**

Almost half of the courses at the national level were focused on the technical stream of climate change, followed by the sociological stream (around one sixth) (Section 5.1, p. 74). Technical and managerial streams represent over three fifths or more of the courses offered in most provinces, except for the NT, NU, ON and QC. QC is the only province where the political and managerial streams are over one fifth of the courses, while in NL not a single course touches upon political issues and in NT there are no managerial courses. In the NT, NU, and ON the environmental/sociological stream is over one fifth, while NL, NS and NT are the ones that offered the most courses in the economic stream (Section 5.2, p. 80).

The PSIs with the largest number of technical stream courses are York University, University of Toronto, University of Waterloo, University of Northern British Columbia and Dalhousie. PSIs with the largest number of managerial stream courses are York University, University of Waterloo, University of Toronto and Queen's University. Sociological stream courses were offered the most at the University of Waterloo, Trent University, Lakehead University and Nipissing University. The PSIs with the largest number of economic stream courses are University of Waterloo, University of Victoria, and Dalhousie University. Political stream courses were taught the most at York University, University of Toronto, Dalhousie University, University of Western Ontario and University of Waterloo (Section 5.3, p. 117).

7.2 Factors that Influence the Formation of Climate Change Curricula

The second set of questions concerns curriculum formation. I sought to explore some of the influences and politics associated with the creation of climate change programs and courses. PSIs that offer climate change programs were selected for two reasons. First, it coincided with this study's top ranking of climate change courses offered per institution, which meant a potentially higher number of climate change faculty for interviewing. And second, considering the novelty of the climate change programs, it was also easier to find program creators and/or administrators who participated in the creation and implementation of these programs. The questions that guided this qualitative part of the research are:

7.2.1 What are factors that selected curriculum leaders identify as significant in curriculum formation in their respective institutions?

My study explored curricula formation in sample institutions through a series of interviews. I focus on four institutions – which were selected on the basis of discerning use of climate change within the programs as well as for the PSI's ecological reputation, inclination and character.

- **Four localised factors emerge as influential in climate change curriculum formation.**

The following four factors appear to have an influence on the formation of climate change curricula in these four Canadian PSIs. Curriculum changes undertaken by individuals/faculties/departments seem to be affected by: a) curriculum champions and

bureaucratic procedures, b) disciplinary allegiances, c) climate leanings, and d) the culture of economics (Section 6.2, p. 143).

- **Bureaucratic procedures in PSIs affect the formation of climate change curricula. Climate curricula champions emerge as key to facilitate and navigate institutional change.**

“Bureaucratic Procedures” refers to institutional practices and traditions within PSIs that are related to the organization, structure, formation and function of curriculum. PSI institutional structures manifest themselves in curricula procedures, that are, mostly hierarchal arrangements, which vary subtly from place-to-place (whether they are individual departments/faculties/ pan-university committees/council). Curricula change is a lengthy process — often involving layers of requirements and governance structures to propose, submit, revise and reform a course or a program. These appear somewhat temporally at odds with the urgency of climate change. To navigate these bureaucratic struggles, the importance of “Climate Curricula Champions” emerged as significant. These champions seem to recognize and establish courses and programs according to their particular interests and knowledge, and are able to confront challenging situations regarding rebuttals or disagreements, either within their own departments or at different points in the governance ladder (Section 6.2.1, p. 144).

- **PSI formation, implementation and continuation of climate change courses and programs are shaped by particular cultures of economics.**

An aspect that climate curricula champions need to learn to navigate is a particular “Culture of Economics,” which refers to the presence of budgets and cost considerations with curriculum formation (in an era of declining state funding and competition) and job market considerations. The prominence of this factor in the four programs analyzed in this study suggests a presence of neoliberal market-driven decision-making on curriculum formation at multiple institutional curricula levels — a ubiquitous culture of budget awareness and market demands. Climate change curriculum initiatives emerge in direct response to a competitive edge with reference to job markets, and promising prospects for student enrolment and retention. In this manner ideological commitments to climate change are considered in parallel with economic viability. In other words, climate change programs are being shaped at multiple levels by economic considerations, such as viability of climate change courses, market driven considerations, gathering economic support for research, and enrolment numbers (see Section 6.2.2, p. 149).

- **“Disciplinary Allegiances” highlights the emergence of climate change curricula mostly within interdisciplinary faculties/departments shaped by cultural traditions of disciplinary knowledge.**

In my discussions, epistemic traditions claim an underlying ownership over climate change, which suggests academic turf issues, in particular, if these courses or programs emerge from places outside the natural sciences. Resistance to the incorporation of climate change is also found within

departments/faculties when the topic is proposed as a guiding philosophy. This defiance translates into challenges to the notion of integrating climate change as part of their teaching praxis, or in the avoidance of the topic under preconceived ideas of complexity (Section 6.2.3, p. 154).

- **Climate change curricula emerge in PSIs with particular and defined climate leanings.**

My use of the term “Climate Leanings” refers to relationships between the emergence of climate change programs and PSI’s local histories and cultures. Some climate curriculum stories seem easier to assemble in some places than others. Each of the four institutions appears to have distinctive leanings and allegiance with ecological thinking and a particular climate change identity. These leanings are associated with the types of expertise that certain PSI attract as well as external identity. It is very likely that the proximity to climate research centers and their experts has an impact on the types of curricula/program, funding and work placements/internships for students (especially graduate) in PSIs. But also, it is possible that the PSI’s reputation attracts certain types of faculty and students, because of its outward identity defined by its ecological identity and idea-fostering environments (Section 6.2.4, p. 161).

7.2.2 How is climate change curriculum influenced by faculty members' expertise?

- **Faculty expertise has a strong influence over curricula.**

Faculty expertise appears to have a strong influence in the formation of climate change curricula in the studied Canadian PSIs. In my study, it was evident that not only do faculty members propose the creation of climate change courses and programs, but also that faculty's expertise defined the orientation, focus, and progress of these courses and programs. These faculty members, who I called climate curricula champions have shaped the PSIs' climate histories by influencing not only the nature of curricula, but also by taking advantage of their administrative skills to develop climate change programs and courses (Section 6.2.1, p. 144)

It is important to recognize that many of these climate champions converge in particular PSIs, probably attracted to or influenced by particular climate change initiatives. For instance, the program in Waterloo was highly influenced by its proximity to Environment Canada's climate change impacts and adaptation center (now dismantled), whose expertise built the foundation to the disciplinary nature of this program and whose many scientists remained in Waterloo after the center had been closed (See Section 6.1.2., p. 129).

7.2.3 How are climate change courses influenced by broader institutional, provincial or/and international policies?

- **Climate course formation seems to be influenced predominately by local departmental/faculty factors and institutional curricula culture rather than institutional, provincial and global climate change policies and mandates**

My data suggests that there is not a clear direct relation between the existence of climate institutional policies and the existence of climate change curricula. The four PSIs included in this study which offer climate change programs — three of which coincidentally are the ones that offered the largest number of climate change courses at the national level — do not have institutional climate action plans (CAPs). In fact, all 10 PSIs who have CAPs offered less than 20 courses, except for Dalhousie University. Furthermore, out of the above-mentioned four PSIs, only UVic signed the UCPCCSAC. Indeed, of the 29 PSIs UCPCCSAC signatories, only Dalhousie University offered more than 20 courses (See Figure 36, p. 119).

It seems necessary to highlight that PSIs started to develop CAPs in recent years, whereas the UCPCCSAC is almost a decade old. In other words, the formation of climate change programs in these four universities was not explicitly linked to institutional policies, suggesting a disconnect between policies and climate change curricula since Canadian PSIs with CAPs and/or UCPCCSAC have not developed larger curricular responses.

Although I started this research project seeking to explore the impact of institutional and provincial policies on climate change curricula, these policies [in a direct sense] did not emerge as an influential factor in curricula formation within my interviews. Initiatives of climate change course and program formation seem to have origins within particular interests of faculty members who identify gaps of knowledge and find ways to address these gaps by developing curricula (section 6.2.1, p. 144). These climate curricula champions help to shape PSI's histories and 'pedagogical discourses' (Bernstein, 2003) by making climate change as one of the PSI's "thrusts" (Section 6.2.4, p. 161). This suggests that there is a separation between PSI higher-level institutional goals and mission statements and CCE curricula formation.

Furthermore, the four climate change programs examined in this study appeared in Canada in a decade dominated by a governmental agenda of climate denial^{xx}. This emergence, I think, instead of "reflect[ing] the distribution of power and principles of social control" (Bernstein, 1975, p. 77), challenge[d] political dominating ideologies. The materialization of these programs and other climate change courses across Canada are, I think, a pedagogical resistance to the view of curriculum as prescribed and in a broad sense as "dispassionate and apolitical" (Goodson, 1989, p. 2).

It was evident during my interviews with climate champions that the formation of curricula in PSIs is a constant struggle of the academic creative processes, in which negotiations at different levels, input by several other individuals with "overarching perspectives" (Goodson, 1989, p. 1), and PSIs' constraining contemporary factors must be factored into these innovative processes. But it was also apparent that climate change stimulates mobilization (similar to social movements in the

past), which, I think, is seen by PSI climate champions as a moral responsibility in their role of producers and/or reproducers of knowledge (Bernstein, 1975), and in their obligation to bring the attention towards otherwise neglected and obscured aspects in societies (Goodson, 1989).

7.3 Limitations

Like all research, this study has a series of limitations that I have mentioned in the proceeding discussions. My focus was on syllabi with the use of a limited number of keywords as the basis of demarcation. These keywords were deliberately chosen to frame the study within clear parameters, but overlook syllabi that explore effects of climate change without using these keywords. The process of data collection presented challenges in all stages, which made the data compilation a time-consuming activity.

First, there were limitations associated with the data collection, which made it impossible to collect the totality of outlines. This was mainly based on three factors: (1) professors and/or departments not sending outlines, sometimes in light of copyright considerations; (2) professors and/or departments not responding to requests; And, (3) professors and/or departments choosing not to participate nor providing any materials for this research. This resulted in a sample of 66% of outlines.^{xxi} This is a relatively high rate of return in comparison with expected survey return rates.

Second, there were limitations associated with the availability of potential interviewees to participate in this research. Since my interviews focused on particular PSIs offering climate change programs, the number of interviewees is focused and representative. I sought to interview people who had the greatest impact on curricula, but also recognise that curricula is most often a collegial social activity involving communities of practice. This study sought to understand curriculum formation through interviews. This rests on a series of empirical assumptions. A more grounded

analysis might have used ethnographic research exploring communities who participated in the formation of climate change programs in particular contexts and settings.

Nevertheless and within these parameters and challenges, I maintain that I was able to address my research questions adequately, and the data that I present, I suggest, raises significant questions for policy and practice.

7.4 Recommendations

7.4.1. Recommendations for Policy and Practice

My first recommendation underscores my commitment to climate change curricula in PSIs. I hope that this study (and subsequent publications) brings greater attention to the climate change courses offered in Canadian PSIs, as well as a greater appreciation of the work involved in the creation of climate change curricula.

- **Greater attention and support should be given to innovative climate change curricula**

My recommendation is that more courses and programs are needed making explicit reference to climate change. Ideally, these courses are made available for all students, regardless of their program or Faculty affiliation. Establishing mechanisms to create general education courses, where pressing issues are taught as modules to all first year students could encourage, I think, some students to follow different pathways, as well as potentially broadening graduates' perspectives in regards to their contributions as professionals in their workplaces. I have a commitment to the possibilities of interdisciplinary academic practices.

- **More climate change courses are needed that are cross-listed and open to all students (independent of particular faculties and departments)**

My second recommendation concerns the importance of climate change curricula leadership in PSIs. According to my interview data, current climate change programs and courses

in Canadian PSIs were conceived, initiated, structured and implemented by faculty members (some with the support selected administrators). With this in mind, I think that PSIs should establish professional developmental programs for mid and high-level administrators and curriculum committee members in which contemporary topics (including climate change) are explored.

- **Support mechanisms and professional development need to be put in place in for climate change innovations in PSIs**

Support and professional development, I hope, would help climate champions to progress and complete courses and programs in a more effective way. Ideally, this would have a multiplying effect, and new climate champions would emerge. PSIs need to encourage and support climate change leaders (from a range of different disciplinary areas). Given their importance, institutional policies, plans and agreements, such as the UCPPCSAC or CAPs, should make explicit reference to establishing mandatory courses and workshops in which leaders from all areas understand the role of their disciplines into the climate change conversations.

Based on the CCE streams and Tiers, PSIs can identify existing gaps on climate change curricula. This, I think, would support the development and/or reinforcement of curricula as well as help to identify desirable topics minimize the prevalence of certain areas.

7.4.2. Recommendations for Future Research

What inspired this research was a curiosity to know how PSIs were responding to climate change. Viewed from the outside, curricula appear as content structured, and somewhat systematically inspired by, guidelines and high-level directives of what areas of study a PSI should explore. My work suggests the need for an inward focus on curricula formation to try to better understand how these processes shape and are shaped by PSIs' cultures. This type of study might focus on — for example — a micro-political, more situated analysis, of curricula formations-in-action.

- **There is a need for a network of climate change curricula leaders and innovators to be established**

Studies with an action focus might help establish networks of climate change leaders, which are harnessed by institutional and provincial provisions. Climate champions within PSIs are key . If these individuals establish networks of support across Canada, it is possible to share best policies/practices, which have a direct influence in climate curricula.

Future work of this genre might include more situated studies (Van Esterick & Baker, 2014) of curriculum formation-in-progress to determine how disciplines, power structures, governance processes, and economics all affect the development of curricula.

- **Future research might focus on the taught and assessed climate change curricula**

Future research might focus on faculty and student experiences within climate change courses. My focus has been on the intended curriculum. Other studies might explore how climate change is taught and assessed. This study focused only on the proposed curricula, what programs and courses plan to teach students. Following this idea and given the vocational argument in which many contemporary programs are created, it would also be interesting to study how and if these programs are influencing students' commitments to climate change, as well as better understanding the students that these programs attract. This should include consideration of the inclusionary/exclusionary politics of these programs. Who are these programs attracting, how and why?

In more general terms, my research suggests that the term 'policy' within the context of studies of higher education should be considered in broader and more dynamic terms. As proposed by Ball et al. (2012) and Axelrod et al. (2013), institutional change is not only fostered by the formulation of policies. Institutional cultures and politics also play a crucial role in the mobilization of knowledge in PSIs. My study focuses on four institutions that have established climate change courses and programs. Further research should explore contexts in which climate change initiatives have potentially been less successful. Future research could study places of modest numbers of courses, existing institutional climate commitments/policies but with no climate courses, notorious and active climate researchers but no climate courses, etc.

- **Regional support in the development of climate change curricula is crucial**

There are also a series of related questions concerning geographic and cultural location. There is an absence of PSIs in the North, but the way in which these institutions are grappling with changing climates needs to be highlighted, and brought to a much wider attention. Canadian First Nations and governments in the North have emphasized their concern in regards to climate change and often build on local knowledges and ongoing climate change adaptation (See Section 2.2). As many persuasively argue (Barnhardt, 2005; Beckford, et al., 2010), traditional indigenous knowledge should be more extensively incorporated into climate change education curricula (and vice versa), not only in the North, but also across Canadian PSIs' climate change curricula.

7.5 Ending

I remain committed to PSIs playing a leading role in climate change. I have no doubt that our way of life will drastically change within the next century. Not enough mitigation and adaptation plans will suffice in certain parts of the world. There are potentially not enough resources or will power to prepare even in the richest nations. Climate change is offering PSIs opportunities to transcend institutional borders, and in the past, PSIs have innovatively responded to other global challenges (See page 24).

I believe that the much-discussed cultures of ranking and metrics in post-secondary education are impacting a more systematic educational analysis of the purposes of higher education. This dissertation is being finalized in an era in which ‘alternative facts’ have become the focus of widespread discussion. In response, PSIs, I think, have an ethical obligation to explicitly teach differences between climate facts and substitutes for climate realities. Current high-level political discourses define climate change as a hoax, and — of course — PSIs’ curricula should emphatically continue to respond to this. This alternate rhetoric has unavoidable consequences and should not be underestimated.

In Canada, 52% of the Canadian population between 25 and 64 years of age holds some sort of degree, certificate or diploma acquired through a PSI (Statistics Canada, 2011). This means that PSIs are distinctively positioned — especially at this particular moment in time — to explore broader questions of what it might mean to be part of a climate just society. I end this dissertation with a quotation from Noam Chomsky. Chomsky responded to Polk in an interview in 2013, by

highlighting the need for PSIs to struggle to become places where students “[come] to understand the world in which [they] live, and what [they] can do to make it a better place” (Chomsky & Polk, 2013, p. 32). In collaboration with many others, my dissertation hopes to contribute in a small way to the realization of this vision. The climate leaders and programs that feature in this dissertation continue inspire me. I hope to build on these initiatives and develop my own courses and program in the future.

I would like to thank all those involved in this dissertation.

ENDNOTES

- i The literature on ‘manufacturing doubt’ (this term is used by John Cook from the University of Queensland in Australia, to group papers on climate change denial) argues that obscuring knowledge on climate change is purposely done to maintain the *status quo*. Read “*Merchants of doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming*” by Oreskes, N., & Conway, E. M., 2010; “*Lost in translation: Climate denial and the return of the political*” by Goeminne, G., 2012; “*Leading voices in the denier choir: Conservative columnists’ dismissal of global warming and denigration of climate science,*” by Elsasser, S. W., & Dunlap, R. E., 2012; “*Climate change prediction: Erring on the side of least drama?*” by Brysse, K., Oreskes, N., O’Reilly, J., & Oppenheimer, M., 2013; “*The Subterranean War on Science*” by Lewandowsky, S., Mann, M. E., Bauld, L., Hastings, G., & Loftus, E. F., 2013; “*Toxic seepage: Climate denial and its corrosive effect on the scientific community*” by Lewandowsky, S., Oreskes, N., Risbey, J. S., Newell, B. R., & Smithson, M., 2015.
- ii In general, PSIs’ mission statements propose to educate critical and independent thinkers for the benefit of society and the public good; to expand the boundaries of knowledge and to share this knowledge; to protect the research and academic freedom and; to stand up for social justice and human rights.
- iii The following are two high profile politicians addressing climate change: Al Gore, a former US Democratic presidential candidate presented a series of lectures to counteract the US government’s position in regards to climate change. His lectures were adapted into a film called the ‘The Inconvenient Truth.’ Directed by Davis Guggenheim and released in 2006, the film became the single most important awareness campaign on climate change at the time (Al Gore, 2016). Former England’s Primer Minister, David Cameron in an address to the House of Commons on February 26, 2014, in a dramatic statement to counteract mounting criticism called climate change “one of the most serious threats we face” (The Guardian, 2014).
- iv At the opening ceremony of the Abu Dhabi Ascent Climate Change Conference in 2014, the UN Secretary General, Ban Ki-Moon stated “climate change is the defining issue of our time. If we do not take urgent action, all our plans for increased global prosperity and security will be undone” (UN, 2014).
- v On a phone interview with Madeline Ostrander from Yes Magazine in 2009, scientist James Hansen, known for the hockey stick analogy to climate change, was clearly frustrated by the outcome of the recent Copenhagen UN Climate talks and stated:
- vi We’re dealing with a planetary crisis. The climate system is in danger of passing tipping points. If we don’t address it, we leave our children with economic and social chaos within this century. Once that situation is understood, it becomes a question of intergenerational justice. It’s analogous to the situation that Abraham Lincoln faced with slavery or Winston Churchill faced with Nazism. It is a moral issue, and you can’t take a compromise position. You can’t say, “Oh, we’ll do a little bit, but we won’t solve the problem” (Yes! Magazine, 2009).

