Climate Change and Glacial Recession in Canada

Amy Bell, Naomi Duska, Genevieve Tiede, Giselle Tiede

William Aberhart High School, Canada, RCMacdonald@cbe.ab.ca , CEFehres@cbe.ab.ca

Abstract

The purpose of this qualitative research is to explore climate change in Canada and its effects on glacial recession. This study intends to determine the causes of glacial recession and the impacts of climate change on glaciers in Canada. The second purpose of this research is to investigate the level of education of the participants, concerning the issue of glacial recession in Canada and its impact on climate change. Thus, the researchers conducted a study to determine whether or not the participants understood and were concerned about glacial recession in Canada.

This research investigates the Peyto Glacier located on the Wapta Icefield, in the Canadian Rocky Mountains in Banff National Park, Alberta. The Peyto Glacier, which has been researched extensively, has extreme melts season to season and has lost 70% of its mass since it was first researched in 1896 (Wallace, 1995). The Peyto Glacier is representative of many other glaciers in the Canadian Rocky Mountains, and, therefore provides a model of projected glacial recession in Canada (Glacier Mass Balance, 2008).

The research illustrates that glacial recession is an increasingly important issue in Canada and that glacial recession could lead to devastating effects if left unattended (Clarke, 2015). Some of these effects include: changing river temperatures, agricultural impacts, and the reduction of available drinking water. As research suggests, the negative impacts of glacial recession on services may affect Canadian quality of life (Struzik, 2014).

Introduction

Today, climate change and gas emissions are affecting the Peyto Glacier. Additionally, people in Calgary seem to be unaware of the importance of glaciers, and seem to lack understanding on the effects of increasing climate. Research by Watson and Luckman, 2004 and Luckman, 2000 establish that the Peyto Glacier is an example of glacial recession in Canada. The Peyto Glacier, additionally, has been continually monitored since 1896 (Wallace & Lennox, 1995), which means there is rich data regarding its changes. Records indicate a slow and steady recession since 1896, and, today, 70% of its first recorded mass is gone (Struzik, 2014). Since the Peyto Glacier is a strong indicator of the current and past effects of climate change in Alberta, it demonstrates that Albertans and Canadians, should be very concerned about the future of icefields and glaciers (Glacier Mass Balance, 2008)..

To summarize, this paper examines the Peyto Glacier and the information that can be discovered through examining the Peyto Glacier. The Peyto provides evidence about the effects of glacial recession on river temperatures, agriculture and drinking water. Overall, the purpose of the study is to first establish that glacial recession is a problem in Alberta and then measure the awareness of participants regarding the impact of glacial recession. In the future, these researchers hope to create an awareness campaign encouraging social change.

Background

As the years progress, climate change increasingly affects glaciers in the Rocky Mountains (Water Impacts, n.d.). As the effects of climate change continue to affect the Peyto Glacier, it is important to understand the Peyto Glacier recession rate's relationship with greenhouse gas emissions. Alberta's emissions account for 37% of Canada's total emissions, and have increased 53% since 1990 (Canada's Emissions Trends, 2013). Alberta is the number one emitter of Canada's total greenhouse gas emissions. Furthermore, Alberta's greenhouse gas emissions are projected to continue to rise from most emission sources from now to 2030 (Canada's Emission Trends, 2013). The effect of greenhouse gasses can be seen through the recession of the Peyto Glacier. The Peyto Glacier loses 3.5 million cubic meters of water per year (Struzik, 2014); comparatively similar to the amount of water consumed per day by the city of Calgary's population of 1.2 million. To clarify, this means that Canadian's lose one day's worth of drinking every year (Struzik, 2014). Under the current rate of recession, the Peyto Glacier will have receded by 90% by the end of the 21st century(Clarke, 2015). The dramatic retreat of Canadian Glaciers will affect freshwater availability for irrigation and domestic use, mountain recreation, and wildlife habitats (Glacial Retreat, n.d).

