Transboundary Regional Planning Collaboration for Climate Change Adaptation: A Case Study of Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Climate change threatens the integrity of many parks and protected areas worldwide. Mountain parks are amongst the most vulnerable, facing changes in temperature, hydrology, glaciation, fire frequency, and pest and disease outbreaks. Species migration is a key tool in climate change adaptation, but often physical and jurisdictional fragmentation makes it impossible for species to migrate, putting species at risk of extirpation or extinction.

Transboundary collaboration and regional planning are tools that can help physically connected parks and protected areas overcome jurisdictional fragmentation and allow for species migration, giving species a greater chance at being able to adapt to climate change. However, there are many barriers to transboundary collaboration and regional planning that makes this difficult to achieve.

This research aims to address the challenges parks face with regards to transboundary collaboration and regional planning, and provide possible solutions for overcoming these challenges. A qualitative research project was conducted to determine the state of transboundary collaboration and regional planning in the Canadian Rocky Mountains, using Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park as the study area. A document review, questionnaire, and Importance-Performance Analysis were conducted to determine: the current policy within the Parks Canada Agency, British Columbia Parks, and Alberta Parks in regards to the management implications of climate change; the degree to which transboundary collaboration and regional planning are occurring in and around the study area with regard to climate change; the challenges parks face with regards to transboundary collaboration and regional planning; how these challenges should be addressed; and to determine what park agencies and managers need to be able to participate in transboundary collaboration and regional planning.

Ultimately, it became clear that while transboundary collaboration is a potentially effective tool for climate change adaptation, little transboundary collaboration is occurring within the study area. In order for this to occur, all parks must have appropriate legislation, policies, and plans in place; British Columbia Parks has these, but both Parks Canada and Alberta Parks do not. Parks planners and managers are not able to put priority on transboundary collaboration until it is mandated within the management plans. However, parks managers are supportive of transboundary collaboration for climate change and it seems likely that the parks will use this tool as it becomes increasingly necessary over the next 25 years.

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Chapter 1
Introduction

Climate change is anticipated to have significant impacts on ecosystems worldwide (Dudley et al., 2010; Fagre, 2007; Heller & Zavaleta, 2009; Scott, Malcolm, & Lemieux, 2002; Scott & Suffling, 2000; Shafer, 1999; Suffling & Scott, 2002; Tompkins & Adger, 2004; Walker & Steffen, 1997; Welch, 2005). Amongst the most vulnerable are mountain ecosystems, which will face changes in temperature, hydrology, glaciation, fire frequency, and pest and disease outbreaks (Beniston, 2003; Byrne & Kienzle, 2007; Carroll, Taylor, Régnière, & Safranyik, 2003; Dudley, et al., 2010; Fagre, 2007; Hauer et al., 1997; Higgins & Vellinga, 2004; Jones & Scott, 2006; Pederson, Whitlock, Watson, Luckman, & Graumlich, 2007; Schindler, 2001; Scott & Suffling, 2000; Suffling & Scott, 2002; Welch, 2005). This puts significant pressure on mountain parks and protected areas to ensure that the species they protect are given the best possible chance of survival in a changing climate.

Many species will be required to migrate to cope with the anticipated changes in climate (Dearden & Rollins, 2009; Miller, 1999; Olson & Lindsay, 2009; Theberge & Theberge, 2009). However, species' ability to migrate can be barred by the physical and jurisdictional fragmentation of habitats (Opdam & Wascher, 2004; Quinn, Duke, & Greenaway, 2007). Unless species' present habitats are connected with future habitat, they will not be able to cope with climate change and thus may face extirpation or even extinction (Dearden & Rollins, 2009; Mahr, 2007; Opdam & Wascher, 2004).

Physical connectivity can be achieved through the creation of more parks and protected areas, especially in areas predicted to become new habitat for threatened or endangered species, and through linking parks and protected areas by corridors that allow for migration (Gatewood, 2003; Mahr, 2007; Opdam & Wascher, 2004). Physically linked parks must also be linked by common policies, mandates, and conservation goals. Transboundary collaboration and regional planning are methods to overcome jurisdictional fragmentation in areas that are physically connected (Brunckhorst, 2000; Chambers & Ham, 1995; Galatowitsch, Frelich, & Phillips-Mao, 2009; Hanna, Clark, & Slocombe, 2008; Heller & Zavaleta, 2009; Lawler, 2009; Nelson & Sportza, 2000; Quinn, Duke, et al., 2007; Steidl, Shaw, & Fromer, 2009; Welch, 2005). If parks and protected areas can work across jurisdictional boundaries towards the common goal of effective connectivity for species migration, there is a greater chance that species will be able to adapt to climate change.

In order to achieve transboundary collaboration, it is essential to understand what challenges to participation parks and protected areas managers must overcome. Once it is known what is needed, it will be possible to work toward addressing those needs and achieving transboundary collaboration.

This thesis will focus on the Canadian Rocky Mountains, using three parks as a case study to determine the potential for transboundary collaboration as an effective response to climate change. Jasper National Park, Willmore Wilderness Park, and Mount Robson Provincial Park represent the three agencies with parks in the Canadian Rocky Mountains (Parks Canada, Alberta Parks, and British Columbia Parks). Through this case study, it is expected that most of the challenges to transboundary collaboration in the Canadian Rocky Mountains will be understood. From this, recommendations will be made regarding how to proceed.

This thesis will address five research questions, as follow:

- What is the current policy within the Parks Canada Agency, British Columbia Parks, and Alberta Parks in regards to the management implications of climate change?
- To what degree is regional planning occurring in and around Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park with regard to climate change?
- What are the challenges that parks face with regards to transboundary collaboration and regional planning?
- What should be done to address the challenges that parks agencies face with regards to transboundary collaboration and regional planning?
- What do parks agencies and managers need to be able to participate in transboundary collaboration and regional planning?

The above research questions will be addressed using a number of methods: a review of existing policy documents relating to the Parks Canada Agency, British Columbia Parks, and Alberta Parks in regards to the potential management implications of climate change; a review of existing documents regarding regional planning within the case study area; and a questionnaire including an Importance-Performance Analysis will be conducted.

Chapter 2
Literature Review

2.1 Climate Change

2.1.1 Global Climate Change

There have been major fluctuations in global average temperature occurring throughout the planet's geological history. However, since the Industrial Revolution in the 18th Century, change has been occurring at an unprecedented rate. This rate of change continues to accelerate, with the greatest amount of change experienced since the 1970s (Welch, 2005). Since the 1970s, average global temperatures have increase by 0.2°C per decade, and average global precipitation has increased 2% in the last century (Heller & Zavaleta, 2009). This accelerated form of climate change, referred to from here on as climate change, is caused by human activity. The rise of the industrial world with widespread use of fossil fuels has resulted in large amounts of greenhouse gases being released into the atmosphere (Opdam & Wascher, 2004; Welch, 2005). This has caused a warming effect worldwide. As a result, it is predicted that, on average, global temperature will rise by 5.2 degrees Celsius, with "regional peaks of more than 8" degrees Celsius by 2100 (Opdam & Wascher, 2004, p. 286). These changes will likely result in "more frequent episodes of high temperature, global average precipitation increasing, areas of snow and ice decreasing, and permafrost becoming thinner" (Olson & Lindsay, 2009; Timko & Innes, 2009, p. 139).

The effects of climate change are expected to be far-reaching and significant (Dudley, et al., 2010). It is anticipated that they will be seen in four ways: 1) through "slow changes in mean climate conditions, 2) increased interannual and seasonal variability, 3) increased frequency of extreme events, and 4) rapid climate changes causing catastrophic shifts in ecosystems" (Tompkins & Adger, 2004). Although the general trend is for the average temperature of the Earth to increase, climate change is predicted to have varying regional impacts (Heller & Zavaleta, 2009). Most climate models indicate that there will be greater warming inland from the oceans; wetter areas will have increased precipitation, while dry areas will be even drier; warming will be more significant towards the poles; and warming will be most significant in the winter (Welch, 2005). It is important to remember that these are general trends, and that exceptions occur.

2.1.2 Climate Change Impacts on Parks and Protected Areas

Climate change is expected to have many impacts on parks and protected areas across the world. Within Canada, the impacts are expected to be far-reaching. The International Panel on Climate change has developed a comprehensive list of the types of parks and protected areas it expects will feel the greatest impacts of climate change (Shafer, 1999). These parks include:

- High latitude parks, where warming will be greater than at lower latitudes;
- Mountain parks, where species living near the peaks will not be able to migrate to cooler locations;
- Interior wetland parks, where wetlands will dry, shrink, or shift north;
- Parks with sea ice, where loss of sea ice will change ecosystems;
- Parks with islands at low elevations, where the islands may become partially or wholly submerged due to sea level rise;
- Parks with salt marshes and coastal forests, where rises in sea level will change the ecological composition, and where some species may not be able to flee flooding;
- Parks with freshwater bodies near the ocean, where saltwater could intrude the ecosystems through entering the groundwater or overwash;
- Parks with dramatically different land uses outside their boundaries, which may prevent species from migrating;
- Parks with rare or endangered species that have limited habitats or ranges, where species may not be able to migrate latitudinally in unison with other species;
- Parks with species at the limits of their latitudinal range, where species may not be able to migrate quickly enough to survive;
- Small parks with uniform habitat;
- Parks without corridors connecting to habitats outside their boundaries, ranging from small-scale corridors to those of continental scale, where a lack of corridors may prevent species migration.

- Parks without connecting, usable corridors, to habitats outside the parks including corridors of continental scale. Lack of corridors may prohibit migration (Shafer, 1999).

The above list indicates that Canadian parks are vulnerable to climate change. Knowing that their parks are at risk, it is imperative that Canadian park managers and planners do all they can to ensure the parks are as prepared to cope with climate change as possible.

Based on a study of predicted vegetation change, it was found that in five of six climate change scenarios; over half of Canada's national parks would experience changes in their biomes in a situation where the current (2002) carbon dioxide concentrations are doubled (Scott, et al., 2002; Welch, 2005). One of the greatest challenges is that biomes are not able to shift in concert with the predicted changes in climate; many species face barriers to migration, and even those usually capable of migration cannot do so quickly enough to adapt to rapid climate change. As a result, it is expected that new biomes will emerge as the climate changes, and they will be dominated by pioneer species; this will result in a shift towards early successional ecosystems dominating the landscape (Walker & Steffen, 1997; Welch, 2005).

Ultimately, it is anticipated that the changes in climate over the next century will be wide-ranging and dramatic across the world (Heller & Zavaleta, 2009). These changes are expected to include new water regimes, permafrost and ice conditions, vegetation successions, wildlife habitat and survival conditions, coastal erosion levels, and sea level changes (IPCC 2001a; Hansen et al. 2003, as cited in Welch, 2005). With such wide-ranging impacts, no ecosystem will be left untouched; therefore it is essential that parks managers and planners make long-term management decisions in a manner that allows for the best chances of species survival.

2.1.3 Climate Change in the Parks and Protected Areas of the Canadian Rockies

Alpine ecosystems are amongst the most vulnerable to climate change (Fagre, 2007; Jones & Scott, 2006; Scott & Suffling, 2000; Suffling & Scott, 2002). High elevation mountain ecosystems are more susceptible to climate variability than those at lower elevations, as seen in records over the past hundred years. As such, it is expected that mountains are going to be "more sensitive to global-scale climate change" than other locations, and those effects are going to be seen at the highest elevations first (Fagre, 2007, p. 188). The following subsections provide examples of the many anticipated impacts of climate change on mountain ecosystems in the Canadian Rocky Mountains.

2.1.3.1 Temperature

Although it is anticipated that there will be increased temperatures throughout the Canadian Rocky Mountains, it is also possible that these effects will be regionalized. However, in areas with increased temperature, waterways are likely to be impacted, with their average temperature increasing (Hauer, et al., 1997). Increased temperature will also result in increased glacial melting (Fagre, 2007; Welch, 2005).

2.1.3.2 Water

Major hydrological changes in mountains are expected with climate change (Beniston, 2003; Byrne & Kienzle, 2007; Fagre, 2007; Higgins & Vellinga, 2004; Schindler, 2001; Welch, 2005).

It is anticipated that precipitation will fall more often as rain than as snow. Instead of major spring runoff events, there will be a steadier year round melt, and higher summertime temperatures will cause greater evaporation, resulting in less water availability overall (Byrne & Kienzle, 2007; Schindler, 2001; Welch, 2005). It is also expected that due to lower water levels at certain times, there will be increased pollutant concentrations in waterways (Byrne & Kienzle, 2007). Therefore, mountain areas that currently experience high levels of snowfall and low levels of winter evaporation or melt are especially likely to be affected (Beniston, 2003; Dudley, et al., 2010; Schindler, 2001; Welch, 2005).

Worldwide, mountains are a vital source of water, providing approximately 50% of drinking water across the globe (Fagre, 2007). This suggests that the predicted changes to mountain hydrology have the potential to have dramatic impacts on worldwide supplies of freshwater (Fagre, 2007). It is therefore vital that the impacts of climate change on hydrology be recognized and planned for accordingly by all those who could be affected.

2.1.3.3 Glaciers

Changes in hydrology (as discussed above), can have great impacts on glaciers, as it can affect glacial mass balance. Worldwide, loss of snowpack and increased summer temperatures result in a decrease in glaciers (Fagre, 2007). In some cases, it is predicted that many glaciers will recede or be lost completely, as is anticipated in Glacier National Park and in many places along the middle and equatorial latitudes (Dudley, et al., 2010; Welch, 2005).

Loss of glaciers will have far reaching impacts on watersheds that are dependent on glacial melting as their headwaters (Fagre, 2007; Welch, 2005). Loss of glaciers can have significant impacts

on water supply, as they store water that is often released during annual dry periods and prolonged drought (Dudley, et al., 2010; Fagre, 2007). Without this supply, streams that once ran year-round could become epheremal , changing not only the hydrology but also the ecology of the area (Fagre, 2007).

2.1.3.4 Ecological Communities

There are many ecological communities within mountainous areas such as the Rockies, and some are affected by climate change more rapidly than others. For example, "the steep environmental gradients result in sharply defined ecotone systems (e.g., upper and lower treeline) that respond relatively rapidly to climate change as species shift their distributions" (Pederson, et al., 2007). Species will then be forced to migrate, or face extirpation or possibly extinction (see below) (Dearden & Rollins, 2009; Miller, 1999; Opdam & Wascher, 2004; Theberge & Theberge, 2009).

2.1.3.5 Fire Frequency

The frequency of fire is expected to increase in the Rocky Mountains, the consequence of summer drought and decreased snowpack in winter. Fire is regulated both by climate and weather (Pederson, et al., 2007).

2.1.3.6 Pests and Disease

Forest pathogen and insect outbreaks are expected to occur more frequently as a result of climate change. Outbreaks tend to occur in during periods of dry, warm climate; thus, it is anticipated that with climate change there will be greater occurrences of climate that are suited to insect outbreaks (Fagre, 2007).

The mountain pine beetle infestation of the mountains in British Columbia and Alberta is an example of an insect outbreak that is exacerbated by climate change (Carroll, et al., 2003). As the beetle's ability to survive is limited by very cold winter temperatures, increases in temperature results in increased survival. This means that the beetle can survive in more habitats over a greater geographical range, including further east, north, and higher elevations, thereby wrecking havoc across the Canadian Rocky Mountains (Carroll, et al., 2003).

2.1.3.7 Jasper National Park and the Western Cordillera Parks

Scott and Suffling (2000) outlined the many anticipated impacts of climate change on Canada's national parks, including the Western Cordillera parks grouping (Banff, Glacier, Mount Revelstoke,

Jasper, Kootenay, Nahanni, Waterton Lakes, and Yoho National Parks). This grouping of parks is expected to experience many changes, including: changes in seasonal hydrology; increase in snow pack and avalanches; increase in river toxins during increased glacial melt; changes in river ecology; loss of some Alpine assemblages from mountain tops; elevational and latitudinal migration of ecozones; increased forest insect infestations and disease outbreaks; increased forest fire frequency and intensity; impaired migration of large animal species; and increased wintering zone pressures (Jones, Scott, Barrow, & Wun, 2003; Olson & Lindsay, 2009; Scott & Suffling, 2000).

Specific predictions for Jasper National Park outlined several of the impacts anticipated in the Park, including: lower elevation glaciers will retreat rapidly, while higher elevation glaciers will be less affected; peak snow melt and spring runoff will occur in May, a month early; water flow will increase and consequently sedimentation will increase; higher water levels in many lakes (including Malgine Lake, a typically intermittent lake); increase in water erosion on Jasper's sand dune system; loss of high alpine species; deeper snow pack due to 2-25% increase in snowfall; increase in summer temperature with a decrease in summer precipitation, resulting in increased fire risks; and increase in avalanche and debris flow activity (Scott & Suffling, 2000).

It can be assumed that, due to the close geographical proximity of the parks in this study, the impacts identified in Jasper National Park and the Western Cordillera parks are likely to also occur in Mount Robson Provincial Park and Willmore Wilderness Park.

2.1.4 Climate Change and Parks Management

One of the greatest concerns in parks and protected areas management is the degree to which parks and protected areas are able to adapt to the impacts of climate change. It has been argued that current management practices are not sufficient for ensuring ecosystem health in the face of climate change (Hannah et al., 2007; Hulme, 2005). Instead, there must be a shift towards management practices that focus on the interactions of species and ecosystems rather than individual species assessments, which is the traditional approach (Hulme, 2005). To achieve these, conservation and environmental policies must address climate change in manner that allows for flexibility to respond to rapid ecosystem changes (Hulme, 2005; C. Lemieux, 2008). This would be a shift away from the muddling through approach typically used by policy makers (Glantz, 1998 in Hulme, 2005).

At present, parks and protected areas are often selected based on the biodiversity of a given area at the time of selection. Although a very practical method, it does not take into account the fluidity of habitat ranges. As ranges shift, both naturally and under the influence of climate change,

parks and protected areas are likely to lose species, regardless of management practices (Araújo, Cabeza, Thuiller, Hannah, & Williams, 2004; C. Lemieux, 2008). Therefore, it would be prudent to create parks and protected areas in anticipation of where species could migrate to as a consequence of climate change (Dudley, et al., 2010; Francis, 2008).

Faced with climate change, parks and protected areas managers must find ways to ensure the protection of as many species as possible with limited resources (i.e., land, money, and time). One way to preserve species' habitats as effectively and efficiently as possible is to have large, connected protected areas. Based on the theories of island biogeography and metapopulations, these networks of protected areas are much better for habitat conservation than those that are small and not connected (Araújo, et al., 2004; Dudley, et al., 2010). This is due to the reduction in edge effect as well as its allowance for species with large habitat range requirements, allowing species to travel long distances through protected lands (Araújo, et al., 2004).

One of the greatest concerns in parks and protected areas is that climate change will result in species' ranges shifting both into and outside of protected areas, potentially resulting in the best habitat for a species laying outside of protected areas (Araújo, et al., 2004; Olson & Lindsay, 2009). Thus, parks and protected areas managers need to work both within and outside of their parks with other managers and with other stakeholders on unprotected lands nearby, to ensure that the species most affected by climate change will be given a chance to survive. This new approach to planning will have long-lasting and broad-reaching changes on how parks and protected areas are managed (Lawler, 2009).

2.2 Connectivity and Fragmentation

2.2.1 Species Migration as a Response to Climate Change

Based on climate modeling, it is expected that changes in climate will have impacts on ecosystems worldwide. This could result in the loss of habitat for species within their historical range, forcing them to migrate (Miller, 1999; Olson & Lindsay, 2009; Theberge & Theberge, 2009). For example, it has been predicted that for every 1°C increase in temperature in the northern hemisphere, biomes will be forced to migrate northward approximately 300 kilometres (Dearden & Rollins, 2009). Based on the minimum predicted increase, it is thus expected that there will be, on average, a shift in biomes of 600-1500 metres (elevation) and 300-750 kilometres (latitudinally) (Dearden & Rollins, 2009). If

species cannot keep up with this rate of change, either by migrating or evolving, they will face local extinction (Dearden & Rollins, 2009). Since these changes are expected to occur rapidly, for species to survive it is vital that parks and protected areas managers do everything in their power to ease the process of migration and adaptation (Dearden & Rollins, 2009).

However, migration is not an easy task, with many barriers preventing a species from migrating. Some species do not have effective dispersal methods for a quick migration required by the impacts of climate change. Others could migrate with relative ease if the landscape allowed for it. Unfortunately, many species will not be able to migrate due to habitat fragmentation, which is the process of habitat being broken up by physical and jurisdictional barriers, ranging from natural (rivers, mountain ranges, etc) to man-made (highways, urban areas, etc) to political boundaries (Opdam & Wascher, 2004; Quinn, Greenaway, & Duke, 2007). This is discussed in greater detail below.

2.2.2 Physical Connectivity and Fragmentation

Although habitats can be fragmented by natural causes, such as natural disasters (landslides, fires, etc.) and rivers, man-made fragmentation is the focus of this study. This is because although species are generally able to cope with natural fragmentation, this is often not the case with man-made fragmentation. (Opdam & Wascher, 2004).