- vii This historical revision is focused on the contemporary history of climate change knowledge, policies and events that have had an influence on CCE. Although I have tried to cover what I considered to be the most important events, I recognize that there are important and relevant events, meetings, actions that I —deliberatively or unintentionally— have left out.
- viii A treaty enters into force when it becomes legally binding for signatory parties. This is different from adopting a treaty, in which case the signatory is not yet legally obligated to the responsibilities acquired through the treaty.
- ix Anticipating the governments’ leaders meeting at the United Nations (UN) Climate Summit in New York on September 23, 2014, the non-governmental organizations (NGOs) 350.org and Avaaz, organized a rally on September 21, 2014, to demand the world leaders to take action to stop climate change. With slogans such as “denial is not a climate policy,” “action, not words,” or “our family had to move here [a picture depicting a slum in the background] after heavy rains last year,” the call to demonstrate was answered by 162 countries around the world in 2646 events. Public figures including former US Vice President Al Gore, Vandana Shiva, and Jane Goodall (within others) marched along with 400,000 people in New York. The march was organized in 6 themes: (1) ‘front lines of the crisis/forefront of change,’ which included indigenous peoples, environmental justice and front-line communities; (2) ‘we can build the future’ included labor, families, elders, and students (college students accounted for one-eighth of the total participants in New York); (3) ‘we have solutions’ included organizations concerning renewable energy, food and water; (4) ‘we know who is responsible’ was composed by campaigners working for anti-corporate practices, peace and justice; (5) ‘the debate is over’ comprised scientists, nature and interfaith groups; (6) ‘to change everything, it takes everyone’ was a gathering of local to global interest groups (350.org, 2016a).
- x According to the World Bank’s World Development Indicators (WDI), China and United States ranked as the number 1 and 2 respectively in terms of CO₂ emissions (kt) worldwide in 2013. At the boom of the industrialization era, the US emitted nearly 6 times more CO₂ than China. However, by 2011 China had an exponential increase of its CO₂ emissions respective to its 1960s emissions to 3,4 million kt in 2000 (441%) and to 8,2 million kt in 2010 (1,073%) (World Bank, 2016).
- xi These PSIs are University of British Columbia, Simon Fraser University, University of Victoria, University of Northern British Columbia, Thompson Rivers University and Royal Roads University (Climate Change Action, 2016).
- xii The American College & University Presidents’ Climate Commitment was launched in December 2006.
- xiii It took Ontario seven years to announce it will implement a cap-and-trade program, which has been already adopted and regulated by California and Quebec (CBC, 2015).
- xiv During the March 2016 First Minister’s Meeting that led to the Vancouver Declaration, Brad Wall, Saskatchewan’s Premier, kept a noticeably (by the media) unsupportive and elusive position to the topics on the agenda. On May 17, 2016, during the speech from the throne, the Lieutenant Governor, Vaughn Solomon Schofield, revealed the province’s clear

position by suggesting that the climate science was a “dogma that has no basis in reality” and that “those who are not comfortable with and even oppose.. [the extraction of] oil and gas, coal and uranium.. would prefer that those sectors ... and the thousand of jobs in those sectors did not exist” (Government of Saskatchewan, 2016, p. 8).

- xv Ball (2012) argues that the power exercised by corporations and funders in PSIs whether they are public or private are “aimed at profit generation rather than knowledge for its own sake or public service” (p.24) therefore, “moral and educational bases of educational practices [in PSIs have become] increasingly murky” (p. 24).
- xvi The authors refer to the tipping point of GHG emissions as ‘peaking.’ Throughout the text, they refer to both stabilizing and reaching the tipping point as peaking.
- xvii Crawler-based refers to the building and maintenance of software to develop searchable web engines. Discussions around the technical aspects of crawler technologies (such as indexing and access) are common within software engineers, but not in other areas of research. In order to standardize results, only a crawler-based engine was used on this research (Google), and no metasearches nor other crawler engines were employed (Thelwall, 2002; Mojeek, 2015).
- xviii At the 2016 Edward W. Said London Lecture, Naomi Klein applied Said’s frequently used term ‘sumud’ — which means ‘to stay put, to hold on’ in the context of the Palestinian region occupation — to appeal to the pervasive apathy that has taken hold of a global reaction to climate change (Klein, 2016).
- xix U15 is a group of Canadian Research Universities founded in 1985, which tries to foster research in Canada. Waterloo is a founding member (U15, 2016).
- xx Although surveyed enrolment numbers were largely incomplete (See Section 4.1.1, p. 68, for unexpected limitations in the collection of data), interview data suggests that the expansion of climate change programs is not only satisfying proposed growth models, but is also pushing program administrators to develop alternative options, such as online platforms, so programs can keep up with the demand.
- xxi Frank Luntz, an advisor to U.S. President George Bush, changed in 2003 the government’s rhetoric around climate change, which was considered at the moment, Bush’s weakest point in its administration (Burkeman, 2003). From that moment on, Republicans began an exhaustive campaign using scientific uncertainty as the central focus of the political debate. By 2006, Prime Minister Harper had adopted Luntz’s tactics, asserting Canadians that climate change was nothing more than an “emerging science,” leading to the 2012 withdrawn from the Kyoto Protocol (Montgomery, 2006) and the so-called ‘war on science,’ which framed the working conditions and persecution by the Canadian government and corporations of scientists and university professors who work and conduct research on climate change issues (Turner, 2013).
- xxii Kittleson (1997) in Cook et al. (2000) maintained that electronic survey efforts would produce a 25-30% response rate from an email survey, with a twofold increase after follow-up reminders

BIBLIOGRAPHY

- 350.org. (2016a). Retrieved October 5, 2016 from <https://350.org/>
- 350.org. (2016b). *Divestment Commitments, Latest News*. Retrieved October 6, 2016 from Fossil Free. Divest from Fossil Fuels: <http://gofossilfree.org/commitments/>
- 350.org. (2016c). *The Science*. Retrieved August 25, 2016 from About: <http://350.org/about/science/>
- 350.org. (2012). *Do The Math*. Retrieved May 30, 2016 from <http://math.350.org/>
- ACCC. (2016). *Pan-Canadian Protocol for Sustainability*. Retrieved September 2, 2016 from <http://www.collegesinstitutes.ca/file/pan-canadian-protocol-for-sustainability/>
- ACUPCC. (2011). *Higher Education's Role in Adapting to a Changing Climate*. American College & University Presidents' Climate Commitment, Boston.
- Al Gore. (2016). *An Inconvenient Truth (Movie)* . Retrieved August 25, 2016 from <https://www.algore.com/library/an-inconvenient-truth-dvd>
- Alberta Government. (2016). *Climate Leadership Plan*. Retrieved August 31, 2016 from Government Projects, Priorities and Consultations: <http://www.alberta.ca/climate-leadership-plan.aspx>
- Alberta Government. (2015). *Climate Leadership. Report to Minister*. Retrieved August 31, 2016 from <http://www.alberta.ca/documents/climate/climate-leadership-report-to-minister.pdf>
- Alsop, S., Greenwood, D., Vaughter, P., & Scott, S. (2014). *Climate Change Education: Acting for Change*. York University, Lakehead University, TD Friends of the Environment Foundation. Toronto: PEASE (Policy Enactments and Sustainability Education Group).
- Anderson, A. (2012). Climate Change Education for Mitigation and Adaptation. *Journal of Education for Sustainable Development* , 6 (2), 191-206.
- Anderson, A. (2010, September). Combating Climate Change Through Quality Education. *Center for Universal Education. Global Economy and Development at Brooking* . Washington, D.C.: The Brookings Institution.
- Anderson, G. (1990). Toward a Critical Constructivist Approach to School Administration: Invisibility, Legitimation, and Study of Non-Events. *Educational Administration Quarterly* , 26 (1), 38-59.
- Arnold, P., & Hammond, T. (1994). The Role of Accounting in Ideological Conflict: Lesson from the South African Divesment Movement. *Accounting, Organization and Society* , 19 (2), 111-126.

- AUCC. (2011). *Trends in Higher Education. Volume 1 - Enrolment*. Ottawa: Association of Universities and Colleges of Canada.
- AUCSN. (2016). *About*. Retrieved September 2, 2016 from <https://aucsn.wordpress.com/>
- Axelrod, P., Trilokekar, R., Shanahan, T., & Wellen, R. (Eds.). (2013). *Making Policy in Turbulent Times. Challenges and Prospects for Higher Education*. Montreal & Kingston: Mc-Gill-Queen's University Press.
- B.C. Government. (2016). *Carbon Neutral Action Reporting (CNARs)*. Retrieved February 24, 2016 from Climate Change. Reports & Data: <http://www2.gov.bc.ca/gov/content/environment/climate-change/reports-data/carbon-neutral-action-reports/2014>
- B.C. Government. (2008, June 12). *Climate Action Plan*. Retrieved January 22, 2013 from www.gov.bc.ca/premier/attachments/climate_action_plan.pdf
- B.C. Government. (n.d.). *Climate Action Plan*. Retrieved January 22, 2013 from www.gov.bc.ca/premier/attachments/climate_action_plan.pdf
- Ball, S. (2012). Performativity, Commodification and Commitment: An I-Spy Guide to the Neoliberal University. *British Journal of Educational Studies*, 60 (1), 17-28.
- Ball, S., Maguire, M., & Braun, A. (2012). *How Schools Do Policy. Policy enactments in secondary schools*. Abingdon, UK: Routledge.
- Bardi, U. (2011). *The Limits to Growth Revisited*. Firenze, Italy: Springer.
- Barnhardt, R. (2005). Indigenous Knowledge Systems and Alaska Native Ways of Knowing. *Anthropology & Education*, 36(1), 8-23.
- Beckford, C.L., Jacobs, C., Williams, N. & Nahdee, R. (2010). Aboriginal Environmental Wisdom, Stewardship, and Sustainability: Lessons from the Walpole Island First Nations, Ontario, Canada. *The Journal of Environmental Education*, 41(4), 239-248.
- Berbary, L., & Boles, J. (2014). Eight Points for Reflection: Revisiting Scaffolding for Improvisational Humanist Qualitative Inquiry. *Leisure Sciences*, 36, 401-419.
- Bernstein, B. (1990). The Structuring of Pedagogic Discourse. In B. Bernstein, *Class, Codes and Control* (2003 ed., Vol. IV, p. 225). London and New York: Routledge.
- Bernstein, B. (1975). Towards a Theory of Educational Transmission. In B. Bernstein, *Class, Codes and Control* (Vol. III, p. 158). London and New York: Routledge.
- Blase, J., & Anderson, G. (1995). *The Micropolitics of Educational Leadership. From Control to Empowerment*. London, New York: Cassell.

- Blauch, L. (1933). Curriculum Surveys in Higher Education. *Journal of Higher Education* , 4 (5), 255-260.
- Bokhoree, C., Baldeo, R., Desvaux-Thomas, D., & Ramprosand, S. (2012). The Role of Education in Understanding Climate Change’s Impacts on Water Resources. *The International Journal of Climate Change: Impacts and Responses* , 3 (3), 149-165.
- Boothe, P., & Boudreault, F.-A. (2016). *By the numbers: Canadian GHG Emissions*. Ivey Business School at Western University. London: Lawrence National Centre for Policy and Management .
- Bourque, A. (2012, April 11). *The 3 Types of Internet Search, Explained* Read more at <http://www.business2community.com/seo/the-3-types-of-internet-search-explained-0161644#WOOSbsSFoQtpUzoPT.99>. Retrieved April 26, 2016 from Business 2 Community: <http://www.business2community.com/seo/the-3-types-of-internet-search-explained-0161644#gEKfDjgmUUE5M073.97>
- Boyd, B. (2015). Climate Change Policy in Manitoba: A Small Province Looking to “Punch above its Weight”. *Manitoba Law Journal* , 38 (2), 155-183.
- British Antarctic Survey. (2014). *Halley Research Station*. Natural Environment Research Council (NERC). Retrieved March 20, 2014 from http://www.antarctica.ac.uk/living_and_working/research_stations/halley/
- Burkeman, O. (2003, March 3). *Memo exposes Bush's new green strategy*. Retrieved November 29, 2013 from The Guardian: <http://www.theguardian.com/environment/2003/mar/04/usnews.climatechange>
- Calgary Herald. (2016, February 5). *Unemployment in Alberta tops national rate for first time in 27 years*. Retrieved August 31, 2016 from Local Business: <http://calgaryherald.com/business/local-business/alberta-unemployment-rate-at-highest-level-in-nearly-20-years>
- Canadian Intergovernmental Conference Secretariat. (2016, March 3). *First Ministers' Meeting — Vancouver Declaration on clean growth and climate change* . Retrieved September 2, 2016 from Conferences: <http://www.scics.gc.ca/english/conferences.asp?a=viewdocument&id=2401>
- CanLII. (2015). *Climate Change and Emissions Management Act, SA 2003, c C-16.7*. Retrieved June 25, 2015 from Alberta › Statutes and Regulations › SA 2003, c C-16.7: <http://www.canlii.org/en/ab/laws/stat/sa-2003-c-c-16.7/latest/sa-2003-c-c-16.7.html>
- Carbon Brief. (2016). *AGU 2015: Scientists react to Paris agreement on climate change*. Retrieved September 22, 2016 from <https://www.carbonbrief.org/agu-2015-scientists-react-to-paris-agreement-on-climate-change>

- CBC. (2016a, October 5). *MPs vote 207 to 81 to back Paris climate change agreement*. By *Katheen Harris*. Retrieved October 6, 2016 from Politics: <http://www.cbc.ca/news/politics/parliament-vote-paris-agreement-climate-change-1.3792313>
- CBC. (2016b, November 29). *Trudeau cabinet approves Trans Mountain, Line 3 pipelines, rejects Northern Gateway*. From CBC News Politics: <http://www.cbc.ca/news/politics/federal-cabinet-trudeau-pipeline-decisions-1.3872828>
- CBC. (2016c, December 9). *Trudeau announces 'pan-Canadian framework' on climate — but Sask., Manitoba hold off*. From CBCNews Politics: <http://www.cbc.ca/news/politics/trudeau-premiers-climate-deal-1.3888244>
- CBC. (2015a, November 3). *How the University of Calgary's Enbridge relationship became controversial*. Retrieved April 11, 2016 from CBC News: CBC Investigates: <http://www.cbc.ca/news/canada/calgary/university-calgary-enbridge-sponsorship-1.3286369>
- CBC. (2015b, December 15). *Naomi Klein calls Paris Climate Agreement 'scientifically inadequate'*. Retrieved September 22, 2016 from <http://www.cbc.ca/radio/thecurrent/the-current-for-december-15-2015-1.3365556/naomi-klein-calls-paris-climate-agreement-scientifically-inadequate-1.3365564>
- CBC. (2012, March 2). *Climate change skeptic's university course criticized*. Retrieved April 11, 2016 from CBC News: Technology & Science: <http://www.cbc.ca/news/technology/climate-change-skeptic-s-university-course-criticized-1.1161341>
- CC-RAI. (2010). *Climate Change. A Dialogue with Stakeholders*. Ontario Regional Climate Change Consortium, Toronto.
- Center for Biological Diversity. (2016, June 28). *Obama Administration Permitted 1,200 Offshore Fracks in Gulf of Mexico*. Retrieved September 21, 2016 from News - Press Releases: http://www.biologicaldiversity.org/news/press_releases/2016/offshore-fracking-06-28-2016.html
- Chew Hung, C. (2014). *Climate Change Education*. London and New York: Routledge.
- Chomsky, N., & Polk, L. (2013). *Nuclear war and Environmental Catastrophe*. New York: Seven Stories Press.
- CLEAN. (2014). *Climate Literacy & Energy Awareness Network*. Retrieved March 20, 2014 from <http://cleanet.org/index.html>
- Climate Change Action. (2016). *University and College Presidents' Climate Change Statement of Action for Canada*. Retrieved March 20, 2014 from <http://www.climatechangeaction.ca/>
- CMEC. (2012). *Education for Sustainable Development in Canadian Faculties of Education*. Toronto: Education for Sustainable Development Working Group of the Council of Ministers of Education, Canada (CMEC ESDWG).

- Cook, C., Heath, F., & Thompson, R. (2000). A Meta-analysis of Response Rates in Web - or Internet-Based Surveys. *Educational and Psychological Measurement* , 60 (6), 821-836.
- Cornbleth, C. (2008). Climates of opinion and curriculum practices. *Journal of Curriculum Studies* , 40 (2), 143-168.
- COU. (2009, November). *Commitment to Sustainability*. Retrieved September 2, 2016 from More about COU: <http://cou.on.ca/about/more/commitment-to-sustainability/>
- Creswell, J. (2013). *Qualitative Inquiry & Research Design. Choosing among five approaches* (Third Edition ed.). Los Angeles, London, New Delhi, Singapore, Washington D.C: Sage.
- Cubasch, U., Wuebbles, D., Chen, D., Facchini, M. F., Mahowald, N., & Winther, J.-G. (2013). Introduction. In T. D.-K. Stocker (Ed.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, New York, United Kingdom, USA: Cambridge University Press.
- Dal, M. (2011). Online data collection and data analysis using emergent technologies. In S. Hesse-Biber, *The Handbook of Emergent Technologies in Social Research* (p. 687). New York: Oxford University Press, Inc.
- Dalhousie University. (2014, November 26). *Dal Board decides not to divest fossil fuel endowment holdings*. Retrieved May 30, 2016 from Dal News: <http://www.dal.ca/news/2014/11/26/dal-board-decides-not-to-divest-its-fossil-fuel-endowment-holdin.html>
- David Suzuki Foundation. (2012). *All Over the Map 2012. A comparison of provincial climate change plans*. Vancouver, BC.
- Davis, W. (2009). *The Wayfinders. Why Ancient Wisdom Matters in the Modern World*. Toronto: House of Anansi Press Inc.
- Deeb, A., French, A., Heiss, J., Jabbour, J., LaRochelle, D., Levintanus, A., et al. (2011). *Climate Change Starter's Guidebook. An Issues Guide for Education Planners and Practitioners*. 72. Paris, France: UNESCO/UNEP.
- Desha, C., & Hargroves, C. (2014). *Higher Education and Sustainable Development A model for curriculum renewal*. New York: Routledge.
- Dewey, J. (1938). *Experience & Education* (Edition 1997 ed.). New York: Touchstone.
- Dunlap, R., & Brulle, R. (Eds.). (2015). *Climate Change and Society. Sociological Perspectives*. New York: Oxford University Press.