Research demonstrates that rising temperatures in Alberta (Mertz, 2013), which have already increased by 5° Celsius since 1962 (Struzik, 2014), have been the main cause for reduced snowpack in the Canadian Rocky Mountains since the 1980's (Struzik, 2014). Additionally, the already reduced winter snows are melting earlier every spring and summer, which further contributes to the reduction of drinking supplies (Struzik, 2014). Thus, if current warming trends continue, warmer temperatures in Alberta will continue to have a substantial impact on glacial melt (Henderson & Sauchyn, 2007).

The increased climate and rapid recession rate of glaciers in Canada, affects both glacial fed services in Alberta and services in other Canadian provinces (Headwaters of the North Saskatchewan River Basin, n.d). Increases in air temperature have already influenced the North Saskatchewan River; and increased climate variability in its area show that in the close future, its stream flow will be smaller in magnitude, with flow rates becoming more unpredictable (Johnson, et al., 2010). Research suggests that further rise in air temperature may lead to increased

water demand from the North Saskatchewan River (Ball, 2008). The majority of irrigation in Saskatchewan currently takes place in the South Saskatchewan River watershed and the Missouri River watershed, however loss of snowpack and runoff from the Peyto Glacier could exacerbate the issues already faced by dropping water levels of the South Saskatchewan River. Currently, the South Saskatchewan recedes by 12 percent each year, while one third of its flow has been consumed by humans(Casey, 2010). The Peyto also supplies the North Saskatchewan River with water, so again, choosing to take from the North Saskatchewan River is short-sighted, because simply, there will not be enough water to support the irrigation program (Casey, 2010).

Furthermore, glacial melt-water from the Peyto Glacier helps regulate water temperature in the North Saskatchewan River (Fish Species of Saskatchewan, 2010). This is important for maintaining the ecosystems of temperature sensitive aquatic species. Sixty-seven species of cold water fish can be found in Saskatchewan. For example, Lake Trout depend on a cold climate in the river and they requires large, cold, deep, lakes to survive throughout the warm summer months(Fish Species of Saskatchewan, 2010).

After reading research regarding the health of the Peyto Glacier, this study hypothesizes that if there is no behavioural change in regards to gas emissions, and climate change, the Peyto Glacier will recede more rapidly (Clarke, 2015). Because the Peyto Glacier is, in fact, representative of other glaciers in Canada, this study predicts that other glaciers will also become non-existent by the end of the 21st century. Stover's research suggests that if Canadian citizens reduce their carbon footprints, and subsequently reduce the short-term effects of climate change on glaciers we will not be able to reverse already done damage, but we can stop further damage (2015). In conclusion, our research shows that the recession of the Peyto Glacier affects many aspects of everyday life for Albertans. The lessons learned from the recession of the Peyto Glacier can also be applied to other glaciers in the Rocky Mountains, as it is representative of the glacial recession in Canada. The researchers, however, could not find research regarding the public's perception of the significance of glacial recession. Therefore, the purpose of this research project is to first research the impacts of climate change on glacial recession in Canada and secondly, to conduct their own research into public perception of glacial recession. Overall, this study is intended to provide a platform from which the researchers can educate others about the pressing problem of glacial recession and the impact of glacial recession on daily life, including impacts in river temperatures and flow, agricultural irrigation, and drinking water.

Methods

This research was conducted in Calgary, Alberta. It is qualitative in design and seeks to measure the amount of knowledge, perceptions that the participants have regarding glacial recession and whether the perception was influenced by factors such as gender, age, level of education and country of residence.