It is possible for habitat to be physically fragmented by human causes in three main ways: by shrinking at the periphery, by being divided into pieces through the construction of roads, and by perforation from the interior of a habitat outwards towards the periphery (Collinge, 1996; Lawler, 2009; Opdam & Wascher, 2004). All of these forms of habitat fragmentation can have negative impacts on species migration as species are often unwilling, or unable, to cross these physical barriers, thereby limiting their ability to migrate.

There are many negative impacts of physical habitat fragmentation, including: population decline and the threat of extirpation or extinction; decreased genetic diversity; decreased population density; slower recovery from large-scale disturbances, possibly resulting in temporary extirpation; and disruption of healthy biotic interactions, reducing reproduction rates and increasing parasitism rates (Mahr, 2007; Opdam & Wascher, 2004).

Many protected areas function already as habitat islands, isolated from other protected areas by developed lands (Mahr, 2007). This puts species with large ranges at risk due to the risks outlined

above. Research has shown that it is possible to mitigate this island effect by creating networks between core habitats (protected areas) that link them together, allowing for species to move amongst them safely (Mahr, 2007; Opdam & Wascher, 2004). In order to achieve this, transboundary collaboration is essential (Mahr, 2007).

Ecological connectivity is essential for biodiversity in the Rocky Mountains (Mahr, 2007). Unfortunately, even though the area has many protected areas, they are neither large enough nor connected enough to be able to successfully maintain full species diversity; support healthy populations of large carnivores; allow for the recovery of threatened species; or maintain healthy ecosystems (Mahr, 2007).

2.2.3 Jurisdictional Connectivity and Fragmentation

Large ecosystems (such as the Crown of the Continent Ecosystem) are often threatened by the management decisions and actions made at the individual park level; this is called transboundary cumulative effects (Quinn, Duke, et al., 2007). As these actions take place, their impacts can add up to have significant consequences across the entire ecosystem (Quinn, Duke, et al., 2007). The reason these cumulative effects occur is because of the fragmentary nature of management within an ecosystem; every jurisdiction within an ecosystem is managed on its own, without any collaboration with nearby and connected jurisdictions (Quinn, Duke, et al., 2007). This is further exacerbated by each jurisdiction focusing on short-term needs (Quinn, Duke, et al., 2007). Although the need for large-scale ecosystem collaboration has been recognized, financial, technical, and political barriers prevent it from happening (Quinn, Duke, et al., 2007). When jurisdictions are separated by political boundaries (i.e. are in different provinces, states, or countries), the above barriers are magnified (Quinn, Duke, et al., 2007).

2.2.4 Importance of Connectivity for Species' Survival in the Face of Climate Change

The impacts of both physical and jurisdictional habitat fragmentation can be wide-reaching, increasing dramatically in the face of climate change. If a species is unable to move towards a more suitable habitat, it risks becoming extirpated or extinct as its former geographical range becoming uninhabitable. Therefore, "we must envisage a landscape that allows species to respond to temperature shift, to respond to increased weather perturbations, and to adapt genetically to changing environments" (Opdam & Wascher, 2004, p. 293). In order to create this landscape, there must be a significant shift in how landscapes are managed, with a greater focus on connectivity (both physical

and jurisdictional) between protected areas (Dudley, et al., 2010; Galatowitsch, et al., 2009; Gatewood, 2003; Mahr, 2007; Opdam, Steingrover, & van Rooiji, 2006; Opdam & Wascher, 2004; Quinn, Greenaway, et al., 2007). Regional planning and transboundary collaboration, as discussed below, are thought to be two of the most effective methods of coping with the issues of climate change and habitat fragmentation.

2.3 Regional Planning

2.3.1 Regional Planning for Climate Change Adaptation

Environmental planning began in response to the recognition of the negative effects our actions have on our environment. In the beginning, it addressed environmental issues on the small scale; divisions between management areas were created to reflect human boundaries (county lines, park boundaries, international borders, etc). The threat of climate change has caused the focus to shift onto regional environmental planning, which addresses environmental problems at the ecosystem level. If a problem exists across a large scale, such as climate change in the Rocky Mountains, then it must be addressed at that scale. Environmental planners and managers must work across jurisdictional boundaries to come to a solution together (Brunckhorst, 2000; Galatowitsch, et al., 2009; Lawler, 2009; Steidl, et al., 2009).

Brunckhorst (2000) coined the term "bioregion" to describe "a regional-landscape scale of matching social and ecological functions as a unit of governance that can be flexible and congruent still with various forms of government found around the world" (2000, p. 8). It is thus an area which is defined by biological rather than political boundaries (Brunckhorst, 2000, p. 37). From this, the concept of bioregional planning was developed, which is "... a planning framework which allows for the variously defined and tenured areas of land or sea within a bioregion to be managed in a complementary way to achieve long-term conservation, resource use and human lifestyle objectives in concert with local communities" (Brunckhorst, 2000, p. 37). It is seen as a tool for "integrative planning and management" (Brunckhorst, 2000, p. 8). Brunckhorst (2000)suggests that "...scientists and managers are recognizing the need to plan *regionally* in order to act locally. To be effective, management and local action must occur in a regionally integrated manner" (p. 16).

Faced with the knowledge of the anticipated impacts of climate change on parks and protected areas, parks managers must find the best way to address these issues. There has been a call

for the regional management of landscapes as a potentially successful solution (Brunckhorst, 2000; Chambers & Ham, 1995; Dudley et al., 1999; Galatowitsch, et al., 2009; Hanna, et al., 2008; Heller & Zavaleta, 2009; Lawler, 2009; Nelson & Sportza, 2000; Welch, 2005).

This needs to happen in two ways. First, parks and protected areas need to be connected physically, through the creation of new protected areas and corridors if connectivity does not already exist. This is to ensure species survival, as large, connected networks of parks and protected areas will best allow them to migrate as necessary to cope with climate change (Hanna, et al., 2008; Welch, 2005). It is not enough for parks and protected areas to be physically connected, however; they must be managed as a connected entity as well (Brunckhorst, 2000; Dudley, et al., 1999; Welch, 2005). Therefore, all physical and non-physical barriers to species migration must be removed (Welch, 2005). This may include adopting policies that allow for transboundary management.

Welch (2005) suggests that parks and protected areas incorporate their neighbours into their management plans and work with them to achieve a sufficient level of environmental protection. These neighbours could be other parks and protected areas, agricultural areas, urban areas, amongst other possible land uses. It is important that they identify their "regional ecosystem partners" so that they can collaborate on the best ways to address the impacts of climate change on their region (Heller & Zavaleta, 2009; Welch, 2005, p. 85). By recognizing the regional impacts of climate change, it could be possible to better understand the different roles of each neighbour. Welch (2005) believes that regional environmental protection occurs best through "...promoting ecological connectivity and porosity between and around protected areas, cooperating to mitigate or eliminate all local and regional threats to ecological integrity, and communicating climate change impacts and adaptation strategies..." (p. 85).

Ultimately, parks and protected areas managers "...will have to be more flexible, more responsible, and more adaptable than sometimes has been the case in the past" in order to deal with climate change effectively (Dudley, et al., 1999, p. 4; Heller & Zavaleta, 2009). This is not any easy task, and is purported to be "... the single biggest challenge facing protected area management in the next few decades" (Dudley, et al., 1999, p. 7). It is vital that parks and protected areas managers step up to this challenge, however, to successfully cope with climate change.

2.4 Transboundary Collaboration

Regional integration is important for climate change adaptation, as discussed above. Traditionally, however, parks are planned and managed as units independent of the wider ecosystem, which does not maximize possible connectivity in a region (Prato, 2007). Attempts at regional integration have been made and are ongoing in the Rocky Mountains. Below are two examples of transboundary collaboration projects within the Rocky Mountains: the Yellowstone to Yukon Conservation Initiative and the Crown of the Continent Ecosystem management project. Their relevance and applicability to the study area of this thesis will be discussed.

2.4.1 Yellowstone to Yukon Conservation Initiative

The Yellowstone to Yukon Corridor (Y2Y) is "one of the most biologically intact areas in North America," spanning 3,200 km of the Rocky Mountains and encompassing the headwaters of many of the continents major rivers including the Yukon, Fraser, Columbia and Missouri rivers (Mahr, 2007, p. 230). The Y2Y includes lands in the Yukon, Northwest Territories, British Columbia, Montana, Idaho, and Wyoming (Gatewood, 2003), crossing numerous jurisdictional boundaries. Figure 2.1, below, depicts the Y2Y corridor and highlights current parks and protected areas.

Figure 2.1 Yellowstone to Yukon Corridor

(Yellowstone to Yukon Conservation Initiative, No Date)

The international Y2Y Conservation Initiative has a vision of contiguous protected area spanning the Rocky Mountains from the Greater Yellowhead Ecosystem in the south to the Mackenzie Mountains in the north (Gatewood, 2003). This role of the Y2Y would be to provide suitable habitat for species with vast habitat ranges, such as grizzly bear, elk, and caribou (Gatewood, 2003).

"One of the initiative's principal messages is that the Y2Y's contiguous landscapes should be treated as one large ecoregion in which nature continues to reign as unimpaired as possible, and where human communities coexist with nature" (Mahr, 2007, p. 230). Over 100 researchers have been studying the Y2Y corridor for over almost two decades (Mahr, 2007). Currently, the Initiative encompasses more than "140 organizations, institutions, and foundations, plus individual scientists, conservationists, economists, and environmental advocates," including the Alberta, British Columbia, and Yukon governments (i.e., Alberta Fish and Wildlife, B.C. Ministry of Environment, B.C. Ministry of Forests and Range, Banff National Park, and Yukon Department of Environment, Fish and Wildlife Branch (Jessen & Ban, 2003, p. 185; Yellowstone to Yukon Conservation Initiative, 2010). This makes it the largest project of its kind, both in terms of geographical area and number of grassroots organizations involved (Gatewood, 2003).

The purpose of this Initiative is to "...build and maintain a life-sustaining system of core protected reserves and connecting wildlife movement corridors, both of which will be further insulated from the impact of industrial development by transition or buffer zones" (Jessen & Ban, 2003, p. 185). This system's core will be made up of existing parks and protected areas. The project aims to fill any gaps in the connections between these parks and protected areas with new protected areas and corridors (Jessen & Ban, 2003). The end goal of the Y2Y project is to have a "...1800-mile contiguous system of protected core reserves, transition or buffer zones, and connecting corridors" (Gatewood, 2003, p. 239). Y2Y has supported research on how to mitigate the impacts of roads on ecological processes (Quinn & Broberg, 2007).

Currently, one of the areas of concentration is the Rocky Mountain Parks in Alberta and British Columbia, as they are host to one of the largest populations of grizzly bears in the Rockies (Yellowstone to Yukon Conservation Initiative, 2010). Grizzly bears are considered an umbrella species, so when they are protected, the habitats and needs of many other species are protected as well (Mahr, 2007). The call for protection of grizzly bear habitat is but one of many examples of why it is

essential that the region have high levels of connectivity and be managed as such, especially in the face of climate change.

2.4.2 Crown of the Continent Ecosystem Management Initiative

The Crown of the Continent Ecosystem Management Initiative (COCE) is a massive transboundary collaboration project in the southern Canadian and northern American Rocky Mountains. Many studies have been conducted regarding its successes and challenges, as discussed below (Byrne & Kienzle, 2007; Carolin et al., 2007; Fagre, 2007; Grant & Quinn, 2007; Long, 2007; Mahr, 2007; Malanson, Butler, & Fagre, 2007; Pederson, et al., 2007; Pedynowski, 2003; Prato, 2007; Prato & Fagre, 2007; Quinn & Broberg, 2007; Quinn, Duke, et al., 2007; Quinn, Greenaway, et al., 2007; Thompson & Thomas, 2007).

2.4.2.1 Crown of the Continent Ecosystem

The Crown of the Continent Ecosystem (COCE) is located where the Rocky Mountains cross the Canadian-American border. It spans 43 000 km^2 of land, with 60% of its land in the United States (Montana), and the remaining 40% in Canada (Alberta and British Columbia) (Prato & Fagre, 2007). The area encompasses over 17 jurisdictions, including Alberta, British Columbia, and Montana, as well as first nations' lands in both Canada and the United States (Pedynowski, 2003). The COCE includes many protected areas, including Waterton Glacier International Peace Park (Alberta and Montana); Castle Rock Wilderness and Elk River Valley (British Columbia); and Glacier National Park (Montana) (Prato & Fagre, 2007). In Montana, 7089 km^2 of land is designated as wilderness areas; there are 10 British Columbia provincial parks in the COCE; and 32 protected areas of ranging levels of protection in Alberta (Quinn & Broberg, 2007). Waterton Glacier International Peace Park is a UNESCO World Heritage Site, recognized internationally for its natural heritage (Long, 2007). Approximately 17% of the COCE is privately owned, most of which is ranch lands, farmlands, or logging lands (Long, 2007). Within the COCE are headwaters for 19 North American rivers (Long, 2007).

Fire is a major component of ecosystem function within the COCE (Long, 2007). It acts in three ways: by creating and maintaining how forests and grasslands are composed and structured; by creating food (through killing trees) for insects and the birds that prey on them; and by preventing trees from encroaching on grasslands (Long, 2007). As a result of the historic presence of fire in the COCE, the area is home to many species that are fire-adapted, including lodgepole pine, black-backed

woodpecker, and huckleberry (Long, 2007). Although fire is an important part of many ecosystem processes in the COCE, the danger of fires in residential areas has resulted in many fires being suppressed before they could run their natural course (Long, 2007). Ideally, managers need to find a way to balance the need for fire for ecosystem health and the safety of those who live in this area (Long, 2007).

2.4.2.2 Management within the COCE

As previously noted, there are over 17 jurisdictions within the COCE, all of which have their own management (Long, 2007; Pedynowski, 2003; Prato & Fagre, 2007). With so many different interests, it is important for the COCE to find a way to meet the economic needs of the region while improving, or at least maintaining, its ecological integrity (Long, 2007).

In 1997, the United States and Canada developed a framework agreement called the Framework for Cooperation between the U.S. Department of the Interior and Environment Canada in the Protection and Recovery of Wild Species at Risk (Quinn & Broberg, 2007). The purpose of this framework is to allow for cooperation and consistency in the "identification, classification, and subsequent recovery activities of species at risk in both countries" (Quinn & Broberg, 2007, p. 106). It aims to aid many species, though does not include sea turtles, fish, or marine mammals; within the COCE both the grizzly bear and swift fox are listed (Quinn & Broberg, 2007).

2.4.2.3 Crown Managers Partnership

In 2001, the Crown Managers Partnership (CMP), a collaborative initiative, was created in the COCE in response to the recognition of the need for transboundary collaboration within the ecosystem (Quinn, Duke, et al., 2007). Through a founding workshop which was attended by over 20 agencies ranging from provincial, state, federal and first nations agencies, the CMP focuses on improving both regional management and communication (Quinn, Duke, et al., 2007). The CMP has outlined five strategic foci, as outlined in Quinn, et al. (2007, p. 217):

> (1) cumulative effects of human activity across the region; (2) increased public interest in how lands are managed and how decisions are reached; (3) increased recreational demands and visitation; (4) collaborative data sharing and standardizing assessment and monitoring methodologies; and (5) maintenance and sustainability of shared (transboundary) wildlife populations.

The CMP aims to address these foci to achieve collaboration throughout the COCE (Quinn, Duke, et al., 2007).

2.4.2.4 Challenges for the CMP and Possible Solutions

The CMP faces two major challenges: the absence of agency mandates for transboundary collaboration, and the absence of legislation and policies supporting it (Quinn, Duke, et al., 2007). It is often difficult for managers to budget time and energy for projects outside of their mandates (MacMynowski, 2007). However, many of the agencies involved have been able to interpret their mandates as supportive of transboundary collaboration, by highlighting the positive effects of CMP on the individual agencies (Quinn, Duke, et al., 2007). Unfortunately, while there is plenty of 'on-the-ground' support, there is little to no support at the higher political levels; again, often because of the absence of mandates and policies supporting work outside of jurisdictional boundaries (Quinn, Duke, et al., 2007).

One of the challenges the COCE faces is rallying public support because the biological changes the COCE aims to address occur over a long time scale. This can make it difficult for the average citizen to see the risks associated with inaction, and therefore they may not see cause to support the COCE. With "changing baselines" of what is the acceptable level of biodiversity changing every generation, it is difficult to explain to people what the COCE once was and could be (MacMynowski, 2007).

Quinn, et al. (2007) have proposed a number of solutions to the challenges faced by the CMP, as follow. The CMP should conduct research on how to best gain high level political support; small group meetings should be held regularly to revisit goals and objectives; efforts should be made to find long-term financial and human resource support; internal communication should be improved; the public and interest groups should be informed for CMP activities and successes; there should be constant monitoring, feedback , and evaluation of all projects; and agencies should incorporate CMP research into their agencies, thereby proving the usefulness of the CMP (Quinn, Duke, et al., 2007).

2.4.2.5 Lessons learned from the COCE and CMP

Transboundary collaboration is a "...gradual process of building trust, relationships, and mechanisms for cooperative projects" (Pedynowski, 2003, p. 1267). While the relationships between jurisdictions are slow to build, it is important to keep focus on the end goal of transboundary collaboration for the

benefit of the greater ecosystem. The barriers to TBC must be recognized in order to be addressed; once this occurs it is possible to move forward.

Chapter 3
Methodology

3.1 Research Questions

This thesis addresses five research questions, as follow:

- What is the current policy within the Parks Canada Agency, British Columbia Parks, and Alberta Parks in regards to the management implications of climate change?
- To what degree is regional planning occurring in and around Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park with regard to climate change?
- What are the challenges that parks face with regards to transboundary collaboration and regional planning?
- What should be done to address the challenges that parks agencies face with regards to transboundary collaboration and regional planning?
- What do parks agencies and managers need to be able to participate in transboundary collaboration and regional planning?

This research was conducted with a qualitative approach, using multiple techniques including: a literature review, a document review, a questionnaire, and an Importance-Performance Analysis to address the research questions. This project addressed the research questions through a case study of three physically connected parks within the Canadian Rocky Mountains: Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park. Although they are all within the Canadian Rocky Mountains, each park falls within a different jurisdiction: Parks Canada, British Columbia Parks, and Alberta Parks, respectfully. Within this case study, I identified individuals that are key actors in parks planning in this area. I was then able to extrapolate the information gathered within the case study area to the greater Canadian Rocky Mountains, in conjunction with the Crown of the Continent Ecosystem management project and the transboundary collaboration and regional planning occurring there.

Research Question 1 was answered by conducting a document review of existing policy documents, including legislation and park management plans, relating to the Parks Canada Agency, British Columbia Parks and Alberta Parks in regards to the potential management implications of climate change.

Research Question 2 was addressed in two steps. First, I conducted a document review of existing documents discussing regional planning within the case study. Second, I conducted a questionnaire and an Importance-Performance Analysis (Martilla & James, 1977) in order to determine what is happening in practice.

Research Question 3 was addressed in a number of ways. By analyzing the answers to Research Questions 1 and 2, it was possible to see the potential barriers to transboundary collaboration and regional planning in the case study area. Once these barriers were recognized, it was possible to move forward in providing suggestions to overcome them. Here, other case studies regarding transboundary collaboration and regional planning, such as the Crown of the Continent Ecosystem (COCE) management project (Pedynowski, 2003), were examined (see Chapter 2.4, above). Through this it was for the examples to be translated to the case study area. As well, the participants were asked for their opinions on what they feel would make it easier for transboundary collaboration and regional planning to occur within their region. The selected participants (see Chapter 3.3, below) are experts on the planning and management of their parks; therefore, their opinions carry weight. By using these two methods, it was possible to develop a list of ways to improve transboundary collaboration and regional planning within the case study area and possibly beyond (Research Question 4).

3.2 Study Area

The study area includes Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park, which are located along the British Columbia –Alberta border (see Figure 3.1, below). These three parks have been chosen for two main reasons: i) they are physically connected already so it is easy to conceptualize them as a single entity since there are no physical barriers between them preventing them from being regionally managed; and ii) since they are managed under three jurisdictions, this site can serve as a test for regional planning. The case study should thus highlight any challenges in regional planning across jurisdictions.