- Eagan, D., Keniry, J., Schott, J., Dayananda, P., Jones, K., & Madry, L. (2008). *Higher Education in a Warming World. The Business Case for Climate Leadership on Campus*. Reston, VA, USA: National Wildlife Federation.
- Earth Day Network. (n.d.). *Earth Day: The History of A Movement*. Retrieved March 20, 2014 from <http://www.earthday.org/earth-day-history-movement>
- ECO. (2014). *Looking for Leadership. The Costs of Climate Inaction. Annual Greenhouse Gas Progress Report 2014, Environmental Commissioner of Ontario*. Commissioner Gord Miller, Toronto.
- Edmonton Journal. (2016, April 11). *Premier Notley rejects Leap Manifesto as naive and tone deaf*. By Codie McLachlan (*The Canadian Press*). Retrieved August 31, 2016 from Local News: <http://edmontonjournal.com/news/local-news/premier-notley-responds-to-federal-ndp-burn>
- Energy Action Coalition. (2016). *Our Work*. Retrieved September 2, 2016 from About: <http://www.energyactioncoalition.org/about/our-work>
- Environment and Climate Change Canada . (2016a, March 6). *British Columbia: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/british-columbia-environment-profile.html>
- Environment and Climate Change Canada. (2016c, March 3). *Alberta: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/alberta-environment-profile.html>
- Environment and Climate Change Canada. (2016d, February 2). *Canada's Second Biennial Report on Climate Change*. Retrieved August 26, 2016 from Climate Change. Canada's GHG Emissions: <https://www.ec.gc.ca/GES-GHG/default.asp?lang=En&n=02D095CB-1>
- Environment and Climate Change Canada. (2016e, April 14). *Environmental Indicators. Greenhouse Gas Emissions*. Retrieved August 26, 2016 from Greenhouse Gas Emissions: <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=FBF8455E-1>
- Environment and Climate Change Canada. (2016f, April 14). *Greenhouse Gas Emissions by Province and Territory*. Retrieved September 1, 2016 from Environmental Indicators. Greenhouse Gas Emissions: <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=18F3BB9C-1>
- Environment and Climate Change Canada. (2016g, April 14). *Greenhouse Gas Emissions from Large Facilities*. Retrieved August 26, 2016 from Environmental Indicators. Greenhouse Gas Emissions: <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=31022B8E-1>

- Environment and Climate Change Canada. (2016h, March 6). *Manitoba: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/manitoba-environment-profile.html>
- Environment and Climate Change Canada. (2016i, March 6). *Ministerial Briefing Book*. Retrieved September 1, 2016 from <https://www.canada.ca/en/environment-climate-change/briefing.html>
- Environment and Climate Change Canada. (2016j). *National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada. Executive Summary. Canada's Submission to the United Nations Framework Convention On Climate Change*. https://www.ec.gc.ca/ges-ghg/662F9C56-B4E4-478B-97D4-BAABE1E6E2E7/2016_NIR_Executive_Summary_en.pdf. Gatineau: Government of Canada.
- Environment and Climate Change Canada. (2016k, March 6). *New Brunswick: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/new-brunswick-environment-profile.html>
- Environment and Climate Change Canada. (2016l, March 6). *Newfoundland and Labrador: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/content/canadasite/en/environment-climate-change/briefing/newfoundland-and-labrador-environment-profile.html>
- Environment and Climate Change Canada. (2016m, March 6). *Northwest Territories: Environment profile*. Retrieved August 31, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/northwest-territories-environment-profile.html>
- Environment and Climate Change Canada. (2016n, March 6). *Ontario: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/ontario-environment-profile.html>
- Environment and Climate Change Canada. (2016o, March 6). *Quebec: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: Environment and Climate Change Canada
- Environment and Climate Change Canada. (2015, December 16). *Renewable Fuels Regulations (SOR/2010-189)*. Retrieved August 28, 2016 from Acts & Regulations: CEPA Environmental Registry: Regulations and Other Instruments: <https://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=186>

- Environment Canada. (2015). *National Inventory Report. Greenhouse Gas Sources and Sinks in Canada. The Canadian Government's Submission to the UN Framework Convention on Climate Change*. Gatineau, QC.
- Evans, G., & Luo, J. (1990). Public Education and Information Mechanisms. In IPCC, *Climate Change. The IPCC Response Strategies. Report prepared for Intergovernmental Panel on Climate Change by Working Group III* (p. 330). WMO, UNEP.
- Fadeeva, Z., Galkute, L., & Mader, C. (Eds.). (2014). *Sustainable Development and Quality Assurance in Higher Education. Transformation of Learning and Society*. Palgrave Macmillan.
- Fahey, S. (2012). Curriculum change and climate change: Inside outside pressures in higher education. *Journal of Curriculum Studies* , 44 (5), 703-722.
- FES. (2016). *Undergraduate Handbook 2016-2017*. Retrieved December 26, 2016 from http://fes.yorku.ca/files/documents/bes/faculty-of-environmental-studies_undergraduate-handbook_2016-2017.pdf
- Fossil Free. (2017). *About Fossil Free*. Retrieved June 3, 2017 from <http://gofossilfree.org>
- Fossil Free Canada. (2016). *Fossil Free. A Campus Guide to Fossil Fuel Divestment*. Retrieved May 30, 2016 from Resources: https://d3n8a8pro7vhmx.cloudfront.net/ourclimate/pages/282/attachments/original/1421184226/CYCC_Toolkit.pdf?1421184226
- Frank, A. (2010). *Letting Stories Breathe: A Socio-Narratology*. London: The University of Chicago Press.
- GHG Management Institute. (2009). *The 2009 Greenhouse Gas & Climate Change Work force Needs. Assessment Survey Report*. Retrieved December 15, 2015 from http://ghginstitute.org/wp-content/uploads/2015/04/2009_green_jobs_survey.pdf
- Gillenwater, M. (2011). Filling a gap in climate change education and scholarship. *Greenhouse Gas Measurement and Management* , 1 (1), 11-16.
- Glasser, B.G and F. Strauss. (1999). *Discovery of Grounded Theory: Strategies for Qualitative Research*. New Jersey: Transaction Publishers.
- Goodson, I. (2005). *Learning, Curriculum and Life Politics: the selected works of Ivor F. Goodson*. London and New York: Routledge.
- Goodson, I. (1992). On Curriculum Form. *Sociology of Education* , 65 (1), 66-75.
- Goodson, I. (1989). Studying Curriculum: Toward a Social Constructionist Perspective. *Curriculum Praxis. Occasional Paper Series* , 21.

- Gough, S., & Stables, A. (2012). Interpretation as Adaptation: Education for Survival in Uncertain Times. *Curriculum Inquiry*, 42 (3), 368-385.
- Gouvernement du Québec. (2012). *2013-2020 Climate Change Action Plan. Quebec in Action. Greener by 2020. Phase 1*. Retrieved September 1, 2016 from http://www.mddelcc.gouv.qc.ca/changements/plan_action/pacc2020-en.pdf
- Gouvernement du Québec. (2011). *Regulation respecting a cap-and-trade system for greenhouse gas emission allowances*. Retrieved August 30, 2016 from Consolidated Statutes and Regulations: <http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2046.1>
- Gouvernement du Québec. (2009a). *Regulation respecting greenhouse gas emissions from motor vehicles*. Retrieved August 30, 2016 from Consolidated Statutes and Regulations: <http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2017>
- Gouvernement du Québec. (2009b, September 26). *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere*. Retrieved August 30, 2016 from Consolidated Statutes and Regulations: <http://legisquebec.gouv.qc.ca/en/showdoc/cr/Q-2,%20r.%2015>
- Gouvernement du Québec. (2004). *Regulation respecting halocarbons*. Retrieved August 30, 2016 from Consolidated Statutes and Regulations: <http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2029>
- Gouvernement du Québec. (1972). *Environment Quality Act*. Retrieved August 30, 2016 from Consolidated Statutes and Regulations: <http://legisquebec.gouv.qc.ca/en/ShowDoc/cs/Q-2>
- Government of Canada. (2012, August 30). *Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations (SOR/2012-167)*. Retrieved May 30, 2016 from Justice Laws Website, Consolidated Regulations: <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-167/page-1.html#h-1>
- Government of New Brunswick. (2016). *Acts by Title*. Retrieved May 29, 2016 from Attorney General: <http://laws.gnb.ca/en/BrowseTitle?letter=all>
- Government of New Brunswick. (2015a). *Approval to Operate (I-8929)*. Retrieved August 30, 2016 from <http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/Class-Categorie1/NBPowerBelleduneCurrentApproval.pdf>
- Government of New Brunswick. (2015b, July). *Guidelines for Greenhouse Gas Management for Industrial Emitters in New Brunswick*. Retrieved May 29, 2016 from New Brunswick Department of Environment and Local Government: <http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Climate-Climatiques/GuidelinesForGreenhouseGasManagement.pdf>
- Government of New Brunswick. (2014). *New Brunswick Climate Change Action Plan 2014-2020*. Retrieved May 29, 2016 from Environment and Local Government:

<http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Climate-Climatiques/ClimateChangeActionPlan2014-2020.pdf>

- Government of New Brunswick. (2003, April 11). *Electricity Act* . Retrieved August 30, 2016 from Legislative Assembly of New Brunswick: <https://www.gnb.ca/legis/bill/editform-e.asp?ID=176&legi=54&num=5>
- Government of New Brunswick. (1997, February 28). *Clean Air Act*. Retrieved August 30, 2016 from Attorney General: <http://laws.gnb.ca/en/showfulldoc/cs/C-5.2//20160831>
- Government of Newfoundland and Labrador. (2016). *Turn Back the Tide*. Retrieved August 31, 2016 from <http://www.turnbackthetide.ca/home.shtml>
- Government of Newfoundland and Labrador. (2015a). *Greening Government Action Plan* . Retrieved August 31, 2016 from Office of Climate Change and Energy Efficiency: http://www.exec.gov.nl.ca/exec/ccee/publications/greening_government_action.pdf
- Government of Newfoundland and Labrador. (2015b). *Greening Government. 2015 Action Plan*. Retrieved May 30, 2016 from Office of Climate Change and Energy Efficiency: http://www.exec.gov.nl.ca/exec/ccee/publications/greening_government_action.pdf
- Government of Newfoundland and Labrador. (2011a, August). *Charting Our Course: Climate Change Action Plan 2011*. Retrieved August 30, 2016 from Government Action. Action Plans: http://www.turnbackthetide.ca/files/government-action/climate_change.pdf
- Government of Newfoundland and Labrador. (2011b). *Moving Forward. Energy Efficiency Action Plan 2011*. Retrieved May 30, 2016 from Office of Climate Change and Energy Efficiency: http://www.exec.gov.nl.ca/exec/ccee/publications/energy_efficiency.pdf
- Government of Newfoundland and Labrador. (2004, May 19). *Air Pollution Control Regulations*. Retrieved August 30, 20016 from Table of Regulations: http://www.assembly.nl.ca/legislation/sr/regulations/rc040039.htm#3_
- Government of Nunavut. (2011). *Climate Change Adaptive Capacity within the Government of Nunavut*. Retrieved September 1, 2016 from Resources: <http://climatechangenunavut.ca/en/resources/publications>
- Government of Nunavut. (2003). *Nunavut Climate Change Strategy*. Retrieved August 31, 2016 from Climate Change Centre. Resources: http://climatechangenunavut.ca/sites/default/files/nunavut_climate_change_strategy-english_0.pdf
- Government of Nunavut. (1988). *Environmental Protection Act*. Retrieved September 1, 2016 from Department of Environment. Programs and Services: <http://www.gov.nu.ca/sites/default/files/rsnwt-nu-1988-c-e-7-part-1.pdf>

- Government of Ontario. (2016a, June 8). *Ontario's Five Year Climate Change Action Plan 2016 - 2020* . Retrieved September 1, 2016 from Climate Change Action Plan: http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf
- Government of Ontario. (2016b, June 2). *Cap and trade* . Retrieved August 26, 2016 from Climate Change: <https://www.ontario.ca/page/cap-and-trade>
- Government of Ontario . (2016c, May 18). *Environmental Protection Act, R.S.O. 1990, c. E.19* . Retrieved August 25, 2016 from Laws: <https://www.ontario.ca/laws/statute/90e19>
- Government of Ontario. (2016d, May 18). *Climate Change Mitigation and Low-carbon Economy Act, 2016, S.O. 2016, c. 7* . Retrieved August 25, 2016 from Laws: <https://www.ontario.ca/laws/statute/16c07>
- Government of Ontario. (2014, April 1). *Greener Diesel – Renewable Fuel Content Requirements for Petroleum Diesel Fuel* . Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/regulation/140097>
- Government of Ontario. (2009a, December 15). *Environmental Protection Amendment Act (Greenhouse Gas Emissions Trading)*. Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/statute/S09027>
- Government of Ontario. (2009b, September 23). *Renewable Energy Approvals Regulation*. Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/regulation/090359>
- Government of Ontario. (2009c, May 14). *Green Energy and Green Economy Act*. Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/statute/s09012>
- Government of Ontario. (2009d). *Greenhouse Gas Emissions Reporting*. Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/regulation/090452>
- Government of Ontario. (2007, August 24). *Cessation of Coal Use – Atikokan, Lambton, Nanticoke and Thunder Bay Generating Stations Regulation*. Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/regulation/070496>
- Government of Ontario. (2005, October 7). *Ethanol in Gasoline*. Retrieved August 30, 2016 from Laws: <https://www.ontario.ca/laws/regulation/050535>
- Government of Prince Edward Island. (2016a, July). *Climate Change Mitigation Strategy. Discussion Document*. Retrieved August 28, 2016 from https://www.princeedwardisland.ca/sites/default/files/publications/climate_change_mitigation_strategy_discussion_document.pdf
- Government of Prince Edward Island. (2016b). *Prince Edward Island Energy Strategy. Second Draft*. Retrieved August 28, 2016 from <http://www.peiec.ca/the-strategy.html>

- Government of Prince Edward Island. (2015, September 2). *Prince Edward Island Energy Strategy Securing our Future: Energy Efficiency and Conservation*. Retrieved August 28, 2016 from http://www.gov.pe.ca/photos/original/env_snergyst.pdf
- Government of Prince Edward Island. (2008). *Prince Edward Island and Climate Change. A Strategy for Reducing the Impacts of Global Warming*. Retrieved August 28, 2016 from http://www.gov.pe.ca/photos/original/env_globalstr.pdf
- Government of Saskatchewan. (2016a). *Climate Change*. Retrieved September 2, 2016 from Programs and Services: <http://www.environment.gov.sk.ca/climatechange>
- Government of Saskatchewan. (2016b). *Climate Change Policy*. Retrieved September 2, 2016 from Environmental Protection and Sustainability: <https://www.saskatchewan.ca/business/environmental-protection-and-sustainability/climate-change-policy>
- Government of Saskatchewan. (2016c). *Environment. Legislation*. Retrieved February 24, 2016 from <http://environment.gov.sk.ca/legislation/>
- Government of Saskatchewan. (2016d, May 17). *Speech from the Throne 2016. Delivered on the Occasion of the Opening of the First Session of the Twenty Eighth Legislature Province of Saskatchewan. The Honourable Vaughn Solomon Schofield Lieutenant Governor of Saskatchewan*. Retrieved September 2, 2016 from News and Media: <http://www.saskatchewan.ca/~media/news%20release%20backgrounders/2016/may/2016%20throne%20speech%20english.pdf>
- Government of Saskatchewan. (2009). *Bill 95 - The Management and Reduction of Greenhouse Gases Act*. Retrieved August 26, 2016 from Publications Centre: <http://www.qp.gov.sk.ca/documents/english/FirstRead/2009/Bill-95.pdf>
- Government of Saskatchewan. (2002a, September 26). *Funding for Climate Change Education Saskatchewan Project*. Retrieved September 2, 2016 from News and Media: <http://www.saskatchewan.ca/government/news-and-media/2002/september/26/funding-for-climate-change-education-saskatchewan-project>
- Government of Saskatchewan. (2002b, October 24). *The Ethanol Fuel (General) Regulations*. Retrieved September 2, 2016 from Publications Centre: <http://www.qp.gov.sk.ca/documents/english/Regulations/Regulations/e11-1r1.pdf>
- GUPES. (2014). *Global Universities Partnership on Environment and Sustainability*. Retrieved March 20, 2014 from <http://gupes.org>
- Helferty, A., Clarke, A., & Kouri, R. (2009). The Campus Climate Challenge: Innovative multi-stakeholder approaches to reducing emissions at Canadian colleges and universities. In W. Leal Filho (Ed.), *Interdisciplinary Aspects of Climate Change* (pp. 365-388). Frankfurt: Peter Lang Scientific Publishers.

- Henderson, J., Bieler, A., & McKenzie, M. (2017). Climate Change and the Canadian Higher Education System: An Institutional Policy Analysis. *Canadian Journal of Higher Education* 47(1). 1-26.
- Howarth, R. (2015). Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy. *Energy and Emission Control Technologies* (3), 45-54.
- Howarth, R., Santoro, R., & Ingraffea, A. (2011). Methane and the greenhouse-gas footprint of natural gas from shale formations. *Climatic Change* (106), 679.
- IPCC. (2016). *Sixth Assessment Report cycle*. Retrieved September 2, 2016 from <http://www.ipcc.ch/index.htm>
- IPCC. (2014a, November 2). Climate Change 2014. Synthesis Report to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. (R. Pachauri, L. Meyer, & Allen, Eds.)
- IPCC. (2014b). Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. (O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, et al., Eds.) Cambridge & New York, United Kingdom & NY, USA: Cambridge University Press.
- IPCC. (2014c). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)*. Geneva, Switzerland: IPCC.
- IPCC. (2014d, November). *IPCC Fifth Assessment Report*. Retrieved September 2, 2016 from Publications and Data: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
- IPCC. (2014e). *Organization*. Retrieved March 20, 2014 from <http://www.ipcc.ch/organization/organization.shtml>
- IPCC. (2013). Summary for Policymakers. In T. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. Allen, J. Boschung, et al. (Eds.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (p. 28). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
- IPCC. (2007). *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]*. Geneva, Switzerland: IPCC.

- IPCC. (2001). Technical Summary. *Climate Change 2001: Impacts, Adaptation, and Vulnerability. A Report of Working Group II of the Intergovernmental Panel on Climate Change* .
- IPCC. (1995). IPCC Second Assessment. *Climate Change 1995. Full Report. A Report of the Intergovernmental Panel on Climate Change* . WMO, UNEP.
- IPCC. (1990a). *Climate Change: The IPCC Scientific Assessment. Report prepared for Intergovernmental Panel on Climate Change by Working Group I* . (J. Houghton, G. Jenkins, & J. Ephraums, Eds.) Cambridge, New York, Melbourne, Great Britain, USA, Australia: Cambridge University Press.
- IPCC. (1990b). Public Education and Information Mechanisms. In IPCC, G. Evans, & J. Luo (Eds.), *Climate Change: The IPCC Response Strategies* (pp. 209-218). Intergovernmental Panel on Climate Change, Working Group III, First Assessment Report (FAR).
- IPCC. (1990c). *Climate Change: The IPCC Response Strategies. Report of the Working Group III of the Intergovernmental Panel on Climate Change* , 332. WMO/UNEP.
- Jones, G. (2008). The University and Society: Four Books on Higher Education in Canada. *Curriculum Inquiry* , 38 (4), 417-432.
- Jones, P., Selby, D., & Sterling, S. (2010). Introduction. In P. Jones, D. Selby, & S. Sterling, *Sustainability Education. Perspectives and Practice Across Higher Education* (pp. 1-16). London: Earthscan.
- Kemmis, S., Cole, P., & Suggett, D. (1983). *Orientations to curriculum and transition: Towards the socially-critical school*. Clifton Hills: Victorian Institute of Secondary Education (VISE).
- Klein, N. (2016, June 2). *Let them drown. The violence of othering in a warming world*. Retrieved May 28, 2016 from <http://www.lrb.co.uk/v38/n11/naomi-klein/let-them-drown>
- Klein, N. (2014). *This Changes Everything*. Toronto: Penguin Random House Knopf Canada.
- Knight, R. (1990). Sanctions, Disinvestment, and US Corporations in South Africa. In R. Edgar, *Sanctioning Apartheid* (pp. 67-89). Trenton, NJ, USA: Africa World Press, Inc.
- Knuth, S., Nagle, B., Steuer, C., & Yarnal, B. (2007). Universities and Climate Change Mitigation: Advancing Grassroots Climate Policy in the US. *Local Environment* , 12 (5), 485-504.
- Kronman, A. (2007). *Education's End. Why our colleges and universities have given up on the meaning of life*. Binghamton, New York: Vail-Ballou Press.
- Kumashiro, K. (2004). *Against common sense: teaching and learning toward social justice*. New York: Routledge.