Participants

The researchers created an online survey, which they shared internationally on three social media sites; Facebook, Instagram and WhatsApp. The researchers shared the link of the survey on their own personal Facebook accounts. This limited participants to those who knew the researchers, those who were "friends" on the researcher's' Facebook. As all of the researchers were Canadian, most of those who were able to see the link for the survey were primarily Canadian. However, some participants shared the link to survey to their personal Facebook accounts, which broadened the spectrum of people who could see the link to the survey. All who were able to view this link, in accordance to the privacy settings of the researchers, were welcome to take part in the survey. The researchers hoped that by sharing the survey on various social media, they would get the most amount of responses possible, in a two week time frame. The survey was shared on WhatsApp to the researchers' Netherlands student exchange group. This targeted the demographic of students 16-18, who were from the Netherlands, and were in involved in the Water is Life exchange. In addition to answering the questions provided by the researchers, participants were invited to add open-ended commentary for some specific questions. Each participant was recorded as a number, their name remaining anonymous. The researchers had access to each participant's response for each question. *Survey Monkey* records the IP address of individual participants; the researchers did not look at or record any part of this information in the study. In total, 96 people completed the survey.

Research Design

This study is qualitative in design as it seeks to measure the perceptions of participants regarding glacial recession. Subjects were not placed in a manipulated environment and each participant willingly chose to partake in the survey. They were invited to participate online by the researchers. They were able to access the survey with the technology of their choice (i.e laptop, phone, tablet). The survey was written in English. The tool used to conduct the survey is an international free website, called *Survey Monkey*. This website allows for users to create a survey, with a topic of their choosing, create questions of their wording, and provide a selection of answers for participants. Users are

limited to a maximum of ten questions per survey, limiting the amount of questions asked.

The first three questions asked for the participant's gender, age, and country of residence. Questions 5 and 6 were designed to gather information regarding the participant's perception on climate change. Questions 7 and 8 were designed to determine the participants' current knowledge of the Peyto Glacier and its recession. Questions 9 and 10 were designed to gather information about the participants' beliefs regarding the importance of glacial recession.

Sample Size, Power, and Precision

As a group, it was decided that the purpose was to reach out to as many different people as possible in order to gather enough information about the level of education of the general public on this topic. The best way to complete this was to have a large sample size, which was achieved by sharing a survey link through different forms of social media.

Measures

The online survey was active from March 13th, 2016 to March 24th, 2016. The survey questions are included at the end of this study under Appendix A. The data from the survey was then recorded in Microsoft Excel. The researchers created a spreadsheet. Each question was given a letter and each answer was given a letter.

Findings and Results

The purpose of this research project was to determine the participants' level of knowledge of glacial recession in Canada, specifically the Peyto Glacier. Participant responses were recorded in a Microsoft Excel Spreadsheet, and graphed the data from the survey.

Data Collection

Survey Questions 1, 2, 3, and 4. Of the 96 participants, 64 identified as female, 30 identified as male, and two identified as "other". The age of the participants ranged from 12-74, as 43 stated they were 12-17 years old, 15 stated they were 18-24 years old, two stated they were 25-34 years old, seven were 35-44 years old, 20 were 45-54 years old, four were 65-74 years old, and one is over 75 years old. Of the 96 participants who responded to the survey, 85 of them live in Canada, four live in the United States, six live in the Netherlands, and one in Germany. In terms of education, 50 participants are currently receiving or have finished senior high school (ages 15-18), four participants are currently receiving or have finished junior high school (ages 12-14), 17 participants are currently receiving or have finished college, 23 participants are currently receiving or have finished university. Two participants listed their education level as "other".

Survey Question 5. In order to gather data about the research questions and to learn about the current beliefs of the participants regarding climate change, the researchers first asked the broader question "Do you believe that climate change exists and is currently affecting the environment? Of the 96 participants surveyed only 92 responded to this question. 87 participants replied *yes*, four participants replied *no*, and one participant replied "other" and specified their answer with the statement: "Believe in climate change but not that it is human caused." question. To further analyze the data, the researchers compared the age of the respondents to the participants' responses. Of the respondents that replied "yes" to this question, the majority (40 people) were of the ages 12-17 and the second largest group to respond "yes" were those respondents from the ages 18-44 years old. Of the respondents who answered "no" to this question the largest group of people (two respondents) were 45-54 years old.