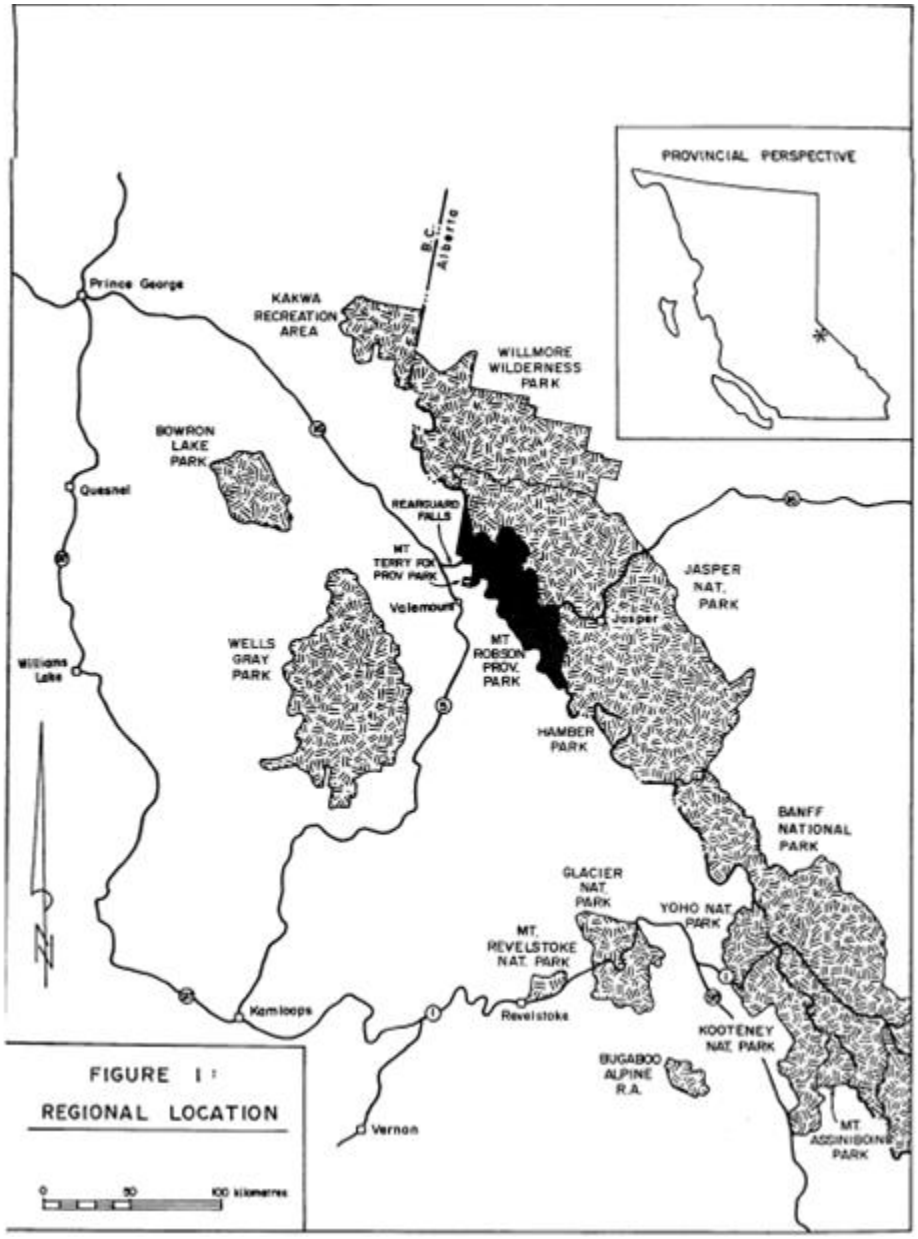

Figure 3.1 Location of Parks in Study Area

(British Columbia Ministry of Environment Lands and Parks, 1992, p. 6)

3.3 Participants

The questionnaire and Importance-Performance Analysis included parks' managers and planners who work for and with the parks within the case study. Park ecologists and other key players, identified by other parks employees, were also included where possible.

3.3.1 Participant Recruitment

An expert panel was created to address Research Questions 2 and 3. Participants were recruited based on their involvement with planning, management, and ecology within the parks included in the case study; job positions included: park ecologists, regional directors, senior parks planners, district conservation officers, science coordinators, science managers, resource conservation managers, land use planning and policy managers, senior advisors, integrated land use planners, and area supervisors. In all cases of contact, potential participants were asked if they had any recommendations for other potential participants.

All potential participants from parks management were informed of the type of participation asked of them, and were assured that they would be given confidentiality within their park. Due to the nature of the research, it was not possible to keep their park anonymous.

3.4 Ethics Approval and Research Permits

3.4.1 University of Waterloo Office of Research Ethics Approval

This thesis was reviewed and approved for research with human participants by the University Of Waterloo Office Of Research Ethics on August 10, 2010 (Office of Research Ethics File # 16582) (See Appendix A). Due to the nature of the research, although the participants were assured their names would not be used without permission, they were told that their positions would not be anonymous (for example, a participant would be referred to as "a park planner from Jasper National Park").

3.4.2 Parks Research Permits

Alberta Parks did not require the researcher to apply for a research permit to include Willmore Wilderness Park in the research project. British Columbia Parks assigned the researcher a Parks Use Permit (No. 105052) (see Appendix B), and Parks Canada issued the researcher a Research and Collection Permit (JNP-2010-6425) for conducting research with staff of Jasper National Park (see Appendix C). All participating parks will receive a finished copy of this thesis.

3.5 IUCN Framework for Evaluating Management Effectiveness

This research used the IUCN Framework for Evaluating Management Effectiveness as a guide, specifically its guidelines for evaluating management at the agency/national scale. At this scale, evaluation reaches beyond a single protected area to a grouping of protected areas, that may or may

not span multiple agencies (Hockings, Stolton, & Dudley, 2000). Following this evaluation, it is important to address both issues within and amongst the protected areas within the study area, and to examine policies and practices at each level (Hockings, et al., 2000). This was accomplished by the document review, questionnaire, and Importance-Performance Analysis conducted for this research undertaking.

3.6 Questionnaire

A questionnaire was developed in conjunction with the thesis supervisor, Dr. Paul F.J Eagles, and the committee member, Dr. Christopher Lemieux (see Appendix D for a copy of the questionnaire). The 23 question questionnaire asked participants questions on the following topics: participant information; park information; perceptions and awareness of climate change impacts and the influence of climate change impacts on park policy, management, and planning; research and monitoring; transboundary collaboration; and an importance-performance analysis of park management (see Chapter 3.7, below). The purpose of the questionnaire was to address Research Questions 2, 3, and 4.

The questionnaire was sent to potential participants electronically with the intention of reducing response times. Although all participants chose to respond electronically, they were given the option of responding on paper if that was their preference.

3.7 Importance-Performance Analysis

Importance-Performance Analysis (IPA) is a method that has been used extensively in the field of marketing since the 1970s (Martilla & James, 1977). IPA is used to form a clear understanding of the perceived importance and performance of a given service to the consumer (Martilla & James, 1977). This is a method by which one can determine both the perceived importance of a service as well as how well that service is being performed (Martilla & James, 1977).

Study participants are asked two sets of questions for each attribute: the first, regarding how important it is to them; the second, how well is the service provider performing on this (Martilla & James, 1977) It is a chance for those being affected by an attribute to have their say on its importance and the agency's performance on the delivery of this attribute (Guadagnolo, 1985). Participants are asked to rank their answers on a scale, usually from 1-5, though this can change based on how much variance the researcher desires (Martilla & James, 1977). Guadagnolo (1985) suggests that a 7-point scale (Delighted-Terrible Scale or DTS) is preferable, as it reduces the skewness of

participants' responses and allows for a more diverse response set. Using the DTS, responses are ranked as follows: Delighted (7), Pleased (6), Mostly Satisfied (5), Mixed (4), Mostly Dissatisfied (3), Unhappy (2), and Terrible (1) (Guadagnolo, 1985). However, the standard 5-point Likert Scale was applied in this research to ensure comparability amongst other Importance-Performance Analyses.

The results from the questionnaire are then displayed on an importance-performance grid, with the response for each question plotted (Martilla & James, 1977). The x-axis ranks the performance from excellent to poor, and the y-axis ranks importance from low to high (Martilla & James, 1977). The grid is then divided into four quadrants, which outline where a service provider needs to improve ("Concentrate Here"), where they are doing well ("Keep up the good work"), where they may be over-doing it ("Possible Overkill"), and where there is little priority for that service to be provided ("Low Priority") (Martilla & James, 1977).

Analysis of the IPA is completed by discerning the placement of each attribute on the grid, focusing on those attributes located towards the extremes of the grid, which indicate those attributes with large differences between their importance and performance rankings (see Appendix B). It is important not only to note the placement of the individual attributes, but also how they compare to the others. This will indicate how important an attribute is in relation to the others, and from there determine where to focus priority (Martilla & James, 1977).

There are a number of factors that must be considered in developing an IPA. First, it is necessary that the IPA questionnaire address issues that are important to the participant (Martilla & James, 1977). In order to be able to do this, the researcher must first conduct a review of the information available to determine a list of noteworthy attributes (Martilla & James, 1977). Also, it is recommended that using a scale of 1-5 or 1-7 will provide a wide enough range of responses to glean a clear understanding of the most important issues. Generally, the middle of the scale should be used as the intersection between x and y axes; however, if the responses are scaled more to one end than the other, it is possible to shift the intersection accordingly (Martilla & James, 1977).

Wade and Eagles (2003) suggest that IPA could be applied to protected areas research, where limited resources (both temporal and financial) prevent researchers from using other, more costly methods such as the SERVQUAL instrument. The authors suggest incorporating other data available to strengthen the results gathered; in the proposed research, results from content analysis of relevant documents (see above section) will be combined to gain the most from this method (Wade & Eagles, 2003).

There is a risk that the positioning of the results on the Importance-Performance grid suggests more variance between results than there actually is. There may not be statistically significant variance between points that end up in different quadrants due to the placement of the x- and y-axes. It is therefore necessary to be aware that although attributes may be in different quadrants, they do not automatically require completely different management strategies (Wade & Eagles, 2003).

IPA has had widespread application, ranging from marketing (Martilla & James, 1977), satisfaction of race participants (Guadagnolo, 1985), restaurant positioning (Keyt, Yavas, & Riecken, 1994), visitor satisfaction at parks and protected areas (Wade & Eagles, 2003), and students' perceptions of the quality of their education (O'Neill & Palmer, 2004). Although IPA has not been used in the context of transboundary collaboration for climate change adaptation, it is expected that it will be transferable to this field as it will be able to show how important different aspects of regional park planning are to parks managers and planners, and how satisfied they are with the current level of performance on these aspects.

3.7.1 Application of IPA to Evaluation of Parks and Protected Areas Climate Change Management

Although IPA has been used in parks and protected areas research (Wade & Eagles, 2003), it has only been in the context of tourism and visitor satisfaction; IPA has yet to be applied in the context of climate change management or planning. However, it is expected that it can be applied successfully to this field, as it can be used to highlight the most important issues of a given subject matter in the opinion of parks planners and managers. In this instance, it will be used to determine how parks planners and managers feel their parks agencies are doing on the issue of climate change management, and how important this subject (and related issues) is to them. It is expected that by conducting an IPA with the parks managers and planners from the parks agencies within the study site, areas of concern will be highlighted. From this, it will be possible to develop management recommendations to address these issues in the coming years.

Chapter 4
Review of Park Acts, Management Plans, and Reports

4.1 Jasper National Park

4.1.1 Canada National Parks Act

The Canada National Parks Act makes no reference to climate change, regional planning or collaboration (Minister of Justice, 2000). This may be an indication of the age of the legislation. It also shows that the overarching law does not encourage regional collaboration to deal with climate change, a potential major problem in conducting such work. Without specifically allowing for or requiring work on climate change, regional planning, or collaboration may be difficult, if not impossible. The Canada National Parks Act will need to be rewritten with a stronger focus on regional planning if national parks are to be fully capable of working within regional ecosystems and regional political regimes.

4.1.1.1 Ecological Integrity

The Canada National Parks Act defines Ecological Integrity as "with respect to a park, a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes" (Minister of Justice, 2000, p. 1). The "maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks" (Minister of Justice, 2000, p. 5). Thus, it is of utmost importance that parks managers and planners continue to ensure the ecological integrity of their parks in the face of climate change.

Lemieux, Beechey and Gray (2011) discuss the meaning of ecological integrity in the face of rapid climate change, noting that "ecological integrity supports the greater ecosystem approach to management where protection of processes that facilitate ecosystem adaptation to climate change often extend beyond the boundaries of individual protected areas" (p. 3). The best way for parks and protected areas to approach ecological integrity in the face of climate change is to focus on protecting ecosystem processes rather than specific species within a park (C. J. Lemieux, et al., 2011).

4.1.2 Jasper National Park of Canada 2008 State of the Park Report

Parks Canada prepares State of the Park reports every five years for its National Parks, timed in combination with the review and renewal of a park's management plan (Parks Canada, 2008). The second State of the Park report for Jasper National Park was released in 2008, with the next expected in 2013. Below are highlights from this report, as pertain to climate change and transboundary collaboration within the study area:

- The Park reported success in slowing the spread of Mountain Pine Beetle (Parks Canada, 2008).
- Climate change impacts were seen in: glacial retreat, decreased winter precipitation, and increasing temperatures (Parks Canada, 2008).
- The report discusses how the management plan did not include climate change related issues.

The State of the Park (2008, p. viii) review also called for a number of issues to be considered in the 2010 Management Plan, including the following pertaining to climate change and transboundary collaboration:

- "Effective regional collaboration to maintain secure habitat for grizzly bears and caribou."
- "Revision of fire targets and mountain pine beetle strategies to improve ecosystem health."
- "Strategies for adapting to the impacts of climate change."

4.1.3 Jasper National Park of Canada Management Plan

The updated 2010 Jasper National Park of Canada Management Plan reflects the comments made in the 2008 State of the Park Report (see Chapter 4.1.3, below).

The 2010 Management Plan makes reference to the regional environment of the park including the many parks nearby and adjacent to Jasper's borders. It specifically states that "Jasper National Park works with jurisdictions in Alberta and British Columbia who share responsibility for the regional landscape and for serving the people who depend on or value it" (Parks Canada, 2010b, p. 6). The reasons for this are clearly outlined:

> Parks Canada and its neighbours share similar ecological, social and economic issues, and cooperate for the benefit of the park and adjoining lands. Areas of most active collaboration include tourism,

> forest health, fire management, caribou recovery planning, grizzly bear viability and security, access management, research and monitoring (e.g. the Foothills Research Institute), and education (e.g. Alberta's Grande Yellowhead Public School Division) (Parks Canada, 2010b, p. 6).

The Management Plan focuses on JNP's role in what it calls the "Southern Mountain Parks," the seven national parks in the Columbia and Rocky Mountains: Jasper, Banff, Waterton, Glacier, Yoho, Kootenay, and Mount Revelstoke (Parks Canada, 2010b). The Management Plan also stresses the importance of Jasper (and four other of the Southern Mountain Parks) being a UNESCO World Heritage Site; this indicates Jasper's international importance (Parks Canada, 2010b). Parks Canada has developed a common vision for these parks, as follows:

> Canada's mountain national parks are renowned living examples of all that is best in the conservation of mountain ecosystems and history, facilitation of authentic nature-based experience, shared initiative, meaningful learning, and mountain culture. Visitors to these places feel welcomed into experiences that exceed their expectations.
>
> The silent peaks, forest mosaics, living waters, wildlife, people, clean air and endless capacity to inspire bring rejuvenation, hope and self-discovery to future generations, just as they have for the many generations that came before (Parks Canada, 2010b, p. 8).

In Section 4.4, Ensuring Healthy Ecosystems, the Management Plan makes reference to the management efforts pertaining to healthy ecosystems: "In the last ten years, management has focused on disturbed ecosystems, fire, wildlife-human interactions, sharing habitat in the valleys, caribou recovery, healthy regional landscapes, regional collaboration and opportunities for visitors to learn about and contribute to resource management" (Parks Canada, 2010b, p. 31).

In Subsection 4.4.1, Direction, regional collaboration is one of the methods the Park intends to use to ensure healthy ecosystems. Specifically, the Park aims to "Work with regional land managers, non-governmental organizations and industry to ensure populations of grizzly bear, caribou and other wide-ranging species remain viable" (Parks Canada, 2010b, p. 34).

Section 4.5 provides many ways in which Jasper National Park can Foster Open Management, which aims to approach "...management challenges as an opportunity to engage a diverse community of interested Canadians in learning together, sharing information, creatively imagining options, and collaborating on solutions that create new success stories" (Parks Canada, 2010b, p. 36). Subsection 4.5.1, Direction, provides details on how Jasper National Park intends to

achieve these goals. The following pertain to transboundary collaboration: “Engage interested stakeholders, park visitors and community members in research, data collection, and integrating and applying scientific findings” ; and “Participate in regional or national initiatives to coordinate land use planning” (Parks Canada, 2010b, pp. 37-38). Jasper National Pak intends to “coordinate land use planning” via pursuing “...common goals for resource protection and visitor experience” and by supporting “...decision-making in the regional ecosystem” (Parks Canada, 2010b, p. 38).

Section 8.3, Assessments and Findings, includes mention of transboundary collaboration. Subsection 8.3.1, Key Strategies, outlines regional collaboration as an important method of maintaining and improving grizzly bear populations (Parks Canada, 2010b).

While climate change and its predicted impacts are not discussed in detail in this Management Plan, Section 8.4, Cumulative Effects, notes that climate change is an external stressor on the park: “Changes in climate impact wildlife and vegetation distributions, freshwater flows and natural disturbance processes” (Parks Canada, 2010b, p. 96).

The Management Plan includes a summary of priorities for the next five years (2010-2015). The goal of Fostering Open Management and Innovation includes participating in regional planning as one its key objectives (Parks Canada, 2010b).

4.1.4 Annual Report Jasper National Park of Canada

The 2010 Annual Report highlights the accomplishments and projects of the year in Jasper National Park, covering all aspects of the Park’s management from visitor services and ecosystem monitoring to management plan development and review. Below are key highlights from this report:

- Spring 2010 was “...the driest on record, with approximately half of the normal average winter precipitation and only eight percent of the normal average precipitation for June” (Parks Canada, 2010a, p. 9). However, fire activity was lower than average, though prescribed burns were postponed due to the dry conditions (Parks Canada, 2010a).
- Mountain pine beetle activity was low in 2010. It was highest in the Miette and Athabasca Valleys as well as in the Smoky District (Parks Canada, 2010a).
- The Park continues its involvement in the Foothills Research Institute. Parks Canada has contributed funding to research on regional issues including: mountain pine beetle management, grizzly bear health, mining impacts, and road access (Parks Canada, 2010a).

- A $2 million legacy fund was created by the Kinder Morgan Canada – Anchor Loop Pipeline Project (TMX), to be used on ecological issues in Jasper National Park and Mount Robson Provincial Park. Specifically, this legacy fund aims to "contribute to long-term ecological gains along transportation corridors" within and between the two parks (Parks Canada, 2010a, p. 19). Currently, there are two projects under this fund: "an inventory of culverts in Mt. Robson Provincial Park and research investigating the extent to which the Yellowhead Highway (Hwy 16) acts as a barrier to large mammal movement" (Parks Canada, 2010a, p. 19).

4.2 Mount Robson Provincial Park

4.2.1 British Columbia Park Act

The Park Act for the Province of British Columbia is valid from 1996 through 2011. Sections 4.1 and 4.2 outline legislation regarding Collaborative Agreements:

> The minister may enter into an agreement relating to the administration and management of matters and things referred to in section 3 or 6 with any of the following:
>
> (a) a government corporation;
>
> (b) a local government;
>
> (c) the government of Canada, the government of a province of Canada, the government of a jurisdiction outside Canada or an official or agency of any of those governments.
>
> (d) [Repealed 2006-25-4.]
>
> (e) any other person or persons (Province of British Columbia, 1996).

This section allows for transboundary agreements amongst Mount Robson Provincial Park and other protected areas.

4.2.2 Mount Robson Provincial Park Ecosystem Management Plan

The Mount Robson Provincial Park Ecosystem Management Plan developed for British Columbia Parks as an Occasional Paper (Number 6), was released in March 2001. The Mount Robson Provincial Park Draft Management Plan (see Chapter 4.6.4, above) draws heavily on recommendations from this report. The Mount Robson Provincial Park Ecosystem Based Management Plan highlights the current situation in Mount Robson Provincial Park, issues of concern, and potential solutions (B.A. Blackwell and Associates Ltd. et al., 2001).

Section 4.0, Adjacency Issues, discusses Mount Robson Provincial Park's current and potential interactions with adjoining lands (protected areas, public, private, and crown lands). Section 4.1 outlines Mount Robson's role in the Greater Yellowhead Ecosystem, noting that many issues within the Park are far-reaching across this larger ecosystem, and that there is often very little the park can do individually to affect these issues (i.e. climate change) (B.A. Blackwell and Associates Ltd., et al., 2001). However, a number of transboundary issues that can be influenced by the Park include: forest pest outbreaks and wildfire; management of animals with large habitat ranges; spread and control of non-native vegetation (B.A. Blackwell and Associates Ltd., et al., 2001).

Section 4.4, Ongoing Interagency Management Initiatives, highlights two such initiatives. The Yellowhead Ecosystems Working Group was "...formed to better coordinate resource management issues among neighbouring jurisdictions along the Yellowhead Highway from Edson to McBride" (B.A. Blackwell and Associates Ltd., et al., 2001, p. 63). Members of this group include: Alberta Wildlife, Jasper National Park, Weldwood of Canada (Hinton Division), BC Parks, B.C. Forest Service, BC Environment, and Slocan Forest Products Ltd. This group focused on nine key issues, including: distribution and representation of habitat; access; fire management; management of mountain pine beetle; role of disturbance processes; grizzly bear conservation; caribou conservation; information sharing; and common data collection and management (B.A. Blackwell and Associates Ltd., et al., 2001, p. 64).