- Kurz, A., Elliott, S., Wehby, J., & Smithson, J. (2010). Alignment of the Intended, Planned, and Enacted Curriculum in General and Special Education and Its Relation to Student Achievement. *The Journal of Special Education* , 44 (3), 131-145.
- Latour, B. (1983). Give me a laboratory and I will move the world. In K. Knorr, & M. Mulkey (Eds.), *Science Observed* (pp. 141-170). London: Sage.
- Law, J. (1992). Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity. *Systems Practice* , 5 (4), 379-393.
- Leal Filho, W. (2010). Climate Change at Universities: Results of a World Survey. In W. Leal Filho (Ed.), *Universities and Climate Change. Introducing Climate Change to University Programmes*. Heidelberg, Germany: Springer.
- Leopold, A. (1966). *A sand county almanac with other essays on conservation from Round River*. New York, New York: Oxford University Press.
- Læssøe, J., Schnack, K., Breiting, S., & Rolls, S. (2009). Climate Change and Sustainable Development: The Response from Education. *Cross-National Report* .
- Levy, D., & Egan, D. (2003). A Neo-Gramscian Approach to Corporate Political Strategy: Conflict and Accommodation in the Climate Change Negotiations. *Journal of Management Studies* , 40 (4), 803-829.
- Liotta, O., & Miskel, J. (2012). *The real population bomb: megacities, global security & the map to the future*. Washington, D.C., USA: Potomac Books.
- Maclean's. (2016a). *Best Environmental Science Universities in Canada: 2017 Ranking*. Retrieved December 22, 2016 from <http://www.macleans.ca/education/unirankings/best-environmental-science-universities-in-canada-2017-ranking/#gallery/best-environmental-science-universities-in-canada-2017-ranking/7>
- Maclean's. (2016b). *York University*. Retrieved December 26, 2016 from <http://www.macleans.ca/schools/york-university/>
- Manitoba's Ministry of Conservation. (2012). *Manitoba's Report on Climate Change for 2012. Progress update on Manitoba's Reductions*. Manitoba Conservation and Water Stewardship, Climate Change Branch, Environmental Stewardship Division, https://www.gov.mb.ca/conservation/climate/pdf/2012_climate_change_web.pdf, Winnipeg.
- McKeown, R., & Hopkins, C. (2010). Rethinking Climate Change Education. Everyone wants it, but what is it? *Green Teacher* (89), 17-21.
- McKibben, B. (2015, December 13). *Falling Short on Climate in Paris*. (The New York Times) Retrieved September 22, 2016 from http://www.nytimes.com/2015/12/14/opinion/falling-short-on-climate-in-paris.html?_r=2

- Merchants of Doubt. (2016). Retrieved August 25, 2016 from <http://www.merchantsofdoubt.org>
- Mojeek. (2015, November 16). *What is a Crawler-based Search Engine? (And Why it Matters)*. Retrieved April 26, 2016 from <https://blog.mojeek.com/2013/10/crawler-based-search-engine.html>
- Molina, M., & Rowland, F. (1974). Stratospheric sink for chlorofluoromethanes: chlorine atom-catalysed destruction of ozone. *Nature* (249), 810-812.
- Montgomery, C. (2006, August 12). *Nurturing doubt about climate change is big business*. Retrieved November 29, 2013 from Globe and Mail: <http://www.theglobeandmail.com/incoming/nurturing-doubt-about-climate-change-is-big-business/article967272/>
- Moser, S. (2010). Communicating climate change: history, challenges, process and future directions. *Wiley Interdisciplinary Reviews: Climate Change* , 1 (1), 31-53.
- Mount Allison University. (2016). *Campus Climate Challenge*. Retrieved September 2, 2016 from Environment Mount Allison : <https://www.mta.ca/c3/>
- National Research Council. (2011). Climate Change Education Goals, Audiences, and Strategies: A Workshop Summary. *Sherrie Forrest & Michael Feder, Rapporteurs. Board on Science Education, Division of Behavioral and Social Sciences and Education* . Washington, D.C.: The National Academies Press.
- NDP. (2016). *The Leap Manifesto*. Retrieved August 31, 2016 from <https://leapmanifesto.org/en/the-leap-manifesto/>
- NEG/ECP. (2001, August). *Climate Change Action Plan 2001*. Retrieved August 28, 2016 from <https://www.novascotia.ca/nse/climate.change/docs/NEG-ECP.pdf>
- NEG/ECP. (2015, August 30-31). *Resolution concerning climate change 39-1*. Retrieved August 31, 2016 from <http://www.cap-cpma.ca/data/Signed%2039-1En.pdf>
- New York Times. (1988, June 24). *Global Warming Has Begun, Expert Tells Senate*. Retrieved March 20, 2014 from Archives: <http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>
- Newswire. (2014, November 27). *Divest Concordia denounces Concordia University Foundation refusal to divest from fossil fuels* . Retrieved May 30, 2016 from News Releases: <http://www.newswire.ca/news-releases/divest-concordia-denounces-concordia-university-foundation-refusal-to-divest-from-fossil-fuels-516567711.html>
- Ng-A-Fook, N. (2014). Provoking the very “Idea” of Canadian Curriculum Studies as a Counterpointed Composition. *Journal of the Canadian Association for Curriculum Studies* , 12 (1), 10-69.

- NOAA. (2011, January). *National Centers for Environmental Information, State of the Climate: Global Analysis for Annual 2010*. Retrieved January 17, 2016 from <http://www.ncdc.noaa.gov/sotc/global/201013>
- Northern Premiers' Forum. (2011, April). *Pan-Territorial Adaptation Strategy. Moving Forward on Climate Change Adaptation in Canada*. Retrieved September 1, 2016 from Resources: http://climatechangenunavut.ca/sites/default/files/pan-territorial_adaptation_strategy.pdf
- Northwest Territories. (2016). *Climate Change*. Retrieved August 31, 2016 from Environment and Natural Resources. Programs: <http://www.enr.gov.nt.ca/node/3697>
- Northwest Territories. (2011). *A Greenhouse Gas Strategy for the Northwest Territories 2011-2015*. Retrieved August 31, 2016 from Environment and Natural Resources. Programs: http://www.enr.gov.nt.ca/sites/default/files/strategies/ghg_strategy_2011-2015.pdf
- Northwest Territories. (2004). *Used Oil and Waste Fuel Management Regulations*. Retrieved August 31, 2016 from Environment and Natural Resources. Regulations: <https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.r3.pdf>
- Northwest Territories. (1990). *Asphalt Paving Industry Emission Regulations*. Retrieved August 31, 2016 from Environment and Natural Resources. Regulations: <https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.r1.pdf>
- Northwest Territories. (1988). *Environmental Protection Act*. Retrieved August 31, 2016 from Environment and Natural Resources. ENR Legislation: <https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.a.pdf>
- Northwest Territories. (1988). *Environmental Rights Act*. Retrieved August 31, 2016 from Environment and Natural Resources. ENR Legislation: <https://www.justice.gov.nt.ca/en/files/legislation/environmental-rights/environmental-rights.a.pdf?v9152>
- Northwest Territories. (1988). *Spill Contingency Planning and Reporting Regulations*. Retrieved August 31, 2016 from Environment and Natural Resources. Regulations: <https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.r2.pdf>
- ORCCC. (2016). *About Us*. Retrieved September 9, 2016 from Ontario Climate Consortium: <http://climateconnections.ca/about-us/>
- Orr, D. (1994). *Earth in Mind. On education, environment, and the human prospect* (2004 ed.). Wasington, Covelo, London: Islsnd Press.

- Osmond, P., Dave, M., Prasad, D., & Li, F. (2013). Greening Universities Toolkit. Transforming Universities into Green and Sustainable Campuses: A toolkit for Implementers. 54. (J. Clayton, Ed.) United Nations Environment Programme.
- Owen, R., Ficher, E., & McKenzie, K. (2013). Beyond reduction: climate change adaptation planning for universities and colleges. *International Journal of Sustainability in Higher Education* , 14 (2), 146-159.
- Page, R. N. (2009). Foreword. In E. C. Waks (Ed.), *Leaders in Curriculum Studies: Intellectual Self-Portraits* (pp. ix-xvi). Rotterdam: Sense Publishers.
- PICS. (2011). *Climate Change Courses in British Columbia Postsecondary Institutions. A Scoping Review*. Pacific Institute for Climate Solutions. Victoria: University of Victoria.
- Pierce, D. (1971). Curriculum Development in Higher Education . *Improving College and University Teaching* , 19 (4), 278-279.
- Pinar, W., Reynolds, W., Slattery, P., & Taubman, P. (1995). Understanding Curriculum as Political Text. In W. Pinar, W. Reynolds, P. Slattery, & P. Taubman, *Understanding Curriculum: An Introduction to the Study of Historical Contemporary Curriculum Discourses* (Vol. 17, pp. 243-314). New York: Peter Lang AG.
- Porter, A. (2006). Curriculum Assessment. In J. Green, G. Camilli, & P. Elmore (Eds.), *Handbook of Complementary Methods in Education Research* (pp. 141-160). Washington, D.C. - Mahwah, N.j.: AERA & Lawrence Erlbaum Associates.
- Prince Edward Island: Environment profile. (2016, March 6). *Prince Edward Island: Environment profile*. Retrieved August 30, 2016 from Ministerial briefing book: <https://www.canada.ca/en/environment-climate-change/briefing/prince-edward-island-environment-profile.html>
- Prindle, D. (2015). *The Politics of Evolution*. New York: Routledge.
- Province of Alberta. (2016). *Climate Leadership Plan. A summary of Alberta's new policy response to climate change*. Retrieved August 26, 2016 from Government Projects, Priorities and Consultations: <http://www.alberta.ca/climate-leadership-plan.aspx>
- Province of Alberta. (2016, June). *Green Transit Incentives Program (GreenTRIP)*. Retrieved August 26, 2016 from Transportation: <http://www.transportation.alberta.ca/5409.htm>
- Province of Alberta. (2016). *Renewable Fuels Standard Regulation*. (E. a. Parks, Producer) Retrieved May 29, 2016 from Guidelines and Legislation: <http://aep.alberta.ca/climate-change/guidelines-legislation/renewable-fuels-standard-regulation.aspx>
- Province of Alberta. (2016). *What is Micro-generation?* Retrieved August 26, 2016 from Energy. Our Business. Electricity: <http://www.energy.alberta.ca/electricity/microgen.asp>

- Province of Alberta. (2014, December 2014). *Climate Change and Emissions Management Act*. Retrieved May 29, 2016 from Laws Online:
<http://www.qp.alberta.ca/documents/Acts/C16P7.pdf>
- Province of Alberta. (2012). *Responsible Energy Development Act*. Retrieved August 30, 2016 from Acts: <http://www.qp.alberta.ca/documents/Acts/r17p3.pdf>
- Province of Alberta. (2011, April 28). *Appendix: Mines and Minerals Act: Carbon Sequestration Tenure Regulation*. Retrieved August 30, 2016 from Orders in Council:
http://www.qp.alberta.ca/documents/orders/orders_in_council/2011/411/2011_179.html
- Province of Alberta. (2009). *Carbon Capture and Storage Funding Act*. Retrieved August 30, 2016 from Acts: <http://www.qp.alberta.ca/documents/Acts/C02P5.pdf>
- Province of Alberta. (2007). *Specified Gas Emitters Regulation*. Retrieved August 30, 2016 from Laws Online/Catalogue:
http://www.qp.alberta.ca/1266.cfm?page=2007_139.cfm&leg_type=Regs&isbncIn=9780779738151
- Province of British Columbia. (2016). *Climate Action Legislation*. Retrieved August 30, 2016 from Environmental Protection & Sustainability. Climate Change. Policy, Legislation & Programs: <http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs/climate-action-legislation>
- Province of British Columbia. (2016). *Policy, Legislation & Programs*. Retrieved May 29, 2016 from Environmental Protection & Sustainability:
<http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs>
- Province of British Columbia. (2016, August). *Climate Leadership Plan*. Retrieved August 31, 2016 from Climate Leadership: https://climate.gov.bc.ca/wp-content/uploads/sites/13/2016/06/4030_CLP_Booklet_web.pdf
- Province of British Columbia. (2012). *Making Progress on B.C.'s Climate Action Plan*. Retrieved August 28, 2016 from Environmental Protection & Sustainability. Climate Change: <http://www2.gov.bc.ca/assets/gov/environment/climate-change/policy-legislation-and-responses/2012-progress-to-targets.pdf>
- Province of Manitoba. (2007, December 12). *Ethanol General Regulation*. Retrieved August 30, 2016 from Laws/Regulations: https://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=165/2007
- Province of Manitoba. (2015). *Manitoba's Climate Change and Green Economy Action Plan*.
- Province of Manitoba. (2014, June). *TomorrowNow – Manitoba's Green Plan*. Retrieved August 31, 2016 from Conservation and Water Stewardship:
http://www.gov.mb.ca/conservation/tomorrownowgreenplan/pdf/tomorrownow_v2.pdf

- Province of Manitoba. (2011, June 16). *The Emissions Tax on Coal and Petroleum Coke Act*. Retrieved August 30, 2016 from Manitoba Laws: <http://web2.gov.mb.ca/laws/statutes/ccsm/e090e.php>
- Province of Manitoba. (2008, June 12). *The Climate Change and Emissions Reductions Act*. Retrieved August 30, 2016 from Manitoba Laws: <http://web2.gov.mb.ca/laws/statutes/ccsm/c135e.php>
- Province of Manitoba. (2003, December 4). *The Biofuels Act*. Retrieved August 30, 2016 from Manitoba Laws: <http://web2.gov.mb.ca/laws/statutes/ccsm/b040e.php>
- Province of Manitoba. (2002). *Kyoto and Beyond. A plan of action to meet and exceed Manitoba's Kyoto targets*. Province of Manitoba Climate Change Action Plan | 2002.
- Province of Nova Scotia. (2016, May 9). *Renewable Electricity Regulations*. Retrieved August 27, 2016 from Regulations by Act: <https://www.novascotia.ca/just/regulations/regs/elecrenew.htm>
- Province of Nova Scotia. (2013, October 1). *Greenhouse Gas Emissions Regulations*. Retrieved August 27, 2016 from Regulations by Act: <http://www.novascotia.ca/just/regulations/regs/envgreenhouse.htm>
- Province of Nova Scotia. (2011, November). *Municipal Climate Change Action Plan Guidebook*. Retrieved August 31, 2016 from Service Nova Scotia and Municipal Relations: https://www.fcm.ca/Documents/tools/PCP/municipal_climate_change_action_plan_guidebook_EN.pdf
- Province of Nova Scotia. (2009, January). *Toward a Greener Future. Nova Scotia's Climate Change Action Plan*. Retrieved August 27, 2016 from Climate Change Nova Scotia: <http://climatechange.novascotia.ca/sites/default/files/uploads/ccap.pdf>
- Queen's University. (2015, November 6). *Investment Committee makes decision on divestment*. Retrieved May 31, 2016 from Queen's Gazette: <http://www.queensu.ca/gazette/stories/investment-committee-makes-decision-divestment>
- Rappaport, A., & Hammond Creighton, S. (2007). *Degrees That Matter. Climate Change and the University*. Cambridge, London: MIT Press.
- Rata, E. (2014). The Three Stages of Critical Policy Methodology: an example from curriculum analysis. *Policy Futures in Education*, 12 (3), 347-358.
- Reichertz, J. (2007) Abduction: The Logic of Discovery of Grounded Theory. In A. Bryant and Charmaz, K. (Ed.), *The Sage Handbook of Grounded Theory* (pp. 214-228). Thousand Oaks: SAGE Publications, Inc.

- Republic of Kenya. (2012). *National Climate Change Action Plan. Knowledge Management and Capacity Development. Chapter 5: Integrating Climate Change in Education System.* Ministry of Environment and Mineral Resources.
- Revelle, R., & Suess, H. (1957). Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO₂ during the Past Decades. *Tellus IX* (9), 18-27.
- Roberts, P. (2010). Cultural Studies in Relation to Curriculum Studies. In C. Kridel (Ed.), *Encyclopedia of Curriculum Studies* (pp. 171-177). Thousand Oaks: SAGE Publications, Inc.
- Saldaña, J. (2009). *The Coding Manual for Qualitative Researchers.* Thousand Oaks: SAGE Publications, Inc.
- SARUA. (2010). Climate Change, Adaptation and Higher Education: Securing our future. *Sarua Leadership Dialogue Series*, 2, 4. (P. Kotecha, Ed.) Wits, South Africa: Southern African Regional Universities Association.
- SaskPower. (2016). *Our Electricity. How Power Gets from Us to You.* Retrieved September 1, 2016 from http://www.saskpower.com/our-power-future/our-electricity/?linkid=MM_our_electricity
- Sauvé, L., Berryman, T., & Brunelle, R. (2007). Three Decades of International Guidelines for Environment-Related Education: A Critical Hermeneutic of the United Nations Discourse. *Canadian Journal of Environmental Education* (12), 33-54.
- Sauvé, L. (2005). Currents in Environmental Education: Mapping a Complex and Evolving Pedagogical Field. *Canadian Journal of Environmental Education*, Spring (10), 11-37.
- Selby, D., & Kagawa, F. (2013). Climate Change in the Classroom: UNESCO Course for Secondary Teachers on Climate Change Education for Sustainable Development. 445. Paris, France: UNESCO.
- Shay, S. (2011). Curriculum formation: a case study from History. *Studies in Higher Education*, 36 (3), 315-329.
- Sims, L., & Falkenberg, T. (2013). Developing Competencies for Education for Sustainable Development: A Case Study of Canadian Faculties of Education. *International Journal of Higher Education*, 2 (4), 1-14.
- Snow, C. (1959). *The Two Cultures and the Scientific Revolution. The Rede Lecture.* New York: Cambridge University Press.
- Stanny, C., Gonzalez, M., & McGowan, B. (2015). Assessing the culture of teaching and learning through a syllabus review. *Assessment & Evaluation in Higher Education*, 40 (7), 898-913.

- Stark, J. (1986). On defining coherence and integrity in the curriculum. *Research in Higher Education* , 24 (4), 433-436.
- Statistics Canada. (2015, September 29). *Population by year, by province and territory (Number)*. Retrieved August 26, 2016 from Population. Summary Tables: <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm>
- Statistics Canada. (2015, November 27). *Postsecondary enrolments, by registration status, Pan-Canadian Standard Classification of Education (PCSCCE), Classification of Instructional Programs, Primary Grouping (CIP_PG), sex and student status*. Retrieved September 2, 2016 from CANSIM: <http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=4770019>
- Statistics Canada. (2011). *Distribution of the population aged 25 to 64, by highest certificate, diploma or degree and age group, Canada, provinces and territories, 2011*. Retrieved November 6, 2015 from 2011 National Household Survey (NHS), 2011, Statistics Canada: <http://www.statcan.gc.ca/pub/81-582-x/2015002/tbl/tbld6.4-eng.htm>
- The Guardian. (2015, March 20). *The biggest story in the world: inside the Guardian's climate change campaign*. Retrieved August 24, 2016 from Environment: Climate Change: <http://www.theguardian.com/environment/ng-interactive/2015/mar/16/the-biggest-story-in-the-world>
- The Guardian. (2014, February 26). *Climate change one of the most serious threats we face, says David Cameron* . Retrieved August 25, 2016 from Environment: Climate Change: <https://www.theguardian.com/environment/2014/feb/26/climate-change-serious-threat-david-cameron-prime-ministers-questions>
- The Guardian. (2009, October 13). *Humanities research threatened by demands for 'economic impact'* . Retrieved September 21, 2016 from Education: <https://www.theguardian.com/education/2009/oct/13/research-funding-economic-impact-humanities>
- The Hindu. (2015, April 27). *'Climate change is the most important story of our lives'* . Retrieved August 25, 2016 from Opinion: Interview: <http://www.thehindu.com/opinion/interview/climate-change-is-the-most-important-story-of-our-lives/article7143655.ece>
- The Nation. (2015, December 12). *The Paris Climate Deal Will Not Save Us*. Retrieved September 22, 2016 from <https://www.thenation.com/article/the-paris-climate-deal-will-not-save-us/>
- The White House. (2014, November 11). U.S.-China Joint Announcement on Climate Change. *The White House. Office of the Press Secretary. Statements & Releases* . Beijing, China: The White House. Office of the Press Secretary.
- Thelwall, M. (2002). Methodologies for crawler based Web surveys. *Internet Research* , 12 (2), 124 - 138.