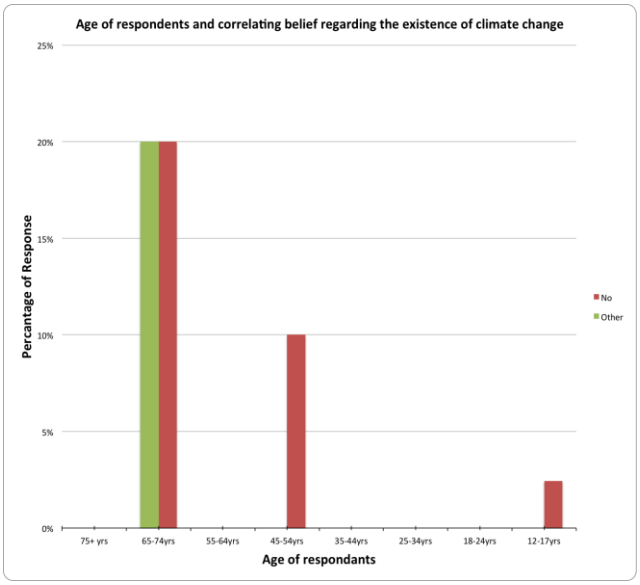

Figure 1. Age of respondents and correlating belief regarding the existence of climate change. Graph show majority of respondents who said *No* were from 65-74 years old. Only respondents *Other* from 65-74 years old.

Survey Question 6. In order to gain understanding about the participants knowledge of glacial recession in Alberta, Canada, the participants were asked to respond to the question: "*Are you aware that most Canadian glaciers are increasingly receding?*" A resounding majority of the respondents said "*yes, they are aware of the recession of the glaciers in Canada.*" Seventy-nine of the 85 respondents who reported they live in Canada were aware that most glaciers in Canada are receding. All of the respondents who report living outside of Canada said, yes

they were aware that most glaciers in Canada were receding.

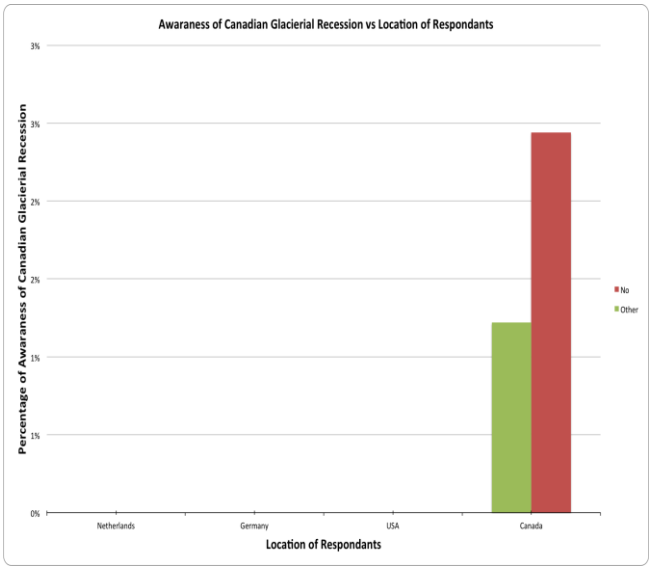

Figure 2. Graph displays awareness of Canadian Glacial recession of respondents by the location of the respondents. The majority of respondents that replied with *No* or *Other* were from Canada.

Survey Question 7 and 8. In order to gather information regarding the participant's knowledge of the Peyto Glacier, the researchers first asked: "***Have you heard of the Peyto Glacier located in the Rocky Mountains, Canada?***" Of the 92 people who responded to this question, the majority had not heard of the Peyto Glacier and only 22 participants replied that they are fully aware of the glacier (see *Figure 3*). The second question regarding knowledge of the Peyto Glacier asked participants: "***Are you aware the the Peyto Glacier has already lost 70% of it's original mass due to climate change?***" Seventy-three of the 89 respondents reported that they were unaware of the current status of glacial melt on the Peyto Glacier.