Section 4.4.2, Four Mountain Parks, discusses the influence of Parks Canada's Four Mountain Parks on Mount Robson Provincial Park. Mount Robson Provincial Park shares a boundary with Jasper National Park, and is as such contiguous with Jasper, Banff, Kootenay, and Yoho. This report notes that the Parks Canada plans for these parks are currently compatible with Mount Robson Provincial Parks goals and objectives (B.A. Blackwell and Associates Ltd., et al., 2001).

Section 5.0, Summary and Implementation, includes a subsection (5.1) on Interagency Cooperation. This report argues that interagency cooperation will be of utmost necessity in order to

minimize the costs and maximize the effects of management actions (B.A. Blackwell and Associates Ltd., et al., 2001).

4.2.3 2007 Mount Robson Provincial Park Management Plan- DRAFT

The Mount Robson Provincial Park Management Plan Draft from 2007 mentions climate change early in the plan, in the Background Summary, Section 1.2. It notes several climate change impacts anticipated over the next 50 years, including: overall warming; increased winter temperatures; increased precipitation; increase in the frequency and intensity of forest fires, pest infestations, and droughts; hydrologic changes (glacial retreat, timing of highs and lows of water events); "forest encroachment on alpine meadows;" "extirpation of some plant and animal species, for example, those in ecological pockets such as microclimates, or at the limits of their range;" and ecosystem change (Ministry of Environment Land and Stewardship Divison, 2007, pp. 7-8).

Section 1.3, Relationships with Other Planning Processes, focuses on the relevance of other planning processes on Mount Robson Provincial Park. This section highlights in the importance of planning within Jasper National Park, noting that Mount Robson is affected by both conservation and recreation planning within Jasper National Park (Ministry of Environment, 2010). It makes note of several planning priorities outlined in the 2007 Jasper National Park of Canada Management Plan, which are repeated in the 2010 Jasper National Park of Canada Management Plan (see above).

Section 1.3 also notes that Mount Robson Provincial Park has been a part of the UNESCO Canadian Rocky Mountain Parks World Heritage Site since 1994. This puts pressure on Mount Robson Provincial Park to maintain a high standard of ecological integrity, and encourages the parks to create a management plan for the Heritage Site (Ministry of Environment Land and Stewardship Divison, 2007).

Section 2.2, Roles of Mount Robson Provincial Park, outlines its importance in conservation. It notes that the Park is part of "...one of the largest contiguous mountain park complexes in the world..." and is an important part of the Yellowhead Ecosystem (Ministry of Environment, 2010, p. 15). It is clear that the Draft Management Plan has envisioned Mount Robson Provincial Park as important not only as a single entity but as part of the bigger picture.

Section 2.4, Management Issues, highlights climate change as an issue of concern. The Draft Management Plan notes that climate change will force the Park to make changes to traditional park planning, which tends to focus on maintaining historical or current ecosystems. It argues that

continuous monitoring of the effects of climate change is necessary. Also: "*Park managers must better understand to what extent climate change effects can or should be tempered within parks to help natural systems adjust to support species that might otherwise be naturally extirpated or to mitigate possible negative impacts on recreational use and public safety*" (Ministry of Environment, 2010, p. 26).

Section 2.4 also discusses the importance of collaborative management, specifically with the Robson Valley and Jasper National Park. While this section of the plan is still being developed, the Draft Management Plan recognizes that:

> *The park management plan for Mount Robson Provincial Park will need to address how best to maintain liaison with other agencies regarding management of adjacent land with a priority to maintain habitat linkages and populations of species such as grizzly bear, mountain goat and woodland caribou, and to manage access, recreation use and visual quality* (Ministry of Environment Land and Stewardship Divison, 2007, pp. 30-31).

This section notes that Jasper National Park has suggested that Mount Robson Provincial Park and Jasper National Park use compatible zoning systems along their adjoining boundaries (Ministry of Environment, 2010).

The Vision Statement for Mount Robson Provincial Park is outlined in Section 3.1, Vision Statement. One section of the vision statement focuses on climate change and ecosystem-based management:

> *Ecosystem based management of Mount Robson Provincial Park as a component of the Canadian Rocky Mountain Parks World Heritage Site continues to support coordinated and well-researched intervention to preserve and restore biodiversity, natural habitats and ecological communities within the limitations imposed by global climate change* (Ministry of Environment, 2010, p. 34).

It is clear that the Park is envisioned as part of the whole of the ecosystem, and there is a desire to plan accordingly. By including its status as a member of the Canadian Rocky Mountains World Heritage Site in its vision, it is intended that the park work in collaboration with the other parks included within the World Heritage Site.

Section 3.2, Natural and Cultural Values Management, outlines the Park's management goals. It stresses that the park will be managed to protect its natural and cultural features; noting that "individual resources will be managed to maintain the naturally evolving characteristics of the park

ecosystem in coordination with adjacent park and provincial forest jurisdictions" (Ministry of Environment, 2010, p. 35).

Mount Robson Provincial Park uses Ecosystem Based Management. Elements of this type of management approach include using adaptive management; focusing on large-scale and long-term issues; and "...interagency cooperation, given that ecosystems extend beyond jurisdictional boundaries..." (Ministry of Environment, 2010, p. 36). The Draft Management Plan notes that while being a part of a large system of contiguous parks and protected areas is ecologically beneficial, it is only possible to maximize these benefits with collaboration and cooperation amongst agencies (Ministry of Environment, 2010).

Section 3.2 also discusses the potential impacts of climate change, and how the Park can be prepared for them. The Park must monitor climate change impacts to determine the rate of change and determine management options to minimize the effects of the park. To achieve this, it will be necessary to increase "...cooperative management initiatives with surrounding land management agencies (Parks Canada, Ministry of Forests and Range, Ministry of Transportation, regional district)..." (Ministry of Environment, 2010, p. 38).

The Draft Management Plan includes Draft Objectives and Draft Strategies for achieving each objective. Many pertain to climate change and transboundary collaboration. Table 4.1, below, is adapted from the Draft Management Plan (Ministry of Environment, 2010, pp. 39-40, 46-48, 50-52):

Table 4.1 Objectives and Strategies in the Mount Robson Provincial Park Draft Management Plan, as pertain to climate change and transboundary collaboration

Draft Objectives	**Draft Strategies**
To cooperate with adjacent land managers to ensure biodiversity is maximized in the Northern Rockies Ecosystem and the area is managed efficiently as a sustainable regional landscape.	• Ensure that any active management strategies employed to meet biodiversity objectives should be preceded by a survey of plant and animal species at risk in the area to be managed. • Recognize and understand the ecological continuums that cross jurisdictional boundaries; • Maintain close liaison with Parks Canada, BC Ministry of Forests and Range, the Ministry of Agriculture and Lands and other land and resource management agencies and private groups that have an effect on the Northern Rockies Ecosystem;

	• Work co-operatively with other government agencies and land managers to ensure wildlife (e.g., grizzly bear, bighorn sheep, mountain goat, mountain caribou) habitat that exists external to the park is maintained, including effective connectivity throughout the region's protected areas and wildlife management areas. • Work with the MoFR [Ministry of Forests and Range] and ILMB [Integrated Land Management Bureau] to maintain high biodiversity emphasis adjacent to the park in support of the Robson Valley LRMP [Land and Resource Management Plan] Conservation Objectives and Strategies. • Provide input through provincial review processes for proposed major developments outside the park that may impact its ecosystem values (including fish and wildlife). • Monitor and provide input into forest stewardship plans, mineral exploration projects, and commercial recreation proposals within the greater ecosystem area affecting the park. • Encourage links between databases for the collection, recording, and sharing of ecological information. • Use existing planning systems, management efforts, and organizations rather than developing new ones. • Encourage governments at First Nations, federal, provincial, and local levels to take an integrated ecological approach to land management.
To increase knowledge of ecological components and processes within the park and an understanding of their response to climate change.	• Encourage and conduct monitoring and research into park hydrology and vegetation to support future management decisions. • Exchange inventory and research information on ecosystem values and processes with other agencies and jurisdictions. • Conduct reconnaissance habitat inventory and develop a species list for the park, preferably in coordination with similar efforts for the surrounding area. Place priority on those areas with present or projected recreational uses and on those areas such as alpine meadows that may have species at risk or unusual species diversity, or may be particularly sensitive to climate change. • If MoFR [Ministry of Forests and Range] or licensees are carrying out Predictive Ecosystem Mapping, supplement these projects to carry out such mapping inside park boundaries.
To build and maintain the necessary public support for the ecological conservation goals within the park.	• Co-ordinate the development of communication and educational resources with other agencies and private groups to enhance the overall effectiveness of activities that support ecosystem integrity.

To manage the park's vegetative communities in a manner that responds to short-term and long-term environmental change, maintains their evolutionary potential and contributes to the conservation, recreation and visual attractions of Mount Robson Provincial Park.	• Continue with the implementation of the ecosystem, vegetation, and forest health (includes prescriptions for forest fire, mountain pine beetle) management plans and strategies that have been developed for Mount Robson Provincial Park. Update these plans and strategies as required to ensure they remain current and valid as management tools. • Continue to work with Parks Canada and other appropriate agencies in developing a consistent vegetation management plan to address fires and disease and insect outbreaks in the World Heritage Site.
To improve knowledge of the park's vegetative communities, with emphasis on protection of rare, endangered and vulnerable native plant communities and species including those elements most sensitive to climate change.	• Consider climate change impacts on rare, endangered, and vulnerable native plant communities and species, and potential management options to increase resilience. • Encourage low-impact scientific studies of vegetation. • Continue with the completion of a comprehensive vegetation inventory to locate, identify, and map plant communities, rare species and threatened plant communities in areas that could potentially be impacted by climate change or recreation. • Develop and implement priorities for applying BRIM (Backcountry Recreation Impact Monitoring) on sensitive vegetative communities. Develop appropriate visitor management strategies to ensure these sensitive vegetative communities are protected. • Intervene where practical if natural processes threaten 'at risk' plant communities and species. • In support of enforcement of the prohibition on wildcrafting (harvesting materials) in parks. • Develop and promote an annual "BioBlitz" enlisting citizen science to fill data gaps.
To prevent the establishment of non-native plant species.	• In cooperation with adjoining land management agencies and permittees, assess, monitor and control alien invasive species and other non-native plant species using the most effective low-impact methods available. • Initiate an annual non-native species monitoring program along the CN right of way. • Research and develop a management protocol for future scenarios in which non-native species may move into the park as a result of changing climate.
To manage the park's wildlife species and habitats in a manner that responds to short-	• Develop a coordinated long-term regional approach to wildlife management with Parks Canada, and other government agencies, including the Ministry of Forests and Range and the Integrated

term and long-term environmental change and maintains their evolutionary potential.	Land Management Bureau, and with First Nations, emphasizing species at risk (such as mountain caribou and grizzly bears), including: • maintaining ecosystem representation, • consideration of the effects of climate change; • conservation and use, • management of biodiversity; • access, connectivity and species movement; • range management; and • coordinating wildlife management objectives, particularly with respect to grizzly bears. • In response to the changing landscape resulting from the implementation of the park's ecosystem management plan coupled with the regional cooperative wildlife management approach, develop a park specific wildlife management strategy. Key elements in this strategy include: • ongoing wildlife inventory; • inventory of habitat requirements of species with particular reference to critical habitats; • role of fire, insect and disease in term of creating a range of habitats including snags for various bird and animal species; • trans-boundary management; • opportunities for research programs; • a travel corridor wildlife management plan based on critical feeding habitats, winter range and migration routes. • control of animals such as beavers when their actions threaten to flood the travel corridor. • Protect critical habitats and enhance declining habitats where it is compatible with other park resource management and recreation use objectives. • Protect the park's limited wetlands and marshes to maintain the natural environment and the diverse bird populations.
To enhance knowledge and understanding of the park's wildlife species and their habitats	• Coordinate inventory work with adjacent park jurisdictions to increase the knowledge and understanding of wildlife, their habitat requirements both inside and outside the park, and how these requirements may be affected in the longer term by climate change factors.

(Ministry of Environment, 2010, pp. 39-40, 46-48, 50-52)

The objectives and strategies of the Mount Robson Provincial Park Draft Management Plan, as seen above, clearly emphasize the importance of collaborating with adjacent parks in order to manage effectively. The objectives and strategies also ensure that the parks planners and managers concentrate their efforts on climate change adaptation strategies.

4.2.4 British Columbia Parks Program Plan, 2007-2012 (2008 Update)

The BC Parks Program Plan of 2008 was designed to create strategic direction for BC Parks from 2007-2012. One of BC Parks' goals is that "BC Parks is recognized for its leadership in the proactive stewardship of ecological and cultural integrity" (British Columbia Ministry of Environment, 2008, p. 15). The third objective for this goal is that " the parks and protected areas system plays a key role in the response to climate change" (British Columbia Ministry of Environment, 2008, p. 16). The report includes three strategies for meeting this goal:

> Develop and implement management strategies to increase the resiliency and adaptability of the parks and protected areas system with respect to climate change.
>
> Develop and implement a carbon neutral plan for facility management, investments and operations.
>
> Work with other government agencies to introduce a carbon credits/ offsets program (British Columbia Ministry of Environment, 2008, p. 16).

BC Parks has focused on ways to reduce the impacts of climate change the best they can as well as ensuring the parks and protected areas system has the resources necessary to adapt to the climate change impacts that cannot be prevented.

Another BC Parks goal is that "BC Parks is a model of organizational excellence"; one of the objectives to reach this goal is to "develop and improve relationships and partnerships to engage British Columbians in achieving parks and protected areas goals" (British Columbia Ministry of Environment, 2008, p. 21). The report outlines many strategies for reaching this objective, including: that BC Parks "collaborate and share information and best practices with other park agencies, nationally and internationally" (British Columbia Ministry of Environment, 2008, p. 21). Another objective for this goal is that "BC Parks' commitment to management excellence and continuous improvement is demonstrated through its own practices," which can be reached in part through BC

Parks working "with other agencies to optimize collaboration on information management" (British Columbia Ministry of Environment, 2008, p. 21).

Through reviewing the BC Parks Program Plan, 2007-2012, it is clear that BC Parks policies value transboundary collaboration in parks management.

4.2.5 Preparing for Climate Change: British Columbia's Adaptation Strategy

The Province of British Columbia created a report entitled *Preparing for Climate Change: British Columbia's Adaptation Strategy*, which outlines how the Province intends to adapt to climate change. It focuses its strategy around its vision, which is "British Columbia is prepared for and resilient to the impacts of climate change" (Province of British Columbia, 2010). To achieve this vision, the Province has outlined three strategies: "build a strong foundation of knowledge and tools to help public and private decision-makers across British Columbia prepare for a changing climate"; "make adaptation a part of the Government of British Columbia's business, ensuring that climate change impacts are considered in planning and decision-making across government. "; and "assess risks and implement priority adaptation actions in key climate sensitive sectors" (Province of British Columbia, 2010).

The Adaptation Strategy focuses on continuous monitoring of climate change impacts; encouraging outreach and education; considering climate change adaptation in planning; integrating climate change adaptation into planning policies; and coordinating with other jurisdictions (Province of British Columbia, 2010). It encourages collaboration not only within British Columbia agencies, but also with other jurisdictions. The Adaptation Strategy asserts:

> As with mitigation, Provincial goals related to adaptation cannot be accomplished exclusively through Provincial action but will require collaboration. The B.C. Government will work with local and federal governments, First Nations and other stakeholders, including research institutions, non-governmental organizations, and professional associations, to implement specific core deliverables (Province of British Columbia, 2010).

Overall, the Adaptation Strategy strives to include climate change adaptation in many levels of its governance, with the aim of a province resilient to climate change impacts.

4.2.6 British Columbia Parks Conservation Principles

British Columbia Parks have nine conservation principles that their parks must follow:

1. Conserving and managing representative examples of British Columbia's ecosystems within the provincial protected areas system designated by government.
2. Maintaining essential ecosystem processes and variety in nature through the conservation and management of complete and functioning ecosystems.
3. Conserving variety in nature (biological diversity) at all levels, giving rare, threatened, and endangered species special management attention.
4. Showing leadership in cooperation and coordination with other agencies, aboriginal people, and the public to protect and manage lands and natural and cultural values within, and adjacent to, the province's parks and ecological reserve boundaries.
5. Recognizing a limited knowledge and understanding of ecosystems, natural processes will be allowed to predominate wherever possible.
6. Encouraging environmental learning and the sharing of knowledge within and between BC Parks' staff and the public, and working toward the resolution of issues through conservation.
7. Giving priority to conservation in BC Parks' planning and management through: environmental evaluation, sound decision making, and by encouragement and support of research and education.
8. Respecting aboriginal peoples' traditional harvesting and cultural activities in parks and ecological reserves, and seeking a special relationship honouring their cultural heritage.
9. Practicing recycling, re-using, and reducing consumable goods and products in all aspects of parks and ecological reserves operations, and selecting environmentally friendly products and practices wherever possible (British Columbia Ministry of Environment, No Date).

These conservation principles clearly put emphasis on the importance of natural processes, though they make no mention of climate change impacts and how BC Parks may cope with those changes specifically. These principles also emphasize the importance of collaboration with other agencies.

4.3 Willmore Wilderness Park

4.3.1 Alberta Park Act

The Alberta Park Act makes no reference to climate change, regional planning or collaboration (The Legislative Assembly of Alberta, 2010). The lack of mention of these important issues may limit Alberta provincial parks managers from making climate change mitigation and adaptation strategies, regional planning, or collaboration priorities for park planning. It is especially concerning that this is a newly updated Park Act from 2010: it is discouraging that in a time where climate change is widely accepted, that law is not reflecting what is required for the parks to be able to adapt to the impacts of climate change.

4.3.2 Willmore Wilderness Park Act

The Willmore Wilderness Park Act makes no reference to climate change, regional planning or collaboration (Province of Alberta, 2002). This is in line with the Alberta Park Act (see section 4.3.1, above).

4.3.3 Willmore Wilderness Fire Management Plan

Willmore Wilderness Park does not have a comprehensive management plan; instead, recreation and ecological values were incorporated into the Fire Management Plan (Graham & Quintilio, 2006). The Fire Management Plan makes mention that Willmore Wilderness Park is likely to experience a changing climate, but does not provide details regarding predicted impacts (Graham & Quintilio, 2006). The exception to this is the mention that climate change may allow mountain pine beetle to spread outside of its historic range.

The Fire Management Plan suggests that fire management should occur at the landscape level in order to be effective, recommending working with outside jurisdictions (Jasper National Park, other protected areas, nearby communities, commercial forest users) to manage the spread of fire. However, it focuses on having complementary fire management plans rather than developing a regional fire management plan (Graham & Quintilio, 2006).

4.4 Role of UNESCO World Heritage Site within the Study Area

Two of the parks in the study site, Jasper National Park and Mount Robson Provincial Park, are part of the Canadian Rocky Mountain Parks World Heritage site. This international designation means that there is pressure from outside of Canada to ensure the protection of the site for future generations. The implications of this are discussed in the subsections below.

4.4.1 Canadian Rocky Mountain Parks World Heritage Site

Mount Robson Provincial Park and Jasper National Park are part of the Canadian Rocky Mountain Parks World Heritage Site, along with Kootenay, Banff and Yoho National Parks; Hamber and Mount Assiniboine Provincial Parks; and the Burgess Shale. This area has been a World Heritage Site since 1984, with an extension to its current size in 1990 (UNESCO World Heritage Centre, 2011a). The area was designated a World Heritage Site for the following reasons:

> The seven parks of the Canadian Rockies form a striking mountain landscape. With rugged mountain peaks, icefields and glaciers, alpine meadows, lakes, waterfalls, extensive karst cave systems and deeply incised canyons, the Canadian Rocky Mountain Parks possess exceptional natural beauty, attracting millions of visitors annually.
>
> The Burgess Shale is one of the most significant fossil areas in the world. Exquisitely preserved fossils record a diverse, abundant marine community dominated by soft-bodied organisms. Originating soon after the rapid unfolding of animal life about 540 million years ago, the Burgess Shale fossils provide key evidence of the history and early evolution of most animal groups known today, and yield a more complete view of life in the sea than any other site for that time period. The seven parks of the Canadian Rockies are a classic representation of significant and on-going glacial processes along the continental divide on highly faulted, folded and uplifted sedimentary rocks (UNESCO World Heritage Centre, 2011a).

The reasons for designating the Canadian Rocky Mountain Parks World Heritage Site include both aspects that will not be affected by climate change (mountain peaks, karst cave systems, canyons), and those vulnerable to the effects of climate change (icefields, glaciers, alpine meadows). This is important to note as World Heritage Sites must maintain the integrity of the components of the Site that promoted the creation of the World Heritage Site (UNESCO World Heritage Centre, 2011b). If climate change causes the severe degradation of any or all of these aspects, the status of the Canadian Rocky Mountain Parks World Heritage Site could be at risk (UNESCO World Heritage Centre, 2011b; United Nations Educational & Heritage, 2008).

4.4.2 UNESCO World Heritage Mission

The UNESCO World Heritage Mission is to:

- encourage countries to sign the World Heritage Convention and to ensure the protection of their natural and cultural heritage;
- encourage States Parties to the Convention to nominate sites within their national territory for inclusion on the World Heritage List;
- encourage States Parties to establish management plans and set up reporting systems on the state of conservation of their World Heritage sites;
- help States Parties safeguard World Heritage properties by providing technical assistance and professional training;
- provide emergency assistance for World Heritage sites in immediate danger;
- support States Parties' public awareness-building activities for World Heritage conservation;
- encourage participation of the local population in the preservation of their cultural and natural heritage;
- encourage international cooperation in the conservation of our world's cultural and natural heritage (UNESCO World Heritage Centre, 2011b).