- Thiessen, D. (2007). Curriculum and Social Change. *Curriculum Inquiry* , 37 (4), 299-302.
- This Changes Everything. (2015). *About*. Retrieved August 25, 2016 from <http://thefilm.thischangeseverything.org/about/>
- Turner, C. (2013). *The War on Science: Muzzled Scientists and Wilful Blindness in Stephen Harper's Canada*. Vancouver/Berkeley: Greystone Books.
- U15. (2016). *History and Milestones*. Retrieved December 22, 2016 from <http://u15.ca/history-milestones>
- Ubelis, A., Abolins, J., Berzina, D., Blahins, J., & Bajars, G. (2010). Graduate Studies of Global Change at the University of Latvia. In W. Filho (Ed.), *Universities and Climate Change* (pp. 259-269). London New York: Springer.
- ULSF. (2016). *Talloires Declaration*. Retrieved August 28, 2016 from http://www.ulsf.org/programs_talloires.html
- UN. (2014). *Gateway to the United Nations System Work on Climate Change*. Retrieved March 20, 2014 from <http://www.un.org/climatechange/>
- UN. (2014, May 4). *'The race is on, it's time to lead', UN chief tells Abu Dhabi climate change event* . Retrieved August 25, 2016 from UN News Centre: http://www.un.org/apps/news/story.asp?NewsID=47718#.V79HYrW_9A8
- UN. (2013a, February 28). *Report of the Conference of the Parties on its eighteenth session, held in Doha from 26 November to 8 December 2012*. From FCCC/CP/2012/8/Add.2: <http://unfccc.int/resource/docs/2012/cop18/eng/08a02.pdf#page=17>
- UN. (2013b, September 2). *Informe resumido del primer Diálogo sobre el artículo 6 de la Convención*. From FCCC /SBI/2013/13: <http://unfccc.int/resource/docs/2013/sbi/spa/13s.pdf>
- UN. (2008a, February 14). *Report of the Subsidiary Body for Implementation on its twenty-seventh session, held in Bali from 3 to 11 December 2007*. From FCCC/SBI/2007/34: <http://unfccc.int/resource/docs/2007/sbi/eng/34.pdf>
- UN. (2008b, March 14). *Amended New Delhi work programme on Article 6 of the Convention*. From FCCC/CP/2007/6/Add.1. Decision 9/CP.13: <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=37>
- UN. (2002, November 1). *New Delhi work programme on Article 6 of the Convention*. From FCCC/CP/2002/7/Add.1: <http://unfccc.int/resource/docs/cop8/07a01.pdf#page=23>
- UN. (1997). *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. From 37 I.L.M. 22 (1998): <http://unfccc.int/resource/docs/convkp/kpeng.html>

- UN. (1992, May 9). United Nations Framework Convention on Climate Change. *Text of the Convention*.
http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf . New York, USA: United Nations.
- UN. (1987, March 20). Report on the World Commission on Environment and Development. *Our Common Future* . Oslo.
- UN. (1972, June 16). *Stockholm Declaration of the United Nations Conference on the Human Environment*. From U.N. Doc.A/Conf.48/14:
<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=97&ArticleID=1503&l=en>
- UN CC:Learn. (2015, December 4). *UN CC:Learn Support to Advance Climate Change Education Showcased at COP21*. Retrieved September 2, 2016 from News:
<http://www.uncclearn.org/news/un-cclearn-support-advance-climate-change-education-showcased-cop21>
- UN CC:Learn. (2013). *Guidance Note for Developing a National Climate Change Learning Strategy*. Retrieved September 2, 2016 from Country Projects:
<http://www.uncclearn.org/national-projects/guidance-note-developing-national-climate-change-learning-strategy>
- UNEP. (2014). *Global Universities Partnership on Environment and Sustainability (GUPES)*. Retrieved March 20, 2014 from GUPES Network:
<http://www.unep.org/training/programmes/gupes.asp>
- UNEP. (2012a). Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer. *Ninth*. Nairobi, Kenya: Secretariat for The Vienna Convention for the Protection of the Ozone Layer & The Montreal Protocol on Substances that Deplete the Ozone Layer.
- UNEP. (2012b). Handbook for the Vienna Convention for the Protection of the Ozone Layer (1985). http://ozone.unep.org/Publications/VC_Handbook/VC-Handbook-2012.pdf , *Ninth*. Nairobi, Kenya: Ozone Secretariat. United Nations Environment Programme.
- UNESCO. (2016). *CCE Clearinghouse. Climate Change Education for Sustainable Development at UNESCO*. Retrieved January 22, 2016 from
<http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/climate-change-education/>
- UNESCO. (2013, April 8-9). *Expert Consultation on Guidelines on Climate Change Education in the context of Education for Sustainable Development*. Retrieved September 2, 2016 from
http://www.unesco.org/new/en/unesco/events/all-events/?tx_browser_pi1%5BshowUid%5D=13635&cHash=7860de2258
- UNESCO. (2012). Education Sector Responses to Climate Change. Bangkok, Thailand: UNESCO Bangkok.

- UNESCO. (2010, November). *The UNESCO Climate Change Initiative. Climate Change Education for Sustainable Development*. Paris, France.
- UNESCO. (2009). *UNESCO International Seminar on Climate Change Education. 27-29 July 2009*. Paris: UNESCO.
- UNESCO. (1998, October 1998). *World Declaration on Higher Education for the Twenty-First Century: Vision and Action*. Retrieved January 18, 2016 from World Conference on Higher Education: http://www.unesco.org/education/educprog/wche/declaration_eng.htm
- UNFCCC. (2016a). *Progress made in implementing the Doha work programme on Article 6 of the Convention* Retrieved June 3, 2017 from: <http://unfccc.int/resource/docs/2016/sbi/eng/06.pdf>
- UNFCCC. (2016b). *The Paris Agreement*. Retrieved October 6, 2016 from Key Steps: http://unfccc.int/paris_agreement/items/9485.php
- UNFCCC. (2016c). *United Nations Alliance on Climate Change Education, Training and Public Awareness*. Retrieved September 2, 2016 from Education & Outreach: http://unfccc.int/cooperation_and_support/education_and_outreach/education_and_training/items/8958.php
- UNFCCC. (2016d). *United Nations Framework Convention on Climate Change*. Retrieved July 14, 2012 from http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf
- UNFCCC. (2016e, May). *4th Dialogue on Action for Climate Empowerment*. Retrieved September 2, 2016 from Education & Outreach: http://unfccc.int/cooperation_and_support/education_and_outreach/dialogues/items/9414.php
- UNFCCC. (2016f). *Education & Outreach*. Retrieved January 19, 2016 from United Nations Framework Convention on Climate Change: http://unfccc.int/cooperation_support/education_outreach/overview/items/8946.php
- UNFCCC. (2015a, November 11). *Summary report on the 3rd Dialogue on Article 6 of the Convention*. Retrieved September 2, 2016 from <http://unfccc.int/resource/docs/2015/sbi/eng/15.pdf>
- UNFCCC. (2015b, June 2-3). *3rd Dialogue on Article 6 of the Convention*. Retrieved September 2, 2016 from Education and Outreach: http://unfccc.int/cooperation_and_support/education_and_outreach/dialogues/items/8938.php
- UNFCCC. (2014a). *Climate Change Information Network*. Retrieved March 23, 2014 from http://unfccc.int/cc_inet/cc_inet/items/3514.php

- UNFCCC. (2014b). *Kyoto Protocol*. Retrieved June 11, 2013 from http://unfccc.int/kyoto_protocol/items/3145.php
- UNFCCC. (2014c). *United Nations Framework Convention on Climate Change*. Retrieved March 20, 2014 from <http://unfccc.int>
- UNFCCC. (2014d, December 13). *The Lima Ministerial Declaration on Education and Awareness-raising*. Retrieved September 2, 2016 from COP 20 Session. Decisions: <http://unfccc.int/resource/docs/2014/cop20/eng/10a03.pdf#page=37>
- UNFCCC. (2014e, June 5). *2nd Dialogue on Article 6 of the Convention*. Retrieved September 2, 2016 from Education and Outreach: http://unfccc.int/cooperation_and_support/education_and_outreach/items/8210.php
- UNFCCC. (2013a, November 11-22). *COP 19*. Retrieved September 2, 2016 from Sessions: http://unfccc.int/meetings/warsaw_nov_2013/session/7767/php/view/decisions.php
- UNFCCC. (2013b, February 28). *Doha work programme on Article 6 of the Convention. Report of the Conference of the Parties on its eighteenth session, held in Doha from 26 November to 8 December 2012*. Retrieved September 2, 2016 from FCCC/CP/2012/8/Add.2: <http://unfccc.int/resource/docs/2012/cop18/eng/08a02.pdf#page=17>
- UNFCCC. (2012, March 15). *Durban Platform for Enhanced Action. Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011*. From FCCC /CP/2011/9/Add.1: <http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=2>
- UNFCCC. (2011, March 15). *The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention. Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010*. From FCCC /CP/2010/7/Add.1: <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=2>
- UNFCCC. (2010, March 30). *Copenhagen Accord. Report of the Conference of the Parties on its fifteenth session, held in Copenhagen from 7 to 19 December 2009*. From FCCC/CP/2009/11/Add.1: <http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf#page=4>
- UNFCCC. (2008, March 14). *Bali Action Plan. Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007*. From FCCC/CP/2007/6/Add.1: <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3>
- UNFCCC. (2004, October 28). *Options for the development of an Article 6 information network clearing house. Subsidiary Body for Implementation. Twenty-first session. Buenos Aires, 6–14 December 2004*. From FCCC/SBI/2004/14: <http://unfccc.int/resource/docs/2004/sbi/14.pdf>

- UNITAR. (2013). *Resource Guide for Advance Learning on Integrating Climate Change in Education at Primary and Secondary Level*. 2011-2013 pilot implementation phase of The One UN Climate Change Learning Partnership (UN CC:Learn). United Nations Institute for Training and Research (UNITAR).
- Universities Canada. (2016). *Enrolment by University*. Retrieved December 22, 2016 from <http://www.univcan.ca/universities/facts-and-stats/enrolment-by-university/>
- University of British Columbia. (2016, February 15). *UBC launches Sustainable Future Fund – giving donors choice, supporting future generations*. Retrieved May 30, 2016 from UBC News: <http://news.ubc.ca/2016/02/15/ubc-launches-sustainable-future-fund-giving-donors-choice-supporting-future-generations/>
- University of Ottawa. (2016, April 25). *uOttawa's climate commitment helps create greener economy for Canada*. Retrieved May 30, 2016 from Media Release.
- University of Toronto. (2016a). *Academic Calendar 2015-2016*. Retrieved March 21, 2016 from http://www.utoronto.ca/~registrar/calendars/calendar/pdf/2015-16_UTSC_Academic_Calendar.Final.9March2015.pdf
- University of Toronto. (2016b). *Graduate Academic Calendar 2015-2016*. Retrieved March 21, 2016 from <http://www.sgs.utoronto.ca/Documents/SGS-Calendar-2015-16.pdf>
- University of Toronto. (2016c, March 30). *Q & A with President Meric Gertler on U of T's 14-point plan, Beyond Divestment*. Retrieved May 30, 2016 from UofT News: <https://www.utoronto.ca/news/q-president-meric-gertler-u-ts-14-point-plan-beyond-divestment>
- University of Toronto. (2011c). *Campus Master Plan University of Toronto Mississauga*. Mississauga.
- University of Toronto. (2011a). *St. George Campus Master Plan*. Toronto.
- University of Toronto. (2011b). *University of Toronto Scarborough Campus Master Plan*. Scarborough.
- University of Victoria. (2016). *Human Dimensions of Climate Change*. Retrieved January 18, 2016 from <http://web.uvic.ca/hdcc/>
- University of Victoria. (2016a). *Human Dimensions of Climate Change*. Retrieved December 21, 2016 from <http://web.uvic.ca/hdcc/>
- University of Victoria. (2016b). *HDCC 490 Experiential Learning*. Retrieved December 21, 2016 from Calendar 2016-2017: <http://web.uvic.ca/calendar2017-01/CDs/HDCC/490.html>
- University of Victoria. (2016c). *2015 Carbon Neutral Action Report*. <http://www.uvic.ca/sustainability/assets/docs/reports/cnar15.pdf>, Victoria.

- University of Victoria. (2014). *Sustainability Action Plan: Campus Operations 2009-2014. Final Report*. <http://www.uvic.ca/sustainability/assets/docs/reports/final-report-action-plan.pdf>, Victoria.
- University of Waterloo. (2016a). *Master of Climate Change*. Retrieved January 17, 2016 from Geography and Environmental Management » Future graduates: <https://uwaterloo.ca/geography-environmental-management/future-graduates/master-climate-change>
- University of Waterloo. (2016b). *Undergraduate Studies Academic Calendar*. Retrieved March 14, 2016 from Department of Geography & Environmental Management. Bachelor of Environmental Studies: <https://ugradcalendar.uwaterloo.ca/page/ENV-Bachelor-Environmental-Stds-Specializations>
- University of Waterloo. (2016c). *Co-operative Education*. Retrieved December 22, 2016 from <https://uwaterloo.ca/co-operative-education/about-co-operative-education>
- University of Waterloo. (2016d). *Waterloo facts*. Retrieved December 22, 2016 from <https://uwaterloo.ca/about/who-we-are/waterloo-facts>
- University of Waterloo. (2016e). *Environmental Sustainability Report*. President's Advisory Committee on Sustainability, Waterloo.
- University of Waterloo. (2015). *Road to Sustainability*. Retrieved December 22, 2016 from https://uwaterloo.ca/sustainability/sites/ca.sustainability/files/uploads/files/sustainability_timeline_final_0.pdf
- University of Winnipeg. (2014, June 22). *UWinnipeg continues to excel in Kyoto commitments*. Retrieved May 29, 2016 from <http://news-centre.uwinnipeg.ca/all-posts/uwinnipeg-continues-to-excel-in-kyoto-commitments/>
- UNPRME. (2016). *Signatories*. (P. P. Education, Producer) Retrieved September 2, 2016 from Participants: <http://www.unprme.org/participants/index.php?sort=country&dir=asc&start=60>
- URAP. (2016). *2016-2017 World Ranking*. Retrieved December 23, 2016 from <http://www.urapcenter.org/2016/world.php?q=MS0yNTA=>
- Van Esterick, P., & Baker, L. (2014). *Trying the Way: Ethnographic Glimpses of York University*. Toronto: York University.
- Vaughter, P., McKenzie, M., Lidstone, L., & Wright, T. (2016). Campus sustainability governance in Canada. A content analysis of post-secondary institutions' sustainability policies. *International Journal of Sustainability in Higher Education*, 17 (1), 16-39.
- Vaughter, P., Wright, T., & Herbert, Y. (2015). 50 Shades of Green: An Examination of Sustainability Policy on Canadian Campuses. *Canadian Journal of Higher Education*, 45 (4), 81-100.

- Vaughter, P., Wright, T., McKenzie, M., & Lidstone, L. (2013). Greening the Ivory Tower: A Review of Educational Research on Sustainability in Post-Secondary Education. *Sustainability* , 5 (5), 2252-2271.
- Webster, A., & Moore, J. (2009, June 17). *Taking Action. British Columbia's Universities and Colleges Repond to the Greenhouse Gas Reduction Targets Act*. Retrieved January 22, 2013 from <http://www.go-beyond.ca/resources: walkingthetalk.bc.ca>
- Whitmarsh, L. (2009). What's in a name? Commonalities and differences in public understanding of "climate change" and "global warming". *Public Understanding of Science* , 18, 104-420.
- Willner, R. (2011). Micro-politics: An Underestimated Field of Qualitative Research in Political Science . *German Policy Studies* , 7 (3), 155-185.
- WMO. (2014a). *International Collaborations and Partnerships on Climate Change*. Retrieved March 20, 2014 from http://www.wmo.int/pages/themes/climate/international_background.php
- WMO. (2014b). *World Climate Conferences*. Retrieved March 20, 2014 from International Collaborations and Partnerships on Climate Change: https://www.wmo.int/pages/themes/climate/international_wcc.php
- WMO. (1988). The Changing Atmosphere: Implications for Global Security. *Conference Proceedings, WMO- No. 710*. Toronto: World Meteorological Organization (WMO).
- World Bank. (2016). *CO2 emissions (kt)*. (E. S. Carbon Dioxide Information Analysis Center, Producer) Retrieved October 5, 2016 from Data: http://data.worldbank.org/indicator/EN.ATM.CO2E.KT?year_high_desc=true
- Yes! Magazine. (2009, December 22). *James Hansen: Good Riddance, Copenhagen. Time for Better Ideas. By Madeline Ostrander*. Retrieved August 25, 2016 from Yes! Magazine. Planet: <http://www.yesmagazine.org/planet/james-hansen-why-copenhagens-failure-is-a-blessing>
- York University. (2016a). *Certificate in Sustainable Energy (SE)*. Retrieved December 26, 2016 from <http://fes.yorku.ca/apply/bes/se/>
- York University. (2016b). *Common University Data Ontario - York University 2015*. Retrieved September 21, 2016 from Office of Institutional Planning and Analysis (OIPA): <http://cudo.info.yorku.ca/report/2015-a-general-information-2/>
- York University. (2016c). *History*. Retrieved September 21, 2016 from Faculty of Environmental Studies: <http://fes.yorku.ca/about/history/>
- York University. (2016d). *Majors & Minors*. Retrieved September 2, 2016 from Future Students: <http://futurestudents.yorku.ca/majors-minors>

Yukon Government. (2015, December). *Climate Change Action Plan*. Retrieved September 2, 2016 from Managing Air, Water & Waste: http://www.env.gov.yk.ca/air-water-waste/documents/CCAP_progressreport_eng_2015.pdf

Yukon Government. (2002). *Environment Act*. Retrieved September 2, 2016 from Environment Yukon: http://www.gov.yk.ca/legislation/acts/environment_c.pdf

Yukon Government. (2000). *Ozone Depleting Substances and Other Halocarbons Regulation*. Retrieved September 2, 2016 from Environment Yukon: http://www.env.gov.yk.ca/environment-you/documents/Ozone_Depleting_Regulation.pdf

Yukon Government. (1998). *Air Emissions Regulation*. Retrieved September 2, 2016 from Environment Yukon: http://www.env.gov.yk.ca/environment-you/documents/Air_Emission_Regulations.pdf

Appendix A

Table 7: Canadian, Provincial and Territorial Emissions, Legislation and Status Update.

| | 1990 Total Emissions (Mt CO₂ eq.) | 2014 Total Emissions (Mt CO₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|---------------|---|---|-----------------------------|---|---|
| Canada | 613 | 732 | 20 | 30% ↓2005 levels by 2030 | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ National carbon price (Effective 2018): \$10/tonne, increasing by \$10 each year to \$50/tonne by 2022. <p>COAL</p> <ul style="list-style-type: none"> ▪ Effective July 1, 2015 limits to 420 tonnes of CO₂ per gigawatt hour (GWh) <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> ▪ Renewable Fuels Regulations (SOR/2010-189) requires 5% of renewable content (5% for gasoline), and since July 2011, 2% on diesel and heating oil <p>CARBON TAX</p> <ul style="list-style-type: none"> ▪ 2008 tax on fossil fuels (gasoline, diesel, natural gas, heating fuel, propane and coal)\$30/tonne of CO₂ <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Energy Efficiency Act (1992) <p>SOURCES (Government of Canada, 2012) (David Suzuki Foundation, 2012) (Environment and Climate Change Canada, 2016j) (Environment and Climate Change Canada, 2016d) (Environment and Climate Change Canada, 2015) (CBC, 2016a)</p> |
| AB | 175 | 274 | 56 | No target | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ 2003 Climate Change and Emissions Management Act (and later the Specified Gas Emitters Regulation A.R. 139/2007 and amendments A.R. 199/2015). Facilities with >100,000 GHGs must cap 12% below 2003-2005 levels. \$15 fee per tonne over the limit ▪ Carbon Capture and Storage (CCS) Funding Act (2009, Chapter C-2.5): to expedite the design, construction and operation of CCS projects in AB |