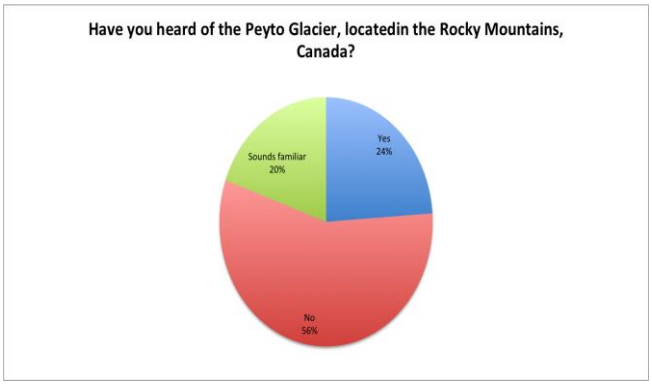

Figure 3. Participants' knowledge of the Peyto Glaciers displayed as graph. Majority of participants had not heard of the Peyto Glacier before.

Survey Question 9. To test their hypothesis regarding the participants' perception of the importance of glacial recession in Canada, the researchers asked participants to rate the importance on a 1 to 5 scale (1 being not important and 5 being very important). The participants' responses are recorded in Figure 4.

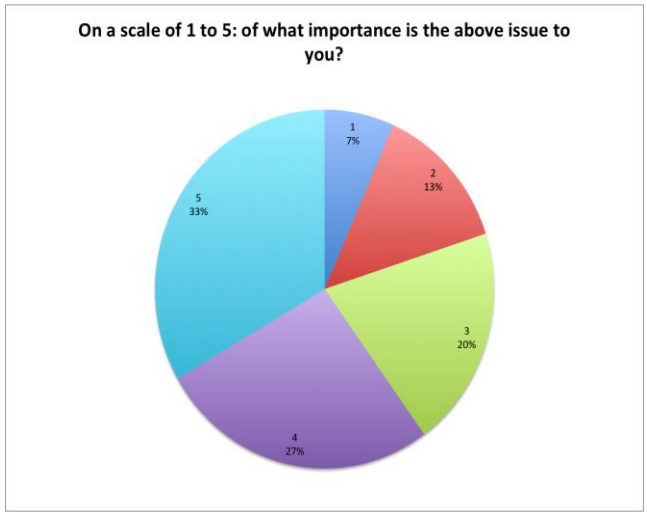

Figure 4. Participant's perception regarding the level of importance of the Peyto Glacier's recession.

Survey Question 10. In order to gauge the level of participant knowledge regarding the effects of glacier recession on daily life, the researchers asked: "***Which of the following do you think are affected by glacial recession? (Check all that apply)***" Of the responses, most participants had a clear understanding that glacial recession affects agriculture, drinking water, ecosystems and tourism. Additionally, the majority of respondents chose all four options in their reply. People whose answers included *Other* were asked to specify what they meant by *Other*. Their replies are listed below;

- *"Melting climate change also cause serious storms, floods, and other natural disasters."*- Respondent 41
- "*Glacier skiing in summer-training."*- Respondent 58
- *"Commerce, various other industries requiring water resources."* - Respondent 64
- *"Everything is affected because science."* - Respondent 73
- *"True effects remain to be seen. There will be effects on all of these things, There will be change, good and bad in all of these areas."*- Respondent 95

Discussion

This study hypothesized that many individuals are currently unaware of the effects of climate change and greenhouse gas emissions on glacier recession in Canada. To test this theory the researchers' conducted an online survey questioning participants about their knowledge of glaciers, particularly the Peyto Glacier.