The Mission is valuable within the context of the study site, as it encourages a management plan and monitoring of conservation within World Heritage Sites. With two of the three study site parks situated within the Canadian Rocky Mountain Park World Heritage Site, this provides a structure for planning and monitoring within this portion of the study area.

4.4.3 Operational Guidelines for the Implementation of the World Heritage Convention

The Operational Guidelines for the Implementation of the World Heritage Convention provide UNESCO with guidelines for placing sites on the List of World Heritage in Danger and World Heritage List; protecting and conserving World Heritage Sites; allocating grants of International Assistance from the World Heritage Fund; and mobilizing international and national support of the World Heritage Convention (United Nations Educational & Heritage, 2008).

The World Heritage Convention includes many aspects that encourage World Heritage Site managers to monitor for and adapt to climate change impacts, including the following sections:

> 4. The cultural and natural heritage is among the priceless and irreplaceable assets, not only of each nation, but of humanity as a whole. The loss, through deterioration or disappearance, of any of these most prized assets constitutes an impoverishment of the heritage of all the peoples of the world. Parts of that heritage, because of their exceptional qualities, can be considered to be of "outstanding universal value" and as such worthy of special protection against the dangers which increasingly threaten them.
>
> 6. Since the adoption of the *Convention* in 1972, the international community has embraced the concept of "sustainable development". The protection and conservation of the natural and cultural heritage are a significant contribution to sustainable development.
>
> 7. The *Convention* aims at the identification, protection, conservation, presentation and transmission to future generations of cultural and natural heritage of outstanding universal value (United Nations Educational & Heritage, 2008, p. 2)

The Convention clearly focuses on the importance of continuing to conserve and protect World Heritage Sites after they have received their designation. The emphasis on protecting these sites for future generations provides motivation for World Heritage Site managers to address climate change impacts in their planning processes.

The Convention encourages State Parties (states which are signing members of the Convention) to encourage multi-stakeholder participation in the "...identification, nomination and protection of World Heritage properties," including but not limited to local and regional governments, non-governmental organizations, local communities, and site managers (United Nations Educational & Heritage, 2008, p. 3).

The Convention outlines the duties of State Parties, including their responsibility to "...ensure the identification, nomination, protection, conservation, presentation, and transmission to future generations of the cultural and natural heritage found within their territory, and give help in these tasks to other States Parties that request it" and "take appropriate legal, scientific, technical, administrative and financial measures to protect the heritage" (United Nations Educational & Heritage, 2008, pp. 3-4).

The Convention insists that:

> All properties inscribed on the World Heritage List must have adequate long-term legislative, regulatory, institutional and/or traditional protection and management to ensure their safeguarding. This protection should include adequately delineated boundaries. Similarly States Parties should demonstrate

> adequate protection at the national, regional, municipal, and/or traditional level for the nominated property. They should append appropriate texts to the nomination with a clear explanation of the way this protection operates to protect the property (United Nations Educational & Heritage, 2008, p. 25).

The Convention outlines the management systems that must be in place to maintain a World Heritage Site:

> 108. Each nominated property should have an appropriate management plan or other documented management system which should specify how the outstanding universal value of a property should be preserved, preferably through participatory means.
>
> 109. The purpose of a management system is to ensure the effective protection of the nominated property for present and future generations.
>
> 110. An effective management system depends on the type, characteristics and needs of the nominated property and its cultural and natural context. Management systems may vary according to different cultural perspectives, the resources available and other factors. They may incorporate traditional practices, existing urban or regional planning instruments, and other planning control mechanisms, both formal and informal.
>
> 111. In recognizing the diversity mentioned above, common elements of an effective management system could include:
>
> a) a thorough shared understanding of the property by all stakeholders;
> b) a cycle of planning, implementation, monitoring, evaluation and feedback;
> c) the involvement of partners and stakeholders;
> d) the allocation of necessary resources;
> e) capacity-building; and
> f) an accountable, transparent description of how the management system functions.
>
> 112. Effective management involves a cycle of long-term and day-to-day actions to protect, conserve and present the nominated property (United Nations Educational & Heritage, 2008, p. 25).

The convention also outlines additional management responsibilities for State Parties, including "...implementing effective management activities for a World Heritage property. State Parties should do so in close collaboration with property managers, the agency with management

authority and other partners, and stakeholders in property management" (United Nations Educational & Heritage, 2008, p. 28).

4.4.4 Implications of World Heritage Site Status on Management within the Study Area

The designation of the Canadian Rocky Mountain Parks World Heritage Site is a source of pride in the Canadian Rockies. It is important that parks managers and planners work together to ensure the integrity of the World Heritage Site is maintained in the face of climate change to ensure it remains a designated World Heritage Site. As see in the subsections above, UNESCO provides clear guidelines for the maintenance of World Heritage Sites, and it is imperative that parks planners and managers incorporate them into their plans. In order for this to occur, the relevant parks acts, policies, and management plans must reflect the UNESCO guidelines.

4.5 Implications of Review of Park Acts, Management Plans, and Reports

This review of park acts, management plans, and reports indicates a lack of focus on climate change, regional planning, and collaboration in the legislation for Parks Canada and Alberta Parks planning and management. This is concerning as parks planners and managers have to have legislative support to make climate change adaptation, regional planning, and collaboration a management priority. As it stands, Canadian National Parks and Alberta Provincial Parks are not provided with all the tools necessary to adapt to the impacts of climate change.

British Columbia Parks appears to be ahead in incorporating climate change, regional planning, and collaboration. BC Parks strong focus on climate change monitoring and adaptation and regional collaboration allow parks planners and managers to make these management priorities within their parks. Unfortunately, in order for collaboration to occur, it must be supported in all parks agencies.

If Parks Canada and Alberta Parks follow British Columbia Parks' lead, then there is hope that climate change, regional planning, and collaboration will be given the legislative backing necessary for success.

The Canadian Rocky Mountain Parks World Heritage Site designation could have a positive impact on the ability of the parks within the study site to plan for adaptation to climate change. While the World Heritage Convention does not directly address climate change adaptation, regional planning, or collaboration, it requires management planning to ensure future generations will be able to enjoy World Heritage Sites for years to come (see Chapter 4.4.2, above). Therefore, in the absence

of agency specific legislative mandate for regional planning and climate change collaboration the World Heritage designation provides a legal framework that can be used for such work.

Chapter 5
Results

5.1 Participant Summary

Fourteen potential participants were contacted, and a total of 9 participants completed the questionnaire: 4 from Alberta Parks, 2 from British Columbia Parks, and 3 from Jasper National Park. While representatives who work directly in Jasper National Park cooperated, both Willmore Wilderness and Mount Robson Provincial Parks are managed within regional divisions; therefore some participants did not have direct dealings within the park they represented for the interview.

The participants' experience in their park ranges from 1 to 32 years, with an average of 12.9 years worked. Seven participants have natural sciences backgrounds; two of these have additional areas of education: earth sciences, and planning and humanities. Two participants have a background in social sciences; one has additional education in planning.

Job titles for the participants varied, from science-based (conservation biologist; science coordinator; protected areas ecologist; ecosystem science coordinator) to planning and management (regional parks planner; integrated land use planner; resource conservation manager); to supervisors (regional director; area supervisor). While potential participants with other job titles were contacted (see Chapter 3.3.1, above), not all chose to participate in the study.

Participants were asked to rate their level of knowledge with respect to climate change (in their opinion), on a scale of 1-5 (no knowledge; some knowledge; average knowledge; above average knowledge; expert knowledge). All participants felt they had at least some knowledge; an additional three participants have average knowledge; three have above average knowledge; and one participant has expert knowledge (Table 5.1, below).

Table 5.1 Participants' level of climate change knowledge

Participant ID	Level of Climate Change Knowledge
AB1	5 Expert Knowledge
AB2	3 Average Knowledge
AB3	2 Some Knowledge
AB4	3 Average Knowledge
BC1	4 Above Average Knowledge
BC2	4 Above Average Knowledge

JNP1	4 Above Average Knowledge
JNP2	3 Average Knowledge
JNP3	2 Some Knowledge

The variation in backgrounds, experience, and job titles were reflected in the responses to the questionnaire. Multiple times, participants expressed their concern to me that they were not qualified to respond to a segment of the questionnaire (which segment varied, based on background). From this, it became apparent that parks' employees are often specialized in their departments, and rely on other employees to provide their insights in areas outside their expertise. This finding suggests that many of the key people dealing with climate change planning in the case study parks do not feel that they have expert knowledge on the issue. In order for the appropriate planning decisions to be made, it is imperative that parks planners and managers have expert knowledge on the issues they will be facing within their park and transboundary region. It is impossible to make appropriate decisions when the knowledge to guide the parks planners and managers is lacking.

5.2 Perceptions and Awareness of Climate Change

Participants were asked to respond to two statements regarding the anticipated effects of climate change on policy, planning, and management within their park in the coming years: "I expect climate change to substantially alter policy, planning, and management in my park over the next 10 years" and "I expect climate change to substantially alter policy, planning, and management in my park over the next 25 years." There was the least agreement on the effects of climate change on policy, planning, and management in their park over the next ten years, with answers ranging from both extremes (1: strongly disagree to 5: strongly agree; see Table 5.2), with median answer of 3: neither agree nor disagree. The variation amongst answers is reflected both within and amongst parks, suggesting that the responses are reflections on the individuals' experiences, which may be different from their coworkers'.

Many more participants agreed with the statement "I expect climate change to substantially alter policy, planning, and management in my park over the next 25 years." While two participants did not agree or disagree, the remaining agreed or strongly agreed with the statement (see Table 5.2). This suggests that while the impacts of climate change on policy, planning, and management may not be apparent in the near future, it is fully expected that climate change will have a significant influence on these aspects of park planning over the next 25 years.

Table 5.2 Perceptions of the influence of climate change on park policy, planning, and management in the next 10 and 25 years

Participant ID	I expect climate change to substantially alter policy, planning, and management in my park over the next 10 years.	I expect climate change to substantially alter policy, planning, and management in my park over the next 25 years.
AB3	3 Neither Agree nor Disagree	4 Agree
AB1	1 Strongly Disagree	4 Agree
AB4	5 Strongly Agree	5 Strongly Agree
AB2	2 Disagree	3 Neither Agree nor Disagree
BC1	4 Agree	5 Strongly Agree
BC2	3 Neither Agree nor Disagree	5 Strongly Agree
JNP1	2 Disagree	4 Agree
JNP3	3 Neither Agree nor Disagree	3 Neither Agree nor Disagree
JNP2	2 Disagree	4 Agree
Average	2.78	4.11
Median	3 Neither Agree nor Disagree	4 Agree
Mode	3 Neither Agree nor Disagree	4 Agree

5.3 Perceived Severity of Climate Change Impacts (Current, Short-, and Long-Term)

Participants were asked to rank the severity of impacts for many climate change related impacts to determine their perceptions on the current and expected severity of these impacts. Table 5.3 provides the mean, median, and mode of the participants' rankings. For current perceived severity, participants were asked to rank on a scale of: 1 (not severe); 2 (moderately severe); 3 (severe); and 4 (very severe). For perceived change in severity, both short-term (10 years) and long-term (25+ years), participants were asked to rank according to a scale of: 1 (very significant decrease); 2 (significant decrease); 3 (moderate decrease); 4 (minor decrease); 5 (no change); 6 (minor increase); 7 (moderate increase); 8 (significant increase); and 9 (very significant increase). Below is a summary of the perceived severity and change in severity.

Table 5.3 Perceived severity of climate change impacts currently, and in the short (10 years) and long-term (25+ years)

Climate Change Impact	Perceived Severity (Current)	Perceived Change in Severity (short-term, 10 years)	Perceived Change in Severity (long term, 25+ years)
Changes in phenology	1.57	6.71	7.43
	2	7	8
	2	7	8
Changes in physiography (e.g., glacial extent, erosion)	2.00	7.29	8.14
	2	7	9
	2	6	9
Changes in water quantity	1.57	6.00	6.86
	1	6	7
	1	6	7
Changes in water quality	1.14	5.57	6.14
	1	5	6
	1	5	5
Changes in the frequency, intensity, severity, or magnitude of forest fires	1.71	6.86	6.57
	2	6	7
	1	6	8
Changes in the frequency, intensity, severity, or magnitude of forest insect outbreaks	2.14	7.00	6.86
	2	7	8
	3	7	8
Change in forest cover type	1.00	5.71	5.71
	1	6	6
	1	5	6
Changes in treeline	1.14	6.14	7.00
	1	6	7
	1	6	6
Changes in wildlife species abundance, movement, and	1.57	5.43	5.71
	2	6	7

ranges	2	7	7
Changes in abundance and ranges of invasive species	1.57	6.86	6.57
	2	7	7
	2	7	8
Changes in land values and land use options	1.43	5.86	6.14
	1	6	6
	1	6	6
Changes in tourism/ recreation/ visitation	1.00	5.57	5.71
	1	5	6
	1	5	5
Change in length of winter road season	1.14	4.29	4.00
	1	5	4
	1	5	4
Changes in economic opportunities in local and adjacent communities	1.29	5.43	5.86
	1	5	6
	1	5	7

*Values listed are mean, median, and mode of participants' responses. Current perceived severity ranked 1 (not severe); 2 (moderately severe); 3 (severe); and 4 (very severe). Perceived change in severity, both short-term (10 years) and long-term (25+ years), ranked 1 (very significant decrease); 2 (significant decrease); 3 (moderate decrease); 4 (minor decrease); 5 (no change); 6 (minor increase); 7 (moderate increase); 8 (significant increase); and 9 (very significant increase).

5.3.1 Perceived Current Severity of Climate Change Impacts

Only one impact was perceived to be severe (ranking: 3) at present: changes in the frequency, intensity, severity, or magnitude of forest insect outbreaks. This reflects the struggle the parks in the Canadian Rocky Mountains are facing with the spread of the mountain pine beetle due to climate change (see Chapter 2.1.3.6, above). While participants did not perceive many climate change impacts at present, it is clear that the participants expect to see many climate change related impacts in their parks increase in severity over both the short- and long- term.

5.3.2 Perceived Severity of Climate Change Impacts over the Short-Term (10 years)

In the short-term, the survey found that there are a number of impacts where little to no change (rank 5) is anticipated in: water quality; forest cover type; tourism/recreation/visitation; length of winter road season; and in economic opportunities in local and adjacent communities. In no instance was a decrease in severity (ranks 1-4) predicted for the short-term. No impacts were anticipated to undergo a significant or very significant increase (ranks 8 and 9) in severity over the short-term; however, many were experience a minor to moderate increase (ranks 6 and 7). Minor increases (rank 6) were expected to been seen in: water quantity; the frequency, intensity, severity, or magnitude of forest fires; treeline; wildlife species abundance, movement, and ranges; and in land values and land use options. Moderate increases (rank 7) were anticipated in: phenology; physiography; the frequency, intensity, severity, or magnitude of forest insect outbreaks; and in abundance and ranges of invasive species. It is clear that the participants do not anticipate severe climate change impacts in the parks within which they work over the next ten years; however, many minor to moderate changes are anticipated, which highlights the participants' perception that while climate change will eventually have severe impacts within the Rocky Mountains, significant impacts are not anticipated for at least 10 years.

5.3.3 Perceived Severity of Climate Change Impacts over the Long-Term (25+ years)

Each climate change impact was anticipated to experience at least minor change (either increase or decrease) over the long-term (25+ years). A minor decrease in length of winter road season is anticipated (rank 4). Minor increases (rank 6) were expected to be seen in: water quality; forest cover type; land values and land use type options; and in economic opportunities in local and adjacent communities. Moderate increases (rank 7) were anticipated in: water quantity; the frequency, intensity, severity, or magnitude of forest fires; treeline; wildlife species abundance, movement, and ranges; and in the abundance and ranges of invasive species. Significant increases (rank 8) are expected in the frequency, intensity, severity, or magnitude of forest insect outbreaks; and a very significant increase (rank 9) is anticipated in physiography.

While the participants did not anticipant that their parks would experience severe climate change impacts over the short-term (10 years), it is evident the severity of these impacts are expected to increase over the long-term (25+ years). If impacts are not expected to be severe for 25+ years, then one of two things could happen: i) parks planners and managers may have sufficient time to plan

for climate change adaptation and be well prepared for the impacts of climate change, or ii) parks planners and managers will not feel the pressure of looming climate change impacts and therefore not make planning for climate change adaption a priority, leaving parks planners and managers unprepared and parks unprotected from the impacts of climate change.

5.4 Transboundary Collaboration

Participants were asked a number of questions regarding transboundary collaboration for climate change mitigation and adaptation within the study area (their park and the two adjacent parks in different jurisdictions). This was done to understand the current state of transboundary collaboration, the potential for it in the future, and any barriers that may exist to implementing it within the study area.

5.4.1 Cooperative and Unilateral Responses to Climate Change Impacts

When asked whether their park was considering any response to adapt to or mitigate any of the identified climate change impacts in their transboundary region (see Chapter 5.3 above for the identified impacts), it was also asked whether the response would be cooperative, unilateral, or both. There was little consensus amongst coworkers within the parks they represented on their park's responses.

Alberta Parks' responses included one "yes (cooperative)" and one "no", each with no explanation of the response given. Two Alberta Parks' participants stated that a unilateral response would be undertaken, with two explanations for this. One park official stated that Alberta Parks would "examine changes in park representation of ecological units under different climate-change scenarios (modelling exercise)," which would allow the park to have an understanding of the potential implications of climate change. One participant explained their answer (unilateral response), stating that "we are considering research on the impacts of climate change on selected taxa (i.e. Whitebark pine) as well as using repeat photography to document landscape change over time."

Both respondents from British Columbia Parks agreed that there would be a cooperative response, and one of the respondents also said that there would be a unilateral response as well. One participant responded by stating that "we have a landscape based connectivity fund with Jasper that will be applied to ongoing change and connectivity issues." No other participant made mention of this legacy fund, though it was highlighted in the Annual Report of Jasper National Park of Canada (see

Chapter 4.1.4, above). The other participant gave a thorough answer regarding the park's unilateral and cooperative responses to climate change:

> We are initiating a system wide monitoring framework with replication across the province. We will be working primarily with staff, but there will be opportunities to partner with volunteers, communities, and naturalist groups. We are also doing work with local communities, using federal and provincial funding to make communities more resilient to forest fires that might start inside parks.

This response was in regard to BC Parks' response as a whole, not only the responses occurring within Mount Robson Provincial Park. However, any monitoring framework implemented by BC Parks would be implemented in Mount Robson Provincial Park, and is thus relevant.

All of the participants from Jasper National Park believe that the park will be attempting to mitigate or adapt to climate change. Two stated that it would be a cooperative effort, stating that Jasper is "working with Natural Resources Canada to model water flow and quantity from icefields over the coming decades", and that Jasper is supportive of the "creation of the Yellowhead Ecosystem Group and continued participation in the Foothills Research Institute"; all of these are collaborative efforts which go beyond the boundaries of Jasper National Park. The third participant believes the response to be unilateral, explaining:

> We have direction in our park management plan to: 1) improve our understanding of the impact of climate change on park ecosystems and identify appropriate management strategies and 2) raise public awareness by including messages about a changing climate at key locations, like the Icefields Centre and Mount Edith Cavell. We can do the former by encouraging and supporting research into various aspects of climate change. Our ecological integrity monitoring program includes measures that are related to climate; the main one is glacier mass balance. We also monitor measures that are related to climate change, such as the area burned by fire and forest insect and diseases (e.g. mountain pine beetle). We work to raise awareness of climate change through personal interpretation (e.g. outdoor theatre shows and roving interpreters who focus on climate change) and non-personal interpretation (e.g. panels, displays at the Icefields Centre), so that visitors can better understand the consequences of a changing climate for park ecosystems. In terms of direct action, we have set a target to reduce emissions from park operations from 2010 by 2014 in the park management plan. The plan also emphasizes: the use of alternative energy and the redevelopment of existing power-generating facilities to improve efficiency and reduce greenhouse gas

> emissions, innovation in the application of new environmental stewardship programs and strengthening best management practices.

This response demonstrates their perception of Jasper's plan to respond to climate change, which works to mitigate and adapt to climate change within the park as best as possible. It is clear from this response, as well as from the analysis the Canada National Parks Act and management plan (see Chapter 4.1, above) that their focus is within the park rather than within the regional landscape.

5.4.2 Climate Change Monitoring Programs

Participants were asked whether their park had a climate change monitoring program and, if so, whether monitoring programs are coordinated between their park and other parks in the transboundary region. All Alberta Parks` participants stated that there is no climate change monitoring program in Willmore Wilderness Park. No explanation for this was given, nor any indication that Albert Parks is considering putting one into place.

Both BC Parks participants stated that BC Parks, and Mount Robson Provincial Park, have climate change monitoring programs. As explained by one participant, BC Parks "monitoring program is under development. We will coordinate with any monitoring that is currently ongoing either within adjacent parks or outside parks as long as we know about it (we are currently beating the bushes) and it fits within our plan." Within Mount Robson Provincial Park, "rangers measure glacier retreat in addition to Mountain Pine Beetle activity and mitigation," two key aspects of climate change in the park and the larger region as well.