| | 1990 Total Emissions (Mt CO₂ eq.) | 2014 Total Emissions (Mt CO₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|--|---|---|-----------------------------|---|--|
| | | | | | <ul style="list-style-type: none"> ▪ Carbon Sequestration Tenure Regulation (A.R 68, 2011): To study and develop underground sites to sequester CO₂ ▪ Target to cap oil sands emissions by a maximum of 100 Mt by 2030 ▪ Methane target reduction of 45% by 2025 <p>COAL</p> <ul style="list-style-type: none"> ▪ Plan to retire 12 out of 18 coal-fired generating plants by 2030. The Climate Leadership Plan proposed to also retire the 6 remaining plants by 2030 and replace them with renewable energy and gas-fired electricity <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> ▪ Renewable Fuels Standard Regulation (part of the 2003 emissions act, came into effect in 2010). For commercial fuel producers to blend no less than 5% of renewable alcohol content into their fuels ▪ Green Transit Incentives Program (GreenTRIP) (2010) <p>CARBON TAX</p> <ul style="list-style-type: none"> ▪ Carbon Levy on fuels (diesel, gasoline, natural gas and propane) starting in Jan. 1, 2017 \$20/tonne and by 2018 \$30/tonne <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Energy Resources Conservation Act (RSA 2000, cE-10, was repealed by the Responsible Energy Development Act of 2012) ▪ Micro-generation regulation (27/2008) ▪ Responsible Energy Development Act (R-17.3, 2012, came into force in June 17, 2013) <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Climate Leadership Plan (2015) <p>SOURCES (Province of Alberta, 2016) (Province of Alberta, 2016) (Province of Alberta, 2014) (Province of Alberta, 2016) (Environment and Climate Change Canada, 2016j) (Province of Alberta, 2016) (David Suzuki Foundation, 2012) (Province of Alberta, 2012) (Province of Alberta, 2009) (Province of</p> |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|-----------|---|---|----------------------|--------------------------------------|---|
| | | | | | Alberta, 2011) (Province of Alberta, 2007) (Environment and Climate Change Canada, 2016c) (Alberta Government, 2016) |
| BC | 53 | 63 | 19 | 80% ↓ 2007 levels by 2050 | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ GHG Reduction Targets Act (2007, came into force Jan. 2008) ▪ Climate Action Charter (2007): local governments voluntarily committed to achieve carbon neutral operations by 2012, measure and report and be more energy efficient ▪ Emission Offsets Regulation (enacted in December 2008) ▪ Carbon Neutral Government Regulation (enacted in December 2008) ▪ GHG Reduction (Emission Standards) Statutes Amendment Act (2008): for industrial operations ▪ Local Government (Green Communities) Statutes Amendment Act (2008): known as Bill 27 supports local governments to reduce GHGs, conserve energy and work to create sustainable communities ▪ Landfill Gas Management Reg. (2009) ▪ GHG Industrial Reporting and Control Act (GGIRCA, 2014 –came into force in Jan. 2016) ▪ Proposed regulation for GGIRCA (2015): Offsets Reg. Policy, Compliance Framework Policy, and Reporting Reg. Policy ▪ Building Code Amendments and Regulation (2014): for new house and building to accommodate future installations of solar hot water systems <p>COAL</p> <ul style="list-style-type: none"> ▪ Not for electricity production, but biggest Canadian exporter (28M tonnes in 2014) <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> ▪ GHG Reduction Act (Renewable and Low Carbon Fuel Requirements, 2008): 5% of renewable content in gasoline and diesel and 10% ↓ by 2020. ▪ GHG Reduction Act 2008 (Vehicle Emissions Standard, 2008) <p>CARBON TAX</p> <ul style="list-style-type: none"> ▪ Carbon Tax Act (2008) Revenue neutral carbon tax \$10/tonnes CO₂ eq. with \$5 annual increase. \$30/tonne by 2012 |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|-----------|---|---|----------------------|--|---|
| | | | | | <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Energy Efficiency Act (1996): for households appliances and industrial equipment ▪ Utilities Commission Amendment Act (2008): demand to produce, generate and acquire electricity from clean or renewable sources ▪ Clean Energy Act (2010): Requires 93% of electricity to come from clean renewable sources by 2016 <p>CAP AND TRADE</p> <ul style="list-style-type: none"> ▪ GHG Reduction Act (2008). Repealed in Dec. 31, 2015 ▪ Western Climate Initiative Member (target 15% ↓2005 by 2020). Premier Clark cancelled the program in 2012 <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Climate Leadership Plan (2016) <p>SOURCES (Province of British Columbia, 2016) (Province of British Columbia, 2016) (Environment and Climate Change Canada, 2016j) (David Suzuki Foundation, 2012) (Environment and Climate Change Canada, 2016a) (Province of British Columbia, 2016)</p> |
| MB | 19 | 21 | 15 | <p>15% ↓2005 levels by 2020 (as subscribed to the Western Climate Initiative) 1/3 ↓2005 levels by 2030, 1/2 ↓2005 levels by 2050 & carbon neutral by 2080 (according to latest plan)</p> | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Climate Change and Emissions Reductions Act (2008, C135): To reduce GHGs and to promote sustainable economic development and energy security <p>COAL</p> <ul style="list-style-type: none"> ▪ Emissions Tax on Coal and Petroleum Coke Act (2011, came into force on Jan 1, 2012, it has been in effect since Nov 5, 2015). The tax rates are as follows: <ul style="list-style-type: none"> - Bituminous coal: \$22.57 per tonne - Sub-bituminous coal: \$17.37 per tonne - Lignite: \$14.27 per tonne - Anthracite and any other grade of coal: \$23.97 per tonne - Petroleum Coke: \$31.90 per tonne |

| | 1990 Total Emissions (Mt CO₂ eq.) | 2014 Total Emissions (Mt CO₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|-----------|---|---|-----------------------------|--|--|
| | | | | | <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> ▪ The Biofuels Act (2003, came into force Nov 1, 2005): To encourage the production and use of cleaner fuels. ▪ Ethanol General Regulation: Gasoline must contain 8.5% ethanol (Reg. Dec 12, 2007, came into force in Jan 1, 2008) ▪ Biodiesel Mandate for Diesel Fuel Regulation (came into force in Nov 1, 2009): Diesel must contain 2% biodiesel <p>CARBON TAX</p> <ul style="list-style-type: none"> ▪ \$10/tonne for users of >1 tonne per year (2008) <p>ENERGY</p> <ul style="list-style-type: none"> ▪ 98% electricity produced by hydroelectricity. Current wind farms with a capacity of 258 megawatts ▪ Energy Savings Act (Bill 24, 2012) <p>CAP AND TRADE</p> <ul style="list-style-type: none"> ▪ Proposed on its 2015 climate report <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Manitoba's Climate Change and Green Economy Action Plan (2015) ▪ Tomorrow Now, Manitoba's Green Plan. 2nd Edition. 2014 <p>SOURCES (Province of Manitoba, 2002) (Manitoba's Ministry of Conservation, 2012) (Boyd, 2015) (Province of Manitoba, 2015) (Environment and Climate Change Canada, 2016j) (David Suzuki Foundation, 2012) (Province of Manitoba, 2003) (Province of Manitoba, 2008) (Environment and Climate Change Canada, 2016h) (Province of Manitoba, 2007) (Province of Manitoba, 2011) (Province of Manitoba, 2014)</p> |
| NB | 16 | 15 | -9 | 10% ↓1990 by 2020, & 75-85% below 2001 by 2050 (confirmed on | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Clean Air Act (1997) ▪ Ozone Depleting Substances and Other Halocarbons Regulation (1997, Reg. 97/132, under the Clean Air Act) |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|----|---|---|----------------------|---|--|
| | | | | the latest NEG-ECP conference in 2015 and as proposed on the climate action plan of 2001) | <ul style="list-style-type: none"> ▪ Air Quality Regulation (1997, Reg. 97/133, under the Clean Air Act) to adopt the Guidelines for GHG Management Plan for Industrial Facilities (2015) <p>COAL</p> <ul style="list-style-type: none"> ▪ Belledune Thermal Generating Station operated by NB Power Corporation is approved to operate (I-8929) from July 1, 2015 to June 30, 2020 <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Energy Efficiency Act (2011) ▪ Electricity Act (2003, Bill 30): Electricity from Renewable Resources 1st repealed in 2014 and 2nd effective 2015 by Dec. 31, 2020 40% province electricity is from renewable resources <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ New Brunswick Climate Change Action Plan 2014–2020 <p>SOURCES (Government of New Brunswick, 2014) (Government of New Brunswick, 2015b) (Environment and Climate Change Canada, 2016j) (Government of New Brunswick, 2016) (David Suzuki Foundation, 2012) (Government of New Brunswick, 1997) (Government of New Brunswick, 2015a) (Government of New Brunswick, 2003) (Environment and Climate Change Canada, 2016k) (NEG/ECP, 2001) (NEG/ECP, 2015)</p> |
| NL | 9.6 | 10.6 | 10 | 10% ↓1990 levels by 2020 and regionally 75-85% ↓1990 levels by 2050 | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Air Pollution Control Regulations (2004, Reg. 39/04 under the Env. Protection Act 2004-232): Standards to maintain air quality in the Province. <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Energy Efficiency in Government Buildings through the ‘Greening Government’ 2015 Action Plan ▪ Muskrat Falls Hydroelectric Project to supply 10% of NS’s energy <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Charting Our Course: Climate Change Action Plan 2011 ▪ Greening Government Action Plan 2015 |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|----|---|---|----------------------|--|--|
| | | | | | SOURCES (Government of Newfoundland and Labrador, 2011b) (NEG/ECP, 2001) (Government of Newfoundland and Labrador, 2015b) (Environment and Climate Change Canada, 2016j) (Government of Newfoundland and Labrador, 2004) (Environment and Climate Change Canada, 2016l) (Government of Newfoundland and Labrador, 2011a) |
| NS | 20 | 17 | -17 | 10% ↓1990 levels by 2020 & regionally 80% ↓2009 levels by 2050 | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Environment Act (1994) GHGs Regulation subsection 28(6) and Section 112 (2009 & 2013): Emission caps for all facilities: <ul style="list-style-type: none"> - 2010-2011 (19.22 million tonnes CO₂ eq. cumulative total) - 2012-2013 (18.5) - 2014-2016 (26.32) - 2017-2019 (24.06) - 2020 (7.5) - 2021-2024 (27.5) - 2025 (6) - 2026-2029 (21.5) - 2030 (4.5) ▪ Facilities must report since 2009 ▪ Environmental Goals and Sustainable Prosperity Act (2007, Charter 7, amended by 2012, c.42) <p>COAL</p> <ul style="list-style-type: none"> ▪ 2009 CC Plan proposed to capture 80%+ of GHGs from coal-fire plants by 2018 (75% energy comes from coal and is half of NS's emissions) <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> ▪ A sustainable transportation strategy/reg. was proposed to regulate by 2010 fuel consumption and emissions standards for new vehicles in the 2009 Plan (Not accomplished yet) <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Electricity Act (2004) |

| | 1990 Total Emissions (Mt CO₂ eq.) | 2014 Total Emissions (Mt CO₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|-----------|---|---|-----------------------------|---|---|
| | | | | | <ul style="list-style-type: none"> ▪ Renewable Electricity Regulation (Reg. 65/2016) amended April 8, 2016: Energy supply must come from renewables: <ul style="list-style-type: none"> - 2015-2020: 25% - 2020+: 40% <p>LATEST PLANS</p> <ul style="list-style-type: none"> ▪ Toward a Greener Future. Nova Scotia's Climate Change Action Plan (2009) ▪ Municipal Climate Change Action Plan Guidebook. Canada-Nova Scotia Agreement on the Transfer of Federal Gas Tax Funds (2011) <p>SOURCES (Environment and Climate Change Canada, 2016j) (Province of Nova Scotia, 2013) (Province of Nova Scotia, 2009) (Province of Nova Scotia, 2016) (David Suzuki Foundation, 2012) (David Suzuki Foundation, 2012) (NEG/ECP, 2001) (Province of Nova Scotia, 2011)</p> |
| NT | - | 1.5 | - | <p>Stabilize to 1,500 Kt, 2005 levels by 2015, Limit to 66% (2,500 Kt) 2005 levels by 2020 Return to 1,500 Kt 2005 levels by 2030</p> | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Environmental Protection Act (1988) ▪ Asphalt Paving Industry Emission Regulations (1990): To limit (1) the emission of pollutant to 0.23 g of particulate matter per m³ of dry and undiluted exhaust gases, (2) an opacity of 20% <p>FUEL</p> <ul style="list-style-type: none"> ▪ Used Oil and Waste Fuel Management Regulations (in force Jan 1, 2004) <p>OTHER</p> <ul style="list-style-type: none"> ▪ Environmental Rights Act (1988) ▪ Spill Contingency Planning and Reporting Regulations (1988) <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Climate Change Strategic Framework (forthcoming) <p>SOURCES (Environment and Climate Change Canada, 2016j) (Northwest Territories, 2011) (Northwest Territories, 1990) (Northwest Territories, 1988) (Northwest Territories, 1988) (Northwest Territories, 1988) (Northwest Territories, 2004) (Environment and Climate Change Canada, 2016m)</p> |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|----|---|---|----------------------|---|---|
| NU | - | 0.3 | - | No target | <p>EMISSIONS</p> <ul style="list-style-type: none"> Environmental Protection Act (1988) <p>OTHER</p> <ul style="list-style-type: none"> Environmental Rights Act (1988) <p>LATEST PLANS</p> <ul style="list-style-type: none"> Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut (2011) Pan-Territorial Adaptation Strategy. Moving Forward on Climate Change Adaptation in Canada (2011) Nunavut Climate Change Strategy (2003) <p>SOURCES (Environment and Climate Change Canada, 2016j) (Government of Nunavut, 2003) (Northern Premiers' Forum, 2011) (Government of Nunavut, 2011) (Government of Nunavut, 1988)</p> |
| ON | 182 | 170 | -6 | 15% ↓1990 levels by 2020, 37% ↓1990 levels by 2030 & 80% ↓1990 levels by 2050 | <p>EMISSIONS</p> <ul style="list-style-type: none"> GHG Emissions Reporting Regulation (2009, Reg. 452/09, under the Env. Protection Act 1990, last amendment Reg. 398/15: Reporting): For facilities with emissions 10,000+ tonnes of CO₂ per year Environmental Protection Amendment Act (GHG Emissions Trading, 2009, Bill 185): To enable trading and other economic and financial instruments and market-based approaches. Bill 172, Climate Change Mitigation and Low-carbon Economy Act (2016) Reg. 143/16 Takes effect Jan. 1, 2017 to support the cap-and-trade program <p>COAL</p> <ul style="list-style-type: none"> Cessation of Coal Use – Atikokan, Lambton, Nanticoke and Thunder Bay Generating Stations Regulation (Reg. 496/07): Phased out coal-fired plants after Dec. 31, 2014 (Part VI.1, under Env. Protection Act, 1990, c. 25, 2015) <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> Ethanol in Gasoline Regulation (2005, Reg. 535/05, under the Env. Protection Act 1990, last amendment O. Reg. 76/07): No less than 5% |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|----|---|---|----------------------|--|--|
| | | | | | <ul style="list-style-type: none"> ▪ Greener Diesel – Renewable Fuel Content Requirements for Petroleum Diesel Fuel Regulation (2014, Reg. 97/2014, under the Env. Protection Act 1990): For diesel and blended diesel to contain biodiesel: <ul style="list-style-type: none"> - 2016: 3% - 2017+: 4% <p>ENERGY</p> <ul style="list-style-type: none"> ▪ Green Energy and Green Economy Act (2009, Bill 150): to enact the Green Energy Act, 2009 and to build a green economy, to repeal the Energy Conservation Leadership Act, 2006 and the Energy Efficiency Act and to amend other statutes ▪ Renewable Energy Approvals Regulation (2009, Reg. 359/09, under part V.0.1 of the Env. Protection Act 1990, last amendment Reg. 97, 2016) ▪ Energy Consumer Protection Act (2010, c. 8) ▪ Energy Conservation Responsibility Act (2006, Bill 21) <p>CAP AND TRADE</p> <ul style="list-style-type: none"> ▪ Took effect Jul. 1, 2016 for facilities generating 25,000+ GHGs per year <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Ontario’s Five Year Climate Change Action Plan 2016 - 2020 (2016) <p>SOURCES (Environment and Climate Change Canada, 2016j) (Government of Ontario, 2016c) (Government of Ontario, 2016d) (Government of Ontario, 2016b) (David Suzuki Foundation, 2012) (Government of Ontario, 2009a) (Government of Ontario, 2009c) (Government of Ontario, 2009b) (Government of Ontario, 2014) (Government of Ontario, 2005) (Government of Ontario, 2009d) (Government of Ontario, 2007) (Environment and Climate Change Canada, 2016n) (Government of Ontario, 2016a)</p> |
| QC | 89 | 83 | -7 | 20% ↓1990 levels by 2020 and 80-95% ↓1990 levels by 2050 | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Environment Quality Act (1972, chapter Q-2) ▪ Regulation Respecting Mandatory Reporting of Certain Emissions of Contaminants into the Atmosphere (2007, r.15 under the Env. Quality Act) ▪ Regulation Respecting halocarbons (2004, r. 29 under the Env. Quality Act): For the use, sells and distribution of CFCs. |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|-----------|---|---|----------------------|---|--|
| | | | | | <ul style="list-style-type: none"> The 2030 Energy Policy (2016) targets: Enhance energy by 15%, ↓40% consumed petroleum, eliminate thermal coal, ↑25% renewable energy output and ↑50% bioenergy production <p>COAL</p> <ul style="list-style-type: none"> Forthcoming coal legislation <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> Regulation respecting greenhouse gas emissions from motor vehicles (2009, r. 17 under the Environment Quality Act): Set maximum standards and fees for large, medium and small volume manufacturers Plan to work with the US tabling a zero-emission legislation <p>CAP AND TRADE</p> <ul style="list-style-type: none"> Regulation respecting a cap-and-trade system for greenhouse gas emission allowances (2011, r. 46.1 under the Q-2): Mandatory reporting for emitters ≥25,000 of CO₂, \$10.75 for the first year (2013), 5% increase + inflation each year until 2020 <p>LATEST PLAN</p> <ul style="list-style-type: none"> 2013-2020 Climate Change Action Plan. Quebec in Action. Greener by 2020. Phase 1 (2012) <p>SOURCES (Environment and Climate Change Canada, 2016j) (David Suzuki Foundation, 2012) (Gouvernement du Québec, 2011) (Gouvernement du Québec, 1972) (Gouvernement du Québec, 2009a) (Gouvernement du Québec, 2004) (Environment and Climate Change Canada, 2016o) (Gouvernement du Québec, 2009b) (NEG/ECP, 2001) (Gouvernement du Québec, 2012)</p> |
| PE | 2 | 1.8 | -8 | 10% ↓1990 levels by 2020 and regionally 75-85% ↓2001 levels by 2050 | <p>EMISSIONS</p> <ul style="list-style-type: none"> 2004 Renewable Energy Act <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> Hybrid tax incentive (2004) <p>ENERGY</p> |

| | 1990 Total Emissions (Mt CO ₂ eq.) | 2014 Total Emissions (Mt CO ₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|-----------|---|---|----------------------|--------------------------------------|--|
| | | | | | <ul style="list-style-type: none"> ▪ Least procurement mandate: minimum target for electric energy efficiency savings (Resol. 31-1, 2007 Conf. of New England Governors and Eastern Canadian Premiers) ▪ PEI Energy Strategy (2015, 2nd draft with focused targets in July 2016 pending public consultation in Sep and Oct 2016) <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Prince Edward Island and Climate Change. A Strategy for Reducing the Impacts of Global Warming (2008) <p>SOURCES (Environment and Climate Change Canada, 2016j) (Government of Prince Edward Island, 2016b) (Government of Prince Edward Island, 2015) (Government of Prince Edward Island, 2016a) (David Suzuki Foundation, 2012) (Prince Edward Island: Environment profile, 2016) (NEG/ECP, 2001)</p> |
| SK | 45 | 76 | 68 | 20% ↓2006 levels by 2020 | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Forthcoming by proclamation Bill 95 – The Management and Reduction of GHGs Act (2009) limits to be set <p>FUEL/TRANSPORTATION</p> <ul style="list-style-type: none"> ▪ Ethanol Fuel Act (2002): Distributors must blend with fuel: <ul style="list-style-type: none"> - Nov. 1, 2005 – Jan. 14, 2007: 1% ethanol - Jan. 15, 2007 – Dec. 31, 2007: 7.5% - Jan. 1, 2008: 7.5% - Starting April 1, 2015: At least 30% ethanol for the purpose of blending ethanol with unleaded automotive gasoline fuel. <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ None <p>SOURCES (Environment and Climate Change Canada, 2016j) (Government of Saskatchewan, 2009) (David Suzuki Foundation, 2012) (Government of Saskatchewan, 2002b)</p> |
| YK | 0.5 | 0.3 | -50 | Reduction of Government of Yukon's | <p>EMISSIONS</p> <ul style="list-style-type: none"> ▪ Environment Act (2002) ▪ Air Emissions Regulation (1988/207) |

| | 1990 Total Emissions (Mt CO₂ eq.) | 2014 Total Emissions (Mt CO₂ eq.) | Change (%) 1990-2014 | Emissions Target (% below ref. date) | Legislation/Status Update |
|--|---|---|-----------------------------|---|--|
| | | | | internal operations: 20% ↓2010 levels by 2015 and become carbon neutral by 2020 | <ul style="list-style-type: none"> ▪ Ozone Depleting Substances and Other Halocarbons Regulation (2000/127) <p>LATEST PLAN</p> <ul style="list-style-type: none"> ▪ Yukon Government Climate Change Action Plan (2015) <p>SOURCES (Environment and Climate Change Canada, 2016j) (Yukon Government, 2002) (Yukon Government, 1998) (Yukon Government, 2000) (Yukon Government, 2015)</p> |

Appendix B

Tiers of Concentration, Coding Sample

The following extract of course description was coded as Tier 1, based on the criteria that “climate change is the central focus for the entire semester”:

Over the past years, we have heard that climate change has the potential to impact our lives. This lecture will introduce the concept of Human Security and explore how climate change is currently impacting our world through the lens of human security. From increasing desertification, the associated challenges to macro livelihood diversification to the social costs of violent human conflict contributed to climate change will be introduced and explored. *Human Security and Climate Change (ALEC 6390), North Island College.*

The following extract was coded as Tier 2, where one module during the semester was dedicated to climate change:

ENVS 200 introduces students to the field of environmental studies and provides them with basic information about a variety of environmental issues, concepts, debates, events, and actors or thinkers. This survey course presents an overview of key concepts related to environmental analysis, such as resilience, carrying capacity, and environmental justice, as well as a range of topics related to contemporary environmental issues such as water, biodiversity, and ecological design. In particular, the course explores the principles of sustainable development and sustainability. Students are introduced to some of the complexity and debate regarding these concepts and are required to critically engage in applying the concepts. The course also introduces students to critical interdisciplinary analysis and provides opportunities to develop and refine such skills – Unit 4: Energy and Climate Change. *Introduction to Environmental Studies (ENVS 200), Athabasca University.*

The following course was coded as Tier 3 because climate change was mentioned in the course description but there is no further development of it on the course syllabus:

IR4702E is the capstone seminar for students in the international relations program. The purpose of the course is to integrate your studies in history and political science and to employ them to produce a final class report with the aim of shaping public policy. The theme of the course changes every year. In previous years, we have examined international development efforts, Canadian foreign policy, global climate change, as well as the conflicts in Afghanistan and the Democratic Republic of Congo, and Canada and the United Nations Security Council.” *International Relations in the Twentieth Century (IR 4702), University of Western Ontario.*

Appendix D

Table 8: Climate Change Education Streams (Categorized based on the field or discipline and the area of study)

| Stream | Field/Discipline | Identification Elements of an Area of Study/Topic |
|-----------------------|---|--|
| Scientific | Science | Climate Systems, Data, Inventories, Causes, Projections/Scenarios, Research, Monitoring, Biodiversity, Ecosystem, Biology, Biological, Ecology |
| Managerial | Planning & Technology | Scale: Local, regional, national or international level Sectors: Water, Agriculture, Health, Energy, Tourism, Urban or Rural, Planning, Transportation, Human, Biodiversity, Coastal Zones Area: Adaptation, Mitigation, Management, Financial, Economics, Resources, Legal, Knowledge base, Praxis, Energy use, Development, Capacity Building, Technology Transfer |
| Sociological | Environmental, Culture, Communications, Behaviour, Psychology | Sources of Information, Awareness, Language, Understanding Disagreement, Controversy, Value-centered, Beliefs, Cultural praxis, philosophy Ethics, Change, Attitude, Indifference, Chaos |
| Economics | Economics, Business | Cost and benefit analysis, Market, Neoliberalism Economic tools and mechanisms |
| Policy and Governance | Policy Studies | Policy, Political affiliation, Mobilization, Authority, Governance, Democracy |

Appendix E

Climate Change Education Streams, Coding Sample

Scientific (Technical)

This stream contains courses that focus on explaining the science behind climate change. This includes the study of climate systems, data, models, projections, scenarios, monitoring local and global climate systems, and the research associated with it. Examples of course extracts classified as technical include:

- The Earth's climate and the general circulation of the atmosphere. Climate models. Long-term stability of the Earth's climate. Anthropogenic impact on the climate, carbon dioxide, and other climate change issues. *Climate and Climate Change (ESSE 4160), York University.*
- Introduction to the ecology of lakes. The biological, chemical and physical properties of lakes are examined at lake and watershed levels. Theoretical and applied topics, including human impacts (e.g., eutrophication, climate change, ultraviolet radiation, contaminants, and angling) are examined. Laboratories and field trips provide training in limnological techniques. *Limnology (BIOL 412), University of Saskatchewan.*
- The course will explore current tools, data, and themes of global climate change through the lens of the scientific literature. The goal is to introduce students to the “science behind the stories” by exploring and critically evaluating the published scientific work that has led to current understanding of global climate change over a variety of time-scales. Major processes of change in the contemporary environment, their history and their interrelationships (climate and sea level change, changes in atmospheric composition, deforestation, desertification, water resource depletion, soil erosion, atmospheric and aquatic pollution); global biogeochemical cycles and their role in environmental change. *Global Change (EAS 457), University of Alberta.*

Managerial

This stream includes courses that propose strategies and “formulat[ing] appropriate responses.. to global climate change” (IPCC, 1990c, p. xxv). Two areas are clearly identified: adaptation and mitigation. Adaptation refers to the ability to adjust to the impacts produced by changes in the climate, while mitigation indicates the mechanisms to correct and minimize such impacts. In both cases, management strategies are part of the language, as well as vulnerability, scale (local, coastal, national, regional, global), the sector (water, agriculture, health, energy, tourism, urban, planning, transportation), the target group (humans, biodiversity, resources), or the solution (guiding principles/rules, management, financial, economics, legal, community-based, place-based, etc.). One common feature of this stream is the link between administrative actions and technological shifts, which has generated a large number of courses in “green technology”, “capacity building”, “energy efficiency”, etc. Some examples of courses classified as managerial are:

- This course covers strategic business management from the perspective of environmental sustainability. By bringing the sustainability theme into focus, the course equips students with the strategic concepts they will need to know about the hospitality industry and their respond to climate change, global warming, and energy availability. Timely, well-researched

and class-tested cases are used throughout. *Strategic Hospitality Management (HOSP 4730)*, *Vancouver Community College*.

- Examines the implications of climate change for agriculture, including its impacts on agricultural production, and the role of agriculture as both a producer of greenhouse gases and a potential mitigating agent in climate change. Emphasis is on climate and crop growth simulation modelling and scenarios for mitigation and adaptation. *Climate Change, Agriculture, and Food Security (SAFS 4650H)*, *Trent University*.
- This course examines the impacts of changing climate on natural and human systems and focuses on the capacity of societies to adjust to, plan for and cope with changing climate and environmental conditions. *Climate Change Vulnerability and Adaptation (GEMCC 602/ GEOG 676)*, *University of Waterloo*.

Environmental/Sociological

This stream refers to the social, cultural, philosophical and environmental practices associated with climate change, including understanding, coping, access to and sources of information, controversy, behaviour, historical or current events that have or continue defining climate change, morality, ethics, faith, and attitudes. This stream also draws questions of equity and equality and challenges lifestyles, (un)sustainable practices and value-centered ideologies. Examples of courses classified as sociological are:

- This course will introduce students to environmental philosophy by surveying some influential selections from the field, with a particular focus on the issues of climate change and geoengineering (using technology to intentionally manipulate the climate). The course will divide roughly into two parts. In the first part of the course, we will look at the variety of reasons philosophers have advanced for ascribing moral status to animals, organisms, and nature. During this part of the course we will read selections from Richard Routley, Peter Singer, Paul Taylor, and Aldo Leopold. In the second part of the course we will turn our focus to the environmental issue of climate change. We will begin with a review of some of the latest findings of the Intergovernmental Panel on Climate Change (IPCC). We will then turn to some philosophical analyses of the moral challenges raised by climate change. We will conclude this part of the course with an in- depth philosophical investigation of geoengineering. During this part of the course, we will read selections from Dale Jamieson, Andrew Light, Stephen Gardiner, as well as several selections from a new volume dealing with the ethics of geoengineering. *Environmental Philosophy (PHIL 2236Y)*, *University of Lethbridge*
- Ecological concerns have begun to permeate our collective consciousness. Rapid species extinction, poisoned air, forest clear-cutting, ozone depletion, global climate change, "climate justice" and the impact of climate "chaos" on vulnerable communities, all weigh heavily on our personal, intellectual, and spiritual lives. Christian communities are increasingly realizing that their faith and outreach must somehow speak to our present ecological crisis if they are to remain vital, and if they are to remain responsible, faithful, and relevant amidst these profound threats to the flourishing of creation.

This course examines how religious and spiritual concerns interface with contemporary environmental issues. While introducing students to concerns and debates in environmental ethics and ecological theology, the course pays particular attention to the challenges posed within a Canadian post-industrial context such as Hamilton, Ontario. In recent years, a growing social and ecological awareness have been emerging in Hamilton, with A Rocha

recently opening a ministry there, urban agriculture groups (e.g. Victory Gardens) sprouting up, and church involvement in the True City movement. This course proposes to interface with such groups, including guest presentations from these organizations as well as site visits. Through such interaction, as well as readings, films, class discussions, and course assignments, a variety of Christian responses to our present ecological and social challenges will be probed, including biblical and theological notions of stewardship and creation care. As well Christian approaches to environmental racism, urban and community supported agriculture, and the nexus between the option for the poor and the option for the earth will be addressed. *Creation Care in the City (WYT 3671 HF)*, Toronto School of Theology (UofT), Wycliffe College

- An opportunity for critical engagement with climate change as physical transformation, cultural object, and incitement to social transformation. This interdisciplinary course approaches climate change as complex phenomena that are co-constituted by social and natural worlds. The course will introduce students to a variety of lenses, knowledge networks, culturally constructed narratives and social justice issues that will help them understand why responding to climate change is challenging but also opens up opportunities for change. *Climate Change as Challenge and Opportunity for Social Transformation (HDCC 300)*, University of Victoria.

Economics

This stream is highly tied to the managerial stream in the sense that many of the administrative strategies convey a “financial responsibility”. The language of the course content is characterized by the primary goal of transitioning to a cleaner, most effective green economy, but also at a low cost. This stream illustrates how local, regional, national or global markets perform, and the procedures and implications for the use of economic mechanisms and tools for transitioning efforts, the commodification of resources, marketing and markets, accounting and being accountable. Examples of courses classified as “economics” are:

- Designed for students with little or no prior background in economics, this course surveys the applications of economic concepts and methodologies in the analyses of contemporary social issues such as poverty, global warming, crime, discrimination, taxation and free trade. *The Economics of Social Issues (ECON 335-3-3)*, Okanagan College.
- How do you decide whether or not to go to university? Why does the price of pizza change so much less than the price of oil? What will better help prevent climate change: a carbon tax, or a cap-and-trade system? Microeconomic analysis, which considers the behaviour of individuals and businesses, can answer questions like these. *Principles of Microeconomics (ECON 1101.03)*, Dalhousie University/Dalhousie Agricultural Campus of Dalhousie University.
- The course focuses on the economic implications of, and problems posed by, predictions of global warming due to anthropogenic emissions of greenhouse gases. Attention is given to economic policies such as carbon taxes and tradeable emission permits and to the problems of displacing fossil fuels with new energy technologies. *Economics of Climate Change (ECON 347)*, McGill University.

Policy and Governance

Policies, regulations, and policy-makers provide the foundation for the context and content of the courses. This stream is concerned with governance, authority, democracy, organizational structures, and public opinion at the local, regional, national, international and global levels. Examples of courses classified within the politics stream are:

- This course provides an in-depth examination of the development and implementation of climate change policy at the international, national and sub-national level. Particular emphasis is on the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and other key bilateral/multilateral agreements on mitigation and adaptation relevant to Canada and its major trading partners. Emergent topics related to climate governance, negotiations, and litigation will also be explored. *Climate Policy, Law and Institutions (GEMCC 640/GEOG 678)*, University of Waterloo.
- Policy process and parliamentary government, federalism and multilevel governance, bureaucracy and public service, charter and rights-based litigation, interest groups and collective action, mechanisms for interest group consultation and input, policy instruments, environmental law, international law, and climate change. *Law, Public Policy, and Governance (ENPP 501)*, University of British Columbia.
- This course provides an in-depth review of Canadian law and policy relating to environmental protection and management. In particular, the course describes the laws governing a variety of topics related to the environment, including constitutional responsibilities, federal and provincial environmental legislation, water law, parks and protected areas, wildlife and fisheries management, species at risk, and international law including climate change. *Advanced Issues in Environmental Law and Policy (ENVR 4650)*, University of Manitoba.

In order to quantify this analysis, I developed a measuring system and gave a weight value to each stream. The content of each course was carefully revised. If the course was dedicated to teach one stream only it was given a value of 1. If a course proposed to teach about two or more streams, 1 was divided accordingly ($S = 1/(S_x + S_y..)$) and an approximate weight was given to each stream (See Table 9, p. 243, for examples of courses with multiple streams).

Appendix F

Table 9: Sample of coding when a climate change course fit in two or more streams.

| PSI's Name | Course Code | Course Title | Course Description | Streams | | | | |
|---------------------------------|-----------------|-------------------------------------|--|-----------|------------|--------------|----------------------|----------|
| | | | | Technical | Managerial | Sociological | Economics & Business | Politics |
| University of the Fraser Valley | GEOG 307 | Urban Climatology | This course explores the climatic effects of urbanization with a focus on the collection and analysis of urban climate data. Human-weather interaction in the urban setting and potential mitigation techniques of negative impacts are also examined. | 0.5 | 0.5 | 0 | 0 | 0 |
| Kwantlen Polytechnic University | POST/POLI 4110 | Advanced Applied Policy Seminar | Students will study applications of policy, with a focus on sustainability, under the guidance of a practitioner. They will examine complex real-life situations and case studies, such as impacts of policy decisions on climate change mitigation, energy efficiency, subsidized housing, green space conservation, and others. They will study how concepts of ethics, governance, and economics, as well as the psychology of public behaviour, are integrated into policy decision-making for sustainability. They will work in groups on a specific project, liaise with community stakeholders, and make recommendations for action in a formal presentation to stakeholders. | 0 | 0.25 | 0.25 | 0.25 | 0.25 |
| Trent University | BIOL-ERSC 4330H | Global Change of Aquatic Ecosystems | Emphasizes the causes and consequences of global environmental change and their interactions with ecological processes in freshwater ecosystems. Issues such as biodiversity, population growth and water use, global warming, land use, emergent diseases, dams, aquaculture, fisheries, water supply, and sustainability will be discussed. | 0.75 | 0.25 | 0 | 0 | 0 |

Appendix G

Table 10: List of Faculties and Departments that offered climate change courses during the calendar year of 2014-2015. Classified by clusters (A: Arts; B: Business; GS: Graduate Studies; H&SC: Humanities & Social Sciences; L: Law; S&T: Science & Technology; O: Other)

| Name | Faculty | Department | Cluster |
|---|----------------|-------------------|----------------|
| Accounting | | x | H&SS |
| Advanced Technology | x | x | S&T |
| Agriculture | x | x | S&T |
| Anthropology | | x | H&SS |
| Applied Arts | x | | A |
| Applied Biology | | x | S&T |
| Applied Science and Engineering Technology | x | | S&T |
| Applied Sciences | x | x | S&T |
| Arts (including University Studies) | x | | A |
| Arts & Education | | x | A |
| Arts & Science | x | x | A; S&T |
| Arts & Social Sciences | x | | A; H&SS |
| Biological & Environmental Sciences | | x | S&T |
| Biological Sciences | | x | S&T |
| Biology | | x | S&T |
| Biotechnology | | x | S&T |
| Business | x | | B |
| Business & Economics | x | | B |
| Business and Sustainability | | x | B; H&SS |
| Canadian Studies | | x | H&SS |
| Centre for Interdisciplinary Studies | | x | O |
| Centre for the Built Environment and Civil Engineering Technology | | x | S&T |
| Chemical Engineering | | x | S&T |
| Chemistry | | x | S&T |
| Chemistry and Environmental Studies | | x | H&SS; S&T |
| Civil and Environmental Engineering | | x | S&T |
| Classics & Religion | | x | H&SS |
| Clean Energy Engineering | | x | S&T |
| Commerce | | x | H&SS |
| Commerce and Business Administration | x | | B |
| Community Services | | x | O |
| Conflict Studies | | x | H&SS |

| | | | |
|---|---|---|-----------|
| Continuing and Professional Studies | x | x | O |
| Continuing Education | | x | O |
| Criminology | | x | H&SS |
| Earth and Environmental Science | | x | S&T |
| Earth Sciences | | x | S&T |
| Earth, Ocean & Atmospheric Sciences | | x | S&T |
| Earth, Space & Science Engineering | | x | S&T |
| Economics | | x | H&SS |
| Economics and Business Economics | | x | H&SS |
| Economics and Political Science | | x | H&SS |
| Education | x | | H&SS |
| Education and Aboriginal Education | | x | H&SS |
| Electrical Engineering | | x | S&T |
| Emergency Management Division | | x | H&SS |
| Energy Systems Engineering Technology | | x | S&T |
| Engineering | x | | S&T |
| Engineering | | x | S&T |
| Engineering and Architecture | x | | H&SS; S&T |
| Engineering and Design | x | | S&T |
| Engineering and Public Policy | | x | S&T |
| Engineering Science | | x | S&T |
| Enterprise and Development | | x | H&SS |
| Environment | x | | H&SS |
| Environment & Sustainability | x | x | H&SS |
| Environment and Resource Management | | x | H&SS |
| Environmental Design | x | | H&SS |
| Environmental Engineering | | x | S&T |
| Environmental Law | | x | H&SS |
| Environmental Sciences | | x | S&T |
| Environmental Studies | x | x | H&SS |
| Extension | x | | O |
| Food, Agricultural and Resource Economics | | x | H&SS; S&T |
| Forestry | | x | S&T |
| Gender Equality and Social Justice | | x | H&SS |
| General Education | x | x | O |
| Geography | | x | H&SS |
| Geography & the Environment | | x | H&SS |
| Geography and Environmental Management | | x | H&SS |
| Geography and Environmental Studies | | x | H&SS |
| Geography and Planning | | x | H&SS |
| Geology | | x | S&T |

| | | | |
|---|---|---|------|
| Geoscience | | x | H&SS |
| Germanic and Slavic Studies | | x | H&SS |
| Global and International Studies | | x | O |
| Global Development Studies | | x | H&SS |
| Global Governance | | x | H&SS |
| Global Health Economics | | x | H&SS |
| Graduate Studies | x | | GS |
| Health & Behavioural Sciences | x | | S&T |
| Health and Human Services | | x | S&T |
| Health Science | | x | S&T |
| Health Sciences | x | | S&T |
| History | | x | H&SS |
| Horticulture | | x | S&T |
| Hospitality | | x | O |
| Human and Community Services | | x | H&SS |
| Human Health Science | | x | S&T |
| Humanities & Social Sciences | x | | H&SS |
| Humanities and Social Sciences | x | | H&SS |
| Indigenous Studies | | x | H&SS |
| Interdisciplinary Studies | | x | O |
| International Development and Globalization | | x | H&SS |
| International Studies | x | x | H&SS |
| Land and Food Systems | x | | S&T |
| Language, Literature & Performing Arts | x | | A |
| Law | x | | L |
| Liberal Arts & Professional Studies | x | | A |
| Life Sciences | | x | S&T |
| Management | x | | H&SS |
| Marketing | | x | H&SS |
| Mathematics | | x | S&T |
| Mathematics and Science | x | | S&T |
| Mechanical and Aerospace Engineering | | x | S&T |
| Mechanical and Materials Engineering | | x | S&T |
| Mechanical and Mechatronics Engineering | | x | S&T |
| Natural Environment and Outdoor Studies | | x | S&T |
| Natural Resources Conservation | | x | S&T |
| Natural Resources Management | x | | S&T |
| Natural Sciences | | x | S&T |
| Northern Studies | | x | H&SS |
| Open Learning | x | | O |
| Peace and Conflict | | x | H&SS |

| | | | |
|---|---|---|-----------|
| Philosophy | | x | H&SS |
| Physical & Environmental Sciences | | x | S&T |
| Physics, Astronomy & Engineering | | x | S&T |
| Planning | | x | H&SS |
| Policy Studies | | x | H&SS |
| Political Science | | x | H&SS |
| Politics and Public Administration | | x | H&SS |
| Psychology | | x | H&SS |
| Public Affairs | x | | H&SS |
| Public and International Affairs | | x | H&SS |
| Public Ethics | | x | H&SS |
| Recreation | | x | O |
| Resources, Environment & Sustainability | | x | S&T |
| School of Environment | | x | H&SS |
| School of Public Safety | | x | H&SS |
| Science | x | x | S&T |
| Science (University Studies) | x | | S&T |
| Science & Management | | x | S&T |
| Science & Technology | x | | S&T |
| Science and Environmental Studies | x | | H&SS; S&T |
| Science and Horticulture | x | | S&T |
| Social and Applied Human Sciences | x | | H&SS |
| Social Sciences | x | | H&SS |
| Sociology | | x | H&SS |
| Sustainability Science and Society | | x | H&SS; S&T |
| Sustainable Communities | | x | H&SS |
| Systems Design Engineering | | x | S&T |
| Theology | x | x | H&SS |
| Theology and Ecology | | x | H&SS |
| Tourism Policy and Planning | | x | H&SS |
| Trades and Technology | | x | O |

Appendix H

Table 11: List of all Post-Secondary Educational Institutions (PSIs) included in this study (n=225).