Of the participants' surveyed 89 self-reported they are aware that glaciers in Canada are receding (out of the 92 that responded to that question). However, when participants were surveyed about their knowledge of the Peyto Glacier's recession specifically, only 16 out of 89

respondent's self-reported they were aware that the Peyto Glacier had already receded by 70%. The results indicate that although participants have a vague understanding glacier melt in Canada, they are not aware of the specifics of the Peyto Glacier's melt. However, the majority of the participants said that the recession of glaciers was very important to them, the researchers would have liked participants to be aware that Canadian glaciers are receding. They had hoped that participants would be aware that if no change is made, this issue will continue to increase, and therefore so will the issues associated with glacial recession. As previously mentioned, some of these issues include loss of drinking water, increased river temperature, wildlife habitats and ecosystems in rivers, as well as water supplies necessary for agriculture (Glick, n.d.*).*

This study further hypothesized that individuals do not understand the importance of glaciers in Canada. Although the 56 (out of 89 participants) rated the importance of glacial recession in Canada as a four or higher, or important to very important, 33 participants rated the importance of glacial recessions as three or lower. These findings align with the second part of the hypothesis. Participants have general knowledge that glaciers are receding and that the glaciers are receding here in Canada. They generally acknowledge that this is an important issue. However, when asked on information about the awareness of a glacier, many failed to say they were, in fact, aware of the Peyto Glacier's current and increasing recession. Through this study, the researchers note that overall education about climate change, and its importance seems to be understood and accepted by a broad majority of participants. However, many participants, Canadians in specific, are not currently aware of the precise facts when it comes to specific Canadian glaciers and their respective recession rates.

Next, those participants who responded "Other" in response to survey question 10, "Which of the following do you think are affected by glacial recession?*"*, gave the researchers some new, yet equally important effects of glacial recession to consider. The respondents' opinions, unaffected by the knowledge of the Peyto Glacier, offered a fresh perspective for the researchers. The responses demonstrated the respondents' assumptions about what is actually affected by glacial recession. It is unclear if the participants who wrote these comments came from higher-level educational backgrounds in the topics of climate change and the effects it has on glaciers. To the researchers all of the responses seemed plausible. These effects included glacier skiing in summer training, commerce and various other industries involving water, and one participant responded by stating that the true effects remain to be seen. This participant believes that there will be change, good and bad, in all these areas. The researchers believe that more research will be required to understand these ideas. Therefore, the researchers believe that the side effects of Canadian glacial recession are even more broad and extensive than previously thought. Again, more research would be required to support these claims.

Implications and Recommendations for Further Research

In the future, it will be as important as ever to continue to monitor the recession of glaciers in the Rocky Mountains and throughout Canada. According to our research, by the end of the 21st century, most Canadian glaciers will have receded entirely *Clarke,2015*). To prevent the complete melt of the glaciers, scientists must continue to study and track the recession of these glaciers. For example, the data regarding Peyto Glaciers allows researchers to analyze the recession patterns more thoroughly and thus, gain deeper understanding of glacial recession. The Peyto Glacier can serve us a model for other countries, who face glacial melts.

Furthermore, we suggest another study similar to ours, be conducted in another ten years' time. If current glacial recession trends continue, the Peyto Glacier is likely to have receded more dramatically. We hope that, in ten years time, the general public will be more aware and understand that glacial recession is an issue that needs to be stopped. It would be important to conduct this survey in order to compare the level of current awareness with past awareness. The researchers hope that in ten years time, the level of awareness concerning Canadian glacial recession and climate change will have increased, and, correspondingly, they further hope motivation for action will increase as well. Due to many of the participants in this survey not being aware of the issue of glacier recession, more education on this issue will be necessary for the public. The delusion that the depletion of glaciers is not a current concern, specifically in Canada, is not only naive, but also dangerous. The researchers' believe that because the general public is not fully aware of this issue, they will not be willing to make a change. This is an issue, because, as our research proves, glaciers are necessary for Canadian livelihood (High Mountain Glaciers, 2010).