All participants from Jasper National Park agreed that Jasper monitors climate change in at least one form. Two participants said that the park has a climate change monitoring program, which included monitoring glacier extent every five years. The third participant was hesitant to state that Jasper has a climate change monitoring program, but rather that the park has "...a monitoring program that monitors key aspects of climate (e.g. Glaciers) or ecological factors that are influenced by climate (e.g. Water quality). Environment Canada also monitors climatic variable, such as temperature and precipitation in the park." While it may not be an official monitoring program, the monitoring described by this participant seems to cover many of the main impacts of climate change within the park, allowing employees to be aware of any changes occurring. While there seems to be little coordination between parks, there is some occurring within glacial monitoring.

5.4.3 Climate Change Discussions within the Transboundary Region

Participants were asked if there have been any climate change discussions amongst land management agencies in their transboundary region to determine the level of communication between the different agencies.

Three out of four Alberta Parks' respondents agreed that there were no such discussions taking place; the fourth participant was not sure, but did not think they were occurring.

Both BC Parks participants thought that climate change discussions were occurring. One participant mentioned that discussions were happening "via the Mount Robson/ Jasper Legacy Fund." The other participant answered for BC Parks as a whole, stating "...there has been a big Crown of the Continent discussion, and the Atlin-Taku has had work." However, no mention was made of discussions within the study area.

One participant from Jasper said that yes, there have been discussions through a research program that is being developed at the Foothills Research Institute. Of the other two participants, one did not think that there were climate change discussions occurring, and the other was not sure. Neither participant provided any explanation for this.

5.4.4 Climate Change Information Sharing within the Transboundary Region

Participants were asked if the three parks within their transboundary region currently share information on climate change, and if so, what type of information. Two out of the four Alberta Parks participants were not sure, but one of these two thought it was possible that the parks shared information on the Mountain Pine Beetle (spread and control of). The remaining two participants agreed that information sharing takes place: both noted sharing information on the Mountain Pine Beetle (spread and control of), and one participant also noted that the parks share information on human use of public lands, and wildlife (health, migration, reproduction) as well.

Only one BC Parks participant provided a response, stating that Mount Robson Park shares information regarding: human use of public lands, Mountain Pine Beetle (spread and control of), wildlife (health, migration, reproduction), and ecosystem change.

While one Jasper National Park participant was unsure if information was shared, the other two participants were aware of information sharing occurring regarding ecosystem change, managerial responses to climate change impacts (adaptation), human use of public lands, weather, Mountain Pine Beetle (spread and control of), and wildlife (health, migration, reproduction).

5.4.5 Climate Change Common Goal or Vision

Participants were asked if protected areas within their transboundary region have a common goal or vision with respect to climate change adaptation. Two Alberta Parks' participants were not sure, while the other two Alberta Parks participants said that Willmore Wilderness Park does not share a common goal or vision with respect to climate change adaptation with the other two parks. One participant elaborated:

> In a collaborative sense, we deal with more immediate management issues such as threatened species, or access management, or MPB spread. Climate change per se hasn't been proposed as a transboundary issue in these collaborative forums, but many issues related to climate change are discussed at length amongst agencies.

This response suggests that there are common goals amongst the parks, though they may not be stated as such, especially in relation to climate change. One participant from BC Parks noted that while "...there are common issues, they may not yet be harmonized with other agencies," and so the transboundary region is not "...at that stage yet..." The other participant noted that there is a BC Parks Adaptation Strategy which is "...very high level and doesn't give much direction except to say that every management action should consider climate change." However, the participant did not note whether this includes support of transboundary collaboration.

While two participants from Jasper National Park believed that there is no common goal or vision (with no explanation given), the third participant was not sure. This participant suggested that there were some areas with common goals/visions, such as prescribed fires, and others where there may be a common goal or vision, such as in water supply.

5.4.6 Climate Change Impacts on Policy Development within the Transboundary Region

Participants were asked if climate change related impacts and events will trigger cooperation or conflict in terms of policy development in their transboundary region. Overall, many participants felt that it would trigger cooperation, in many different aspects of policy development.

Two Alberta Parks participants were unsure whether it would trigger cooperation or conflict, with one stating that "it is likely to trigger cooperation between protected areas agencies- may trigger conflict with other non-protected area agencies given differences in mandates." The other two participants felt that climate change related impacts and events were likely to trigger cooperation. One participant explained: "The 3 planning regions in this study already have a history of working

together on several transboundary issues, mostly within groups housed at the Foothills Research Institute. Currently we are working together in the Yellowhead Ecosystem Working Group in such a context." The other participant provided two instances of climate change related cooperation: control of Mountain Pine Beetle, and "conservation of critical wildlife habitat."

Both BC Parks participants felt it would foster cooperation. One suggested that "If we are to manage on a landscape level we need to ensure cooperation and collaboration to prevent protected areas from becoming ecologically isolated from the larger area." The other participant noted that "...cooperation is the name of the game these days as budgets shrink and problems grow," indicating hope that cooperation could maximize the use of available financial resources.

There was less agreement amongst Jasper National Park participants. One felt unsure whether climate change related impacts would trigger cooperation or conflict, stating that "I'm an optimist, so I hope the impacts of climate change would engender cooperation, but I'm really not sure." Another participant believes it will trigger conflict, as citing "differing mandates and capacity to respond particularly over shared interests" as the reason for this. The third participant felt it would trigger "cooperation in landscape broad objectives..." but allowed for "possible conflict over certain species at risk such as caribou."

While there was no consensus amongst the participants, a sense of hope that climate change related impacts would trigger cooperation emerged. The participants highlighted differences in mandates and available resources in the parks as the reasons for possible conflict, while noting the importance of cooperation in order to be able to adapt to climate change. If the reasons for conflict can be eliminated through developing symbiotic mandates and allocating resources to transboundary collaboration, it has the potential to be a useful tool for climate change adaption within the study area.

5.4.7 Formal Agreement on Transboundary Collaboration for Climate Change Adaptation

Participants were asked if a formal agreement to support climate change adaptation amongst Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park would provide the support needed for policy and decision making. Four participants said yes (two from Alberta Parks, and one each from BC Parks and Jasper National Park); one (from Alberta Parks) said no; one participant (from Jasper National Park) did not provide a response; and the remaining three were unsure (one from Alberta Parks; two from Jasper National Park). Although there was not agreement

amongst all participants, this research has shown that formal agreements and legislative backing will be necessary to allow the parks within the study area to collaborate.

5.4.8 Advantages and Disadvantages of Transboundary Collaboration

Participants were asked to outline the potential advantages and disadvantages of transboundary collaboration with respect to climate change within their region. The following table (Table 5.4) provides a summary of their responses.

Table 5.4 Participants' perceptions of advantages and disadvantages to transboundary collaboration with respect to climate change within their region

Participant ID	Advantages	Disadvantages
AB1	I am not sure we would ever collaborate JUST on "climate change." We would likely maintain working relationships on derivatives of climate change, such as SARA species recovery, or ecosystem integrity. The advantages for collaboration are mostly to gain jurisdictional support for whatever actions are chosen, and this is simply to acquire public or managerial buy-in for proposed action plans. Ultimately the advantages of us all working together would be clean air, clean water, and ecosystem goods and services, but we never pitch it as such.	None that I can see.
AB2	Not Sure.	Committing time and manpower resources to an issue that is beyond our immediate control.
AB3	Information sharing; ability to collaborate on joint initiatives; potential to come up with new & innovative solutions through collaboration; greater consistency of management throughout land bases through coordinated effort.	Takes time & resources to collaborate with other agencies. In a period of budget restraints, when we have less resources and staff to do our job it's hard to prioritize these types of collaboration projects.
AB4	Improved communication and messaging to local communities, coordinated response to climate change issues, improved efficiencies through research collaborations, improved management of large-ranging species and their habitats.	Differing mandates and capacity between agencies leading to difficulties in moving forward at the same pace.

BC1	A regional perspective that ensures we are not managing ecological islands.	Variations in funding, policy, priorities, and impacts.
BC2	Any time a landscape approach is taken, it opens up the possibility for a bigger lens on connectivity and the movement of organisms between areas as ecosystems reorganize.	I can't think of a single one... Unless one member of the collaboration could stall progress.
JNP1	Coordinated management actions and adaptive management.	Loss of time to focus on other issues with greater certainty of occurrence. We know climate change will happen, but we don't know what effects it will have and how to respond to those changes. It is challenging to make concrete commitments in the face of such uncertainty.
JNP2	Preparing citizens for the changing landscape conditions. Species and landscape management objectives more closely entwined.	(none given)
JNP3	We have long recognized that parks are not islands and that ecosystems extend beyond park boundaries. We need to work collaboratively with our neighbours to ensure that we are meeting the needs of wide-ranging species, to influence decision-making about land use and development on adjacent lands and to pursue common objectives (e.g. better understanding regional ecosystems, reserve the decline of species-at-risk).	It takes time to develop strategies within Parks Canada for managing complex issues, like the ecological and social effects of climate change. I would expect transboundary collaboration to require more time and resources and results would likely be slow in emerging.

As seen in Table 5.4, the participants offered many insights to the advantages and disadvantages of transboundary collaboration with respect to climate change in their region. The predominant finding is that the advantages are more plentiful than the disadvantages. However, most of the disadvantages flowed from not enough time or resources to conduct collaboration properly. Therefore, the disadvantages would largely cease to exist if the park agencies were given sufficient resources so that transboundary cooperation could take place. From these, it will be possible to develop a list of recommendations to achieve effective transboundary collaboration (see Chapter 6.0).

5.5 Importance-Performance Analysis

An Importance-Performance Analysis (IPA) was conducted in order to determine the participants' perceived importance of climate change issues within their park and the transboundary region, and to

compare their perceived importance with their perceptions of how well their park is performing on these issues (see Chapter 3.5, above). Conducting an IPA analysis highlights areas for concern, allowing the researcher to develop management recommendations.

A standard IPA analysis strives to have an equal division of attributes in each quadrant. However, in this instance the coordinates were located in such a way that it was difficult to get an even distribution of attributes. If the quadrants were shifted, attributes ranked as "important" yet performing "poorly" would be situated in the "keep up the good work" quadrant, which would lead to a false sense of achievement for those attributes. Priority was given to preventing skewing the results, so the crosshairs were kept at the 0,0 (neutral) point on the graph. This distribution was discussed with the thesis supervisor.

The Importance-Performance Analysis highlighted areas where participants felt their park should "keep up the good work"; where they felt that the level of resources applied to certain areas is "possible overkill"; where attributes are of "low priority"; and where parks officials should "concentrate here." These results, as discussed below, are depicted in Figure 5.1 and Table 5.5.

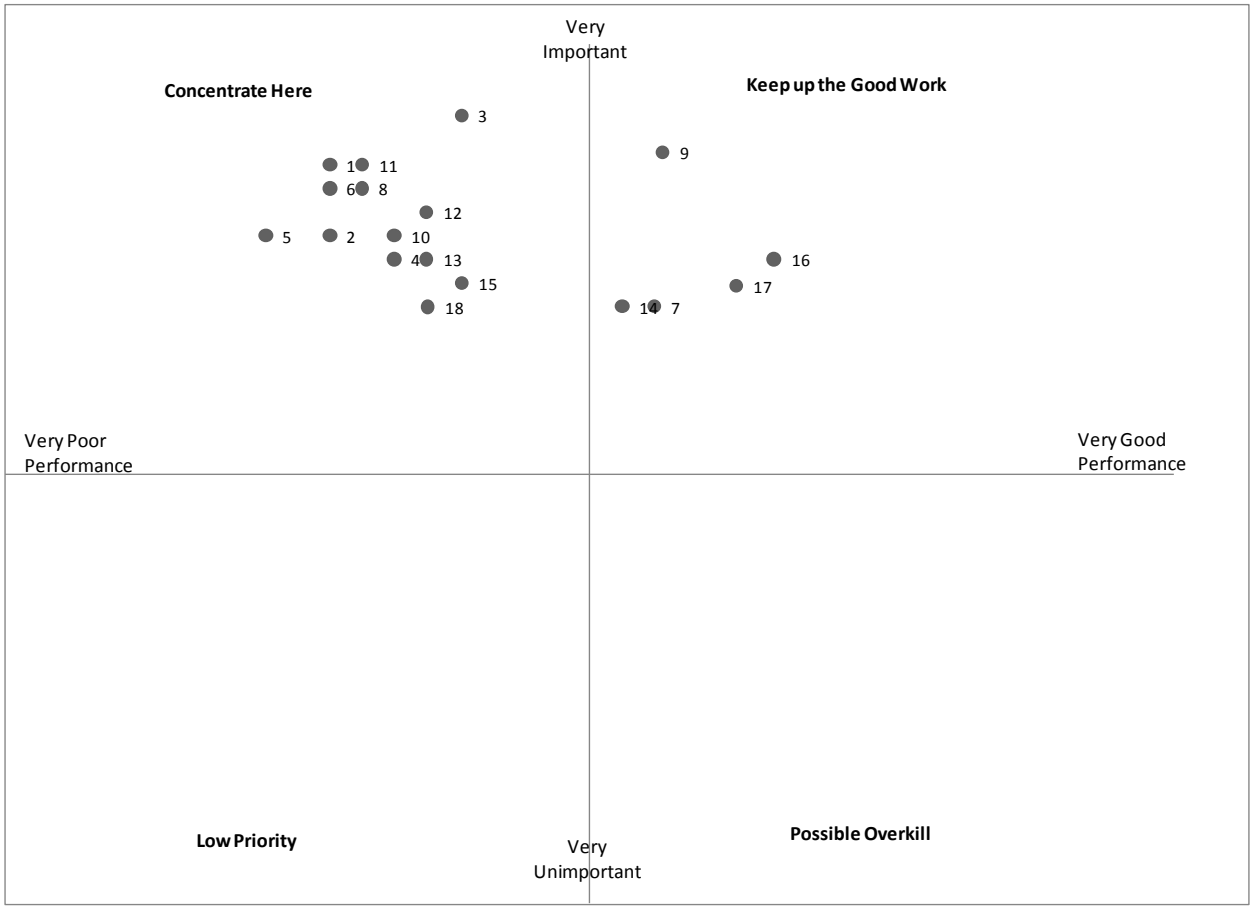

Figure 5.1 Importance-Performance Grid

Table 5.5 Importance-Performance Analysis chart, showing mean importance and performance ratings, as well as the difference ("gap") between the ratings

Attribute Number	Attribute	Mean Importance Rating[1]	Mean Performance Rating[2]	Difference (Gap)
1	My agency has a clear mandate on climate change.	1.44	-0.89	2.33
5	My park has appropriate park policies in place to mitigate climate change.	1.11	-1.11	2.22
6	My park has appropriate park policies in place to adapt to	1.33	-0.89	2.22

	climate change.			
11	My park has adequate research, monitoring and reporting measures implemented to effectively address climate change.	1.44	-0.78	2.22
3	My park has a supportive political environment to mitigate and adapt to climate change.	1.67	-0.44	2.11
8	My park has sufficient financial resources to adapt to climate change.	1.33	-0.78	2.11
2	Activities pertaining to climate change within my agency are well-defined and support decision-making at the scale relevant to my park.	1.11	-0.89	2.00
13	My park communicates effectively the facts, issues, consequences of and solutions to climate change.	1.00	-0.56	1.56
15	My park effectively disseminates information on climate change to a range of users and stakeholders.	0.89	-0.44	1.33
18	My park develops climate change adaptation strategies with nearby and adjacent parks.	0.78	-0.56	1.33
9	My park has adequate staff to effectively address climate change (i.e., staff are educated to the levels required).	1.50	0.25	1.25
7	My park's human resources policies allow staff to be innovative and adaptive in the	0.78	0.22	0.56

	development of climate change response strategies.			
17	My park considers its role in the Greater Yellowhead Ecosystem when making management decisions for climate change.	0.88	0.50	0.38
16	My park has the legal ability to participate in transboundary collaboration.	1.00	0.63	0.37
10	My park supports continuous staff training on climate change.	1.11	-0.67	1.78
12	Research, monitoring and reporting measures within my park are time-sensitive (i.e., periodic and conducive to adaptive management).	1.22	-0.56	1.78
4	Climate change is a management priority in my park.	1.00	-0.67	1.67
14	My park is transparent in its climate change operations and process (i.e., climate change outputs are made available to outside sources).	0.78	0.11	0.67

[A] Ratings were ranked on a 5-point scale: "very unimportant" (-2); "unimportant" (-1); "neutral" (0); "important" (+1); and "very important."

[B] Ratings were ranked on a 5-point scale: "very poorly" (-2); "poorly" (-1); "neutral" (0); "well" (+1); and "very well" (+2).

It is important to the note the different purposes of Figure 5.1 and Table 5.5. The Importance-Performance Grid (Figure 5.1, above) is meant to act as a reference tool for managers to decide where to focus this resources (see Chapter 3.7, above). The Importance-Performance Chart, including Gap Analysis (Table 5.5, above) provides a much more detailed overview of the participants' perceptions of the importance and performance of the attributes. Importantly, it shows the gap between the

importance and performance values of each attribute, signifying how different the performance is from the importance.

5.5.1 Importance-Performance Chart

No attributes are located in the "Low Priority" and "Possible Overkill" quadrants, indicating that the participants considered all attributes to be at least somewhat importance.

Five attributes are located in the "keep up the good work" quadrant: "My park has adequate staff to effectively address climate change (i.e., staff are educated to the levels required)"; My park is transparent in its climate change operations and processes (i.e., climate change outputs are made available to outside sources)"; "My park's human resources policies allow staff to be innovative and adaptive in the development of climate change response strategies"; "My park considers its role in the Greater Yellowhead Ecosystem when making management decisions for climate change"; and "My park has the legal ability to participate in transboundary collaboration."

The remaining thirteen attributes are located in the "concentrate here" quadrant: "My agency has a clear mandate on climate change"; "My park has adequate researching, monitoring and reporting measures implemented to effectively address climate change"; "My park has appropriate park policies in place to adapt to climate change"; "My park has sufficient financial resources to adapt to climate change"; "My park has a supportive political environment to mitigate and adapt to climate change"; "Research, monitoring and reporting measures within my park are time-sensitive (i.e., periodic and conducive to adaptive management)"; "My park has appropriate park policies in place to mitigate climate change"; "Activities pertaining to climate change within my agency are well-defined and support decision-making at the scale relevant to my park"; "My park supports continuous staff training on climate change"; "Climate change is a management priority in my park"; "My park communicates effectively the facts, issues, consequences of and solutions to climate change"; "My park effectively disseminates information on climate change to a range of users and stakeholders"; and "My park develops climate change adaptation strategies with nearby and adjacent parks." These attributes are highlighted by the participants as the most important of all the attributes considered in this IPA. They are attributes with high importance yet low performance. Therefore significant improvements need to be made to how these attributes are approached within the parks in the study site. It is very concerning that so many of the attributes fall in to the "concentrate here" quadrant, as it indicates how much work the parks have ahead of them to achieve sufficient performance on each attribute.

5.5.2 Importance-Performance Gap Analysis

The gap analysis highlights important findings in the IPA. The larger the gap, the greater the difference is between the participants' perceived importance and performance of an attribute. In all instances, the importance of attributes was ranked more highly than the performance. This negative gap reveals that the respondents feel that the climate change policy and planning performance overall is below its importance. This means these park officials feel that the parks and the park agencies must do more so as to improve performance.

The attribute with the largest gap (2.33) was "My agency has a clear mandate on climate change," indicates that while the participants ranked this issue as very important (1.44), they feel their parks are performing poorly on this issue (-0.89). Three attributes have a gap of 2.22: "My park has appropriate park policies in place to mitigate climate change"; "My park has appropriate park policies in place to adapt to climate change"; and "My park has adequate research, monitoring and reporting measures implemented to effectively address climate change." Two attributes have a gap of 2.11: "My park has sufficient financial resources to adapt to climate change"; and "Activities pertaining to climate change within my agency are well-defined and support decision-making at the scale relevant to my park." One attribute had a gap of 2.00: "My park communicates effectively the facts, issues, consequences of and solutions to climate change." This reveals that the respondents see major deficiencies in the areas of overall climate change mandate, park policies, research and monitoring, financial resources, and communication.

All remaining attributes have a gap of less than 2.00 and greater than 1.00. Two attributes have a gap of 1.78: "My park supports continuous staff training on climate change" and "Research, monitoring and reporting measures within my park are time-sensitive (i.e., periodic and conducive to adaptive management)." One attribute has a gap of 1.67: "My park is transparent in its climate change operations and process (i.e., climate change outputs are made available to outside sources)." The attribute "My park effectively disseminates information on climate change to a range of users and stakeholders" has a gap of 1.56. Two attributes have a gap of 1.33: "My park effectively disseminates information on climate change to a range of users and stakeholders" and "My park develops climate change adaptation strategies with nearby and adjacent parks." One attribute has a gap of 1.25: "My park has adequate staff to effectively address climate change (i.e., staff are educated to the levels required)." These attributes fall into the "middle of the rung" range in the gap analysis, indicating that while there are no major deficiencies, there remains much work to be done to achieve adequate performance on these attributes.