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|----------|----------------------------------|--|------------------|
| AB | 1 | University of Alberta | 15 |
| AB | 1 | University of Calgary | 14 |
| AB | 1 | Athabasca University | 6 |
| AB | 1 | University of Lethbridge | 5 |
| AB | 1 | Grant MacEwan University | 5 |
| AB | 1 | Mount Royal University | 4 |
| AB | 2 | King's University College Edmonton | 4 |
| AB | 2 | Lakeland College | 4 |
| AB | 2 | St. Mary's University College | 3 |
| AB | 2 | Red Deer College | 2 |
| AB | 2 | Northern Lakes College | 2 |
| AB | 2 | Grande Prairie Regional College | 2 |
| AB | 2 | Concordia University College of Alberta | 2 |
| AB | 2 | Northern Alberta Institute of Technology | 2 |
| AB | 2 | Lethbridge College | 1 |
| AB | 2 | Vanguard College | 0 |
| AB | 2 | Taylor College and Seminary | 0 |
| AB | 2 | Southern Alberta Institute of Technology | 0 |
| AB | 2 | Rocky Mountain College | 0 |
| AB | 2 | Robertson College | 0 |
| AB | 2 | Reeves College | 0 |
| AB | 2 | Red Crow Community College | 0 |
| AB | 2 | Prairie Bible Institute | 0 |
| AB | 2 | Portage College | 0 |
| AB | 2 | Peace River Bible Institute | 0 |
| AB | 2 | Olds College | 0 |
| AB | 2 | NorQuest College | 0 |
| AB | 2 | Medicine Hat College | 0 |
| AB | 2 | Keyano College | 0 |
| AB | 2 | Evergreen College | 0 |
| AB | 2 | CDI College | 0 |
| AB | 2 | Canadian University College | 0 |
| AB | 2 | Canadian Southern Baptist Seminary and College | 0 |

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|-----------------|---|---|-------------------------|
| AB | 2 | Burman University | 0 |
| AB | 2 | Bow Valley College | 0 |
| AB | 2 | Augustana University College | 0 |
| AB | 2 | Ambrose University College | 0 |
| AB | 2 | Alberta College of Art and Design | 0 |
| AB | 2 | Alberta Bible College | 0 |
| AB | 2 | ABM College of Health and Technology | 0 |
| BC | 1 | University of British Columbia | 20 |
| BC | 1 | University of Victoria | 20 |
| BC | 1 | University of Northern British Columbia | 20 |
| BC | 1 | University of the Fraser Valley | 19 |
| BC | 1 | Quest University | 11 |
| BC | 1 | Vancouver Island University | 10 |
| BC | 1 | Simon Fraser University | 10 |
| BC | 1 | Thompson Rivers University | 7 |
| BC | 1 | Kwantlen Polytechnic University | 6 |
| BC | 1 | Royal Roads University | 2 |
| BC | 1 | Trinity Western University | 2 |
| BC | 1 | University Canada West | 1 |
| BC | 1 | Capilano University | 0 |
| BC | 1 | Emily Carr University of Art and Design | 0 |
| BC | 1 | Fairleigh Dickinson University | 0 |
| BC | 2 | Douglas College | 20 |
| BC | 2 | Okanagan College | 7 |
| BC | 2 | Camosun College | 5 |
| BC | 2 | Langara College | 4 |
| BC | 2 | North Island College | 3 |
| BC | 2 | Alexander College | 2 |
| BC | 2 | Justice Institute of British Columbia | 1 |
| BC | 2 | Vancouver Community College | 1 |
| BC | 2 | College of the Rockies | 1 |
| BC | 2 | Selkirk College | 1 |
| BC | 2 | Ashton College | 0 |
| BC | 2 | Brighton College | 0 |
| BC | 2 | Canadian College | 0 |
| BC | 2 | College of New Caledonia | 0 |
| BC | 2 | Columbia College | 0 |
| BC | 2 | Eton College | 0 |
| BC | 2 | MTI Community College | 0 |
| BC | 2 | Native Education College | 0 |

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|----------|----------------------------------|---|------------------|
| BC | 2 | Nicola Valley Institute of Technology | 0 |
| BC | 2 | Northern Lights College | 0 |
| BC | 2 | Northwest Community College | 0 |
| BC | 2 | Pera College | 0 |
| BC | 2 | Sprott Shaw College | 0 |
| BC | 2 | Vancouver Central College | 0 |
| BC | 2 | Vancouver Institute of Media Arts | 0 |
| BC | 2 | VCAD Vancouver College of Art and Design | 0 |
| MB | 1 | University of Winnipeg | 15 |
| MB | 1 | University of Manitoba | 8 |
| MB | 1 | Brandon University | 5 |
| MB | 1 | University College of the North | 3 |
| MB | 1 | Canadian Mennonite University | 1 |
| MB | 1 | Booth University College | 0 |
| MB | 2 | Red River College | 1 |
| MB | 2 | Assiniboine Community College | 0 |
| MB | 2 | Herzing College | 0 |
| MB | 2 | Robertson College | 0 |
| MB | 2 | Winnipeg Technical College | 0 |
| NB | 1 | University of New Brunswick | 14 |
| NB | 1 | Mount Allison University | 3 |
| NB | 1 | St. Thomas University | 1 |
| NB | 1 | Crandall University | 0 |
| NB | 1 | Kingswood University | 0 |
| NB | 1 | St. Stephens's University | 0 |
| NB | 1 | University of Fredericton | 0 |
| NB | 1 | Yorkville University | 0 |
| NB | 2 | Maritime College of Forest Technology | 0 |
| NB | 2 | New Brunswick Bible Institute | 0 |
| NB | 2 | New Brunswick College of Craft and Design | 0 |
| NB | 2 | New Brunswick Community College (NBCC) | 0 |
| NL | 1 | Memorial University of Newfoundland | 5 |
| NL | 2 | Marine Institute | 3 |
| NL | 2 | Academy Canada | 0 |
| NL | 2 | Centre for Nursing Studies | 0 |
| NL | 2 | College of the North Atlantic (CNA) | 0 |
| NS | 1 | Dalhousie University | 29 |
| NS | 1 | Acadia University | 11 |
| NS | 1 | Saint Mary's University | 5 |
| NS | 1 | Cape Breton University | 4 |

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|-----------------|---|--|-------------------------|
| NS | 1 | Mount Saint Vincent University | 1 |
| NS | 1 | Atlantic School of Theology | 0 |
| NS | 1 | Nova Scotia College of Art and Design (NSCAD University) | 0 |
| NS | 1 | St. Francis Xavier University | 0 |
| NS | 1 | University of King's College | 0 |
| NS | 2 | Nova Scotia Community College (NSCC) | 1 |
| NS | 2 | Canadian Coast Guard College | 0 |
| NS | 2 | Gaelic College | 0 |
| NS | 2 | Kingston Bible College | 0 |
| NS | 2 | Mactech Distance Education | 0 |
| NS | 2 | McKenzie College | 0 |
| NT | 2 | Aurora College | 2 |
| NU | 2 | Nunavut Arctic College | 3 |
| ON | 1 | University of Waterloo | 51 |
| ON | 1 | York University | 45 |
| ON | 1 | University of Toronto | 35 |
| ON | 1 | Lakehead University | 22 |
| ON | 1 | University of Ottawa | 20 |
| ON | 1 | Queen's University | 19 |
| ON | 1 | Trent University | 18 |
| ON | 1 | University of Western Ontario | 18 |
| ON | 1 | University of Guelph | 15 |
| ON | 1 | Brock University | 14 |
| ON | 1 | Wilfrid Laurier University | 13 |
| ON | 1 | University of Windsor | 12 |
| ON | 1 | Nipissing University | 11 |
| ON | 1 | Carleton University | 10 |
| ON | 1 | McMaster University | 10 |
| ON | 1 | Ryerson University | 9 |
| ON | 1 | Algoma University | 6 |
| ON | 1 | Laurentian University | 6 |
| ON | 1 | University of Ontario Institute of Technology | 6 |
| ON | 1 | St. Paul University | 4 |
| ON | 1 | University of Sudbury | 3 |
| ON | 1 | Redeemer University College | 1 |
| ON | 1 | Tyndale University College | 1 |
| ON | 1 | Dominican University College | 0 |
| ON | 1 | Michener Institute for Applied Health Sciences | 0 |
| ON | 1 | OCAD University | 0 |

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|-----------------|---|---|-------------------------|
| ON | 1 | St. Jerome's University | 0 |
| ON | 1 | Victoria University | 0 |
| ON | 2 | Algonquin College of Applied Arts and Technology | 8 |
| ON | 2 | Seneca College of Applied Arts and Technology | 6 |
| ON | 2 | Niagara College of Applied Arts and Technology | 5 |
| ON | 2 | Durham College of Applied Arts and Technology | 5 |
| ON | 2 | Sault College of Applied Arts and Technology | 4 |
| ON | 2 | University of St. Michael's College | 4 |
| ON | 2 | Humber College Institute of Technology and Advanced Learning | 4 |
| ON | 2 | Centennial College | 3 |
| ON | 2 | Fleming College | 3 |
| ON | 2 | Sheridan College Institute of Technology and Advanced Learning | 3 |
| ON | 2 | George Brown College of Applied Arts and Technology | 3 |
| ON | 2 | Cambrian College of Applied Arts and Technology | 1 |
| ON | 2 | Fanshawe College of Applied Arts and Technology | 1 |
| ON | 2 | Toronto School of Theology (UofT), Wycliffe College | 1 |
| ON | 2 | Loyalist College of Applied Arts and Technology | 1 |
| ON | 2 | Georgian College of Applied Arts and Technology | 1 |
| ON | 2 | St. Clair College of Applied Arts and Technology | 1 |
| ON | 2 | Academy of Learning College | 0 |
| ON | 2 | Bonnie Gordon College | 0 |
| ON | 2 | Canadore College of Applied Arts and Technology | 0 |
| ON | 2 | Conestoga College Institute of Technology and Advanced Learning | 0 |
| ON | 2 | Confederation College of Applied Arts and Technology | 0 |
| ON | 2 | Huron University College | 0 |

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|----------|----------------------------------|---|------------------|
| ON | 2 | King's University College London | 0 |
| ON | 2 | Lambton College of Applied Arts and Technology | 0 |
| ON | 2 | Mohawk College of Applied Arts and Technology | 0 |
| ON | 2 | Northern College of Applied Arts and Technology | 0 |
| ON | 2 | Royal Military College of Canada | 0 |
| ON | 2 | St. Lawrence College of Applied Arts and Technology | 0 |
| ON | 2 | University of Trinity College | 0 |
| ON | 2 | Westervelt College | 0 |
| PE | 1 | University of Prince Edward Island | 6 |
| PE | 2 | Holland College | 0 |
| PE | 2 | Maritime Christian College | 0 |
| QC | 1 | McGill University | 19 |
| QC | 1 | Concordia University | 14 |
| QC | 1 | Bishop's University | 4 |
| QC | 2 | Centennial College | 0 |
| QC | 2 | Champlain Regional College | 0 |
| QC | 2 | Dawson College | 0 |
| QC | 2 | Heritage College | 0 |
| QC | 2 | LaSalle College (Montreal) | 0 |
| QC | 2 | Marianopolis College (Montreal) | 0 |
| QC | 2 | National Circus School (Montreal) | 0 |
| QC | 2 | O'Sullivan College of Montreal (Montreal) | 0 |
| QC | 2 | Recording Arts Canada (Montreal) | 0 |
| QC | 2 | TAV College (Montreal) | 0 |
| QC | 2 | Trebas Institute (Montreal) | 0 |
| QC | 2 | Vanier College | 0 |
| SK | 1 | University of Regina | 13 |
| SK | 1 | University of Saskatchewan | 10 |
| SK | 1 | First Nations University of Canada | 0 |
| SK | 2 | Briercrest College and Seminary | 2 |
| SK | 2 | Bethany College | 0 |
| SK | 2 | Carlton Trail Regional College | 0 |
| SK | 2 | Cumberland College | 0 |
| SK | 2 | Eston College | 0 |
| SK | 2 | Great Plains College | 0 |
| SK | 2 | Horizon College and Seminary | 0 |

| Province | TYPE (1: University; 2: College) | PSI Name | Total CC Courses |
|-----------------|---|--|-------------------------|
| SK | 2 | Nipawin Bible College | 0 |
| SK | 2 | North West Regional College | 0 |
| SK | 2 | Northlands College | 0 |
| SK | 2 | Parkland College | 0 |
| SK | 2 | Saint Thomas More College | 0 |
| SK | 2 | Saskatchewan Indian Institute of Technologies | 0 |
| SK | 2 | Saskatchewan Institute of Applied Science and Technology | 0 |
| SK | 2 | Saskatchewan Polytechnic | 0 |
| SK | 2 | Southeast Regional College | 0 |
| SK | 2 | St. Peter's College | 0 |
| SK | 2 | Western Academy Broadcasting College | 0 |
| YK | 2 | Yukon College | 9 |

Appendix I

Guide to Interview Questions

General

1. Do you think that the number of climate change courses is limited in higher education? Why?
2. What features do you think might influence the number of courses, and the content of these courses?

Process (Course/Program)

3. How do your courses connect with climate change? What do you include? Not include? What factors influence this?
4. Was it an existing course?
5. Whose idea was to create this course/program?
6. How was it organized? Who led the process and why?
7. How did it get approved?
8. Where there any challenges or constraints during the process? If any, what was it done to overcome these challenges?
9. How did the committee decide on the direction of the program and scope of the courses?
10. When developing the objectives of the program was the idea to bring new professors into the university or to use the existing ones?
11. Was the development of this course/program influenced by any institutional policies? Which ones?
12. What are the expectations of the course/program?
13. Students have the possibility to select from a number of elective courses, what are the most popular? The least popular? And why?
14. How has the enrolment been?
15. How do courses get allocated to the faculty?
16. How has the course/program changed since it was established?

Departmental/Faculty

17. How has your department/faculty grappled with climate change at the undergraduate/ graduate level?
18. Has it been a topic of curriculum conversation during the annual faculty meetings? When? How?
19. What sort of factors influence climate change curriculum in your department? What is a desirable balance?
20. Do you think that your department/faculty has been influential in moving the climate change conversations forward at this PSI? How? How not?
21. Are there any discernable recruitment trends in the faculty? Has recruitment been influenced by central university policies?
22. How does the faculty decide on the direction and scope of the courses?
23. How did/does the department make decisions regarding which courses/topics are more desirable and less desirable?

24. What is the process of curriculum formation in this PSI?

Institutional

25. Who/ what do you think are the main drivers of the climate change conversations within the university?
26. Can you identify a person/group (other than yourself) that has advocated for climate change within the university?
27. Do you think that there are groups that are misrepresented in the climate change conversations at this PSI?
28. What do you see as one of the biggest accomplishment this university has had on climate change?

Final

29. Are there other thoughts on this program that you may think are important to my study?

Appendix J

Table 12: HDCC List of Courses (Core and electives) (University of Victoria, 2016a)

| Core Courses | Electives |
|--|---|
| <ul style="list-style-type: none"> • HDCC 200: Introduction to Human Dimensions of Climate Change • HDCC 300: Climate Change as Challenge and Opportunity for Social Transformation • HDCC 400: Seminar on Human Dimensions of Climate Change | <ul style="list-style-type: none"> • ANTH 302: Globalization, Health and the Environment • COM 362: Business and Sustainability • ECON 381: Environmental Economics • ECON 382: Natural Resource Economics • ECON 383: Climate Economics • ENGL 478: Special Studies in Literature and Environment • EOS 110: Oceans and Atmosphere • EOS 365: Climate and Society • ES 240 Ecological processes • ES 301: Political Ecology • ES 321: Ethnoecology • ES 365: Climate and Society • ES 402: Global Issues in Sustainability • ES 405: Climate, Energy Politics • ES 443: Climate Change and Biodiversity • GEOG 101A: Environment, Society and Sustainability • GEOG 103: Introduction to Physical Geography • GEOG 314: Global Environment Change and Human Response • GEOG 373: Applied Climatology • HSTR 325: Environmental History of British Columbia • LAW 328: Green Legal Theory • LAW 329: Environmental Law • PHIL 333: Philosophy and Environment • POLI 357: Canadian Environmental Politics • POLI 365 British Columbia Political Economy • POLI 458: Seminar in Environmental Politics • PSYC 325: Environmental Psychology • PSYC 425: Advanced Environmental Psychology • SOCI 391: Environmental Sociology Field School • SOCI 465: Environmental Sociology • WS 206: Globalization and Resistance • WS 316: Gender and International Development • WS 319: Topics in Economies, State and Global Issues |

Appendix K

Table 13: Master of Environmental Science Program (Climate Change Impact Assessment) and PhD (Climate Change and Environment) (University of Toronto, 2016b, pp. 466-467).

| | |
|--|--|
| <p>Core Courses Master</p> <ul style="list-style-type: none"> • EES 1100H: Advanced Seminar in Environmental Science • EES 1117H: Climate Change Impact Assessment • EES 1131H: Applied Climatology • EES 1132H: Climate Data Analysis • EES 1133H Climate Change Science and Modelling • EES 1134H Climate Change Policy <p>Mandatory Course PhD</p> <ul style="list-style-type: none"> • EES 2200H: Advanced Seminar in Environmental Science | <p>Elective Courses</p> <ul style="list-style-type: none"> • EES 1102H: Analytical Chemistry for Geoscientists • EES 1103H: Air and Water Quality Sampling and Monitoring • EES 1104H: Microorganisms and the Environment • EES 1105H: Soil Contamination Chemistry • EES 1106H: Environmental Challenges in Urban Areas • EES 1107H: Remediation Methods • EES 1109H: Advanced Techniques in Geographic Information Systems • EES 1110H: Sediment and Contaminant Transport in Aquatic Systems • EES 1111H: Freshwater Ecology and Biomonitoring • EES 1112H: Boundary Layer Climates and Contaminant Fate • EES 1113H: Groundwater Hydrochemistry and Contaminant Transport • EES 1117H: Climate Change Impact Assessment • EES 1118H: Fundamentals of Ecological Modelling • EES 1119H: Quantitative Environmental Analysis • EES 1120H: Fluid Dynamics of Contaminant Transport • EES 1121H: Modeling the Fate of Organic Chemicals in the Environment • EES 1122H: Global Environmental Security and Sustainable Development • EES 1126H: Environmental Tracers • EES 1127H: Geomicrobiology and Biogeochemistry • EES 1128H: Biophysical Interactions in Managed Environments • EES 1131H: Applied Climatology • EES 1132H: Climate Data Analysis • EES 1133H: Climate Change Science and Modelling • EES 1134H: Climate Change Policy • EES 1135H: Environmental Change and Human Health • EES 2201H: Advanced Readings in Environmental Science • EES 3000H: Applied Conservation Biology • EES 3001H: Professional Scientific Literacy • EES 3002H: Conservation Policy • EES 3003H: Topics in Applied Biodiversity • EES 3111H: Conservation Genetics • EES 3113H: Topics in Population and Community Ecology • EES 3114H: Topics in Urban and Rural Ecology |
|--|--|

Appendix L

Table 14: Certificate in Sustainable Energy, Bachelor in Environmental Studies, Honours Degree (FES, 2016, p. 41).

| Core Courses | Elective Courses |
|--|---|
| <ul style="list-style-type: none"> • ENVS 3130: Energy and the Environment in Canada • ENVS 3400: Introduction to Climate Change Science and Policy • ENVS 3505: Business and Sustainability • ENVS 3510: Environmental Economics • ENVS 4400: Fundamentals of Renewable Energy: Theory, Policy and Practice • ENVS 4401: Fundamentals of Energy Efficiency: Theory, Policy and Practice in the Canadian Context | <ul style="list-style-type: none"> • ENVS 3125: Popular Education for Environmental and Social Justice • ENVS 3140: Environmental and Sustainability Education • ENVS 3151: Environmental Politics and Advocacy I • ENVS 3340: Global Environmental Politics • ENVS 3410: Environmental Policy I • ENVS 3420: Environmental Law • ENVS 3430: Environmental Assessment • ENVS 3440: Resource Management • ENVS 3520: Applications of Geographic Information Systems in Environmental Studies • ENVS 4230: Design for Sustainability in the Built Environment • ENVS 4320: Gender & Development • ENVS 4402: Climate Change Mitigation • ENVS 4430: Impact Assessment • ENVS 4440: Environmental Disasters • ENVS 4510: Ecological Economics • ENVS 4520: Geographical Information Systems Applications in Environmental Studies • ENVS 4523: Systems Thinking |