Implications for the Future of Glaciers

We hypothesize, *if* no change is made to our behaviours that contribute to glacial recession, the glaciers will disappear entirely from the Rocky Mountains. Not only will this create a devastating change to Canada's glaciers, a historic sight, it will additionally affect many aspects of Canadian quality of life, such as drinking water, river temperatures, and agriculture. Furthermore, scientific research and innovation will be necessary to develop new ways to address the loss of the runoff from the glaciers. If,

for example, the Peyto Glacier disappears completely, fish, like the Lake Trout, who survives in cold temperate, glacier-fed rivers, will no longer be able to survive. Additional to the environmental impacts of glacial recession, there are recreational impacts as well. For example, backcountry enthusiasts will no longer have the opportunity to ski or hike the glaciers.

These outline only minute impact of glacier loss. Perhaps, most frightening of all, in a hundred years, glaciers in Canada will be a vague memory that people reflect wistfully about, wondering exactly what they were, and if we could have saved them.

Limitations

There were many limitations in this research.

Survey limitations. Firstly, the amount of questions the researches were allowed to include on this survey was limited to ten by Survey Monkey. As a result, the researchers were unable to test the participants' knowledge regarding glacial recession in Canada more thoroughly. Plus, the researchers had to use three out of the ten questions to gather demographic information about the participants. Furthermore, the data provided from the Survey Monkey did not enable the researchers to compare participants effectively. For example, the age of the participants could not be compared with their perspective of climate change. To create such comparisons, the researchers had to create codes for each question alternative (yes is a one, no is a two, other is a three, etc). The researchers then took this converted data and manually entered it into the excel spreadsheet.

Question limitations. When developing the questions, the researchers only considered the negative side of glacial recession, which could have led to a biased or incomplete understanding of glacial recession. Some of the questions asked in the survey were vague, or open for respondents' interpretations, making it difficult to draw definitive conclusions from the responses. When the participants answered "Other", they were given the opportunity to write an open-ended response. While the researchers hoped the participants would respond in beneficial ways, one participant replied a with: "ALIENS?", which made the researcher question the validity of all of this respondent's' answers. With such a small sample size, such responses affected the overall findings. Furthermore, participants were not tested on basic knowledge of what extent glacial recession is taking place.

Hypothesis limitations. Finally, the researchers' hypothesis itself was limiting. It was hypothesized that individuals had a lack of understanding of glacial recession and its effects. Due to this, the questions asked on the survey were biased towards finding that showed a limited understanding of glacial recession.

Personal Action Plans

After completing this research, the driving question for the researchers is: "*How can we prevent increasing glacier recession?*" As Canadian citizens who are currently affected by glacier recession's effects, we believe that it is important that all Canadians and those affected by Canadian glacial recession are aware of the circumstances that are associated with this issue. Although the recession of glaciers in the Rocky Mountains is not reversible, it is also not unstoppable. We plan to educate citizens, starting locally in Calgary, and working outwards. This summer, we will conduct a press conference for friends, family and teachers intended to further educate about the importance of reducing our carbon dioxide emissions. We also plan to create a simple brochure highlighting the main points of our project that can be shared through social media and in print form. Furthermore, we will write an article highlighting the importance of our project in our school's newspaper, *The Advocat*e. The goal these actions is to spread awareness, in the hope of creating the understanding for our peers that this issue is important, relevant, and currently affecting Canadian livelihood. Additionally, the researchers will continue monitoring the research of scientists regarding the Peyto Glacier and other glaciers in the Rocky Mountains, in order to remain current and accurate about our knowledge of glacial recession.