The remaining attributes have a gap of less than one, indicating that the participants ranked the importance and performance of these attributes very closely. The attribute "My park is transparent in its climate change operations and process (i.e., climate change outputs are made available to outside sources)" has a gap of 0.67. One attribute has a gap of 0.56: "My park's human resources policies allow staff to be innovative and adaptive in the development of climate change response strategies." The two attributes with the lowest gaps are "My park considers its role in the Greater Yellowhead Ecosystem when making management decisions for climate change" (gap of 0.38) and "My park has the legal ability to participate in transboundary collaboration" (gap of 0.37). Both of these attributes have small gaps because the participants ranked their importance in the neutral-important range (0.88 and 1.00 respectively) and their performance in the neutral-well range. These attributes are therefore of the least concern; participants feel that the level of performance closely matches the level of performance. Once again, however, it is important to note that while the participants did not rank the parks' legal ability to participate in transboundary collaboration to be of high priority, this research indicated that this is an area of major concern (see Chapter 4, above).

Chapter 6
Discussion

6.1 Significant Findings

6.1.1 Park Acts, Management Plans, and Reports

A review of relevant parks acts, management plans, and reports determined that Jasper National and Willmore Wilderness Parks do not have the legislation or policies in place for encouraging transboundary collaboration for climate change adaptation. British Columbia Parks was found to be the leader in both climate change adaptation and transboundary collaboration, with all legal and policy documents making reference to the importance of both to maintain the integrity of the ecosystems in the coming years.

Although the Canada National Parks Act does not specifically address climate change, transboundary collaboration, or regional planning, the mandate to maintain ecological integrity will likely force parks planners and managers to participate in transboundary collaboration and regional planning. Without considering the broader regions in which national parks are located, it will be impossible for natural resources and processes to be protected in the face of climate change.

While the presence of a World Heritage Site (Canadian Rocky Mountain Parks World Heritage Site) encompassing two of three parks within the study site may help to encourage climate change adaptation, regional planning, and collaboration, the World Heritage Convention does not explicitly mandate these actions in World Heritage Sites. Ultimately, parks planners and managers are limited to what they have the legal authority to do. Without legislation supporting transboundary collaboration for climate change adaptation, parks planners and managers will not be able to use this as a tool for climate change adaptation.

6.1.2 Perceptions and Awareness of Climate Change Impacts

Although participants were not concerned about the influence of climate change on policy, planning, and management over the next ten years, they were felt that climate change was likely to substantially alter policy, planning, and management in the long-term (25+ years). This can be attributed to the perceived impacts of climate change on their parks in the long- term (see Chapters 5.3.3). While many impacts are not anticipated to be very severe over the short-term (10 years), all listed impacts

are expected to felt over the long-term (see Chapter 6.1.2). Since the impacts of climate change are not anticipated in the short-term, there is a risk that significant changes in policy, planning, and management due to climate change will not be experienced until the long-term impacts are well underway. This could be severely detrimental to the integrity of these parks, and as such parks planners and managers are encouraged to plan for climate change impacts well before they are anticipated to be felt.

6.1.3 Perceived Severity of Climate Change Impacts (Current, Short-, and Long-Term)

Currently, many climate change impacts are perceived to be not severe, with the exception of the spread of the mountain pine beetle; as apparently the impacts are just beginning to be seen, with many more changes predicted in coming years (Carroll, et al., 2003; Scott & Suffling, 2000). Only one impact was perceived to be severe at present: changes in the frequency, intensity, severity, or magnitude of forest insect outbreaks. This reflects the struggle the parks in the Canadian Rocky Mountains are facing with the spread of the mountain pine beetle due to climate change (see Chapter 2.1.3.6, above).

The research found that the respondents feel that as the length of the forecast changes from current to short-term and long-term, the perception of the severity of climate change impacts increased dramatically. This is consistent with climate change predictions, as outlined in Chapter 2.1, above. It is clear that the participants recognize the threat of climate change and how it is likely to affect their parks in the coming years.

While all parks do some climate change monitoring, it is not under an official climate change monitoring program. Key climate change monitoring currently focuses on mountain pine beetle, glacial retreat, and water quality. In order to be able to adapt to climate change, parks need to develop more formal, in-depth climate change monitoring programs.

6.1.4 Transboundary Collaboration

The questionnaires suggest that if there is transboundary collaboration occurring amongst the three parks in the case study, not all participants were aware of it. This is particularly concerning, as it is difficult to imagine efficient and effective transboundary collaboration occurring in an environment where not all employees are aware of it.

Transboundary collaboration is currently occurring on a few climate change issues, such as the mountain pine beetle and glacier retreat, as outlined in Chapter 5.4, above. However, it is clear

that the individual parks are working toward creating their own climate change management strategies, and have made this their priority rather than working with the other parks. This can be seen in their approach to their climate change goals and visions, as well.

While there is minimal transboundary collaboration in active management and planning, the parks do share information on climate change. There are many examples of instances of information sharing regarding climate change impacts, including: ecosystem change, managerial responses to climate change impacts (adaptation), human use of public lands, weather, Mountain Pine Beetle (spread and control of), and wildlife (health, migration, reproduction). Sharing information helps the parks to be more aware of the extent of the issues, and could give them a chance to prepare for a problem before it arrives, as in the case of the mountain pine beetle.

Generally, interview participants feel that climate change impacts will trigger cooperation amongst the parks within their transboundary region. If the parks can find common ground in their mandates, then collaboration is seen as necessary both from a financial and ecological perspective. However, parks face challenges in coming to agreement over which issues to give priority to, and how to balance their own park's needs with the needs of the transboundary region. It is unclear if such cooperation can be fulsome unless a much more robust legal regime and overarching regional planning policy is put into place.

Currently, participants do not agree whether a formal agreement to support climate change adaptation amongst Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park would provide the support needed for policy and decision making. This is an interesting conclusion. While the parks are working together informally where they deem necessary (see Chapter 5, above), there is little to no legal backing for their collaboration (see Chapter 4, above). Although the participants agree they will most likely have to work together to face climate change in the long term, they will need to have the legal support to allow them to do so. It is my feeling that a much upgraded regional planning process is needed if climate change adaptation is to be tackled effectively.

Transboundary collaboration is a complicated undertaking, with many drivers and barriers. The following table (Table 6.1) outlines the drivers and barriers to transboundary collaboration for climate change in the study area, as outlined by this research's participants.

Table 6.1 Drivers and barriers to transboundary collaboration for climate change adaptation in the study area as determined by participants

Drivers	Barriers

Information sharing	Not enough time or staff
Greater consistency of management throughout land bases through coordinated effort	Variations in funding, policy, priorities, and impacts
Potential to come up with new & innovative solutions through collaboration	
Ability to collaborate on joint initiatives	
Coordinated response to climate change issues	
Greater efficiency	
Improved management of large-ranging species and their habitats	
Regional perspective	
Improved communication	
Gain Jurisdictional Support	

While the participants outlined notably more drivers than barriers, the outlined barriers present significant challenges. In an era of budget constraints, it will be difficult for the parks to be granted further funding for transboundary collaboration. This could be especially difficult as the parks will be looking for funding that helps across jurisdictions (and thus across funding agencies). This barrier could be mitigated by highlighting the long-term savings that may be possible if the parks work together and improve efficiencies in climate change adaptation. It will be necessary for the parks planners and managers to advocate for transboundary collaboration, encouraging their agencies to create complementary policies and priorities, and to allow for increased funding.

Participants did not note legislation as a driver or a barrier to transboundary collaboration for climate change adaptation. However, parks planners and managers need legislative support to participate in transboundary collaboration. Currently, British Columbia Parks is legislatively supportive of climate change adaptation, regional planning, and collaboration while Parks Canada and Alberta Parks acts are not (see Chapter 4, above).

Overall, while it is clear that there is no formal agreement regarding transboundary collaboration currently within the study area, the parks do some collaborate on a number of climate change issues that span the their transboundary region. There is a likelihood of increased transboundary collaboration over the long-term, as more climate change impacts are felt and the need for it increases, as long as legislation is changed to support transboundary collaboration for climate change adaptation.

6.1.5 Importance-Performance Analysis

The Importance-Performance analysis indicated thirteen of the eighteen attributes must be concentrated on: "My agency has a clear mandate on climate change"; "My park has adequate researching, monitoring and reporting measures implemented to effectively address climate change"; "My park has appropriate park policies in place to adapt to climate change"; "My park has sufficient financial resources to adapt to climate change"; "My park has a supportive political environment to mitigate and adapt to climate change"; "Research, monitoring and reporting measures within my park are time-sensitive (i.e., periodic and conducive to adaptive management)"; "My park has appropriate park policies in place to mitigate climate change"; "Activities pertaining to climate change within my agency are well-defined and support decision-making at the scale relevant to my park"; "My park supports continuous staff training on climate change"; "Climate change is a management priority in my park"; "My park communicates effectively the facts, issues, consequences of and solutions to climate change"; "My park effectively disseminates information on climate change to a range of users and stakeholders"; and "My park develops climate change adaptation strategies with nearby and adjacent parks" (see Chapter 5.5.1, above). These attributes are of concerning significance; according to the participants, the parks do not have what they need to adapt to climate change: research, support, mandates, policies, and financial resources are lacking, yet without these parks will not be able to face the challenges ahead. This indicates that there is much work yet to be done on climate change planning within the study area.

It is particularly interesting to note that the participants ranked the attribute "My park has the legal ability to participate in transboundary collaboration" as between "neutral" and "unimportant," suggesting they are not very concerned about the fact that their parks are performing "poorly" on this attribute. Given the research findings, it surprising that participants do not put greater importance on this very important climate change adaptation tool.

The gap analysis indicated attributes that had the largest gap between importance of an issue and the parks' performance on the issue. The attributes with the largest gaps were: "My agency has a clear mandate on climate change" (gap of 2.33); "My park has appropriate park policies in place to mitigate climate change" (gap of2.22); "My park has appropriate park policies in place to adapt to climate change"; "My park has adequate research, monitoring and reporting measures implemented to effectively address climate change" (gap of 2.22); "My park has sufficient financial resources to adapt to climate change" (gap of 2.11); and "Activities pertaining to climate change within my agency are well-defined and support decision-making at the scale relevant to my park" (gap of 2.11). These

attributes are ranked as very important by the research participants, yet the participants recognize that there is not enough being done to address them (see Chapter 5.5.2, above). Parks lack key tools for adapting to climate change, including mandates, policies, research, monitoring, and reporting measures, and financial resources. Without these tools, it will not be possible for parks planners and managers to adapt to climate change within and amongst their parks.

6.2 Recommendations

Based on the research conducted, the following recommendations for parks planners and policy-makers are:

1. Alter the Canada National Parks Act and Alberta Parks Act to allow for and encourage climate change adaptation, regional planning, and collaboration to be management priorities. As discussed in Chapters 4 and 5, above, Parks Canada and Alberta Parks do not have sufficient legislation, policies, or management plans for adapting to climate change or participating in regional planning and collaboration. As regional planning is a crucial tool for climate change adaptation (see Chapters 2.3 and 2.4, above), it is imperative that parks have the legal ability to participate.
2. Strengthen climate change mandates, policies, and programs within individual parks. While British Columbia Parks is a leader in including climate change in their laws, policies, and management plans, all parks in this research would benefit from strengthened climate change mandates, policies, and programs. This would provide them with stronger tools for climate change adaptation, allowing them to be better able to adapt to the impacts of climate change as they are felt.
3. Use the designation of the Canadian Rocky Mountain Park World Heritage Site as leverage for allowing for climate change adaptation, regional planning, and collaboration within and amongst Parks Canada, Alberta Parks, and British Columbia Parks. As discussed in Chapter 4.4 (above), designated World Heritage Sites must protect their integrity or risk the loss of designation of as World Heritage Site. Parks included in World Heritage Sites, such as Jasper National Park and Mount Robson Provincial Park in the Canadian Rocky Mountain Parks World Heritage Site, should lobby their government agencies to ensure their legislation and management plans protect the status of their World Heritage Site. In the case of the Canadian

Rocky Mountain Parks World Heritage Site, allowing for transboundary collaboration for climate change adaptation is a key strategy for maintaining the integrity of the World Heritage Site.

4. Outline the importance of communication with adjacent parks in management plans. Since adjacent parks are likely to experience similar climate change impacts and related management problems (see Chapter 2, above), parks gain to benefit by communicating with adjacent parks. If one park recognizes a climate change impact appearing in their park, they can alter adjacent parks to be on guard for its arrival, allowing for earlier adaptation.
5. Develop forums for communication on transboundary climate change issues, including research and monitoring. Currently, communication on transboundary climate change issues occurs on a casual basis (see Chapter 5.4, above). A formalized means of transboundary discussions would encourage all parks to participate and would allow for the development of reports on the topics discussed to be developed and referenced.
6. Include transboundary collaboration in budget considerations, as it will likely lead to budget savings over the long-term. Working collaboratively spreads the costs of climate change adaptation across participating agencies, thus lowering the cost per park (see Chapters 2.3 and 2.4, above). This could act as an incentive for government bodies to legally allow for, or even require, transboundary collaboration.

6.3 Implementation of Recommendations

As climate change impacts become more severe over the coming years, parks will need climate change adaptation tools. When this occurs, it is anticipated that parks planners and managers, as well as agency leaders, will turn to this and other related research for advice on how to proceed. However, if parks are equipped with climate change adaptation tools such as transboundary collaboration before significant climate change impacts occur, they will be better able to adapt. Therefore, it is important to implement the recommendations of this research as soon as possible. A potential avenue for disseminating these recommendations is to present the findings directly to the parks planners and managers as well as agency leaders.

6.4 Research Limitations

As the parks acts, management plans, and reports are available to the public through the Internet, no limitations occurred within the document review aspect of this research.

The biggest limitation to the questionnaires conducted for this research is the number of participants. While this research provides a case study of transboundary collaboration as a climate change adaptation tool, there are simply not enough participants for the research to have statistical significance. It was very difficult to find participants for this study, for the following reasons:

- contact information for potential participants was difficult to find (especially for British Columbia Parks);
- not all potential participants who were contacted responded; and
- the pool of potential participants was small, based on the number of people working for the parks in the study area.

One additional limitation to the research occurred during the Importance-Performance Analysis. Typically, an Importance-Performance graph will have equal numbers of attributes in each quadrant, making clear the priorities for each attribute (see Chapter 3.5, above). Based on the distribution of the points, it was not possible to divide the attributes evenly amongst the quadrants without skewing the results. In order to prevent skewing the results, the crosshairs were left at the 0,0 (neutral) point, which allowed for accurate results but did not allow for even distribution amongst the four quadrants (see Chapter 5.5, above).

6.5 Further Research

The following research would add value to transboundary collaboration for climate change adaptation discussions:

- Take the discussions from this thesis to the agency level. What do the higher-level agency officials think is necessary for coping with climate change? Do they see the potential for transboundary collaboration in their agency?
- Expand the research to all of the connected parks and protected areas in the Canadian Rockies. What is necessary for transboundary collaboration on such a massive scale?

6.6 Conclusion

Climate change is an issue that parks will face with increasing severity in the coming years. It is vital that parks planners and managers develop the necessary tools for adapting to climate change impacts in order to minimize negative effects on their parks.

Based on the review of the literature, it is clear that transboundary collaboration is seen as a potentially effective tool for climate change adaptation (see Chapter 2, above). However, little transboundary collaboration is occurring within the study area (see Chapter 5.4, above). There needs to be legislation, policies, and plans in place to allow for this to occur, and this is currently lacking in two of three parks within the study area (see Chapter 4, above). Parks planners and managers are not able to put priority on transboundary collaboration until it is mandated within the management plans. The researcher remains hopeful, however, that the parks managers are supportive of transboundary collaboration for climate change and believes the parks will use this tool as it becomes increasingly necessary over the next 25 years.

Appendix A
Research Ethics Approval

UNIVERSITY OF WATERLOO

OFFICE OF RESEARCH ETHICS

Notification of Ethics Clearance of Application to Conduct Research with Human Participants

Faculty Supervisor: Dr. Paul F.J. Eagles **Department:** Recreation & Leisure Studies

Student Investigator: Natasha O'Neill **Department:** Planning, School of

ORE File #: 16582

Project Title: Transboundary Regional Planning Collaboration for Climate Change Adaptation: A Case Study of Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Area.

This certificate provides confirmation that the additional information/revised materials requested for the above project have been reviewed and are considered acceptable in accordance with the University of Waterloo's Guidelines for Research with Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. Thus, the project now has received ethics clearance. This clearance is valid for a period of ***four years*** *from the date shown below and is subject to an* ***annual ethics review process*** *(see Note 2). A new application must be submitted for on-going projects continuing beyond four years.*

Note 1*: This project must be conducted in accordance with the description in the application and revised materials for which ethics clearance has been granted. All subsequent modifications to the application must be submitted for prior ethics review using ORE Form 104 and must not be intiated until notification of ethics clearance has been received.*

Note 2*: All ongoing research projects must undergo annual ethics review. ORE Form 105 is used for this purpose and must be submitted by the Faculty Investigator/Supervisor (FI/FS) when requested by the ORE. Researchers must submit a Form 105 at the conclusion of the project if it continues for less than a year.*

Note 3*: FIs and FSs also are reminded that they must immediately report to the ORE (using ORE Form 106) any events related to the procedures used that adversely affected the participants and the steps taken to deal with these.*

Aug. 3/10
Date

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Appendix B

Parks Canada Agency Research and Collection Permit

PARKS CANADA AGENCY
RESEARCH AND COLLECTION PERMIT
(NOT TRANSFERABLE)

PERMIT No.: JNP-2010-6452

START DATE: 2010-09-01 **EXPIRY DATE** 2010-12-01

Project Title: Transboundary Regional Planning Collaboration for Climate Change Adaptation: A Case Study of Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Area.

Principal Investigator Name: Natasha O'Neill

Address: 2377 Schafer Court, Bright's Grove, ON N0N 1C0

Telephone: 226.220.9201

Email: noneill@uwaterloo.ca

Affiliation: University of Waterloo (Faculty of Environment, School of Planning)

Is hereby authorized to conduct the research project entitled "Transboundary Regional Planning Collaboration for Climate Change Adaptation: A Case Study of Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Area. " , Research and Collection Permit Application Number 7839, In Jasper National Park of Canada, subject to the terms and conditions set out below and/or attached to and forming part of this Research and Collection Permit.

Members of Research Team:

Dr. Paul F.J. Eagles, Department of Recreation and Leisure Studies, Burt Matthews Hall, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L 3G1; 519.888.4567, ext. 32716; eagles@healthy.uwaterloo.ca.

Additional PHA's involved

Issuing Authorities and Terms and Conditions:

Permit issued pursuant to:

National Parks General Regulations: Section(s) __7(5)

Parks Canada Parcs Canada

Canada

(Other applicable Act(s) or Regulations)

General Conditions Governing Social Science Research:

1.1 As a corporate member of the Marketing Research and Intelligence Association (MRIA), Parks Canada strives to ensure that all research conducted in its National Parks, National Historic Sites, and Marine Conservation Areas complies with the MRIA Code of Conduct.
•The MRIA Code of Conduct can be found at:
http://www.mria-arim.ca/STANDARDS/CODE2007.asp
•This application did not include any details of data collection, but Parks Canada would expect that any researcher conducting interviews with park staff would comply with the rules outlined in Section C: Rules Specific to the Conduct of Qualitative Research.

1.2Also available on the MRIA website is the Respondent's Charter of Rights. This brief document outlines the consideration that researchers are expected to give of respondents when operating in Parks Canada areas and facilities.
•The Respondent's Charter of Rights can be found at:
http://www.mria-arim.ca/STANDARDS/PDF/RespondentCharter.pdf

1.3 When conducting interviews, the requirements of the Access to Information and Privacy Acts, and those outlined in the Personal Information Protection Electronic Documents Act (PIPEDA) must be adhered to.
•Additional information on the Access to Information Act can be obtained at
http://www.justice.gc.ca/en/ps/atip/index.html.

•Additional information on the Privacy Act can be obtained at http://laws.justice.gc.ca/en/P-21/ or at http://www.privcom.gc.ca/legislation/02_07_01_e.asp.

•Additional information on PIPEDA can be obtained at
http://www.privcom.gc.ca/legislation/index_e.asp.

1.4In general, the privacy of the individual being interviewed must be protected, including the safekeeping and protection of personal information records such as digital recordings and transcripts. The person interviewed will also need to give explicit permission in order to have their name used in any publication. The following are guidelines on the minimum information that should be provided to participants in interviews:
•who is collecting the information;
•what the information will be used for;
•that the information will only be used for the stated purposes;
•participation is voluntary;
•individual responses will be kept anonymous and confidential;
•final results will be available in an aggregate form (i.e. no individual will be identified);
•a name and number they may contact for more information on the research.

Special Conditions:

1.0 The researcher will contact Amber Stewart, Integrated Land Use Planner for an interview and for an introduction to candidates for the questionnaire.

National General Conditions:

Failure to comply with applicable Heritage Area regulations or the conditions of the permit may

constitute grounds to cancel or suspend the permit, refuse to issue future permits, and may be considered as grounds for prosecution under the applicable Act(s) or Regulation(s).