References

Struzik, E. (2014, July 10). Loss of Snowpack and Glaciers In Rockies Poses Water Threat. Retrieved October, 2016, from http://e360.yale.edu/feature/loss_of_snowpack_and_glaciers_in_rockies_poses_water_threat/2785/

Canada's Emissions Trends, 2013. *Canada's Emissions Trends, Environment Canada, October2013* Retrieved November, 2016, from https://www.ec.gc.ca/ges-ghg/985F05FB-4744-4269-8C1A-D443F8A86814/1001-Canada's%20Emissions%20Trends%202013_e.pdf

Wallace, Alistair Lennox, "The volumetric change of the Peyto Glacier, Alberta, Canada, 1896-1966" (1995). *Theses and Dissertations (Comprehensive).* Paper 330.

http://scholars.wlu.ca/etd/330

Glacier Mass Balance. (2008) *Glacier mass balance in the northern U.S. and Canadian Rockies: Paleo-perspectives and 20th century change.* Retrieved October, 2016, from https://pubs.er.usgs.gov/publication/70160114

Water impacts. (2016). *David Suzuki Foundation*. http://www.davidsuzuki.org/issues/climate-change/science/impacts/water-impacts

Photograph Michael Melford, N. (2011). *Melting Glaciers Mean Double Trouble for Water Supplies*.

http://news.nationalgeographic.com/news/2011/12/1112-melting-glaciers-mean-double-trouble-for-water-supplies/

Glacier Retreat (n.d). *Glacial Retreat.* Retrieved February, 2016 from http://www.global-greenhouse-warming.com/glacial-retreat.html

Mertz, E. (2013). *Report released on climate change impacts on Alberta*. *Global News*. http://globalnews.ca/news/804738/report-released-on-climate-change-impacts-on-alberta/

Henderson & Sauchyn (2007) *Climate Change Impacts On Canada's Prairie Provinces: A Summary Of Our State Of Knowledge.* Retrieved November, 2016, from http://www.parc.ca/pdf/research_publications/summary_docs/SD2008-01.pdf

Demuth, M.N, & Pietroniro A (n.d) *The impact of climate change on the glaciers of the Canadian Rocky Mountain eastern slopes and implications for water resource-related adaptation in the Canadian prairies.* Retrieved February, 2016, from http://www.parc.ca/pdf/research_publications/water1.pdf

Ball, M. (2008) *North Saskatchewan River Watershed - Source Water Protection Plan.* Retrieved February, 2016, from https://www.wsask.ca/Global/Water%20Info/Watershed%20Planning/NorthSaskatchewanRiverWatershedSourceWaterProtectionPlan.pdf

Casey (2010) *Climate Prosperity.* Retrieved December, 2016, from http://www.canadiangeographic.ca/magazine/oct10/south_saskatchewan_river.asp

Fish Species of Saskatchewan (2010) *Fish Species of Saskatchewan.* Retrieved April, 2016, from http://www.southsaskriverstewards.ca/ckfinder/userfiles/files/Web%20SK%20Fish%20Sp_%20complete%201.pdf?PHPSESSID=ddlairp3jfngdebo3pjie8vce1

APPENDICES

Appendix A: Survey Monkey Questionnaire: *designed to gather information regarding participants' knowledge and perception of glacial recession in Canada***.**

1. What is your gender?
    a. Female
    b. Male
    c. Other
2. What is your age?
    a. 12 to 17
    b. 18 to 24
    c. 25-34
    d. 35 to 44
    e. 45 to 54
    f. 55 to 64
    g. 65 to 74
    h. 75 or older
3. What is your current level of education?
    a. Junior High School
    b. Senior High School
    c. College
    d. University
    e. Other (please specify)
4. In what country do you live?
5. Do you believe that climate change exists and is currently affecting the environment?
    a. Yes
    b. No
    c. Other (please specify)
6. Are you aware that most Canadian glaciers are increasingly receding?
    a. Yes
    b. No
    c. Not currently aware
    d. Other (please specify)
7. Have you heard of the Peyto Glacier, located in the Rocky Mountains, Canada?
    a. Yes
    b. No
    c. Sounds familiar
8. Are you aware that the Peyto Glacier has already lost 70% of it's original mass due to climate change?
    a. Yes
    b. No
9. On a scale of 1 to 5: of what importance is the above issue to you?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
10. Which of the following do you think are affected by glacial recession? (Check all that apply)
    a. Agriculture
    b. Drinking water
    c. Ecosystems
    d. Tourism
    e. Other (please specify)