All permit holders must be in possession of a valid permit before the fieldwork commences and at other periods as stated on the permit.

Permits are not transferable and each member of the field work team must have a copy of the valid permit in their possession.

The permit is valid only for the geographic location, the time period, the activities, and under the terms and conditions described on the permit, unless amended and revalidated by the Superintendent.

Restrictions:

The Superintendent may suspend, cancel, or restrict the scope of the permit.

The permit shall cease to be valid if the fieldwork is not started within six months of the date of issue.

Other Acts and Regulations:

The Principal Investigator must abide by applicable regulations and all other federal, provincial, territorial or municipal regulations applying to the Heritage Area.

If requested by the Superintendent, an authorized Heritage Area staff member, or police constable, the Principal Investigator or any team member will identify themselves and show the permit.

Principal Investigator Responsibilities :

A site, or site component(s) that has been excavated or disturbed shall be restored or conserved by the Principal Investigator to the satisfaction of the Superintendent.

The Principal Investigator must advise the Research Coordinator of any adjustments in work location, research plan and methodology, implementation schedule, or main personnel, etc., during the course of the research.

Unless otherwise negotiated, Researchers working in a Heritage Area are required, as a condition of their permit, to submit:

a) A report of progress sixty (60) days following the completion of the field season, unless otherwise agreed with the Research Coordinator;

b) A final report, one (1) electronic copy and three (3) hard copies, no later than eight (8) months following the completion of the field season, unless otherwise agreed with the Research Coordinator;

c) Submission of an online Investigator's Annual Report (IAR) within one year of signing the permit. In the case of a multi-year permits, the principal investigator will submit an IAR for each year of the research.

The reporting requirements above do not replace any reporting requirements set out in any contract between Parks Canada and the Principal Investigator.

The Principal Investigator will be responsible for all members of their party. All field assistants must observe any general or specific conditions of the permit.

The Principal Investigator shall at all times indemnify and save harmless the Crown from and against all claims, demands, loss, costs, damages, actions, suits, or other proceedings, by whosoever made, sustained, brought or prosecuted, in any manner based upon, occasioned by, or attributable to, anything done or omitted by the Principal Investigator or the project personnel in the fulfillment or purported fulfillment of any of the conditions of the Permit.

Principal Investigator Signature

I, Natasha O'Neill, Principal Investigator, accept all the stated Research and Collection Permit terms and conditions.

Year/Month/Day

Reviewed and Recommended by:

2010/08/06
Year/Month/Day

2010/08/03
Year/Month/Day

6 Aug 10
Year/Month/Day

2010/08/06
Year/Month/Day

Appendix C

Mount Robson Provincial Park Use Permit

BRITISH COLUMBIA
The Best Place on Earth

PARK USE PERMIT

RESEARCH

This Park Use Permit No. **105052** (the "Permit") is issued under the authority of the *Park Act*	**Mount Robson Park** (the "Park")

FROM:
HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, represented by the Minister responsible for the *Park Act* (the "Province") at the following address:

Ministry of Environment
Parks and Protected Areas Division
Omineca
4051-18th Avenue
Prince George BC V2N 1B3

TO:

University of Waterloo

(the "Permittee") at the following address:

School of Planning
200 University Avenue West
Waterloo ON N2L 3G1

THE PROVINCE AND THE PERMITTEE AGREE AS FOLLOWS:

ARTICLE I - GRANT OF PERMIT

1.01 The Province, on the terms and conditions of this Permit, grants to the Permittee permission to enter upon and use that part of the Park (the "Permit Area") described, and for the purposes described, in the Management Plan Schedule.

1.02 Nothing in this Permit grants to the Permittee the right to the exclusive use and occupancy of the Permit Area.

1.03 The Permittee must be in possession of a copy of this Permit when undertaking activities in the Permit Area under this Permit.

ARTICLE II - TERM

2.01 The duration of this Permit is for the term of **3 months and 1 day** commencing on **September 1, 2010** (the "Commencement Date") and ending on **December 1, 2010** (the "Expiration Date"), unless cancelled, terminated or renewed in accordance with the terms of this Permit.

ARTICLE III - INDEMNITY AND INSURANCE

3.01 The Permittee will indemnify and save harmless the Province, its servants, employees and agents against all losses, claims, damages, actions, costs and expenses that the Province, its servants, employees and agents may sustain, incur, suffer or be put to at any time arising, directly or indirectly, from any act or omission of the Permittee, its employees, agents, contractors or licensees under this Permit, except for any liability arising from any independent, negligent act of the Province.

3.02 The Permittee will, during the term of this Permit, provide, maintain and pay for Insurance in such form and amounts and with such deductibles, if any, as prescribed in the Insurance Schedule. **Not Required**

ARTICLE IV – COVENANTS OF THE PERMITTEE

4.01 The Permittee must

(a) comply with the terms and conditions of this Permit, the *Park Act* and any regulations made under the *Park Act*;

(b) comply with all laws, bylaws, orders, directions, ordinances and regulations of any governmental authority that affect the Permit Area, its use and occupation or the Permittee's activities under this Permit;

(c) inform its employees, agents, contractors and licensees of the *Park Act*, regulations made under it, and this Permit as each of them relate to the conduct and activities of persons within the Park;

(d) comply with all orders and directions made verbally or in writing by a park officer (as defined in the *Park Act*) relating to the Park, this Permit or the Permit Area;

(e) not damage, destroy, disturb or remove plants, animals, archaeological or cultural artefacts found in or on the Permit Area, except as authorised by this Permit and only in accordance with the *Park Act* and all other applicable laws;

(f) not introduce plants or animals in or on the Permit Area, except as authorised by this Permit;

(g) not commit or permit any wilful or voluntary waste, damage or destruction in or on the Permit Area;

(h) not use procedures or methods which are disruptive to the natural environment in conducting research, except as authorised by this Permit;

(i) keep the Permit Area in a safe, clean and sanitary condition and remove from the Permit Area, to the satisfaction of the Province, all garbage, debris and effluent resulting from the Permittee's use of the Permit Area;

(j) not use motorised vehicles or equipment in the Permit Area, except as authorised by this Permit;

(k) not construct, erect, place, repair, maintain or alter any building, fixture, structure or improvement on the Permit Area, except as authorised by this Permit;

(l) not interfere with public access or the activities or operations of any other Permittee in the Permit Area except as authorised by this Permit;

(m) pay for or repair, as determined by the Province, any damage to the Permit Area or to the property of the Province caused by the Permittee, its employees, agents, contractors or licensees;

(n) upon expiration, cancellation or termination of this Permit:

(I) peaceably quit and deliver up possession of the Permit Area to the Province, and

(ii) restore the Permit Area to the satisfaction of the Province;

and to the extent necessary, this covenant shall survive the expiration, cancellation or termination of this Permit;

(o) acknowledge the Province, the Park and the Permit Area in any press release, announcement, publication or report released by the Permittee in respect of its use of the Permit Area under this Permit;

(p) comply with all provisions of the Management Plan Schedule.

ARTICLE V - RIGHTS OF THE PROVINCE

5.01 Nothing in this Permit diminishes from the rights of the Province in the Permit Area and the Permittee acknowledges that the Province's rights in the Permit Area include the right to

(a) free and uninterrupted access for the Province, its employees, agents, licensees and invitees in or through the Permit Area;

(b) manage, protect, develop, construct, repair, alter and maintain all buildings, structures, equipment, improvements and natural resources (as that term is defined in the *Park Act*) in or on the Permit Area;

(c) limit or suspend the use authorised under this Permit, if the Province determines in its sole opinion, that such use causes environmental damage to the Permit Area; and

(d) grant to any person the right to enter upon and use the Permit Area, or any part of it, for any purpose.

ARTICLE VI - NOTICE

6.01 Any notice required to be given by either party to the other will be deemed to be given if it is in writing and is delivered by hand or prepaid registered mail to the address first written above or any other address that may be specified in writing by a party and a notice will be deemed to be delivered, if mailed, 48 hours after the time of mailing except, in the case of a postal interruption, actual receipt is required.

ARTICLE VII - RENEWAL

7.01 Not later than 30 days prior to the Expiration Date, the Permittee may, by notice in writing delivered to the Province, apply to the Province for a renewal of this Permit.

7.02 Provided that the Permittee is not in default under this Permit and subject to the *Park Act*, the Province may renew this Permit upon the terms and conditions determined by the Province.

7.03 The Permittee acknowledges and agrees that nothing in this Permit obliges the Province to renew this Permit and the Province's decision in that respect is completely within its discretion.

ARTICLE VIII - TRANSFER

8.01 The Permittee must not assign, transfer, sublicence or grant any of the rights or privileges granted by this Permit without the prior written consent of, and on the terms and conditions determined by, the Province.

ARTICLE IX - CANCELLATION

9.01 The Province may cancel this Permit on the happening of any one or more of the following events:

(a) the Permittee fails to observe, perform or keep any of its covenants or agreements under this Permit and that failure is not rectified within the number of days set out in a written notice delivered to the Permittee requiring the Permittee's failure to be rectified;

(b) the Permit Area is damaged or destroyed by any cause whatsoever;

(c) the Permittee has wilfully misrepresented information:

(i) on the application form which led to the granting of this Permit, or

(ii) required to be provided under the terms and conditions of this Permit;

(d) the Park is closed by the Province; or

(e) the Permittee ceases to use the Permit Area for the purposes set out in this Permit.

ARTICLE X - MISCELLANEOUS

10.01 This Permit may be inspected by the public at any time.

10.02 Time is of the essence in this Permit.

10.03 Nothing in this Permit will be deemed to be waived by the Province unless the waiver is in writing.

10.04 Nothing in this Permit constitutes the Permittee as the employee, agent or partner of the Province or gives the Permittee any power or authority to bind the Province in any way.

10.05 Nothing in this Permit, expressed or implied, obliges the Province to assume any liability, monetary or otherwise for any loss, damage, cost or expense incurred by the Permittee for an interruption of the Permittee's activit under this Permit resulting from, among other things, a strike, lockout, labour dispute, act of God, fire, flood o other natural disaster.

ARTICLE XI - INTERPRETATION

11.01 In this Permit, unless the context otherwise requires, the singular includes the plural and the masculine include the feminine, a corporation and body politic.

11.02 The captions and headings contained in the Permit are for convenience only and are not to be construed a defining or in any way limiting the scope or intent of the provisions of this Permit.

11.03 In this Permit, a reference to an enactment of the Province of British Columbia or of Canada includes a referenc to any subsequent enactment of like effect, and unless the context otherwise requires, all statutes referred to i this Permit are enactment's of the Province of British Columbia.

11.04 If any part of this Permit is found to be illegal or unenforceable, that part will be considered separate an severable and the remaining parts will be enforceable to the fullest extent permitted by law.

11.05 If all or part of the Permit Area is in a recreation area established or continued under the *Park Act*, this Permit deemed to be a resource use permit as that term is defined in the *Park Act*.

11.06 All schedules to this Permit form an integral part of this Permit.

IN WITNESS WHEREOF the parties have duly executed this Permit.

SIGNED and **DELIVERED** on behalf of the **Province** by a duly authorized representative of the Province.

Duly Authorized Representative

October 5, 2010

Date

MANAGEMENT PLAN SCHEDULE

PERMIT AREA DESCRIPTION

The Permittee is authorized to enter the Permit Area described below.

- **Mount Robson Park**

FEE(s)

Protected Land: Mount Robson Park

Activities: Inventory
Purpose: Research
Fee Description: No fee is charged for research permits
Schedule K Ref: Section 53 of the *Park, Conservancy and Recreation Area Regulation*, Item 4

Fees:

Item	Number	Rate	Total
Minimum Fee	1	$0.00	$0.00
Sub Total (based on Fee Description above):			$0.00
		Total:	**$.00**

SPECIAL PROVISIONS

1. Purpose

This Permit is issued to the Permittee for the purpose of **determining what parks managers need to be able to participate in transboundary collaboration and regional planning to ensure that species have the best possible opportunity to cope with the impacts of climate change**.

2. Permittee Designated Representative

The Permittee appoints the following representative to be responsible for liaison between BC Parks and the Permittee:

Name: Natasha O'Neill
Address: 200 University Avenue West, Waterloo ON N2L 3G1
Telephone: 226-220-9201
Fax: 519-746-2031
Email: noneill@uwaterloo.ca

3. The Designated Representatives Responsibilities

(a) Be onsite for the duration of the research activities, or provide contact information for an alternative representative;
(b) Provide the BC Parks Area Supervisor with a local contact number;
(c) Ensure that no activities beyond those described in the permit dated **September 1, 2010** will be undertaken without prior consent from the Area Supervisor.

4. BC Parks Representative(s)

Park, Protected Area or Conservancy Name	Area Supervisor	Phone	Email
Mount Robson Park	Wayne Van Velzen	250-566-4325	Wayne.Vanvelzen@gov.bc.ca

5. Reports

The Permittee shall provide to the Province at the following address:

Ministry of Environment
PASB – Park Use Permits
PO Box 9371 STN PROV GOVT
Victoria BC V8W 9M3
Fax: 250-387-1695

One (1) hard copy and one (1) digital copy of all dissertations, reports, mapping and publications that result from work conducted under this permit (the study area/sites must be clearly identified). This information will be submitted as it is completed.

** Please quote name of Permittee and Permit # with submission of documents.

Appendix D
Research Questionnaire

Transboundary Regional Planning Collaboration for Climate Change: A Case Study of Jasper National Park, Mount Robson Provincial Park, and Willmore Wilderness Park.

This research aims to understand the potential for transboundary collaboration as a tool for climate change adaptation in the Canadian Rocky Mountains, using a regional case study. The following questions aim to provide context for the case study; to understand the current situation; and to understand what protected areas need to adapt to climate change impacts.

In the case of this research, your region encompasses Jasper National, Mount Robson Provincial, and Willmore Wilderness Parks. Please respond to the questions accordingly; however, any additional information regarding collaboration with other protected areas would be valued. Your responses will be compiled with the others to determine what is needed for successful transboundary collaboration in the region.

Questionnaire

Participant Information

Please answer the following questions to the best of your ability.

1. Name of Participant:
2. Title:
3. Affiliation:
4. Years with Park:
5. Phone:
6. E-mail:
7. Educational Background:

☐ Earth Sciences (e.g., geology, soil science, physical geography, etc.)

☐ Natural Sciences (e.g., biology, ecology, zoology, forestry, etc.)

☐ Social Sciences (e.g., economics, political science, human geography, resource management, policy, etc.)

☐ Planning (e.g., rural, urban, environmental, etc.)

☐ Other (please identify):

8. How would you rate your level of knowledge with respect to climate change?

3- Average Knowledge

Park Information

9. Does your park have a budget dedicated to climate change?

☐Yes ☐No ☐ Not sure

10. Does your park employ anyone whose job description includes climate change?

☐Yes ☐No ☐ Not sure

Perceptions and Awareness of Climate Change Impacts

How much do you agree with the following statements?

11. I expect climate change to substantially alter policy, planning, and management in my park over the next 10 years.

3- Neither Agree nor Disagree

12. I expect climate change to substantially alter policy, planning, and management in my park over the next 25 years.

3- Neither Agree nor Disagree

Identified Climate Change Impacts, Research, and Monitoring

13. The following question is designed to examine your opinion on the current and expected severity of climate change impacts in your protected area. Please rank the severity of the impacts for each issue using the scales provided.

Climate Change Impact	**Perceived Severity (Current)**	**Perceived Change in Severity (short-term, 10 years)**	**Perceived Change in Severity (long term, 25+ years)**
Changes in phenology	Not Severe	No Change	No Change
Changes in physiography (e.g., glacial extent, erosion)	Not Severe	No Change	No Change
Changes in water quantity	Not Severe	No Change	No Change
Changes in water quality	Not Severe	No Change	No Change
Changes in the frequency, intensity, severity, or magnitude of forest fires	Not Severe	No Change	No Change

Changes in the frequency, intensity, severity, or magnitude of forest insect outbreaks	Not Severe	No Change	No Change
Change in forest cover type	Not Severe	No Change	No Change
Changes in treeline	Not Severe	No Change	No Change
Changes in wildlife species abundance, movement, and ranges	Not Severe	No Change	No Change
Changes in abundance and ranges of invasive species	Not Severe	No Change	No Change
Changes in land values and land use options	Not Severe	No Change	No Change
Changes in tourism/ recreation/ visitation	Not Severe	No Change	No Change
Change in length of winter road season	Not Severe	No Change	No Change
Changes in economic opportunities in local and adjacent communities	Not Severe	No Change	No Change
Other (please explain):	Not Severe	No Change	No Change
Other (please explain):	Not Severe	No Change	No Change
Other (please explain):	Not Severe	No Change	No Change

14. Is your park considering any response to adapt or mitigate to any of the identified climate change related impacts in your transboundary region in question 13 (e.g., further research or implementation of adaptation measures)?

☐Yes (unilateral) ☐ Yes (cooperative) ☐ No ☐Not Sure

Please explain:

15. a) Does your park have a climate change monitoring program?

☐Yes ☐No

b) If yes, are monitoring programs coordinated between your park and other parks in the transboundary region?

☐Yes ☐No

Please explain:

16. Have there been any climate change discussions amongst land management agencies in your transboundary region (e.g., workshops, strategic/expert meetings, etc)?

☐Yes ☐No ☐ Not sure

Please identify:

17. a) Do the three parks within your transboundary region currently share information on climate change?

☐Yes ☐No ☐ Not sure

b) If yes, please identify the types of information being shared:

☐	Strategies to reduce or slow climate change impacts (mitigation)
☐	Managerial responses to climate change impacts (adaptation)
☐	Human use of public lands
☐	Weather
☐	Climate
☐	Water resources (changes in supply)
☐	Pine Beetle (spread and control of)
☐	Wildlife (health, migration, reproduction)
☐	Ecosystem change
☐	Other (please explain):

18. Do protected areas within your transboundary region have a common goal or vision with respect to climate change adaptation?

☐Yes ☐No ☐ Not sure

Please explain:

19. What are the potential advantages of transboundary collaboration with respect to climate change in your region?

20. What are the potential disadvantages associated with transboundary collaboration with respect to climate change in your region?

21. Overall, will climate change related impacts and events trigger cooperation or conflict in terms of policy development in your transboundary region? You may choose more than one answer if necessary; please provide an explanation below.

☐Cooperation ☐Conflict ☐Not Sure

Please explain:

22. Would a formal agreement to support climate change adaptation amongst Jasper National, Mount Robson Provincial, and Willmore Wilderness Parks provide the support needed for policy and decision-making?

☐Yes ☐No ☐Not Sure

Importance-Performance Analysis of Park Management

23. Please complete the following table using the 5-point scales provided. The importance column asks how important an issue is to the park in which you work, in your opinion, with the scale ranging from very unimportant (-2), unimportant (-1), neutral (0), important (+1), to very important (+2). The performance column asks how the park you work for is performing on this issue, from very poorly (-2), poorly (-1), neutral (0), well (+1), very well (+2).

How important is the following issue to the park in which you work? (Importance)

How well is park management performing on this issue? (Performance)

	Importance	**Performance**
My agency has a clear mandate on climate change.	0 Neutral	0 Neutral
Activities pertaining to climate change within my agency are well-defined and support decision-making at the	0 Neutral	0 Neutral

scale relevant to my park.		
My park has a supportive political environment to mitigate and adapt to climate change.	0 Neutral	0 Neutral
Climate change is a management priority in my park.	0 Neutral	0 Neutral
My park has appropriate park policies in place to mitigate climate change.	0 Neutral	0 Neutral
My park has appropriate park policies in place to adapt to climate change.	0 Neutral	0 Neutral
My park's human resources policies allow staff to be innovative and adaptive in the development of climate change response strategies.	0 Neutral	0 Neutral
My park has sufficient financial resources to adapt to climate change.	0 Neutral	0 Neutral
My park has adequate staff to effectively address climate change (i.e., staff are educated to the levels required).	0 Neutral	0 Neutral
My park supports continuous staff training on climate change.	0 Neutral	0 Neutral
My park has adequate research, monitoring and reporting measures implemented to effectively address climate change.	0 Neutral	0 Neutral
Research, monitoring and reporting measures within my park are time-	0 Neutral	0 Neutral

sensitive (i.e., periodic and conducive to adaptive management).		
My park communicates effectively the facts, issues, consequences of and solutions to climate change.	0 Neutral	0 Neutral
My park is transparent in its climate change operations and process (i.e., climate change outputs are made available to outside sources).	0 Neutral	0 Neutral
My park effectively disseminates information on climate change to a range of users and stakeholders.	0 Neutral	0 Neutral
My park has the legal ability to participate in transboundary collaboration.	0 Neutral	0 Neutral
My park considers its role in the Greater Yellowhead Ecosystem when making management decisions for climate change.	0 Neutral	0 Neutral
My park develops climate change adaptation strategies with nearby and adjacent parks.	0 Neutral	0 Neutral

Please provide any comments you have in regards to the issues addressed above. In addition, if you feel an important issue has been missed, please include it here and provide an explanation.

Additional Information

Please provide any additional information or comments as you feel would be beneficial to this research.

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